



COMMONWEALTH OF VIRGINIA
STANDARD CONTRACT

Contract No. UCPJMU5844

This contract entered into this 4th day of August 2020, by **MS Benbow and Associates, Inc.** hereinafter called the "Contractor" and Commonwealth of Virginia, James Madison University called the "Purchasing Agency".

WITNESSETH that the Contractor and the Purchasing Agency, in consideration of the mutual covenants, promises and agreements herein contained, agree as follows:

SCOPE OF CONTRACT: The Contractor shall provide the services to the Purchasing Agency as set forth in the Contract Documents.

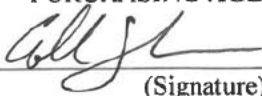
PERIOD OF PERFORMANCE: From August 4, 2020 through August 3, 2023 with seven (7) one-year renewal options.

The contract documents shall consist of:

- (1) This signed form;
- (2) The following portions of the Request for Proposal CMJ-1068 dated December 2, 2019:
 - (a) The Statement of Needs,
 - (b) The General Terms and Conditions,
 - (c) The Special Terms and Conditions together with any negotiated modifications of those Special Conditions;
 - (d) Addendum No. One, dated December 17, 2019
 - (e) Addendum No. Two, dated January 7, 2020
 - (f) Addendum No. Three, dated January 9, 2020
 - (g) Addendum No. Four, dated January 14, 2020
- (3) The Contractor's Proposal dated January 13, 2020 and the following negotiated modification to the Proposal, all of which documents are incorporated herein.
 - (a) Negotiations Summary, dated August 3, 2020.
 - (b) Information Technology Services Addendum, dated July 22, 2020

IN WITNESS WHEREOF, the parties have caused this Contract to be duly executed intending to be bound thereby.

CONTRACTOR:
By: 
(Signature)
Leo L. Holzenthal, Jr., P.E.
(Printed Name)
Title: President

PURCHASING AGENCY:
By: 
(Signature)
Colleen Johnson
(Printed Name)
Title: Buyer Specialist

**RFP # CMJ-1068, Atlantic Union Bank Center
High Density Wireless Network
Negotiation Summary for
MS Benbow and Associates Professional Engineering Corporation
(MSB)**

August 3, 2020

1. Parties agree that items within this Negotiation Summary modify RFP# CMJ-1068 and the Contractor's response to RFP# CMJ-1068 and that this Negotiation Summary takes precedence in conflict.
2. Attachment A: The Contractor's negotiated Scope of Work is detailed in the attached letters from Contractor dated July 29, 2020 and July 24, 2020 (Sub-contractor: Apogee) and are hereby incorporated into the contract.
3. Attachment B: AUBC Network Diagram, dated July 30, 2020
4. Contractor's proposal pricing for James Madison University is hereby modified from the proposal, dated January 13, 2019 as follows:
 - a. Attachment C: The attached Pricing Sheet, dated July 28, 2020 replaces the Pricing Sheet Attachment F submitted with the original RFP response.
 - i. In the attached Attachment C Pricing Sheet, Option 3: Remote Event Support: Contractor shall guarantee remote event support pricing in the amount of \$720 per event until October 30, 2021 and charges shall be invoiced monthly in arrears based on the actual quantity of events monitored. Contractor will contact the university sixty (60) days prior to October 30, 2021 to discuss optional renewal of this service offering on an annual basis. The price for remote event support will be evaluated annually in conjunction with the renewal discussion.
 5. Remote Event Support Description: includes complete Wi-Fi system diagnostic analysis, setup, live event monitoring, data analysis, and post – event report generation which provides system performance stats for the event. Hours worked per event will vary based on the type of event but the typical assumption for basketball is 4-5 hours on average for both event support, report generation, and performance analysis.
 - ii. Optional Annual On-Site Event Walk: To include performing an Ekahau scan, complete system performance analysis, and reporting complete with recommendations to the university is included at \$6,683 and is inclusive of travel costs.
 - iii. Contract includes 3-year support for all manufactures products. Additional support years for Aruba and Cisco can be purchased via Contractor, pricing to be established at time of purchase. Exception: Aruba Access Points include a lifetime warranty and perpetual license as a one (1) time fee (Attachment C line item 59).

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August 3, 2020

- b. Contractor will provide Ad Hoc phone support to at the rate of \$165 per hour for calls initiated by the university or on behalf of the university by MS Benbow sub-contractor, Apogee. Contractor will provide the university with detailed backup timesheets with a written narrative for all support hours on any invoice submitted for phone support.
 - c. Labor pricing in this proposal is based upon Contractor's assumption that all labor will take place during standard business hours, 8am -5pm, Monday through Friday. Any required overtime charges are to be negotiated with the university over and above the agreed to pricing and shall require prior written approval from appropriate representatives of JMU Telecom and the AUBC Project Manager with an adjusted purchase order.
 - d. Contractor will submit a detailed invoice to the university monthly on a percentage complete basis which shall be mutually agreed.
 - e. For the avoidance of doubt, no equipment refresh is included in the pricing of this contract.
5. Contractor shall finalize project schedule with appropriate representatives from JMU Telecom and the AUBC Project Manager upon contract award. Contractor will not be held responsible for delays in project execution due to Force Majeure events, government action, pandemic restrictions, other trades or similar occurrences.
6. Contractor shall convey all ownership of equipment to the university upon final acceptance and payment.
7. The following changes are mutually agreed to in regards to the exceptions and clarifications of the referenced requirements of RFP# CMJ-1068 Attachment D *Performance Specifications*:
- a. Take Rate – Contractor has adjusted the quantity of catwalk mounted overhead AP's from the original RFP offering of 80 to 65. This adjustment changes the Wi-Fi RF coverage from approximately 125 seats/AP to 150 seats/AP, which translates to an approximate 17% reduction in the number of possible connected users to the Atlantic Union Bank Center Wi-Fi network.
 - b. Section 1.4. *Submittal Requirements*
The university acknowledges that delivery of shop drawings in 20 days from contract award will necessitate prompt building access, coordinated through the Telecom Project Manager, for survey and availability of university personnel to accompany MS Benbow to address aesthetic concerns and stealthing requirements.
 - c. Section 3.1.A.7. *Systems Narrative Description - Seamless Roaming*
The university acknowledges that MS Benbow shall design coverage to 'bleed' into stairwells

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August 3, 2020

and elevator cabs from adjacent locations but that specific, as dedicated service cannot be provided.

d. Section 3.2.A.2. *Expected System Performance - Parking*

The university confirms that parking area will not be included in the scope of this RFP, as stated in RFP Addendum #2 dated January 7, 2020. In the same addendum the university addressed that “it is desirable for WiFi coverage to be available external to the building immediately adjacent to the main entrance to the facility.”

e. Section 3.6.B. *Warranties, Maintenance and Licenses - Successful Events:*

The university acknowledges that WiFi networks operate in unlicensed frequency bands and network performance is subject to transmissions from both compliant and non-compliant devices that are not authorized to operate at the center. Contractor will not be held responsible for network performance issues related to transmissions from unauthorized devices that operate in the center.

8. The following changes are mutually agreed to in regards to the exceptions and clarifications of terms and conditions of RFP# CMJ-1068:

a. Special Term and Condition VIII.G. *Renewal of Contract* is hereby replaced with the following:

G. RENEWAL OF CONTRACT: This contract may be renewed by the Commonwealth for a period of seven (7) successive one year periods under the terms and conditions of the original contract except as stated in 1. and 2. below. Price increases may be negotiated only at the time of renewal. Written notice of the Commonwealth's intention to renew shall be given approximately 90 days prior to the expiration date of each contract period.

- i. If the Commonwealth elects to exercise the option to renew the contract for an additional one-year period, the contract price(s) for the additional one year shall not exceed the contract price(s) of the original contract increased/decreased by no more than the percentage increase/decrease of the other services category of the CPI-W section of the Consumer Price Index of the United States Bureau of Labor Statistics for the latest twelve months for which statistics are available.
- ii. If during any subsequent renewal periods, the Commonwealth elects to exercise the option to renew the contract, the contract price(s) for the subsequent renewal period shall not exceed the contract price(s) of the previous renewal period increased/decreased by more than the percentage increase/decrease of the other services category of the CPI-W section of the Consumer Price Index of the United

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States Bureau of Labor Statistics for the latest twelve months for which statistics are available.

- b. Contractor agrees that all exceptions taken within their initial response to RFP# CMJ-1068 that are not specifically addressed within this negotiation summary are null and void.
- 9. Cooperative Use: All telecommunication hardware that Contractor procures is negotiated with partner manufacturers on a project by project basis. Contractor will provide pricing for cooperative contract use by request.
- 10. Contractor has disclosed all potential fees. Additional charges will not be accepted.

M S Benbow & Associates

A Professional Engineering Corporation



Corporate Office • 2450 Severn Avenue • Suite 400
Metairie, LA 70001 • 504.832.2000
msbenbow.com

July 29, 2020

James Madison University
MSC 5720
752 Ott Street, Room 1042
Wine Price Building
Harrisonburg, VA 22807
Email: johns9cm@jmu.edu

Attention: Colleen Johnson – Buyer Specialist Procurement Services

References: James Madison University – Atlantic Union Bank Center, High Density Wireless Network Request for Proposal #CMJ-1068. MSB Proposal #2020KMW2004

Dear Ms. Johnson:

M S Benbow & Associates ('MSB') appreciates the opportunity to offer James Madison University ('JMU') our final scope summary for a High Density Wi-Fi network for the Atlantic Union Bank Center. The proposed scope herein supplants all previous proposals. We believe that our discussions with JMU have allowed us to successfully arrive at a solution that will provide a guest pleasing Wi-Fi experience to the Atlantic Union Bank Center while delivering great value to JMU.

MSB proposes to provide JMU a Single Threaded, Non-Redundant network utilizing Apogee's outsourced core network infrastructure (for greater detail on Apogee's scope please see attachment "*Apogee Response to MSB Re JMU RFP# CMJ_1068 July 24_2020 FINAL.pdf*").

MSB's scope to include:

- A single Cisco Catalyst 9500 as a single threaded Aggregation Switch
- Dual Aruba Mobility 7220 Controllers for AP management
- Cisco 9300 Catalyst Switches (quantity 10) for Access Point connectivity throughout the stadium IDFs
- Wireless Access Points (quantity 158) for bowl seating, concourses, back of house, and Point of Sale areas with zero on-hand spare stock

- VM server cluster (quantity 2) to run Mobility Master and AirWave via ESXI Virtual Server
- Captive Portal via a single Aruba ClearPass C2000 DL20 Gen9 appliance
- Installation labor and materials supplied by a MSB provided subcontractor of the wireless system, inclusive of Wireless Access points, antennas, switches, controllers, and VMware servers
- Integration of the Wi-Fi network into Apogee supplied core network infrastructure
- Tuning and Optimization of the Wi-Fi network to ensure High Density Wi-Fi operability

MSB has incorporated this summary scope herein this document into our updated Attachment F – Pricing Sheet (see attached, *"Attachment F – Pricing Sheet_Apogee-WLAN_Final_20200728.xls"*).

We look forward to working with James Madison University on this project and would be honored to leverage our extensive Wi-Fi experience for the Atlantic Union Bank Center. Please contact me at 504-400-8178, or by email at kkeen@msbenbow.com should you have any questions or needs.

Sincerely,

M S Benbow & Associates

Kit Keen

Kit Keen

Snr. Technology Consultant





July 24, 2020

Ken Wright, P.E.
Director
MS Benbow & Associates
2450 Severn Avenue, Suite 400
Metairie, Louisiana 70001

Re: RFP# CMJ-1068

Dear Ken,

The Atlantic Union Bank Center is truly a unique space and we are thankful for the opportunity to engage with MS Benbow on such an amazing project. Although Apogee does not possess deep experience within this unique space, we believe we can add value and create financial efficiency for the University. Based on our engagements over the past few weeks with you and your team, we believe we can accomplish this through expansion of Apogee's managed service and support model, leveraging Apogee's financially sustainable business model to operationalize the long-term viability of this project.

At MSB's request, Apogee is prepared to offer the following services as an expansion to our existing partnership with JMU.

- DNS / DHCP services with sufficient capacity to meet LPV demands
- Internet Service Provider (ISP) transport services
- Network core connectivity
- Layer 2 connection to campus for portability of student SSID
- Private IP address space and NAT
- Integration support both for the project buildout and network commissioning / testing
- Fiber DMARC in the arena for connection back to Apogee network. Shall consist of two (2) 10 gig single mode fiber pairs for dual uplinks from Arena Aggregation Switch. (JMU to provide fiber path/link.)
- Apogee will not be providing NAC or a Guest Portal as part of the proposed solution. If JMU or MSB would like Apogee to provide NAC, we are happy to arrange a call to discuss.
- Tier 2 network support services driven by SLA. (Please reference priority level and field dispatch protocol figure on next page.) SLAs align with ResNet and are familiar to all.



Priority Level and Field Dispatch Protocols

Priority Level	Description	Users Affected	Remote Monitoring	Field Dispatch
P0 - Critical	Requires emergency type action. Involves core, circuit, or widespread outage affecting large number of users.	Outage service for 20% or greater of the end users	Within 15 minutes	Within 2-4 hours
P1 - High	A need greater than normal, but not a critical priority. Can be used for a significant outage with a workaround in place. Can be used if there is a systematic problem that could easily escalate into a critical outage if no action is taken, even though no outage has occurred yet. NOC will use all due haste to fix the problem, but not working at emergency levels. Example would include: 10 APs in a localized area, border router showing signs of imminent failure.	Degraded, but usable service for 21-40% of the end users	Within 1 hour	Within 6-8 hours
P2 - Normal	Describes issues that affect a small number of users or where there is a solid workaround. Example might include several access points showing down, or an access switch failure (small number of users)	Degraded, but usable service for 1% to 20% of end users.	Within 8 hours	Next business day
P3 - Low	Not service disrupting, or very minimal.		Within 72 hours	Next business day

Apogee is committed to a great partnership with James Madison University and MS Benbow. Understanding risk, accountability, and experience in this environment is paramount to partnering for successful outcomes. We take pride in our years of experience dedicated to serving higher education and this experience has positioned us well to deliver the right solution to James Madison University.

Apogee can adopt the Atlantic Union Bank Center into our existing service portfolio for the following investment. If JMU or Benbow prefers on-site support available during all events, we are happy to supply pricing.

Facility	Year one annual operational support cost	Year two annual operational support cost	Year three annual operational support cost
JMU stadium - 157-167 APs	\$39,360.00	\$40,875.36	\$42,449.06

*36-month commitment to align with MSB proposed term length

*3.85% annual increase commitment to align with existing ResNet agreement.

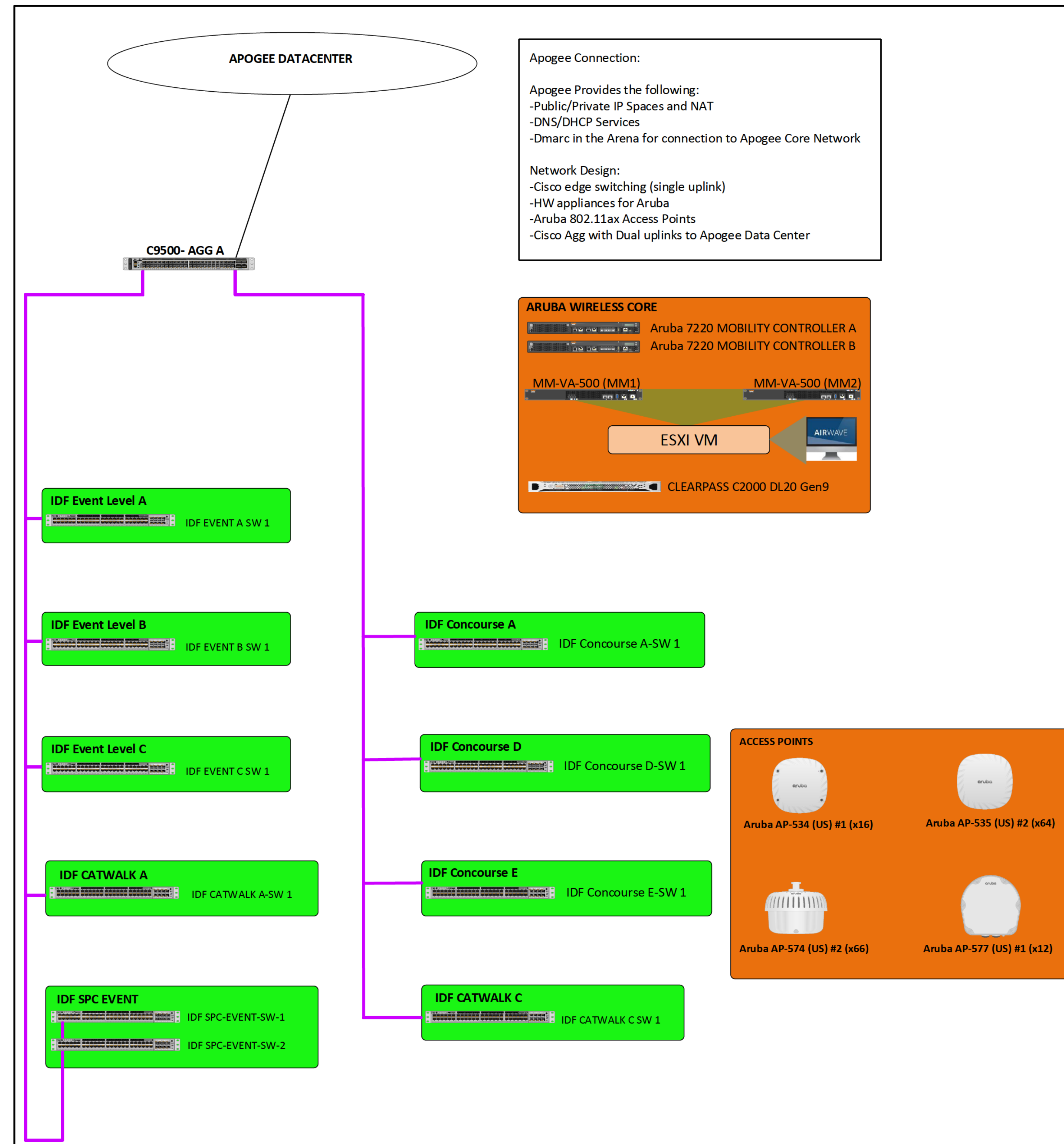


We look forward to working with MS Benbow through this process to expand our managed service and support model at James Madison University. We welcome the opportunity to answer any questions you might have about this recommendation.




Regards,

Gerad Johnson
Director, Business Development

Attachment B: Network Diagram - 7/30/2020



NETWORK BLOCK DIAGRAM OPTION B
SCALE: N.T.S.

EQUIPMENT MANUFACTURERS	CLIENT	REVISION						ENGINEERING CORPORATION	<p>JAMES MADISON UNIVERSITY ATLANTIC UNION BANK CENTER WI-FI DESIGN NETWORK BLOCK DIAGRAM OPTION A</p>	<div><div></div><div>M S BENBOW & ASSOCIATES CONSULTING ENGINEERS</div></div>			
<div></div>	<div></div>	NO.	DATE	REVISION DESCRIPTION	DRWN	CHK'D	APP'D	<p>Copyright © 2020, M S Benbow and Associates Professional Engineering Corporation, all rights reserved. Any reproduction, possession or use without the express written permission of M S Benbow and Associates Professional Engineering Corporation is prohibited, a violation of US Copyright laws, and will be prosecuted to the full extent of law. M S Benbow and Associates Professional Engineering Corporation will take all appropriate actions to protect and enforce its rights.</p>		PROJECT NO: Z19-02510		DATE: JULY 30, 2020	
		1	3/31/20	CONCEPTUAL DESIGN	JP	GP	KW			DESIGNER: G. POLO		SCALE: AS NOTED	
		2	7/30/20	Update Stencils	JP	GP	KW			ENGINEER: G. POLO		DRAWING NO:	REV.
										APPROVAL: K. WRIGHT		Z19-02510-T-102	A

**ATTACHMENT C: PRICING SHEET (submitted 7/28/2020):
To replace CMJ-1068 Attachment F**



				Configuration: SYSTEM UTILIZING APOGEE		
REF#	MFG	MODEL	DESCRIPTION	QTY.	UNIT	EXTENDED
SERVER						
1						\$ -
2						\$ -
SERVER					SERVER	\$ -
APPLICATIONS						
3						\$ -
4						
5						\$ -
APPLICATIONS					APPLICATIONS	\$ -
CORE AND EDGE SWITCHING						
6	Cisco	C9300-48UXM-A	Cisco Catalyst 9300 48-port 2.5G (12 mGig) UPOE, Network Advantage { IDF SWITCHES + EVENT }	10	\$ 9,078.07	\$ 90,780.74
7	Cisco	CON-SNT-C93A048M	SNTC-8X5XNBD Catalyst 9300 48-port(12 mGig36 2.5Gbps	10	\$ 991.79	\$ 9,917.94
8	Cisco	C9300-DNA-A-48	C9300 DNA Advantage, 48-Port Term Licenses	10	\$ -	\$ -
9	Cisco	C9300-DNA-A-48-3Y	C9300 DNA Advantage, 48-Port, 3 Year Term License	10	\$ 2,626.58	\$ 26,265.76
10	Cisco	C9300-DNA-A-48	C9300 DNA Advantage, 48-Port Term Licenses	10	\$ -	\$ -
11	Cisco	CAB-SPWR-30CM	Catalyst Stack Power Cable 30 CM	10	\$ 66.19	\$ 661.85
12	Cisco	PWR-C1-1100WAC	1100W AC Config 1 Power Supply	10	\$ -	\$ -
13	Cisco	S9300UK9-169	Cisco Catalyst 9300 XE 16.12 UNIVERSAL	10	\$ -	\$ -
14	Cisco	PWR-C1-1100WAC/2	1100W AC Config 1 Secondary Power Supply	10	\$ 1,323.74	\$ 13,237.36
15	Cisco	CAB-TA-NA	North America AC Type A Power Cable	10	\$ -	\$ -
16	Cisco	NETWORK-PNP-LIC	Network Plug-n-Play Connect for zero-touch device deployment	10	\$ -	\$ -
17	Cisco	STACK-T1-1M	1M Type 1 Stacking Cable	10	\$ 139.34	\$ 1,393.36
18	Cisco	STACK-T1-50CM	50CM Type 1 Stacking Cable	10	\$ 69.67	\$ 696.68
19	Cisco	C9300-NM-8X	Catalyst 9300 8 x 10GE Network Module	10	\$ 1,776.60	\$ 17,766.00
20	Cisco	SFP-10G-LR=	10GBASE-LR SFP Module	10	\$ 2,876.01	\$ 28,760.05
21						
22	Cisco	C9500-48X-A	Cisco Catalyst 9500 48-port 10G bundle, Network Advantage { Aggregation Switch }	1	\$ 18,393.04	\$ 18,393.04
23	Cisco	CON-SNT-C95048XA	SNTC-8X5XNBD Catalyst 9500 48-port 10G bundle, Networ	1	\$ 2,049.04	\$ 2,049.04
24	Cisco	C9500-NW-A	C9500 Network Stack, Advantage	1	\$ -	\$ -
25	Cisco	C9500-NM-8X	Cisco Catalyst 9500 8 x 10GE Network Module	1	\$ 2,856.49	\$ 2,856.49
26	Cisco	SWATCH-T	StealthWatch 1 FPS Term License	50	\$ -	\$ -
27	Cisco	SWATCH-TRK-3Y	ISE BASE Tracker Term 3Y	50	\$ -	\$ -
28	Cisco	S9500UK9-169	UNIVERSAL	2	\$ -	\$ -
29	Cisco	ISE-PLS-T	ISE PLS Term License	50	\$ -	\$ -
30	Cisco	ISE-PLS-TRK-3Y	ISE PLS Tracker Term 3Y	50	\$ -	\$ -
31	Cisco	PWR-C4-950WAC-R	950W AC Config 4 Power Supply front to back cooling	2	\$ -	\$ -
32	Cisco	C9500-DNA-40X-P	C9500 DNA Premier, 40X Port , Term License	2	\$ -	\$ -
33	Cisco	C9500-DNA-P-3Y	C9500 DNA Premier 40X/24Q/48Y4C/32C/32QC ,3Year Term License	1	\$ 9,022.34	\$ 9,022.34
34	Cisco	ISE-BASE-T	ISE BASE Term License	50	\$ -	\$ -
35	Cisco	ISE-BASE-TRK-3Y	ISE BASE Tracker Term 3Y	50	\$ -	\$ -
36	Cisco	PWR-C4-950WAC-R/2	950W AC Config 4 Power Supply front to back cooling	1	\$ 1,463.09	\$ 1,463.09

37	Cisco	PI-LFAS-T	Prime Infrastructure Lifecycle & Assurance Term - Smart Lic	6	\$	-	\$	-
38	Cisco	PI-LFAS-AP-T-3Y	PI Dev Lic for Lifecycle & Assurance Term 3Y	6	\$	-	\$	-
39	Cisco	CAB-TA-NA	North America AC Type A Power Cable	4	\$	-	\$	-
40	Cisco	SFP-10G-LR	10GBASE-LR SFP Module	20	\$	2,876.01	\$	57,520.10
41	Cisco	SFP-H10GB-CU3M	10GBASE-CU SFP+ Cable 3 Meter	2	\$	75.94	\$	151.89
42	Cisco	NETWORK-PNP-LIC	Network Plug-n-Play Connect for zero-touch device deployment	2	\$	-	\$	-
43	Cisco	SFP-10G-AOC3M=	10GBASE Active Optical SFP+ Cable, 3M	1	\$	164.42	\$	164.42
CORE AND EDGE SWITCHING				CORE AND EDGE SWITCHING		\$	281,100.15	
DHCP / DNS SERVICES APPLIANCE								
44			To Be Provided By Apogee	0	\$	-	\$	-
45				0	\$	-	\$	-
DHCP / DNS SERVICES APPLIANCE				DHCP / DNS APPLIANCE		\$	-	
ENCLOSURES AND UPS								
46	APC	SRT5KRMXLT	APC Smart-UPS SRT 5000VA RM 208V	8	\$	3,422.00	\$	27,376.00
47	Chatsworth	12419-736	Chatsworth CUBE-IT 24inW x 30inD x 36in H 19RU #12-24 rails; Tempered Glass door { Catwalk IDF cab	2	\$	801.30	\$	1,602.60
48	APC	AP9571A	APC Rack PDU Basic 1U, 30A, 208V, (10) C13	8	\$	260.00	\$	2,080.00
49	Ortronics	SHMC2RU	Horizontal Cable Manager, Single Sided, 19" 2RU	21	\$	60.00	\$	1,260.00
ENCLOSURES AND UPS				ENCOLOSURES AND UPS		\$	32,318.60	
MOBILITY CONTROLLER								
50		VM Server	VM Server cluster to run MM and Airwave via ESXI Virtual Server	2	\$	7,000.00	\$	14,000.00
51	Hewlett Packard	JY895AAE	Aruba MM-VA-500 Mob Mstr SW E-LTU	1	\$	4,408.03	\$	4,408.03
52	Hewlett Packard	H8UE3E	Aruba 3Y FC 24x7 ED/R MM-VA-500 ELTU SVC	1	\$	2,450.35	\$	2,450.35
53	Hewlett Packard	JW752A	Aruba 7220 (US) Controller	2	\$	11,243.74	\$	22,487.47
54	Hewlett Packard	H7VHOE	Aruba 3Y FC NBD Exch ED/R 7220 Cntrl SVC	2	\$	5,954.93	\$	11,909.86
55	Hewlett Packard	JW657A	Aruba PSU-350-AC 350W AC Power Supply	2	\$	218.41	\$	436.82
56	Hewlett Packard	JW124A	PC-AC-NA North America AC Power Cord	4	\$	2.10	\$	8.40
57	Hewlett Packard	JW092A	10GBASE-LR LC Connector SFP+ XCVR	4	\$	1,100.44	\$	4,401.74
58	Hewlett Packard	JW471AAE	Aruba Cntrlr Per AP Ent Lic Bundle E-LTU	158	\$	126.00	\$	19,908.00
59	Hewlett Packard	H2XW3E	Aruba 1Y FC 24x7 License Cn Bundle SVC	158	\$	45.32	\$	7,161.19
60	Hewlett Packard	JW546AAE	Aruba AirWave 1 Device Lic E-LTU	17	\$	31.50	\$	535.50
MOBILITY CONTROLLER				MOBILITY CONTROLLER		\$	87,707.37	
ACCESS POINTS AND ANTENNAS								
61	Hewlett Packard	JZ332A	Aruba AP-534 (US) Unified AP	16	\$	659.42	\$	10,550.78
62	Hewlett Packard	JW018A	AP-ANT-45 2.4/5G 5dBi 4x4 Panel	16	\$	199.50	\$	3,192.00
63	Hewlett Packard	Q9G71A	AP-MNT-MP10-D *10-pack AP mount bracket	2	\$	109.20	\$	218.40
64	Hewlett Packard	JW022A	AP-ANT-MNT-5 Antenna Mount	16	\$	46.21	\$	739.39
65	Hewlett Packard	JZ337A	Aruba AP-535 (US) Dual Radio 4x4:4 802.1	64	\$	659.42	\$	42,203.14
66	Hewlett Packard	Q9G71A	AP-MNT-MP10-D *10-pack AP mount bracket	7	\$	109.20	\$	764.40
67	Hewlett Packard	JZ368A	AP-535-CVR-20 20-pack Snap-on Covers	4	\$	109.20	\$	436.80
68	Hewlett Packard	R4H23A	Aruba AP-577 (US) Outdoor 11ax AP	12	\$	924.02	\$	11,088.29
69	Hewlett Packard	JW054A	AP-270-MNT-H1 270 Series Mt Kit	12	\$	56.70	\$	680.40
70	Hewlett Packard	R4H13A	Aruba AP-574 (US) Outdoor 11ax AP	66	\$	747.62	\$	49,343.18
71	Hewlett Packard	JX988A	ANT-4x4-5314 5G 14dBi Panel	66	\$	306.61	\$	20,236.39
72	Hewlett Packard	JW055A	AP-270-MNT-H2 270 Series Mt Kit	66	\$	29.41	\$	1,941.19
73	Hewlett Packard	JW064A	AFC7DL03-00 3M 7D Antenna Cable	264	\$	21.01	\$	5,547.17
ACCESS POINTS AND ANTENNAS				ACCESS POINTS AND ANTENNAS		\$	146,941.54	
Captive Portal								
74	Hewlett Packard	JZ509A	Aruba ClearPass C2000 DL20 Gen9 HW Appliance	1	\$	6,174.18	\$	6,174.18

75	Hewlett Packard	H9UK6E	Aruba 3Y FC NBD Exch CP C2k DL20 ApplSVC [for JZ509A]	1	\$	6,775.04	\$	6,775.04
76	Hewlett Packard	JX923A	Aruba ClearPass DL20 Spare PSU	1	\$	331.80	\$	331.80
77	Hewlett Packard	JZ405AAE	Aruba ClearPass NL AC 10K CE E-LTU	1	\$	46,201.32	\$	46,201.32
78	Hewlett Packard	HT9B1E	Aruba 3Y FC 24x7 ClearPass NL AC10KCESVC [for JZ405AAE]	1	\$	23,671.84	\$	23,671.84
79	Hewlett Packard	JW470AAE	Aruba ClearPass Guest Custom Skin E-LTU	1	\$	1,890.05	\$	1,890.05
Captive Portal						CAPTIVE PORTAL	\$	85,044.23
STRUCTURED CABLE								
80	SUPERIOR ESSEX	6H272D	Cat6A Cabling (Plenum)	31	\$	701.00	\$	21,731.00
81	ORTRONICS	OR-40300548	Cat6A Face plates (2 Port) Trac Jack	250	\$	2.09	\$	522.50
82	ORTRONICS	OR-TJ610-68	Cat6A Jacks (Single)	500	\$	15.78	\$	7,890.00
83	ORTRONICS	OR-40300546	Cat6A Face plates (4-Port) Trac Jack	250	\$	2.09	\$	522.50
84	ORTRONICS	OR-PHDHJU24	24 Port Flat Modular Patch Panel (Unloaded)HD	37	\$	78.00	\$	2,886.00
85	ORTRONICS	OR-HDJ6A-45	High Density Patch panel Jacks (Green) Modular	768	\$	17.00	\$	13,056.00
86	ORTRONICS	MC6A03-06	Patch Cords { 3m for End Devices and IDF Patch Panels }	600	\$	13.00	\$	7,800.00
STRUCTURED CABLE						STRUCTURED CABLE	\$	54,408.00
INSTALLATION, MATERIALS AND LABOR								
87	Integrator	Materials	Materials	1	\$	58,918.00	\$	58,918.00
88	Integrator	Installation Labor	Installation Labor	1	\$	99,366.00	\$	99,366.00
89	Integrator	Structured Cable Labor	Per Drop Rate	158	\$	345.00	\$	54,510.00
90	Integrator	Project Management	Project Management & Construction Management	1	\$	50,000.00	\$	50,000.00
91	Integrator	Engineering	Engineering	1	\$	90,000.00	\$	90,000.00
92	Integrator	Configuration	Configuration	1	\$	69,000.00	\$	69,000.00
93	Integrator	Tuning & Optimization	Tuning & Optimization/ Live Event Support (5 Live Events - Onsite Support)	1	\$	77,400.00	\$	77,400.00
94	Integrator	Travel and Expenses	Travel and Expenses	1	\$	60,580.00	\$	60,580.00
95	Integrator	AP Custom Paint for Stealthling	* Cost per AP not included in pricing calculation. Qty determined by client's need.	1	\$	200.00	\$	-
INSTALLATION, MATERIALS AND LABOR						INSTALLATION, MATERIALS AND LABOR	\$	559,774.00
MANAGED SERVICES (MANAGED SERVICES AND ISP ONLY)								
Managed Services (SLA to be proposed with pricing) and ISP circuits.				Months		Monthly Cost		Annual Cost
	Apogee		Year 1	12	\$	3,608.00	\$	43,296.00
			Year 2	12	\$	3,746.91	\$	44,962.92
			Year 3	12	\$	3,891.16	\$	46,693.92
						OPTION 1 (MAN. SRVC, ISP)	\$	134,952.84
SUMMARY - BASE NETWORK COST								
BASE NETWORK COST TOTAL						BASE NETWORK COST TOTAL	\$	1,382,246.73
OPTION 1: EVENT SUPPORT / EVENT RATE (EVENT SUPPORT ONLY)								
Remote Monitoring and Event Support (Assumes 120 events annually) - Assume Remote Event Monitoring Only				1	\$	720.00	\$	86,400.00
Subtotal						Subtotal	\$	86,400.00
OPTION 1: EVENT SUPPORT / EVENT RATE (EVENT SUPPORT ONLY)						OPTION 3 - EVENT SUPPORT / RATE	\$	86,400.00

Aruba Foundation Care and Cisco DNA Support for Atlantic Union Bank Center Wi-Fi project, extracted from full Pricing List

REF#	MFG	MODEL	DESCRIPTION		QTY.	UNIT	EXTENDED
8	Cisco	C9300-DNA-A-48	C9300 DNA Advantage, 48-Port Term Licenses		10	0	0
9	Cisco	C9300-DNA-A-48-3Y	C9300 DNA Advantage, 48-Port, 3 Year Term License		10	2626.5762	26265.762
10	Cisco	C9300-DNA-A-48	C9300 DNA Advantage, 48-Port Term Licenses		10	0	0
24	Cisco	C9500-NW-A	C9500 Network Stack, Advantage Lic		1	0	0
27	Cisco	SWATCH-TRK-3Y	ISE BASE Tracker Term 3Y		50	0	0
30	Cisco	ISE-PLS-TRK-3Y	ISE PLS Tracker Term 3Y		50	0	0
32	Cisco	C9500-DNA-40X-P	C9500 DNA Premier, 40X Port , Term License		2	0	0
33	Cisco	C9500-DNA-P-3Y	C9500 DNA Premier 40X/24Q/48Y4C/32C/32QC ,3Year Term License		1	9022.3362	9022.3362
35	Cisco	ISE-BASE-TRK-3Y	ISE BASE Tracker Term 3Y		50	0	0
38	Cisco	PI-LFAS-AP-T-3Y	PI Dev Lic for Lifecycle & Assurance Term 3Y		6	0	0
52	Hewlett Packard Enterprise	H8UE3E	Aruba 3Y FC 24x7 ED/R MM-VA-500 ELTU SVC		1	2450.352	2450.352
54	Hewlett Packard Enterprise	H7VH0E	Aruba 3Y FC NBD Exch ED/R 7220 Cntrl SVC		2	5954.928	11909.856
59	Hewlett Packard Enterprise	H2XW3E	Aruba 1Y FC 24x7 License Cn Bundle SVC		158	45.324	7161.192
Option 2: Captive Portal - Option							
91	Hewlett Packard	H9UK6E	Aruba 3Y FC NBD Exch CP C2k DL20 ApplSVC [for JZ509A]		1	\$ 6,775.04	\$ 6,775.04
94	Hewlett Packard	HT9B1E	Aruba 3Y FC 24x7 ClearPass NL AC10KCESVC [for JZ405AAE]		1	\$ 23,671.84	\$ 23,671.84

Optional Yearly Event Walk

Option for MSB to perform yearly Event Walk							
**	Integrator	Annual RF checkup	Event walk, ekahau scan and analysis, provide recommendations to JMU		1	\$ 6,683.00	\$ 6,683.00

ATTACHMENT H

James Madison University Information Technology Services Addendum

M S Benbow & Associates Professional Engineering

CONTRACTOR NAME: Corporation

PRODUCT/SOLUTION: Wi-Fi & LAN Network

Definitions:

- Agreement: The "Agreement" includes the contract, this addendum and any additional addenda and attachments to the contract, including the Contractor's Form.
 - University: "University" or "the University" means James Madison University, its trustees, officers and employees.
 - University Data: "University Data" is defined as any data that the Contractor creates, obtains, accesses, transmits, maintains, uses, processes, stores or disposes of in performance of the Agreement. It includes all Personally Identifiable Information and other information that is not intentionally made generally available by the University on public websites.
 - Personally Identifiable Information: "Personally Identifiable Information" (PII) includes but is not limited to: Any information that directly relates to an individual and is reasonably likely to enable identification of that individual or information that is defined as PII and subject to protection by James Madison University under federal or Commonwealth of Virginia law.
 - Security Breach: "Security Breach" means a security-relevant event in which the security of a system or procedure involving University Data is breached, and in which University Data is exposed to unauthorized disclosure, access, alteration, or use.
 - Service(s): "Service" or "Services" means any goods or services acquired by the University from the Contractor.
1. **Rights and License in and to University Data**: The parties agree that as between them, all rights including all intellectual property rights in and to University Data shall remain the exclusive property of the University, and Contractor has a limited, nonexclusive license to use the data as provided in the Agreement solely for the purpose of performing its obligations hereunder. The Agreement does not give a party any rights, implied or otherwise, to the other's data, content, or intellectual property.
 2. **Disclosure**: All goods, products, materials, documents, reports, writings, video images, photographs, or papers of any nature including software or computer images prepared or provided to the Contractor (or its subcontractors) for the University will not be disclosed to any other person or entity without the written permission of the University.
 3. **Data Privacy**:
 - a. Contractor will use University Data only for the purpose of fulfilling its duties under the Agreement and will not share such data with or disclose it to any third party without the prior written consent of the University, except as required by law.
 - b. University Data will not be stored outside the United States without prior written consent from the University.

- c. Contractor will provide access to University Data only to its employees and subcontractors who need to access the data to fulfill obligations under the Agreement. The Contractor will ensure that the Contractor's employees, and subcontractors when applicable, who perform work under the Agreement have received appropriate instruction as to how to comply with the data protection provisions of the Agreement and have agreed to confidentiality obligations at least as restrictive as those contained in this Addendum.
 - i. If the Contractor will have access to the records protected by the Family Educational Rights and Privacy Act (FERPA), Contractor acknowledges that for the purposes of the Agreement it will be designated as a "school official" with "legitimate educational interests" in such records, as those terms have been defined under FERPA and its implementing regulations, and Contractor agrees to abide by the limitations and requirements imposed on school officials. Contractor will use such records only for the purpose of fulfilling its duties under the Agreement for University's and its End Users' benefit, and will not share such data with or disclose it to any third party except as required by law or authorized in writing by the University. Contractor acknowledges that its access to such records is limited to only those directly related to and necessary for the completion of Contractor's duties under the Agreement.
- d. The Contractor shall be responsible and liable for the acts and omissions of its subcontractors, including but not limited to third-party cloud hosting providers, and shall assure compliance with the requirements of the Agreement.

4. Data Security:

- a. Contractor will store and process University Data in accordance with commercial best practices, including appropriate administrative, physical, and technical safeguards, to secure such data from unauthorized access, disclosure, alteration, and use. Such measures will be no less protective than those used to secure Contractor's own data of a similar type, and in no event less than reasonable in view of the type and nature of the data involved.
- b. Contractor will store and process University Data in a secure site and will provide a SOC 2 or other security report deemed sufficient by the University from a third party reviewer along with annual updated security reports. If the Contractor is using a third-party cloud hosting company such as AWS, Rackspace, etc., the Contractor will obtain the security audit report from its hosting company and give the results to the University. The University should not have to request the report directly from the hosting company.
- c. Contractor will use industry-standards and up-to-date security tools, technologies and practices such as network firewalls, anti-virus, vulnerability scans, system logging, intrusion detection, 24x7 system monitoring, and third-party penetration testing in providing services under the Agreement.
- d. Without limiting the foregoing, Contractor warrants that all electronic University Data will be encrypted in transmission (including via web interface) and stored at AES 256 or stronger.

5. Data Authenticity, Integrity and Availability:

- a. Contractor will take reasonable measures, including audit trails, to protect University Data against deterioration or degradation of data quality and authenticity. Contractor shall be responsible for ensuring that University Data, per the Virginia Public Records

Act, is “preserved, maintained, and accessible throughout their lifecycle, including converting and migrating electronic records as often as necessary so that information is not lost due to hardware, software, or media obsolescence or deterioration.”

- b. Contractor will ensure backups are successfully completed at the agreed interval and that restoration capability is maintained for restoration to a point-in-time and/or to the most current backup available.
- c. Contractor will maintain an uptime of 99.99% or greater as agreed to for the contracted services via the use of appropriate redundancy, continuity of operations and disaster recovery planning and implementations, excluding regularly scheduled maintenance time.

6. Employee Background Checks and Qualifications:

- a. Contractor shall ensure that its employees have undergone appropriate background screening and possess all needed qualifications to comply with the terms of the Agreement including but not limited to all terms relating to data and intellectual property protection.
- b. If the Contractor must under this agreement create, obtain, transmit, use, maintain, process, or dispose of the subset of University Data known as Personally Identifiable Information or financial or business data, the Contractor shall perform the following background checks on all employees who have potential to access such data in accordance with the Fair Credit Reporting Act: Social Security Number trace; seven (7) year felony and misdemeanor criminal records check of federal, state, or local records (as applicable) for job related crimes; Office of Foreign Assets Control List (OFAC) check; Bureau of Industry and Security List (BIS) check; and Office of Defense Trade Controls Debarred Persons List (DDTC).

7. Security Breach:

- a. Response: Immediately (within one day) upon becoming aware of a Security Breach, or of circumstances that could have resulted in unauthorized access to or disclosure or use of University Data, Contractor will notify the University, fully investigate the incident, and cooperate fully with the University’s investigation of and response to the incident. Except as otherwise required by law, Contractor will not provide notice of the incident directly to individuals whose Personally Identifiable Information was involved, regulatory agencies, or other entities, without prior written permission from the University.
- b. Liability:
 - i. If Contractor must under this agreement create, obtain, transmit, use, maintain, process, or dispose of the subset of University Data known as Personally Identifiable Information, the following provisions apply. In addition to any other remedies available to the University under law or equity, Contractor will reimburse the University in full for all costs incurred by the University in investigation and remediation of any Security Breach caused by Contractor, including but not limited to providing notification to individuals whose Personally Identifiable Information was compromised and to regulatory agencies or other entities as required by law or contract; providing one year’s credit monitoring to the affected individuals if the Personally Identifiable Information exposed during the breach could be used to commit financial identity theft; and the payment of legal fees, audit costs, fines, and other fees imposed by regulatory agencies or contracting partners as a result of the Security Breach.

- ii. If Contractor will NOT under this agreement create, obtain, transmit, use, maintain, process, or dispose of the subset of University Data known as Personally Identifiable Information, the following provisions apply. In addition to any other remedies available to the University under law or equity, Contractor will reimburse the University in full for all costs reasonably incurred by the University in investigation and remediation of any Security Breach caused by Contractor.

8. Requests for Data, Response to Legal Orders or Demands for Data:

- a. Except as otherwise expressly prohibited by law, Contractor will:
 - i. immediately notify the University of any subpoenas, warrants, or other legal orders, demands or requests received by Contractor seeking University Data;
 - ii. consult with the University regarding its response;
 - iii. cooperate with the University's requests in connection with efforts by the University to intervene and quash or modify the legal order, demand or request; and
 - iv. Upon the University's request, provide the University with a copy of its response.
- b. Contractor will make itself and any employees, contractors, or agents assisting in the performance of its obligations under the Agreement, available to the University at no cost to the University based upon claimed violation of any laws relating to security and/or privacy of the data that arises out of the Agreement. This shall include any data preservation or eDiscovery required by the University.
- c. The University may request and obtain access to University Data and related logs at any time for any reason and at no extra cost.

9. Data Transfer Upon Termination or Expiration:

- a. Contractor's obligations to protect University Data shall survive termination of the Agreement until all University Data has been returned or securely destroyed, meaning taking actions that render data written on media unrecoverable by both ordinary and extraordinary means.
- b. Upon termination or expiration of the Agreement, Contractor will ensure that all University Data are securely transferred, returned or destroyed as directed by the University in its sole discretion within 60 days of termination of the Agreement. Transfer/migration to the University or a third party designated by the University shall occur without significant interruption in service. Contractor shall ensure that such transfer/migration uses facilities, methods, and data formats that are accessible and compatible with the relevant systems of the University or its transferee, and to the extent technologically feasible, that the University will have reasonable access to University Data during the transition.
- c. In the event that the University requests destruction of its data, Contractor agrees to securely destroy all data in its possession and in the possession of any subcontractors or agents to which Contractor might have transferred University data. Contractor agrees to provide documentation of data destruction to the University.
- d. Contractor will notify the University of impending cessation of its business and any contingency plans. This includes immediate transfer of any previously escrowed assets and data and providing the University access to Contractor's facilities to remove and destroy University-owned assets and data. Contractor shall implement its exit plan and take all necessary actions to ensure a smooth transition of service with minimal disruption to the University. The Contractor will also provide, as

applicable, a full inventory and configuration of servers, routers, other hardware, and software involved in service delivery along with supporting documentation, indicating which if any of these are owned by or dedicated to the University. Contractor will work closely with its successor to ensure a successful transition to the new service, with minimal downtime and effect on the University, all such work to be coordinated and performed in advance of the formal, final transition date.

10. Audits:

- a. The University reserves the right in its sole discretion to perform audits of the Contractor to ensure compliance with the terms of the Agreement. Contractor shall reasonably cooperate in the performance of such audits. This provision applies to all agreements under which Contractor must create, obtain, transmit, use, maintain, process, or dispose of University Data.
- b. If Contractor must under the Agreement create, obtain, transmit, use, maintain, process, or dispose of the subset of University Data known as Personally Identifiable Information or financial or business data, Contractor will at its expense conduct or have conducted at least annually a(n):
 - i. American Institute of CPAs Service Organization Controls 2 (SOC 2) audit, or other independent security audit with audit objectives deemed sufficient by the University, which attests to Contractor's security policies, procedures, and controls. Contractor shall also submit such documentation for any third-party cloud hosting provider(s) they may use (e.g. AWS, Rackspace, Azure, etc.) and for all subservice providers or business partners relevant to the Agreement. Contractor shall also provide James Madison University with a designated point of contact for the SOC reports and risks related to the contract. This person shall address issues raised in the SOC reports of the Contractor and its relevant providers and partners, and respond to any follow up questions posed by the University in relation to technology systems, infrastructure, or information security concerns related to the contract.
 - ii. vulnerability scan of Contractor's electronic systems and facilities that are used in any way to deliver electronic services under the Agreement; and
 - iii. formal penetration test performed by qualified personnel of Contractor's electronic systems and facilities that are used in any way to deliver electronic services under the Agreement.
- c. Additionally, Contractor will provide the University upon request the results of the above audits, scans and tests, and will promptly modify its security measures as needed based on those results in order to meet its obligations under the Agreement. The University may require, at University expense, the Contractor to perform additional audits and tests, the results of which will be provided promptly to the University.

11. Compliance:

- a. Contractor will comply with all applicable laws and industry standards in performing services under the Agreement. Any Contractor personnel visiting the University's facilities will comply with all applicable University policies regarding access to, use of, and conduct within such facilities. The University will provide copies of such policies to Contractor upon request.
- b. To the extent applicable to the design and intended use of the service, Contractor warrants that the service it will provide to the University is fully compliant with and will enable the University to be compliant with relevant requirements of all laws,

regulation, and guidance applicable to the University and/or Contractor, including but not limited to: the Family Educational Rights and Privacy Act (FERPA), Health Insurance Portability and Accountability Act (HIPAA), Health Information Technology for Economic and Clinical Health Act (HITECH), Gramm-Leach-Bliley Financial Modernization Act (GLB), Payment Card Industry Data Security Standards (PCI-DSS), Americans with Disabilities Act (ADA), Federal Export Administration Regulations, and Defense Federal Acquisitions Regulations.

12. **No End User Agreements:** Any agreements or understandings, whether electronic, click through, verbal or in writing, between Contractor and University employees or other end users under the Agreement that conflict with the terms of the Agreement, including but not limited to this Addendum, shall not be valid or binding on the University or any such end users.

IN WITNESS WHEREOF, the parties have caused this addendum to be duly executed, intending thereby to be legally bound. In the event of conflict or inconsistency between terms of the Agreement and this Addendum, the terms of this Addendum shall prevail.

JAMES MADISON UNIVERSITY

SIGNATURE: 

PRINTED
NAME: Colleen Johnson

TITLE: Buyer Specialist

DATE: 7/22/2020

CONTRACTOR

SIGNATURE: 

PRINTED NAME: Leo L. Holzerthal, Jr.

TITLE: President

DATE: 1/13/20

January 13, 2020

**James Madison University
MSC 5720
752 Ott Street, Room 1042
Wine Price Building
Harrisonburg, Virginia 22807**

Attention: Ms. Colleen Johnson – Buyer Specialist Procurement Services

**Reference: James Madison University - Atlantic Union Bank Center, High
Density Wireless Network Request for Proposal #CMJ-1068
MSB Proposal No. 2020KMW2004, Letter no. 200008**

Dear Ms. Johnson,

M S Benbow & Associates ('MSB') is pleased to respond to James Madison University's ('JMU'), High Density Wireless Network Request for Proposal #CMJ-1068 ('RFP') for Atlantic Union Bank Center ('Center'). MSB has extensive experience with Large Public Venue, High Density, capacity driven network design, construction, integration and support services projects.

Since 1978, MSB has been building one of the Gulf South's most respected and versatile multi-discipline engineering corporations, providing professional engineering and consulting services to major private and public sector clients throughout the nation. MSB supports projects from coast to coast from our offices in New Orleans, LA, Houston and Dallas, TX.

Born from the energy sector, MSB's innovative thinking in telecommunications and technology, electrical power and instrumentation & controls systems has led to thousands of successful outcomes for a wide range of clients who require complete solutions to complex engineering projects. From public utilities, municipalities, and manufacturing facilities to some of the most notable refineries, airports, convention centers, campuses, and large public venues in the United States, MSB delivers detailed engineering, technical expertise and comprehensive project management for every project.

MSB provides engineering consulting with a tremendous focus on solutions that align with client and project needs. Simply put, our recommendations deliver world class solutions for world class projects using relationships with all of the leading equipment manufacturers. Our success is built on the responsiveness, attention to detail and dedication of our engineering and support staff who provide a wide array of capabilities in conceptual design, analysis, detailed design, execution and maintenance from the early stages of project planning to final commissioning and acceptance. At MSB, Senior Engineering Consultants are personally involved in all aspects of our clients' work and lead the effort in combination with our project management staff. Our team of over 100 employees holds professional engineering registrations in over 30 states including Virginia.

MSB has earned recognition from clients and industry leaders for its technical excellence and outstanding safety record by creating an employee culture that cultivates innovation and transcends safety and efficiency standards. MSB has successfully delivered High Density Wi-Fi and LAN project for a variety of clients including NFL, NBA, MLS, Collegiate and private venues.

We have worked diligently for many years to build a reputation for best-in-class engineering solutions, and we would be honored to leverage our extensive Wi-Fi and network upgrade experience for JMU on this exciting project.

We appreciate the opportunity to provide this response and look forward to your review and feedback. If you have any questions or need additional information, please let me know.

Sincerely,

M S Benbow & Associates

Kenneth M. Wright

Kenneth M. Wright, P.E.

Director



Request for Proposal

RFP# CMJ-1068

**ATLANTIC UNION BANK CENTER
– HIGH DENSITY WIRELESS NETWORK**

December 2, 2019



REQUEST FOR PROPOSAL
RFP# CMJ-1068

Issue Date: December 2, 2019
Title: ATLANTIC UNION BANK CENTER - AV SYSTEMS PACKAGE
Issuing Agency: Commonwealth of Virginia
James Madison University
Procurement Services MSC 5720
752 Ott Street, Wine Price Building
First Floor, Suite 1023
Harrisonburg, VA 22807

Period of Contract: From Date of Award Through One Year (Renewable)

Sealed Proposals Will Be Received Until 2:00 PM on January 14, 2020 for Furnishing The Services Described Herein.

SEALED PROPOSALS MAY BE MAILED, EXPRESS MAILED, OR HAND DELIVERED DIRECTLY TO THE ISSUING AGENCY SHOWN ABOVE.

All Inquiries For Information And Clarification Should Be Directed To: Colleen Johnson, Buyer Specialist, Procurement Services, johns9cm@jmu.edu; 540-568-3137; (Fax) 540-568-7935 not later than **January 3, 2020**.

NOTE: THE SIGNED PROPOSAL AND ALL ATTACHMENTS SHALL BE RETURNED.

In compliance with this Request for Proposal and to all the conditions imposed herein, the undersigned offers and agrees to furnish the goods/services in accordance with the attached signed proposal or as mutually agreed upon by subsequent negotiation.

Name and Address of Firm:

MS Benbow & Associates
2450 Severn Ave Suite 400
Mt Airie, LA 70001

By:



(Signature in Ink)

Name:

Leo L. Holzenthal, Jr.
(Please Print)

Date:

1/13/20

Title:

President

Web Address:

www.msbenbow.com

Phone:

(504) 836-8902

Email:

Leo@msbenbow.com

Fax #:

(504) 836-2088

ACKNOWLEDGE RECEIPT OF ADDENDUM: #1 ☒ #2 ☒ #3 ☐ #4 ☐ #5 ☐ (please initial)

CONTRACTOR/SUBCONTRACTOR LICENSE REQUIREMENT: By my signature on this solicitation, I certify that this firm/individual and subcontractor is properly licensed for providing the goods/services specified. License # Applied For Type Temporary Contractors License

SMALL, WOMAN OR MINORITY OWNED BUSINESS:

☐ YES; ☒ NO; IF YES $\Rightarrow \Rightarrow$ ☐ SMALL; ☐ WOMAN; ☐ MINORITY **IF MINORITY:** ☐ AA; ☐ HA; ☐ AsA; ☐ NW; ☐ Micro

Note: This public body does not discriminate against faith-based organizations in accordance with the Code of Virginia, § 2.2-4343.1 or against an offeror because of race, religion, color, sex, national origin, age, disability, or any other basis prohibited by state law relating to discrimination in employment.

REQUEST FOR PROPOSAL

RFP # CMJ-1068

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	E. Wi-Fi Exclusion Areas – attached as a separate PDF file		
	F. High-Density Wi-Fi Systems Pricing Form - attached as a separate Excel spreadsheet (<i>All Offerors are required to complete in addition to information requested in Section IV</i>)		
	G. 17963 JMU Convo Composite Set.zip (Click here for download 1.5g)		
	H. Information Technology Services Addendum (<i>All Offerors are required to complete</i>)		
	I. Higher Education Cloud Assessment Tool (HECVAT) Lite - attached as a separate Excel spreadsheet (<i>All Offerors are required to complete</i>)		

I. PURPOSE

The purpose of this Request for Proposal (RFP) is to solicit sealed proposals from qualified sources to enter into a contract to provide a Wi-Fi Systems Package for the Atlantic Bank Union Center for James Madison University (JMU), an agency of the Commonwealth of Virginia. Initial contract shall be for two (2) years with an option to renew for eight (8) additional one-year periods.

II. BACKGROUND

James Madison University (JMU) is a comprehensive public institution in Harrisonburg, Virginia with an enrollment of approximately 22,000 students and 4,000 faculty and staff. Further information about the University may be found at the following website: <http://www.jmu.edu>. The University sponsors an 18-sport intercollegiate athletics program that competes at The Division I level of the National Collegiate Athletic Association. JMU is also affiliated with the Colonial Athletic Association, of which it was a charter member in 1985, and with the Eastern College Athletic Conference.

James Madison University has invested heavily in its athletics facilities, highlighted by Bridgeforth Stadium/Zane Showker Field. In 2020, the Atlantic Union Bank Center will complete construction as the 8,500-seat home of JMU men's and women's basketball while also serving as a destination for numerous campus and community events with capacity potential for 10,000 for certain special event configurations. More details on the Atlantic Union Bank Center can be found at <https://jmusports.com/feature/AtlanticUnionBankCenter>.

III. SMALL, WOMAN-OWNED AND MINORITY PARTICIPATION

It is the policy of the Commonwealth of Virginia to contribute to the establishment, preservation, and strengthening of small businesses and businesses owned by women and minorities, and to encourage their participation in State procurement activities. The Commonwealth encourages contractors to provide for the participation of small businesses and businesses owned by women and minorities through partnerships, joint ventures, subcontracts, and other contractual opportunities. Attachment B contains information on reporting spend data with subcontractors.

IV. STATEMENT OF NEEDS

With the upcoming debut of the Atlantic Union Bank Center, JMU seeks proposals for a High Density Wi-Fi Network System Package. Project highlights can be found at: <https://jmusports.com/feature/AtlanticUnionBankCenter>.

NOTE: Offerors shall provide pricing information for the items listed in Section IV *Statement of Needs* and Attachment D *Performance Specifications* by returning Attachment F *Pricing Form (excel)* and providing additional information on pricing models or narrative as needed in Section X *Pricing Schedule* in the RFP document.

A. GENERAL INFORMATION:

1. The work contemplated in this RFP includes manufacture, supply, delivery, installation, labor, tools, engineering, supervision, licenses, insurance, permits, related services (including design) and testing of all equipment, and materials necessary to install and operate the High Density Wi-Fi Network as described in the RFP Documents, and more

particularly in Attachment D *Performance Specifications*.

2. Offerors responding to this RFP must provide pricing inclusive of cost for the provision and installation of all items necessary to provide finished and fully operational systems as specified in the Options in Attachment D Section 1.1.B. Materials, equipment and related services required for the provision and installation of such a system that are not expressly addressed in this RFP are understood to be the responsibility of the Offeror.
3. Offerors are clearly advised that any drawings, plans, charts or other materials, whether supplied by or on behalf of James Madison University, AJP, or third parties, describing aspects of the site provided as part of this document or otherwise are not to be considered as definitive or as a substitute for any information which would otherwise be obtained by the Offeror during negotiation.
4. Offerors must submit proposals for the complete package including all required equipment, installation and functional connection of all equipment as described in this document and related attachments. A proposal submitted in response to this RFP signifies the Offeror agrees to sell to the University the indicated products, in whole or in part, at the sole discretion of the University.
5. Contractor shall be responsible for day to day premises and facilities cleanup, including temporary storage, removal and disposal of debris, trash and rubbish caused by its employees, or installation material men or workmen. All tools, equipment and materials shall be secured upon completion of the day's work. Surplus materials shall be removed from the work site and stored in their appropriate location.
6. Contractor's personnel shall follow University standards and personal conduct codes while on the University's premises. A copy of those standards and codes will be provided to Contractor on request. Personnel found violating these standards or regulations will be asked to leave the work site and shall not be allowed to return.
7. It is Contractor's responsibility to guarantee that all items of hardware, services rendered or working environments meet or exceed those requirements and guidelines established by the Occupational Safety and Health Act (OSHA).
8. Contractor shall warrant and guarantee to the University, without limitations or qualification, that all equipment, components, materials, workmanship and the system as an entity shall conform to and perform in accordance with local building codes.

B. DELIVERY, STORAGE, AND SECUIRITY

1. The Contractor shall provide pricing for each item to include delivery to the site for all system components and related materials.
2. The Contractor shall coordinate delivery with the University.
3. The Contractor shall unload, uncrate, assemble, and transport each component to its desired location for installation and install the system on-site in accordance with on-site regulations.

4. The Contractor shall be responsible for the cleanup and disposal of all packaging materials and debris.
5. The Contractor shall be responsible for providing any temporary on-site storage for equipment and materials unless adequate on-site storage is available from the University.
6. The University shall not be responsible for security or insurance related to said equipment or materials, even if stored on-site at locations designated or approved by the University.
7. Any temporary storage requirements must be coordinated with the University.

C. DEFINITIONS:

1. “Substantial Completion” – shall be defined as all work under the Contract has been substantially completed in accordance with the terms of the Contract and the system is fully operational and ready for the intended use. Systems shall be installed, all rack equipment installed, all cabling completed, system has been commissioned and tested in accordance with applicable requirements of the Technical Specifications and the Contract. The project is ready for final punch list by the University and/or the University’s designated representative.
2. “Final Completion” – shall be defined as all punch list items have been completed and all work under the Contract is ready for final acceptance by the University once five (5) consecutive problem free events have been completed as defined by Section 3.6.B. of the Performance Specifications (Attachment D).

D. RESPONSE REQUIRED BY OFFERORS

1. Describe in detail offeror’s approach to provide the RFP parameters as laid out in the Performance Specifications, Attachment D.
 - a. Provide the following: In addition to proposing specifically for what is specified in this RFP, the Offeror is encouraged to furnish alternative solutions that may satisfy or complement the solution proposed in this RFP.

MSB Response: *MSB has provided a comprehensive solution that is based on utilizing products from both Aruba and Cisco to meet the requirements of the RFP. MSB has selected proven hardware products that have been utilized in several HD Wi-Fi project implementations across the country. In accordance with the Addendum, we have utilized 802.11 AC wave 2 rated AP’s for this implementation. Please note that MSB has implemented Aruba’s AX series AP’s successfully in LPV’s and if JMU is interested in discussing use of these products we would gladly provide insight on our experience.*

- b. Provide the following: Offerors are also encouraged to suggest alternative solutions that would reduce the overall cost without hindering the performance of the system from its intended use.

MSB Response: *MSB interpreted the specification to require the design to support a very high take rate in the bowl of the Center. MSB’s experience in large public venue Arenas for both professional sporting and collegiate venues have recorded take rates in the 30 – 45% range on average. If JMU was willing to reduce the take rate for this project, it*

would provide cost savings to the project. In addition, MSB recommends JMU consider utilizing Aruba's AX series AP's for this project. The AX series AP that includes external antenna connections will be released in Spring 2020. The AX technology provides spectral efficiency that will drive performance results for the bowl and bowl facing areas such as suites. The AX series Access Point will be priced comparably to the 300 series AP that is specified and deployment of this technology would provide JMU with a greater return on the investment by virtue of the Access Point not becoming technologically obsolete in the next couple of years.

2. Training:

- a. Describe all training included in project implementation (remote and/or on premises).

MSB Response: *MSB has included a 40 manhour allowance for a combination of both hands on, on-site training and remote training for the JMU staff. The training would cover the Wireless Controller, Airwave, Switches, DHCP/ DNS appliances and Firewalls. JMU has the option to elect where MSB focuses our training effort with the staff. In addition, Aruba, Cisco, Infoblox and Palo Alto offer training and certification courses on their hardware products. Manufacturer training isn't included in the base response but can be added to the proposal if JMU desires.*

- b. Describe all ongoing training options available (remote and/or on premises) for the duration of the contract.

MSB Response: *If JMU elects to utilize MSB for remote event support, we will include up to 4 hours per month for remote training of JMU's staff at no additional charge. In the event JMU requires additional onsite training of new or additional staff, MSB will provide training based on JMU's direction in accordance with our latest published rate schedule that is in effect at the time services are rendered.*

- c. Provide any associated training pricing for hourly and daily rates (to include travel costs for on premises training) in X. Pricing Schedule.

MSB Response: *Understood and Provided in Pricing Schedule.*

3. Describe the procedures for obtaining services for all types of maintenance and applicable "escalation" procedures for providing additional assistance in diagnosing a failure that is not resolved in a timely manner, to include notification procedures and timing as well as what higher levels of assistance will be made available.

MSB Response: *If JMU selects post implementation support services, MSB would provide technical support on the hardware implemented for this project. In the event post implementation support isn't selected, JMU has the option to engage MSB on an as needed basis for support or to contact the respective manufacturer for support and / or hardware replacement based on the service level agreement selected for each product.*

4. Provide a complete list of references for similar installations performed in the past three (3) years with name of facility, photo of installation, contact name, title, address and direct phone number.

MSB Response:

i. Liberty University

Arthur L. Williams Stadium

T. J. Norton - Wireless Network Architect

1971 University Blvd

Lynchburg, VA 24515

Phone: (434) 592-6552

ii. Northwestern University

Welsh-Ryan Arena

Chris Hart – Network Operations Engineer

2020 Ridge Ave

Evanston, IL 60209

(847) 467-7747

iii. Brigham Young University

Marriott Center

Justin Durfey – Director of Special Events

500 E University Parkway

Provo, UT 84604

(801) 422-6022

5. Provide a formal list of intended design professionals, sub-contractors and suppliers, including primary place of business, and estimated dollar amount. Contractor, subcontractors, and design professionals shall be licensed by appropriate Virginia authorities / board as appropriate and required by law. Proposals should include a statement indicating the licensing status of Contractor, subcontractors, and design professionals required to be licensed in Virginia and identified in your proposal.

MSB Response: *MSB intends to subcontract aspects of physical construction for this project. We have contacted two firms, Avia and CCTCI thus far for pricing. MSB will engage a licensed, approved contractor for this scope of work in accordance with the*

guidelines set forth in the RFP.

6. Provide an Equipment List with line item pricing.

MSB Response - *Comply.*

7. Provide product cut sheets and technical data for each item proposed.

MSB Response: - *Comply.*

8. Specify parts and labor warranty to include cost and length of service.

MSB Response: *MSB included 3-year support for all manufacturers products. Additional support terms are available and can be quoted separately.*

9. Provide the most recent SOC 2 Report available.

MSB Response: *At the time of this response, MSB doesn't have this report available.*

E. TENTATIVE SCHEDULE

1. The University anticipates delivery and installation will begin approximately **March 30, 2020**, subject to change based on overall project schedule, to be coordinated and confirmed by the awarded vendor with the University and General Contractor.
 - a. Describe, in detail, your ability to meet the tentative schedule provided.

V. PROPOSAL PREPARATION AND SUBMISSION

A. GENERAL INSTRUCTIONS

To ensure timely and adequate consideration of your proposal, offerors are to limit all contact, whether verbal or written, pertaining to this RFP to the James Madison University Procurement Office for the duration of this Proposal process. Failure to do so may jeopardize further consideration of Offeror's proposal.

1. RFP Response: In order to be considered for selection, the **Offeror shall submit a complete response to this RFP**; and shall submit to the issuing Purchasing Agency:
 - a. **One (1) original and fifteen (15) copies** of the entire proposal, INCLUDING ALL ATTACHMENTS. Any proprietary information should be clearly marked in accordance with 3.f. below.

MSB Response: *Understood and Comply.*

- b. **One (1) electronic copy in WORD format or searchable PDF** (*CD or flash drive*) of the entire proposal, INCLUDING ALL ATTACHMENTS. **Attachments F and I should additionally be returned as Excel files on a CD or flash drive.** Any proprietary information should be clearly marked in accordance with 3.f. below.

MSB Response: *Understood and Comply.*

- c. Should the proposal contain **proprietary information**, provide **one (1) redacted hard copy** of the proposal and all attachments with **proprietary portions removed or blacked out**. This copy should be clearly marked “*Redacted Copy*” on the front cover. The classification of an entire proposal document, line item prices, and/or total proposal prices as proprietary or trade secrets is not acceptable. JMU shall not be responsible for the Contractor’s failure to exclude proprietary information from this redacted copy.

MSB Response: *Understood and Comply.*

No other distribution of the proposal shall be made by the Offeror.

- 2. The version of the solicitation issued by JMU Procurement Services, as amended by an addenda, is the mandatory controlling version of the document. Any modification of, or additions to, the solicitation by the Offeror shall not modify the official version of the solicitation issued by JMU Procurement services unless accepted in writing by the University. Such modifications or additions to the solicitation by the Offeror may be cause for rejection of the proposal; however, JMU reserves the right to decide, on a case-by-case basis in its sole discretion, whether to reject such a proposal. If the modification or additions are not identified until after the award of the contract, the controlling version of the solicitation document shall still be the official state form issued by Procurement Services.
- 3. Proposal Preparation
 - a. Proposals shall be signed by an authorized representative of the Offeror. All information requested should be submitted. Failure to submit all information requested may result in the purchasing agency requiring prompt submissions of missing information and/or giving a lowered evaluation of the proposal. Proposals which are substantially incomplete or lack key information may be rejected by the purchasing agency. Mandatory requirements are those required by law or regulation or are such that they cannot be waived and are not subject to negotiation.
 - b. Proposals shall be prepared simply and economically, providing a straightforward, concise description of capabilities to satisfy the requirements of the RFP. Emphasis should be placed on completeness and clarity of content.
 - c. Proposals should be organized in the order in which the requirements are presented in the RFP. All pages of the proposal should be numbered. Each paragraph in the proposal should reference the paragraph number of the corresponding section of the RFP. It is also helpful to cite the paragraph number, sub letter, and repeat the text of the requirement as it appears in the RFP. If a response covers more than one page, the paragraph number and sub letter should be repeated at the top of the next page. The proposal should contain a table of contents which cross references the RFP requirements. Information which the offeror desires to present that does not fall within any of the requirements of the RFP should be inserted at the appropriate place or be

attached at the end of the proposal and designated as additional material. Proposals that are not organized in this manner risk elimination from consideration if the evaluators are unable to find where the RFP requirements are specifically addressed.

- d. As used in this RFP, the terms “must”, “shall”, “should” and “may” identify the criticality of requirements. “Must” and “shall” identify requirements whose absence will have a major negative impact on the suitability of the proposed solution. Items labeled as “should” or “may” are highly desirable, although their absence will not have a large impact and would be useful, but are not necessary. Depending on the overall response to the RFP, some individual “must” and “shall” items may not be fully satisfied, but it is the intent to satisfy most, if not all, “must” and “shall” requirements. The inability of an offeror to satisfy a “must” or “shall” requirement does not automatically remove that offeror from consideration; however, it may seriously affect the overall rating of the offeror’s proposal.
 - e. Each copy of the proposal should be bound or contained in a single volume where practical. All documentation submitted with the proposal should be contained in that single volume.
 - f. Ownership of all data, materials and documentation originated and prepared for the State pursuant to the RFP shall belong exclusively to the State and be subject to public inspection in accordance with the Virginia Freedom of Information Act. Trade secrets or proprietary information submitted by the offeror shall not be subject to public disclosure under the Virginia Freedom of Information Act; however, the offeror must invoke the protection of Section 2.2-4342F of the Code of Virginia, in writing, either before or at the time the data is submitted. The written notice must specifically identify the data or materials to be protected and state the reasons why protection is necessary. The proprietary or trade secret materials submitted must be identified by some distinct method such as highlighting or underlining and must indicate only the specific words, figures, or paragraphs that constitute trade secret or proprietary information. The classification of an entire proposal document, line item prices and/or total proposal prices as proprietary or trade secrets is not acceptable and will result in rejection and return of the proposal.
4. Oral Presentation: Offerors who submit a proposal in response to this RFP may be required to give an oral presentation of their proposal to James Madison University. This provides an opportunity for the Offeror to clarify or elaborate on the proposal. This is a fact-finding and explanation session only and does not include negotiation. James Madison University will schedule the time and location of these presentations. Oral presentations are an option of the University and may or may not be conducted. Therefore, proposals should be complete.

The University may request select offerors to provide a demonstration of the proposed solution on one of the following possible dates: February 4 or 5, 2020. Selected offerors will be given as much advanced notice as possible; however, all offerors should maintain flexibility in scheduling during these days.

B. SPECIFIC PROPOSAL INSTRUCTIONS

Proposals should be as thorough and detailed as possible so that James Madison University may properly evaluate your capabilities to provide the required services. Offerors are required to submit the following items as a complete proposal:

1. Return RFP cover sheet and all addenda acknowledgements, if any, signed and filled out as required.

MSB Response: [Understood and Comply.](#)

2. Plan and methodology for providing the goods/services as described in Section IV. Statement of Needs of this Request for Proposal.

MSB Response:

MSB has developed a structured approach to executing High Density, Large Public Venue, Wi-Fi and LAN projects over the past several years. The combination of our practical experience and manufacturer knowledgebase of various solutions positions our team to provide unbiased, expert design and consulting services that will be in alignment with JMU's project objectives. .

MSB has utilized the approach provided below successfully on a large variety of LPV projects. MSB is always open to refine and modify the approach to best fit every clients' individual project needs and requirements.

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[REDACTED]

[REDACTED]

3. A written narrative statement to include, but not be limited to, the expertise, qualifications, and experience of the firm and resumes of specific personnel to be assigned to perform the work.
4. Offeror Data Sheet, included as *Attachment A* to this RFP.
5. Small Business Subcontracting Plan, included as *Attachment B* to this RFP. Offeror shall provide a Small Business Subcontracting plan which summarizes the planned utilization of Department of Small Business and Supplier Diversity (SBSD)-certified small businesses which include businesses owned by women and minorities, when they have received Department of Small Business and Supplier Diversity (SBSD) small business certification, under the contract to be awarded as a result of this solicitation. This is a requirement for all prime contracts in excess of \$100,000 unless no subcontracting opportunities exist.

MSB Response: *MSB intends to identify and utilize SBSD firms for physical construction of the network if they have the skills and prior experience performing this type of work and have manpower that meets the scheduling aspects of the project.*

6. Identify the amount of sales your company had during the last twelve months with each VASCUPP Member Institution. A list of VASCUPP Members can be found at: www.VASCUPP.org.

MSB Response: *MSB has not worked with any of the member institutions in the past 12 months.*

7. Proposed Cost. See Section X. Pricing Schedule of this Request for Proposal.

MSB Response: *Comply.*

VI. EVALUATION AND AWARD CRITERIA

A. EVALUATION CRITERIA

Proposals shall be evaluated by James Madison University using the following criteria:

1. Quality of products/services offered and suitability for intended purposes
2. Qualifications and experience of Offeror in providing the goods/services
3. Specific plans or methodology to be used to perform the services
4. Participation of Small, Women-Owned, & Minority (SWaM) Businesses
5. Cost

Allocation of points for evaluation criteria will be published to the eVA solicitation posting prior to the closing date and time.

- B. **AWARD TO MULTIPLE OFFERORS:** Selection shall be made of two or more offerors deemed to be fully qualified and best suited among those submitting proposals on the basis of the evaluation factors included in the Request for Proposals, including price, if so stated in the Request for Proposals. Negotiations shall be conducted with the offerors so selected. Price shall be considered, but need not be the sole determining factor. After negotiations have been conducted with each offeror so selected, the agency shall select the offeror which, in its opinion, has made the best proposal, and shall award the contract to that offeror. The Commonwealth reserves the right to make multiple awards as a result of this solicitation. The Commonwealth may cancel this Request for Proposals or reject proposals at any time prior to an award, and is not required to furnish a statement of the reasons why a particular proposal was not deemed to be the most advantageous. Should the Commonwealth determine in writing and in its sole discretion that only one offeror is fully qualified, or that one offeror is clearly more highly qualified than the others under consideration, a contract may be negotiated and awarded to that offeror. The award document will be a contract incorporating by reference all the requirements, terms and conditions of the solicitation and the contractor's proposal as negotiated.

VII. GENERAL TERMS AND CONDITIONS

- A. PURCHASING MANUAL: This solicitation is subject to the provisions of the Commonwealth of Virginia's Purchasing Manual for Institutions of Higher Education and Their Vendors and any revisions thereto, which are hereby incorporated into this contract in their entirety. A copy of the manual is available for review at the purchasing office. In addition, the manual may be accessed electronically at <http://www.jmu.edu/procurement> or a copy can be obtained by calling Procurement Services at (540) 568-3145.
- B. APPLICABLE LAWS AND COURTS: This solicitation and any resulting contract shall be governed in all respects by the laws of the Commonwealth of Virginia and any litigation with respect thereto shall be brought in the courts of the Commonwealth. The Contractor shall comply with applicable federal, state and local laws and regulations.
- C. ANTI-DISCRIMINATION: By submitting their proposals, offerors certify to the Commonwealth that they will conform to the provisions of the Federal Civil Rights Act of 1964, as amended, as well as the Virginia Fair Employment Contracting Act of 1975, as amended, where applicable, the Virginians With Disabilities Act, the Americans With Disabilities Act and §10 of the Rules Governing Procurement, Chapter 2, Exhibit J, Attachment 1 (available for review at <http://www.jmu.edu/procurement>). If the award is made to a faith-based organization, the organization shall not discriminate against any recipient of goods, services, or disbursements made pursuant to the contract on the basis of the recipient's religion, religious belief, refusal to participate in a religious practice, or on the basis of race, age, color, gender or national origin and shall be subject to the same rules as other organizations that contract with public bodies to account for the use of the funds provided; however, if the faith-based organization segregates public funds into separate accounts, only the accounts and programs funded with public funds shall be subject to audit by the public body. (*§6 of the Rules Governing Procurement*).

In every contract over \$10,000 the provisions in 1. and 2. below apply:

1. During the performance of this contract, the contractor agrees as follows:
 - a. The contractor will not discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, age, disability, or any other basis prohibited by state law relating to discrimination in employment, except where there is a bona fide occupational qualification reasonably necessary to the normal operation of the contractor. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.
 - b. The contractor, in all solicitations or advertisements for employees placed by or on behalf of the contractor, will state that such contractor is an equal opportunity employer.
 - c. Notices, advertisements, and solicitations placed in accordance with federal law, rule, or regulation shall be deemed sufficient for the purpose of meeting these requirements.
 2. The contractor will include the provisions of 1. Above in every subcontract or purchase order over \$10,000, so that the provisions will be binding upon each subcontractor or vendor.
- D. ETHICS IN PUBLIC CONTRACTING: By submitting their proposals, offerors certify that their proposals are made without collusion or fraud and that they have not offered or received any kickbacks or inducements from any other offeror, supplier, manufacturer or subcontractor

in connection with their proposal, and that they have not conferred on any public employee having official responsibility for this procurement transaction any payment, loan, subscription, advance, deposit of money, services or anything of more than nominal value, present or promised, unless consideration of substantially equal or greater value was exchanged.

- E. IMMIGRATION REFORM AND CONTROL ACT OF 1986: By entering into a written contract with the Commonwealth of Virginia, the Contractor certifies that the Contractor does not, and shall not during the performance of the contract for goods and services in the Commonwealth, knowingly employ an unauthorized alien as defined in the federal Immigration Reform and Control Act of 1986.
- F. DEBARMENT STATUS: By submitting their proposals, offerors certify that they are not currently debarred by the Commonwealth of Virginia from submitting proposals on contracts for the type of goods and/or services covered by this solicitation, nor are they an agent of any person or entity that is currently so debarred.
- G. ANTITRUST: By entering into a contract, the contractor conveys, sells, assigns, and transfers to the Commonwealth of Virginia all rights, title and interest in and to all causes of action it may now have or hereafter acquire under the antitrust laws of the United States and the Commonwealth of Virginia, relating to the particular goods or services purchased or acquired by the Commonwealth of Virginia under said contract.
- H. MANDATORY USE OF STATE FORM AND TERMS AND CONDITIONS RFPs: Failure to submit a proposal on the official state form provided for that purpose may be a cause for rejection of the proposal. Modification of or additions to the General Terms and Conditions of the solicitation may be cause for rejection of the proposal; however, the Commonwealth reserves the right to decide, on a case by case basis, in its sole discretion, whether to reject such a proposal.
- I. CLARIFICATION OF TERMS: If any prospective offeror has questions about the specifications or other solicitation documents, the prospective offeror should contact the buyer whose name appears on the face of the solicitation no later than **January 3, 2020**. Any revisions to the solicitation will be made only by addendum issued by the buyer.
- J. PAYMENT:
 - 1. To Prime Contractor:
 - a. Invoices for items ordered, delivered and accepted shall be submitted by the contractor directly to the payment address shown on the purchase order/contract. All invoices shall show the state contract number and/or purchase order number; social security number (for individual contractors) or the federal employer identification number (for proprietorships, partnerships, and corporations).
 - b. Any payment terms requiring payment in less than 30 days will be regarded as requiring payment 30 days after invoice or delivery, whichever occurs last. This shall not affect offers of discounts for payment in less than 30 days, however.
 - c. All goods or services provided under this contract or purchase order, that are to be paid for with public funds, shall be billed by the contractor at the contract price, regardless of which public agency is being billed.

- d. The following shall be deemed to be the date of payment: the date of postmark in all cases where payment is made by mail, or the date of offset when offset proceedings have been instituted as authorized under the Virginia Debt Collection Act.
- e. Unreasonable Charges. Under certain emergency procurements and for most time and material purchases, final job costs cannot be accurately determined at the time orders are placed. In such cases, contractors should be put on notice that final payment in full is contingent on a determination of reasonableness with respect to all invoiced charges. Charges which appear to be unreasonable will be researched and challenged, and that portion of the invoice held in abeyance until a settlement can be reached. Upon determining that invoiced charges are not reasonable, the Commonwealth shall promptly notify the contractor, in writing, as to those charges which it considers unreasonable and the basis for the determination. A contractor may not institute legal action unless a settlement cannot be reached within thirty (30) days of notification. The provisions of this section do not relieve an agency of its prompt payment obligations with respect to those charges which are not in dispute (*Rules Governing Procurement, Chapter 2, Exhibit J, Attachment 1 § 53; available for review at <http://www.jmu.edu/procurement>*).

2. To Subcontractors:

- a. A contractor awarded a contract under this solicitation is hereby obligated:
 - (1) To pay the subcontractor(s) within seven (7) days of the contractor's receipt of payment from the Commonwealth for the proportionate share of the payment received for work performed by the subcontractor(s) under the contract; or
 - (2) To notify the agency and the subcontractors, in writing, of the contractor's intention to withhold payment and the reason.
 - b. The contractor is obligated to pay the subcontractor(s) interest at the rate of one percent per month (unless otherwise provided under the terms of the contract) on all amounts owed by the contractor that remain unpaid seven (7) days following receipt of payment from the Commonwealth, except for amounts withheld as stated in (2) above. The date of mailing of any payment by U. S. Mail is deemed to be payment to the addressee. These provisions apply to each sub-tier contractor performing under the primary contract. A contractor's obligation to pay an interest charge to a subcontractor may not be construed to be an obligation of the Commonwealth.
3. Each prime contractor who wins an award in which provision of a SWAM procurement plan is a condition to the award, shall deliver to the contracting agency or institution, on or before request for final payment, evidence and certification of compliance (subject only to insubstantial shortfalls and to shortfalls arising from subcontractor default) with the SWAM procurement plan. Final payment under the contract in question may be withheld until such certification is delivered and, if necessary, confirmed by the agency or institution, or other appropriate penalties may be assessed in lieu of withholding such payment.
4. The Commonwealth of Virginia encourages contractors and subcontractors to accept electronic and credit card payments.

- K. PRECEDENCE OF TERMS: Paragraphs A through J of these General Terms and Conditions and the Commonwealth of Virginia Purchasing Manual for Institutions of Higher Education and their Vendors, shall apply in all instances. In the event there is a conflict between any of the other General Terms and Conditions and any Special Terms and Conditions in this solicitation, the Special Terms and Conditions shall apply.
- L. QUALIFICATIONS OF OFFERORS: The Commonwealth may make such reasonable investigations as deemed proper and necessary to determine the ability of the offeror to perform the services/furnish the goods and the offeror shall furnish to the Commonwealth all such information and data for this purpose as may be requested. The Commonwealth reserves the right to inspect offeror's physical facilities prior to award to satisfy questions regarding the offeror's capabilities. The Commonwealth further reserves the right to reject any proposal if the evidence submitted by, or investigations of, such offeror fails to satisfy the Commonwealth that such offeror is properly qualified to carry out the obligations of the contract and to provide the services and/or furnish the goods contemplated therein.
- M. TESTING AND INSPECTION: The Commonwealth reserves the right to conduct any test/inspection it may deem advisable to assure goods and services conform to the specifications.
- N. ASSIGNMENT OF CONTRACT: A contract shall not be assignable by the contractor in whole or in part without the written consent of the Commonwealth.
- O. CHANGES TO THE CONTRACT: Changes can be made to the contract in any of the following ways:
1. The parties may agree in writing to modify the scope of the contract. An increase or decrease in the price of the contract resulting from such modification shall be agreed to by the parties as a part of their written agreement to modify the scope of the contract.
 2. The Purchasing Agency may order changes within the general scope of the contract at any time by written notice to the contractor. Changes within the scope of the contract include, but are not limited to, things such as services to be performed, the method of packing or shipment, and the place of delivery or installation. The contractor shall comply with the notice upon receipt. The contractor shall be compensated for any additional costs incurred as the result of such order and shall give the Purchasing Agency a credit for any savings. Said compensation shall be determined by one of the following methods:
 - a. By mutual agreement between the parties in writing; or
 - b. By agreeing upon a unit price or using a unit price set forth in the contract, if the work to be done can be expressed in units, and the contractor accounts for the number of units of work performed, subject to the Purchasing Agency's right to audit the contractor's records and/or to determine the correct number of units independently; or
 - c. By ordering the contractor to proceed with the work and keep a record of all costs incurred and savings realized. A markup for overhead and profit may be allowed if provided by the contract. The same markup shall be used for determining a decrease in price as the result of savings realized. The contractor shall present the Purchasing Agency with all vouchers and records of expenses incurred and savings realized. The Purchasing Agency shall have the right to audit the records of the contractor as it deems necessary to determine costs or savings. Any claim for an adjustment in price under

this provision must be asserted by written notice to the Purchasing Agency within thirty (30) days from the date of receipt of the written order from the Purchasing Agency. If the parties fail to agree on an amount of adjustment, the question of an increase or decrease in the contract price or time for performance shall be resolved in accordance with the procedures for resolving disputes provided by the Disputes Clause of this contract or, if there is none, in accordance with the disputes provisions of the Commonwealth of Virginia Purchasing Manual for Institutions of Higher Education and their Vendors. Neither the existence of a claim nor a dispute resolution process, litigation or any other provision of this contract shall excuse the contractor from promptly complying with the changes ordered by the Purchasing Agency or with the performance of the contract generally.

- P. DEFAULT: In case of failure to deliver goods or services in accordance with the contract terms and conditions, the Commonwealth, after due oral or written notice, may procure them from other sources and hold the contractor responsible for any resulting additional purchase and administrative costs. This remedy shall be in addition to any other remedies which the Commonwealth may have.
- Q. INSURANCE: By signing and submitting a proposal under this solicitation, the offeror certifies that if awarded the contract, it will have the following insurance coverage at the time the contract is awarded. For construction contracts, if any subcontractors are involved, the subcontractor will have workers' compensation insurance in accordance with § 25 of the Rules Governing Procurement – Chapter 2, Exhibit J, Attachment 1, and 65.2-800 et. Seq. of the Code of Virginia (available for review at <http://www.jmu.edu/procurement>) The offeror further certifies that the contractor and any subcontractors will maintain these insurance coverage during the entire term of the contract and that all insurance coverage will be provided by insurance companies authorized to sell insurance in Virginia by the Virginia State Corporation Commission.

MINIMUM INSURANCE COVERAGES AND LIMITS REQUIRED FOR MOST CONTRACTS:

1. Workers' Compensation: Statutory requirements and benefits. Coverage is compulsory for employers of three or more employees, to include the employer. Contractors who fail to notify the Commonwealth of increases in the number of employees that change their workers' compensation requirement under the Code of Virginia during the course of the contract shall be in noncompliance with the contract.
 2. Employer's Liability: \$100,000
 3. Commercial General Liability: \$1,000,000 per occurrence and \$2,000,000 in the aggregate. Commercial General Liability is to include bodily injury and property damage, personal injury and advertising injury, products and completed operations coverage. The Commonwealth of Virginia must be named as an additional insured and so endorsed on the policy.
 4. Automobile Liability: \$1,000,000 combined single limit. *(Required only if a motor vehicle not owned by the Commonwealth is to be used in the contract. Contractor must assure that the required coverage is maintained by the Contractor (or third party owner of such motor vehicle.)*
- R. ANNOUNCEMENT OF AWARD: Upon the award or the announcement of the decision to award a contract over \$100,000, as a result of this solicitation, the purchasing agency will

publicly post such notice on the DGS/DPS eVA web site (www.eva.virginia.gov) for a minimum of 10 days.

- S. **DRUG-FREE WORKPLACE:** During the performance of this contract, the contractor agrees to (i) provide a drug-free workplace for the contractor's employees; (ii) post in conspicuous places, available to employees and applicants for employment, a statement notifying employees that the unlawful manufacture, sale, distribution, dispensation, possession, or use of a controlled substance or marijuana is prohibited in the contractor's workplace and specifying the actions that will be taken against employees for violations of such prohibition; (iii) state in all solicitations or advertisements for employees placed by or on behalf of the contractor that the contractor maintains a drug-free workplace; and (iv) include the provisions of the foregoing clauses in every subcontract or purchase order of over \$10,000, so that the provisions will be binding upon each subcontractor or vendor.

For the purposes of this section, "drug-free workplace" means a site for the performance of work done in connection with a specific contract awarded to a contractor, the employees of whom are prohibited from engaging in the unlawful manufacture, sale, distribution, dispensation, possession or use of any controlled substance or marijuana during the performance of the contract.

- T. **NONDISCRIMINATION OF CONTRACTORS:** An offeror, or contractor shall not be discriminated against in the solicitation or award of this contract because of race, religion, color, sex, national origin, age, disability, faith-based organizational status, any other basis prohibited by state law relating to discrimination in employment or because the offeror employs ex-offenders unless the state agency, department or institution has made a written determination that employing ex-offenders on the specific contract is not in its best interest. If the award of this contract is made to a faith-based organization and an individual, who applies for or receives goods, services, or disbursements provided pursuant to this contract objects to the religious character of the faith-based organization from which the individual receives or would receive the goods, services, or disbursements, the public body shall offer the individual, within a reasonable period of time after the date of his objection, access to equivalent goods, services, or disbursements from an alternative provider.
- U. **eVA BUSINESS TO GOVERNMENT VENDOR REGISTRATION, CONTRACTS, AND ORDERS:** The eVA Internet electronic procurement solution, website portal www.eVA.virginia.gov, streamlines and automates government purchasing activities in the Commonwealth. The eVA portal is the gateway for vendors to conduct business with state agencies and public bodies. All vendors desiring to provide goods and/or services to the Commonwealth shall participate in the eVA Internet eprocurement solution by completing the free eVA Vendor Registration. All offerors must register in eVA and pay the Vendor Transaction Fees specified below; failure to register will result in the proposal being rejected. Vendor transaction fees are determined by the date the original purchase order is issued and the current fees are as follows:

Vendor transaction fees are determined by the date the original purchase order is issued and the current fees are as follows:

1. For orders issued July 1, 2014 and after, the Vendor Transaction Fee is:
 - a. Department of Small Business and Supplier Diversity (SBSD) certified Small Businesses: 1% capped at \$500 per order.

- b. Businesses that are not Department of Small Business and Supplier Diversity (SBSD) certified Small Businesses: 1% capped at \$1,500 per order.
- 2. For orders issued prior to July 1, 2014 the vendor transaction fees can be found at www.eVA.virginia.gov.
- 3. The specified vendor transaction fee will be invoiced by the Commonwealth of Virginia Department of General Services approximately 60 days after the corresponding purchase order is issued and payable 30 days after the invoice date. Any adjustments (increases/decreases) will be handled through purchase order changes.
- V. AVAILABILITY OF FUNDS: It is understood and agreed between the parties herein that the Commonwealth of Virginia shall be bound hereunder only to the extent of the funds available or which may hereafter become available for the purpose of this agreement.
- W. PRICING CURRENCY: Unless stated otherwise in the solicitation, offerors shall state offered prices in U.S. dollars.
- X. E-VERIFY REQUIREMENT OF ANY CONTRACTOR: Any employer with more than an average of 50 employees for the previous 12 months entering into a contract in excess of \$50,000 with James Madison University to perform work or provide services pursuant to such contract shall register and participate in the E-Verify program to verify information and work authorization of its newly hired employees performing work pursuant to any awarded contract.
- Y. TAXES: Sales to the Commonwealth of Virginia are normally exempt from State sales tax. State sales and use tax certificates of exemption, Form ST-12, will be issued upon request. Deliveries against this contract shall usually be free of Federal excise and transportation taxes. The Commonwealth's excise tax exemption registration number is 54-73-0076K.
- Z. TRANSPORTATION AND PACKAGING: By submitting their proposals, all Offerors certify and warrant that the price offered for FOB destination includes only the actual freight rate costs at the lowest and best rate and is based upon the actual weight of the goods to be shipped. Except as otherwise specified herein, standard commercial packaging, packing and shipping containers shall be used. All shipping containers shall be legibly marked or labeled on the outside with purchase order number, commodity description, and quantity.

VIII. SPECIAL TERMS AND CONDITIONS

- A. ADVERTISING: In the event a contract is awarded for supplies, equipment, or services resulting from this bid/proposal, no indication of such sales or services to James Madison University will be used in product literature or advertising. The contractor shall not state in any of its advertising or product literature that James Madison University has purchased or uses any of its products or services, and the contractor shall not include James Madison University in any client list in advertising and promotional materials.
- B. AUDIT: The Contractor hereby agrees to retain all books, records, systems, and other documents relative to this contract for five (5) years after final payment, or until audited by the Commonwealth of Virginia, whichever is sooner. The Commonwealth of Virginia, its authorized agents, and/or State auditors shall have full access to and the right to examine any of said materials during said period.

- C. CANCELLATION OF CONTRACT: James Madison University reserves the right to cancel and terminate any resulting contract, in part or in whole, without penalty, upon 60 days written notice to the contractor. In the event the initial contract period is for more than 12 months, the resulting contract may be terminated by either party, without penalty, after the initial 12 months of the contract period upon 60 days written notice to the other party. Any contract cancellation notice shall not relieve the contractor of the obligation to deliver and/or perform on all outstanding orders issued prior to the effective date of cancellation.
- D. IDENTIFICATION OF PROPOSAL ENVELOPE: The signed proposal should be returned in a separate envelope or package, sealed and identified as follows:

From: _____

Name of Offeror	Due Date	Time
Street or Box No.	RFP #	
City, State, Zip Code	RFP Title	

Name of Purchasing Officer: _____

The envelope should be addressed as directed on the title page of the solicitation.

The Offeror takes the risk that if the envelope is not marked as described above, it may be inadvertently opened and the information compromised, which may cause the proposal to be disqualified. Proposals may be hand-delivered to the designated location in the office issuing the solicitation. No other correspondence or other proposals should be placed in the envelope.

- E. LATE PROPOSALS: To be considered for selection, proposals must be received by the issuing office by the designated date and hour. The official time used in the receipt of proposals is that time on the automatic time stamp machine in the issuing office. Proposals received in the issuing office after the date and hour designated are automatically non responsive and will not be considered. The University is not responsible for delays in the delivery of mail by the U.S. Postal Service, private couriers, or the intra university mail system. It is the sole responsibility of the Offeror to ensure that its proposal reaches the issuing office by the designated date and hour.
- F. UNDERSTANDING OF REQUIREMENTS: It is the responsibility of each offeror to inquire about and clarify any requirements of this solicitation that is not understood. The University will not be bound by oral explanations as to the meaning of specifications or language contained in this solicitation. Therefore, all inquiries deemed to be substantive in nature must be in writing and submitted to the responsible buyer in the Procurement Services Office. **Offerors are asked to include reference to RFP section, page, and item number in their questions when relevant.** Offerors must ensure that written inquiries reach the buyer by **January 3, 2020**. A copy of all queries and the respective response will be provided in the form of an addendum to all offerors who have indicated an interest in responding to this solicitation. Your signature on your Offer certifies that you fully understand all facets of this solicitation. These questions may be sent to the Buyer as referenced on the signature sheet.
- G. RENEWAL OF CONTRACT: This contract may be renewed by the Commonwealth for a period of eight (8) successive one year periods under the terms and conditions of the original contract except as stated in 1. and 2. below. Price increases may be negotiated only at the time of renewal. Written notice of the Commonwealth's intention to renew shall be given approximately 90 days prior to the expiration date of each contract period.

1. If the Commonwealth elects to exercise the option to renew the contract for an additional one-year period, the contract price(s) for the additional one year shall not exceed the contract price(s) of the original contract increased/decreased by no more than the percentage increase/decrease of the other services category of the CPI-W section of the Consumer Price Index of the United States Bureau of Labor Statistics for the latest twelve months for which statistics are available.
 2. If during any subsequent renewal periods, the Commonwealth elects to exercise the option to renew the contract, the contract price(s) for the subsequent renewal period shall not exceed the contract price(s) of the previous renewal period increased/decreased by more than the percentage increase/decrease of the other services category of the CPI-W section of the Consumer Price Index of the United States Bureau of Labor Statistics for the latest twelve months for which statistics are available.
- H. SUBMISSION OF INVOICES: All invoices shall be submitted within sixty days of contract term expiration for the initial contract period as well as for each subsequent contract renewal period. Any invoices submitted after the sixty day period will not be processed for payment.
- I. OPERATING VEHICLES ON JAMES MADISON UNIVERSITY CAMPUS: Operating vehicles on sidewalks, plazas, and areas heavily used by pedestrians is prohibited. In the unlikely event a driver should find it necessary to drive on James Madison University sidewalks, plazas, and areas heavily used by pedestrians, the driver must yield to pedestrians. For a complete list of parking regulations, please go to www.jmu.edu/parking; or to acquire a service representative parking permit, contact Parking Services at 540.568.3300. The safety of our students, faculty and staff is of paramount importance to us. Accordingly, violators may be charged.
- J. COOPERATIVE PURCHASING / USE OF AGREEMENT BY THIRD PARTIES: It is the intent of this solicitation and resulting contract(s) to allow for cooperative procurement. Accordingly, any public body, (to include government/state agencies, political subdivisions, etc.), cooperative purchasing organizations, public or private health or educational institutions or any University related foundation and affiliated corporations may access any resulting contract if authorized by the Contractor.

Participation in this cooperative procurement is strictly voluntary. If authorized by the Contractor(s), the resultant contract(s) will be extended to the entities indicated above to purchase goods and services in accordance with contract terms. As a separate contractual relationship, the participating entity will place its own orders directly with the Contractor(s) and shall fully and independently administer its use of the contract(s) to include contractual disputes, invoicing and payments without direct administration from the University. No modification of this contract or execution of a separate agreement is required to participate; however, the participating entity and the Contractor may modify the terms and conditions of this contract to accommodate specific governing laws, regulations, policies, and business goals required by the participating entity. Any such modification will apply solely between the participating entity and the Contractor.

The Contractor will notify the University in writing of any such entities accessing this contract. The Contractor will provide semi-annual usage reports for all entities accessing the contract. The University shall not be held liable for any costs or damages incurred by any other participating entity as a result of any authorization by the Contractor to extend the contract. It is understood and agreed that the University is not responsible for the acts or omissions of any entity and will not be considered in default of the contract no matter the circumstances.

Use of this contract(s) does not preclude any participating entity from using other contracts or competitive processes as needed.

K. SMALL BUSINESS SUBCONTRACTING AND EVIDENCE OF COMPLIANCE:

1. It is the goal of the Commonwealth that 42% of its purchases are made from small businesses. This includes discretionary spending in prime contracts and subcontracts. All potential offerors are required to submit a Small Business Subcontracting Plan. Unless the offeror is registered as a Department of Small Business and Supplier Diversity (SBSD)-certified small business and where it is practicable for any portion of the awarded contract to be subcontracted to other suppliers, the contractor is encouraged to offer such subcontracting opportunities to SBSD-certified small businesses. This shall not exclude SBSD-certified women-owned and minority-owned businesses when they have received SBSD small business certification. No offeror or subcontractor shall be considered a Small Business, a Women-Owned Business or a Minority-Owned Business unless certified as such by the Department of Small Business and Supplier Diversity (SBSD) by the due date for receipt of proposals. If small business subcontractors are used, the prime contractor agrees to report the use of small business subcontractors by providing the purchasing office at a minimum the following information: name of small business with the SBSD certification number or FEIN, phone number, total dollar amount subcontracted, category type (small, women-owned, or minority-owned), and type of product/service provided. **This information shall be submitted to: JMU Office of Procurement Services, Attn: SWAM Subcontracting Compliance, MSC 5720, Harrisonburg, VA 22807.**
2. Each prime contractor who wins an award in which provision of a small business subcontracting plan is a condition of the award, shall deliver to the contracting agency or institution with every request for payment, evidence of compliance (subject only to insubstantial shortfalls and to shortfalls arising from subcontractor default) with the small business subcontracting plan. **This information shall be submitted to: JMU Office of Procurement Services, SWAM Subcontracting Compliance, MSC 5720, Harrisonburg, VA 22807.** When such business has been subcontracted to these firms and upon completion of the contract, the contractor agrees to furnish the purchasing office at a minimum the following information: name of firm with the Department of Small Business and Supplier Diversity (SBSD) certification number or FEIN number, phone number, total dollar amount subcontracted, category type (small, women-owned, or minority-owned), and type of product or service provided. Payment(s) may be withheld until compliance with the plan is received and confirmed by the agency or institution. The agency or institution reserves the right to pursue other appropriate remedies to include, but not be limited to, termination for default.
3. Each prime contractor who wins an award valued over \$200,000 shall deliver to the contracting agency or institution with every request for payment, information on use of subcontractors that are not Department of Small Business and Supplier Diversity (SBSD)-certified small businesses. When such business has been subcontracted to these firms and upon completion of the contract, the contractor agrees to furnish the purchasing office at a minimum the following information: name of firm, phone number, FEIN number, total dollar amount subcontracted, and type of product or service provided. **This information shall be submitted to: JMU Office of Procurement Services, Attn: SWAM Subcontracting Compliance, MSC 5720, Harrisonburg, VA 22807.**

L. AUTHORIZATION TO CONDUCT BUSINESS IN THE COMMONWEALTH: A contractor organized as a stock or nonstock corporation, limited liability company, business trust, or

- limited partnership or registered as a registered limited liability partnership shall be authorized to transact business in the Commonwealth as a domestic or foreign business entity if so required by Title 13.1 or Title 50 of the Code of Virginia or as otherwise required by law. Any business entity described above that enters into a contract with a public body shall not allow its existence to lapse or its certificate of authority or registration to transact business in the Commonwealth, if so required under Title 13.1 or Title 50, to be revoked or cancelled at any time during the term of the contract. A public body may void any contract with a business entity if the business entity fails to remain in compliance with the provisions of this section.
- M. PUBLIC POSTING OF COOPERATIVE CONTRACTS: James Madison University maintains a web-based contracts database with a public gateway access. Any resulting cooperative contract/s to this solicitation will be posted to the publicly accessible website. Contents identified as proprietary information will not be made public.
- N. CRIMINAL BACKGROUND CHECKS OF PERSONNEL ASSIGNED BY CONTRACTOR TO PERFORM WORK ON JMU PROPERTY: The Contractor shall obtain criminal background checks on all of their contracted employees who will be assigned to perform services on James Madison University property. The results of the background checks will be directed solely to the Contractor. The Contractor bears responsibility for confirming to the University contract administrator that the background checks have been completed prior to work being performed by their employees or subcontractors. The Contractor shall only assign to work on the University campus those individuals whom it deems qualified and permissible based on the results of completed background checks. Notwithstanding any other provision herein, and to ensure the safety of students, faculty, staff and facilities, James Madison University reserves the right to approve or disapprove any contract employee that will work on JMU property. Disapproval by the University will solely apply to JMU property and should have no bearing on the Contractor's employment of an individual outside of James Madison University.
- O. INDEMNIFICATION: Contractor agrees to indemnify, defend and hold harmless the Commonwealth of Virginia, its officers, agents, and employees from any claims, damages and actions of any kind or nature, whether at law or in equity, arising from or caused by the use of any materials, goods, or equipment of any kind or nature furnished by the contractor/any services of any kind or nature furnished by the contractor, provided that such liability is not attributable to the sole negligence of the using agency or to failure of the using agency to use the materials, goods, or equipment in the manner already and permanently described by the contractor on the materials, goods or equipment delivered.
- P. ADDITIONAL GOODS AND SERVICES: The University may acquire other goods or services that the supplier provides than those specifically solicited. The University reserves the right, subject to mutual agreement, for the Contractor to provide additional goods and/or services under the same pricing, terms, and conditions and to make modifications or enhancements to the existing goods and services. Such additional goods and services may include other products, components, accessories, subsystems, or related services that are newly introduced during the term of this Agreement. Such additional goods and services will be provided to the University at favored nations pricing, terms, and conditions.
- Q. ELECTRICAL EQUIPMENT STANDARDS: All equipment/material shall conform to the latest issue of all applicable standards as established by National Electrical Manufacturer's Association (NEMA), American National Standards Institute (ANSI), and Occupational Safety & Health Administration (OSHA). All equipment and material, for which there are OSHA standards, shall bear an appropriate label of approval for use intended from a Nationally Recognized Testing Laboratory (NRTL).

- R. EXTRA CHARGES NOT ALLOWED: The pricing shall be for complete installation ready for the Commonwealth's use, and shall include all applicable freight and installation charges; extra charges will not be allowed.
- S. CONFIDENTIALITY (Commonwealth): The Commonwealth agrees that neither it nor its employees, representatives, or agents shall knowingly divulge any proprietary information with respect to the operation of the software, the technology embodied therein, or any other trade secret or proprietary information related thereto, except as specifically authorized by the contractor in writing or as required by the Freedom of Information Act or similar law. It shall be the contractor's responsibility to fully comply with § 11-52 D of the *Code of Virginia*. All trade secrets or proprietary information must be identified in writing or other tangible form and conspicuously labeled as "proprietary" either prior to or at the time of submission to the Commonwealth.
- T. LATEST SOFTWARE VERSION: Any software product(s) provided under the contract shall be the latest version available to the general public as of the due date of this solicitation.
- U. PRODUCT SUBSTITUTION: During the term of any contract resulting from this solicitation, the vendor is not authorized to substitute any item for that product and/or software identified in the solicitation without the prior written consent of the contracting officer whose name appears on the front of this solicitation, or their designee.
- V. QUALIFIED REPAIR PERSONNEL: All warranty or maintenance services to be performed on the items specified in this solicitation as well as any associated hardware or software shall be performed by qualified technicians properly authorized by the manufacturer to perform such services. The Commonwealth reserves the right to require proof of certification prior to award and at any time during the term of the contract.
- W. RELOCATION OF EQUIPMENT: Should it become necessary to move equipment covered by the contract to another location, the Commonwealth reserves the right to do so at its own expense. If contractor supervision is required, the Commonwealth will provide prior written notice of the move at least thirty days in advance, in which case the contractor shall provide the required services and be reasonably compensated by the Commonwealth. Both the compensation to be paid and any adjustment to the maintenance terms resulting from the move shall be as mutually agreed between the parties. Regular maintenance charges shall be suspended on the day the equipment is dismantled and resume once the equipment is again certified ready for operational use.
- X. RENEWAL OF MAINTENANCE: Maintenance of the hardware or software specified in the resultant contract may be renewed by the mutual written agreement of both parties for additional one-year periods, under the terms and conditions of the original contract except as noted herein. Price changes may be negotiated at time of renewal; however, in no case shall the maintenance costs for a succeeding one-year period exceed the prior year's contract price(s), increased or decreased by more than the percentage increase or decrease in the other services category of the CPI-W section of the US Bureau of Labor Statistics Consumer Price Index, for the latest twelve months for which statistics are available.
- Y. REPAIR PARTS: In the event that the performance of maintenance services under the contract results in a need to replace defective parts, such items may only be replaced by new parts. In no instance shall the contractor be permitted to replace defective items with refurbished, remanufactured, or surplus items without prior written authorization of the Commonwealth.

- Z. SERVICE PERIOD (EXTENDED): Due to the criticality of the applications for which the equipment and/or software is purchased, the contractor shall provide 24 hours a day, 7 days a week, maintenance support, including state holidays. On-site response time shall be within 12-24 hours following initial notification. All necessary repairs or corrections shall be completed within 72 hours of the initial notification.
- AA. SERVICE PERIOD (ROUTINE): Contractor shall provide 24-hour toll free phone support with a 24 hour return call response time. On-site maintenance services shall carry a 12-24 hour response time following initial notification and be available during the normal working hours of 8 A.M. to 5 P.M. Monday through Friday, excluding state holidays. All necessary repairs or corrections shall be completed within 72 hours of the initial notification.
- BB. SERVICE REPORTS: Upon completion of any maintenance call, the contractor shall provide the agency with a signed service report that includes, at a minimum: a general statement as to the problem, action taken, any materials or parts furnished or used, and the number of hours required to complete the repairs.
- CC. SOFTWARE UPGRADES: The Commonwealth shall be entitled to any and all upgraded versions of the software covered in the contract that becomes available from the contractor. The maximum charge for upgrade shall not exceed the total difference between the cost of the Commonwealth's current version and the price the contractor sells or licenses the upgraded software under similar circumstances.
- DD. SOURCE CODE: In the event the contractor ceases to maintain experienced staff and the resources needed to provide required software maintenance, the Commonwealth shall be entitled to have, use, and duplicate for its own use, a copy of the source code and associated documentation for the software products covered by the contract. Until such time as a complete copy of such material is provided, the Commonwealth shall have exclusive right to possess all physical embodiments of such contractor owned materials. The rights of the Commonwealth in this respect shall survive for a period of twenty years after the expiration or termination of the contract. All lease and royalty fees necessary to support this right are included in the initial license fee as contained in the pricing schedule.
- EE. TERM OF SOFTWARE LICENSE: Unless otherwise stated in the solicitation, the software license(s) identified in the pricing schedule shall be purchased on a perpetual basis and shall continue in perpetuity. However the Commonwealth reserves the right to terminate the license at any time, although the mere expiration or termination of this contract shall not be construed as an intent to terminate the license. All acquired license(s) shall be for use at any computing facilities, on any equipment, by any number of users, and for any purposes for which it is procured. The Commonwealth further reserves the right to transfer all rights under the license to another state agency to which some or all of its functions are transferred.
- FF. THIRD PARTY ACQUISITION OF SOFTWARE: The contractor shall notify the procuring agency in writing should the intellectual property, associated business, or all of its assets be acquired by a third party. The contractor further agrees that the contract's terms and conditions, including any and all license rights and related services, shall not be affected by the acquisition. Prior to completion of the acquisition, the contractor shall obtain, for the Commonwealth's benefit and deliver thereto, the assignee's agreement to fully honor the terms of the contract.
- GG. TITLE TO SOFTWARE: By submitting a bid or proposal, the bidder or offeror represents and warrants that it is the sole owner of the software or, if not the owner, that it has received all legally required authorizations from the owner to license the software, has the full power to grant the rights required by this solicitation, and that neither the software nor its use in

accordance with the contract will violate or infringe upon any patent, copyright, trade secret, or any other property rights of another person or organization.

HH. WARRANTY AGAINST SHUTDOWN DEVICES: The contractor warrants that the equipment and software provided under the contract shall not contain any lock, counter, CPU reference, virus, worm, or other device capable of halting operations or erasing or altering data or programs. Contractor further warrants that neither it, nor its agents, employees, or subcontractors shall insert any shutdown device following delivery of the equipment and software.

II. WARRANTY (COMMERCIAL): The contractor agrees that the goods or services furnished under any award resulting from this solicitation shall be covered by the most favorable commercial warranties the contractor gives any customer for such goods or services and that the rights and remedies provided therein are in addition to and do not limit those available to the Commonwealth by any other clause of this solicitation. A copy of this warranty should be furnished with the proposal.

JJ. NONVISUAL ACCESS TO TECHNOLOGY: All information technology which, pursuant to this Agreement, is purchased or upgraded by or for the use of any State agency or institution or political subdivision of the Commonwealth (the "Technology") shall comply with the following nonvisual access standards from the date of purchase or upgrade until the expiration of this Agreement:

- (i) effective, interactive control and use of the Technology shall be readily achievable by nonvisual means;
- (ii) the Technology equipped for nonvisual access shall be compatible with information technology used by other individuals with whom any blind or visually impaired user of the Technology interacts;
- (iii) nonvisual access technology shall be integrated into any networks used to share communications among employees, program participants or the public; and
- (iv) the technology for nonvisual access shall have the capability of providing equivalent access by nonvisual means to telecommunications or other interconnected network services used by persons who are not blind or visually impaired.

Compliance with the foregoing nonvisual access standards shall not be required if the head of the using agency, institution or political subdivision determines that (i) the Technology is not available with nonvisual access because the essential elements of the Technology are visual and (ii) nonvisual equivalence is not available.

Installation of hardware, software or peripheral devices used for nonvisual access is not required when the Technology is being used exclusively by individuals who are not blind or visually impaired, but applications programs and underlying operating systems (including the format of the data) used for the manipulation and presentation of information shall permit the installation and effective use of nonvisual access software and peripheral devices.

If requested, the Contractor must provide a detailed explanation of how compliance with the foregoing nonvisual access standards is achieved and a validation of concept demonstration.

The requirements of this Paragraph shall be construed to achieve full compliance with the Information Technology Access Act, 2.2-3500 through 2.2-3504 of the *Code of Virginia*.

All information technology which, pursuant to this Agreement, is purchased or upgraded by or for the use of any Commonwealth agency or institution or political subdivision of the Commonwealth (the "Technology") shall comply with Section 508 of the Rehabilitation Act (29 U.S.C. 794d), as amended. If requested, the Contractor must provide a detailed explanation of how compliance with Section 508 of the Rehabilitation Act is achieved and a validation of concept demonstration. (<http://www.section508.gov/>). The requirements of this Paragraph along with the Non-Visual Access to Technology Clause shall be construed to achieve full compliance with the Information Technology Access Act, §§2.2-3500 through 2.2-3504 of the *Code of Virginia*.

- KK. AS BUILT DRAWINGS: The contractor shall provide the Commonwealth a clean set of reproducible "as built" drawings and wiring diagrams, marked to record all changes made during installation or construction. The contractor shall also provide the Commonwealth with maintenance manuals, parts lists and a copy of all warranties for all equipment. All "as built" drawings and wiring diagrams, maintenance manuals, parts lists and warranties shall be delivered to the Commonwealth upon completion of the work and prior to final payment.
- LL. CONTRACTOR REGISTRATION: If a contract for construction, removal, repair or improvement of a building or other real property is for \$120,000 or more, or if the total value of all such contracts undertaken by bidder/offeree within any 12-month period is \$750,000 or more, the bidder/offeree is required under Title 54.1-1100, *Code of Virginia* (1950), as amended, to be licensed by the State Board of Contractors a "CLASS A CONTRACTOR." If such a contract is for \$10,000 or more but less than \$120,000, or if the total value of all such contracts undertaken by bidder/offeree within any 12-month period is \$150,000 or more, but less than \$750,000 or more, the bidder/offeree is required to be licensed as a "CLASS B CONTRACTOR." If such a contract is over \$1,000 but less than \$10,000, or if the contractor does less than \$150,000 in business in a 12-month period, the bidder/offeree is required to be licensed as a "CLASS C CONTRACTOR." The board shall require a master tradesmen license as a condition of licensure for electrical, plumbing and heating, ventilation and air conditioning contractors. The bidder/offeree shall place on the outside of the envelope containing the bid/proposal and shall place in the bid/proposal over his signature whichever of the following notations is appropriate, inserting his contractor license number:

Licensed Class A		
Virginia Contractor No.	_____	Specialty _____
Licensed Class B		
Virginia Contractor No.	_____	Specialty _____
Licensed Class C		
Virginia Contractor No.	_____	Specialty _____

If the bidder/offeree shall fail to provide this information on his bid/proposal or on the envelope containing the bid/proposal and shall fail to promptly provide said contractor license number to the Commonwealth in writing when requested to do so before or after the opening of bids/proposals, he shall be deemed to be in violation of § 54.1-1115 of the *Code of Virginia* (1950), as amended, and his bid/proposal will not be considered.

If a bidder/offeree shall fail to obtain the required license prior to submission of his bid/proposal, the bid/proposal shall not be considered.

MSB Response: *MSB understands the provisions of this section and has applied for the respective license. We will provide the license number to JMU upon receipt. MSB has a licensed professional engineer on staff, Leo L. Holzenthal, Jr., P.E (License No. 038752) that will be the engineer of record for this project.*

- MM. **DELIVERY AND STORAGE:** It shall be the responsibility of the contractor to make all arrangements for delivery, unloading, receiving and storing materials in the building during installation. The owner will not assume any responsibility for receiving these shipments. Contractor shall check with the owner and make necessary arrangements for security and storage space in the building during installation.
- NN. **FINAL INSPECTION:** At the conclusion of the work, the contractor shall demonstrate to the authorized owner's representative that the work is fully operational and in compliance with contract specifications and codes. Any deficiencies shall be promptly and permanently corrected by the contractor at the contractor's sole expense prior to final acceptance of the work.
- OO. **MAINTENANCE MANUALS:** The contractor shall provide with each piece of equipment an operations and maintenance manual with wiring diagrams, parts list, and a copy of all warranties.
- GGG. **WORK SITE DAMAGES:** Any damage to existing utilities, equipment or finished surfaces resulting from the performance of this contract shall be repaired to the Commonwealth's satisfaction at the contractor's expense.
- HHH. **INSTALLATION:** All items must be assembled and set in place, ready for use. All crating and other debris must be removed from the premises.
- III. **CONTRACTOR'S TITLE TO MATERIALS:** No materials or supplies for the work shall be purchased by the contractor or by any subcontractor subject to any chattel mortgage or under a conditional sales or other agreement by which an interest is retained by the seller. The contractor warrants that he has clear title to all materials and supplies for which he invoices for payment.
- JJJ. **PRIME CONTRACTOR RESPONSIBILITIES:** The contractor shall be responsible for completely supervising and directing the work under this contract and all subcontractors that he may utilize, using his best skill and attention. Subcontractors who perform work under this contract shall be responsible to the prime contractor. The contractor agrees that he is as fully responsible for the acts and omissions of his subcontractors and of persons employed by them as he is for the acts and omissions of his own employees.
- KKK. **SUBCONTRACTS:** No portion of the work shall be subcontracted without prior written consent of the purchasing agency. In the event that the contractor desires to subcontract some part of the work specified herein, the contractor shall furnish the purchasing agency the names, qualifications and experience of their proposed subcontractors. The contractor shall, however, remain fully liable and responsible for the work to be done by its subcontractor(s) and shall assure compliance with all requirements of the contract.
- LLL. **KEYS:** If the Contractor is given keys for this project, it is the Contractor's responsibility to return the keys when the contract is terminated, as well as for the safekeeping of the keys during

the contract period. The Contractor shall not loan or duplicate the keys. In the event the Contractor loses the keys, they will be charged for the replacement of the keys and any locks which are rekeyed or replaced.

- MMM. **STANDARDS OF CONDUCT:** The work site will be occupied by students and University Personnel during the times work is performed. Contractor and Contractor's personnel shall exercise a particularly high level of discipline, safety and cooperation at all times while on the job site. The Contractor shall be responsible for controlling employee conduct, for assuring that its employees are not boisterous or rude, and assuring that they are not engaging in any destructive or criminal activity.

IX. METHOD OF PAYMENT

The contractor will be paid on the basis of invoices submitted in accordance with the solicitation and any negotiations. James Madison University recognizes the importance of expediting the payment process for our vendors and suppliers. We are asking our vendors and suppliers to enroll in the Wells Fargo Bank single use Commercial Card Number process or electronic deposit (ACH) to your bank account so that future payments are made electronically. Contractors signed up for the Wells Fargo Bank single use Commercial Card Number process will receive the benefit of being paid in Net 15 days. Additional information is available online at:

<http://www.jmu.edu/financeoffice/accounting-operations-disbursements/cash-investments/vendor-payment-methods.shtml>

X. PRICING SCHEDULE

The offeror shall provide pricing for all products and services included in proposal indicating one-time and on-going costs. **Provide pricing for items included in Section IV Statement of Needs.**

Provide a completed copy of the attached **High-Density Wi-Fi Systems Pricing Form (Attachment F, attached to posting as a separate Excel spreadsheet)** both in print and accompanying your electronic submission (See Section V. Proposal Preparation and Submission).

Specify any associated charge card processing fees, if applicable, to be billed to the university. Vendors shall provide their VISA registration number when indicating charge card processing fees. Any vendor requiring information on VISA registration may refer to

<https://usa.visa.com/support/small-business/regulations-fees.html> and for questions <https://usa.visa.com/dam/VCOM/global/support-legal/documents/merchant-surcharging-qa-for-web.pdf>.

MSB Response: *Understand and Comply.*

XI. ATTACHMENTS

Attachment A: Offeror Data Sheet

Attachment B: Small, Women, and Minority-owned Business (SWaM) Utilization Plan

Attachment C: Standard Contract Sample

Attachment D: Performance Specifications

- Attachment E: Wi-Fi Exclusion Areas – attached as a separate PDF file
- Attachment F: High-Density Wi-Fi Systems Pricing Form - attached as a separate Excel spreadsheet (***All Offerors are required to complete***)
- Attachment G: 17963 JMU Convo Composite Set.zip ([Click here for download 1.5g](#))
- Attachment H: Information Technology Services Addendum (***All Offerors are required to complete***)
- Attachment I: Higher Education Cloud Assessment Tool (HECVAT) Lite - attached as a separate Excel spreadsheet (***All Offerors are required to complete***)

ATTACHMENT A

OFFEROR DATA SHEET

TO BE COMPLETED BY OFFEROR

1. QUALIFICATIONS OF OFFEROR: Offerors must have the capability and capacity in all respects to fully satisfy the contractual requirements.
2. YEARS IN BUSINESS: Indicate the length of time you have been in business providing these types of goods and services.

Years 41 Months 4

3. REFERENCES: Indicate below a listing of at least five (5) organizations, either commercial or governmental/educational, that your agency is servicing. Include the name and address of the person the purchasing agency has your permission to contact.

CLIENT	LENGTH OF SERVICE	ADDRESS	CONTACT PERSON/PHONE #
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

4. List full names and addresses of Offeror and any branch offices which may be responsible for administering the contract.

M S Benbow & Associates Professional Engineering Corporation

2450 Severn Avenue, Suite 400

Metairie, Louisiana 70001

5. RELATIONSHIP WITH THE COMMONWEALTH OF VIRGINIA: Is any member of the firm an employee of the Commonwealth of Virginia who has a personal interest in this contract pursuant to the CODE OF VIRGINIA, SECTION 2.2-3100 – 3131?

[] YES [X] NO

IF YES, EXPLAIN: _____

ATTACHMENT B

Small, Women and Minority-owned Businesses (SWaM) Utilization Plan

Offeror Name: M S Benbow & Associates Professional Engineering Corporation **Preparer Name: Kenneth M. Wright, P.E.**

Date: 1/13/20

Is your firm a **Small Business Enterprise** certified by the Department of Small Business and Supplier Diversity (SBSD)? Yes_____ No___x__

If yes, certification number: _____ Certification date: _____

Is your firm a **Woman-owned Business Enterprise** certified by the Department of Small Business and Supplier Diversity (SBSD)? Yes_____ No___x__

If yes, certification number: _____ Certification date: _____

Is your firm a **Minority-Owned Business Enterprise** certified by the Department of Small Business and Supplier Diversity (SBSD)? Yes_____ No___x__

If yes, certification number: _____ Certification date: _____

Is your firm a **Micro Business** certified by the Department of Small Business and Supplier Diversity (SBSD)? Yes_____ No___x__

If yes, certification number: _____ Certification date: _____

Instructions: *Populate the table below to show your firm's plans for utilization of small, women-owned and minority-owned business enterprises in the performance of the contract. Describe plans to utilize SWAMs businesses as part of joint ventures, partnerships, subcontractors, suppliers, etc.*

Small Business: "Small business " means a business, independently owned or operated by one or more persons who are citizens of the United States or non-citizens who are in full compliance with United States immigration law, which, together with affiliates, has 250 or fewer employees, or average annual gross receipts of \$10 million or less averaged over the previous three years.

Woman-Owned Business Enterprise: A business concern which is at least 51 percent owned by one or more women who are U.S. citizens or legal resident aliens, or in the case of a corporation, partnership or limited liability company or other entity, at least 51 percent of the equity ownership interest in which is owned by one or more women, and whose management and daily business operations are controlled by one or more of such individuals. **For purposes of the SWAM Program, all certified women-owned businesses are also a small business enterprise.**

Minority-Owned Business Enterprise: A business concern which is at least 51 percent owned by one or more minorities or in the case of a corporation, partnership or limited liability company or other entity, at least 51 percent of the equity ownership interest in which is owned by one or more minorities and whose management and daily business operations are controlled by one or more of such individuals. **For purposes of the SWAM Program, all certified minority-owned businesses are also a small business enterprise.**

Micro Business is a certified Small Business under the SWaM Program and has no more than twenty-five (25) employees **AND** no more than \$3 million in average annual revenue over the three-year period prior to their certification.

All small, women, and minority owned businesses must be certified by the Commonwealth of Virginia Department of Small Business and Supplier Diversity (SBSD) to be counted in the SWAM program. Certification applications are available through SBSD at 800-223-0671 in Virginia, 804-786-6585 outside Virginia, or online at <http://www.sbsd.virginia.gov/> (Customer Service).

RETURN OF THIS PAGE IS REQUIRED

ATTACHMENT B (CNT'D)
Small, Women and Minority-owned Businesses (SWaM) Utilization Plan

Procurement Name and Number: CMJ -1068
Completed: 1/13/20

Date Form

Listing of Sub-Contractors, to include, Small, Woman Owned and Minority Owned Businesses
for this Proposal and Subsequent Contract

Offeror / Proposer:

M S Benbow & Associates
Firm

2450 Severn Avenue, Suite 400 Metairie LA 70001
Address

Kenneth M Wright
Contact Person/No.

Sub-Contractor's Name and Address	Contact Person & Phone Number	SBSD Certification Number	Services or Materials Provided	Total Subcontractor Contract Amount (to include change orders)	Total Dollars Paid Subcontractor to date (to be submitted with request for payment from JMU)

(Form shall be submitted with proposal and if awarded, again with submission of each request for payment)

RETURN OF THIS PAGE IS REQUIRED

ATTACHMENT C



**COMMONWEALTH OF VIRGINIA
STANDARD CONTRACT**

Contract No. _____

This contract entered into this _____ day of _____, 20____, by _____ hereinafter called the "Contractor" and Commonwealth of Virginia, James Madison University called the "Purchasing Agency".

WITNESSETH that the Contractor and the Purchasing Agency, in consideration of the mutual covenants, promises and agreements herein contained, agree as follows:

SCOPE OF CONTRACT: The Contractor shall provide the services to the Purchasing Agency as set forth in the Contract Documents.

PERIOD OF PERFORMANCE From _____ through _____

The contract documents shall consist of:

- (1) This signed form;
- (2) The following portions of the Request for Proposals dated _____:
 - (a) The Statement of Needs,
 - (b) The General Terms and Conditions,
 - (c) The Special Terms and Conditions together with any negotiated modifications of those Special Conditions;
 - (d) List each addendum that may be issued
 - (e) Performance Specifications
- (3) The Contractor's Proposal dated _____ and the following negotiated modification to the Proposal, all of which documents are incorporated herein.
 - (a) Negotiations summary dated _____.

IN WITNESS WHEREOF, the parties have caused this Contract to be duly executed intending to be bound thereby.

CONTRACTOR:

PURCHASING AGENCY:

By: _____
(Signature)

By: _____
(Signature)

(Printed Name)

(Printed Name)

Title: _____

Title: _____

ATTACHMENT D

PERFORMANCE SPECIFICATIONS

JAMES MADISON UNIVERSITY - ATLANTIC UNION BANK CENTER

PERFORMANCE SPECIFICATIONS – HIGH DENSITY WIRELESS NETWORK

Proposals need to also include Offeror response to the items included in the RFP Statement of Needs (Section IV) in addition to the addenda.

PART 1 GENERAL

1.1 INTRODUCTION

- A. James Madison University – Atlantic Union Bank Center (hereinafter referred to as “the University”) intends to acquire a high density wireless networking system(s). The University herewith requests proposals for the design, engineering, installation, commissioning, testing, and acceptance of the systems described in the attached specifications and to include forthcoming drawings from the Offerors. Offerors may propose the complete package (Option 1) or any one of the Options as broken out in 1.1.B. below. Prices quoted shall be all-inclusive and represent complete installation at the site shown on the forthcoming drawings and in the attached specifications. The Contractor shall be responsible for all parts, labor, and all other associated apparatus necessary to completely install, test, and turn-over for acceptance to the University turnkey, fully operational systems. These systems (Indicated as Base Cost on Pricing Form) include, but are not limited to, the following:
1. State of The Art High Density Wireless Network
 2. Wi-Fi User Onboarding Service
 3. Wi-Fi Analytics
- B. The University requests itemized pricing for the following Options (offerors shall provide pricing using the Attachment F *Pricing Form [excel]* and in the RFP Section X *Pricing Schedule*):
1. Option 1 All Inclusive (Solution, Managed Services, and ISP): Complete all-inclusive turnkey system and system operation including detailed methodology and ISP pricing per RFP and attachments included.
 2. Option 2 Managed Services (Managed Services and ISP only - assumes separate solution purchase by owner): Turnkey Operation and Management of the proposed wireless system including ISP to begin upon final system acceptance. The pricing shall include contractor provided internet service connectivity appropriate to the performance as specified in this specification. The submittal should include a detailed methodology plan clearly stating all service level agreements for managing, operating, and maintaining the system.
 3. Option 3 Event Support/Event Rate (Event Support Only - assumes separate solution purchase with ISP and operation by owner): The University requests pricing for remote event support at a per event rate, assuming an estimated 120 events annually to begin upon final system completion. The submittal should include a detailed methodology plan clearly stating all service level agreements for providing remote event support.

MSB Response: *Understood and Comply. See pricing schedule.*

1.2 GENERAL DESCRIPTION OF CONTRACTOR REQUIREMENTS

- A. The Contractor shall be responsible for providing all system(s) equipment as proposed by such Contractor.
- B. The Contractor shall be responsible for the provision and installation of all secondary structural steel (i.e., conduit supports and mounting structures) and mounting brackets/hardware required to accommodate the new system(s). This includes all labor, materials, equipment, tools, transportation, and project management required to complete a fully operational system(s) on the project.
- C. Contractor shall be responsible for assembly, secondary modifications (if necessary) and mounting of all system(s) components onto new or existing structures.

- D. The University will provide Primary Power at defined demarcation points as shown on the project electrical drawings. Contractor shall be responsible for all power and electrical distribution from demarcation point (Secondary Power) to new system(s). Contractor shall provide all Secondary Power connections/terminations required to power new system(s).
- E. The University will provide conduits or raceways as shown on the project electrical drawings for low voltage. All additional conduit and raceways required to complete a path to each solution component shall be furnished and installed by Contractor. Contractor shall be responsible to furnish, install, and terminate all required cabling needed to make new system(s) complete and fully operational.
- F. Contractor is responsible for supplying a complete and fully operational system(s) as intended by the RFP documents and any subsequent addendums. Prior to entering into a contract for the project, Contractor (then as an Offeror) is responsible for notifying the University of any equipment omissions in the RFP documents that may prevent the completion of a fully operational system(s). If Contractor (then Offeror) fails to notify of any equipment omissions, Contractor shall assume responsibility for providing the required equipment at no additional cost to the University.
- G. Contractor shall field verify all work site conditions prior to submitting shop drawings.
- H. Contractor shall grant the University an irrevocable license to use all proprietary software provided with this RFP for the life of the system(s).
- I. All equipment (except University Furnished (OFE)) and materials shall be new (latest version at time of proposal) and shall conform to applicable UL, EIA, TIA, or ANSI provisions. Re-manufactured or "B" stock equipment shall not be accepted without prior written consent from the University. Evidence of unauthorized re-manufactured or "B" stock equipment on the project site shall be deemed evidence of the Contractor's Failure to Perform the Work. Contractor shall take care during installation to prevent scratches, dents, chips or disfiguration.
- J. All network equipment power circuits must have an emergency back-up system as deemed necessary per the local or state fire code; whichever is more restrictive.
- K. MSB Response: Understood and comply with the requirements of this section and as further specified in the Addenda.

1.3 OFFEROR QUALIFICATIONS

- A. The University seeks to contract with an Offeror for the full performance of the work as described in this RFP and has the option to obtain a long-term service contract and support for all equipment supplied by the selected Offeror. In an effort to ensure the chosen Offeror has the long-term interests of the University in mind, the following shall be required in order to submit a proposal for this project. Failure to submit acceptable responses to all of these requirements shall eliminate an Offeror from consideration. The University, in its sole discretion, shall reserve the right to waive any or all of the requirements listed below.
- B. Offeror shall provide a list of a minimum of three (3) facilities (facility, contact name, title, address and current phone number) where the Offeror has provided equipment and services of equivalent size and scope within the last five (5) years.
- C. MSB Response: See Section IV, Statement of Needs, Subpart D
- D. Offeror shall provide a minimum of one (1) facility (facility, contact name, title, address and current phone number) where the Offeror has provided equipment and services of equivalent size and scope that is at least five (5) years old.

MSB Response:

The Pit

University of New Mexico

1 University of New Mexico

Albuquerque, New Mexico 87131

Adiel Sanchez – Sr. Network Engineer

Phone (505) 238-5472

Offeror shall have a direct service employee or certified contractor capable of providing maintenance response on site within three (3) hours of a call for service.

MSB Response: *MSB has had discussions with a 3rd party company that has support personnel onsite under another contract. The 3rd party company wants to have direct discussions with JMU about adding this service to their existing contract. MSB recommends a conference call with the appropriate parties to discuss this opportunity to leverage existing contract assets to support the network.*

- E. Offeror shall have a minimum of five (5) years in the communications, networking, and structured cabling business.

F. **MSB Response:** *Understand and Comply.*

- G. Offeror's primary line of business shall be communications and structured cabling.

H. **MSB Response:** *MSB's primary line of business is engineering and technology integration services. MSB will identify a sub-contractor that meets this requirement.*

- I. Offeror will have a minimum of ten (10) full-time installers.

J. **MSB Response:** *MSB will identify a subcontractor that meets this requirement.*

1.4 SUBMITTAL REQUIREMENTS

- A. Contractor shall be required to provide submittals and shop drawings (print and electronic) to the University within twenty (20) calendar days of date shown on award notice, acknowledged with a binding letter of intent. Contractor shall be responsible to ensure that the dimensions and specifications of each component and all systems fit within the building allowances. Contractor shall advise the University of any discrepancy that may affect installation. If Contractor fails to notify the University of any discrepancies, Contractor shall assume responsibility for providing the required equipment or correcting such discrepancies at no additional cost to the University. The following required submittals will be defined by guidelines established by the University and shall include but not be limited to:
1. One set of electronic shop drawings in PDF format, and predictive analysis studies product data and samples together in one package within twenty (20) calendar days of date shown on award notice to Contract and prior to ordering equipment.
 2. Catalog data sheets, neatly bound with title page, space for submittal stamps, and tabbed dividers between Sections. Provide a complete list of proposed equipment with reference to its

corresponding specification paragraph number or equipment title in specification paragraph order. Denote all approved substitutions.

3. Point-to-point wiring diagrams and typed wire lists identifying every connection. Include electronic devices such as switches, transformers and terminal blocks. Indicate locations of all components. Identify cables by types, colors and wire numbers. Complete, detailed wiring diagrams for the systems, based on the contract documents but including cable types, identification and color codes, and detailed wiring of connections, both at equipment and between equipment racks and wiring conduit, connector types, expansion loops and cable lengths. Drawings shall comply with ANSI and International Electro Technical Commission recommendations and standards as appropriate. Provide drawing set cover sheet clearly dimensioning all cable preparation details for each cable type and connector utilized in the system.
4. Structural engineered drawings (if required) for all secondary steel framing required for this scope of work. Structural drawings submitted shall include attachments to primary steel structure. Structural engineered drawings shall also include method of attachment for all components required for this scope of work. A licensed/registered engineer in the state where this project is located shall stamp all structural drawings.
5. Conduit riser diagrams showing required conduits and junction boxes along with types of quantities of cables to be contained in each conduit. Show details of weatherproofing, lightning protection and grounding, strain relief and cable support, fire stop protection, and wall penetrations through all rated partitions.
6. Rack elevations indicating the proposed arrangement of mounted equipment including power junction box location and locations of conduit penetrations. Rack elevations shall include front and rear views. BTU loads for each piece of equipment shall also be included on the rack elevation drawing.
7. Detail drawings of all custom fabricated items and approved equipment modifications. Include complete parts lists, schematic diagrams, and all dimensions required for proper assembly.
8. Proposed color selections and finishes for all exposed surfaces and custom fabricated items. Submit actual color/finish samples, wall plates, and custom labels.
9. A list of all lower tier subcontractors and suppliers. List shall include lower tier subcontractor's qualifications indicating performance of similar work on past projects of this type and scope.
10. A project schedule in Gantt chart format outlining equipment delivery dates and installation start and finish dates. Project schedule shall be broken down into sufficient detail (work task and duration) to permit the University to monitor installation progress on a daily basis.
11. Copies of all required business and contractor licenses.
12. Proof of compliance with all insurance requirements.
13. Approval of submitted items indicates only the acceptance of the manufacturer and quality. Specific requirements, arrangements, and quantities shall comply with the intent of the Contract Documents as interpreted by the University unless specifically approved in writing.
14. Submittals that are incomplete, deviate significantly from the requirements of the Contract Documents, or contain numerous errors will be returned without review for rework and re-submittal, and may result in back charges to the Contractor.

MSB Response: *MSB understands the requirements of this section. MSB requests the 20 calendar day duration for Shop drawings be evaluated at the time of award or binding letter of intent to confirm building access for the survey and availability of JMU personnel to accompany MSB that can address aesthetic concerns and stealthing requirements.*

1.5 CONTRACT CLOSEOUT SUBMITTAL

- A. When the installation is substantially complete including the Testing Reports in Part 3 of this Section, Contractor shall submit two (2) complete initial hard copy sets of contract closeout submittals to the University for review. After review and approval of initial set, the University shall return one (1) initial hard copy to Contractor with comments for updating. Contractor shall provide four (4) final sets of closeout submittals and one (1) electronic copy in PDF format, or format related to discipline. Closeout submittals shall include, but not be limited to:
1. Project Record Drawings (As-Built Drawings) including final secondary steel structural drawings, electrical drawings, systems block diagrams, rack elevation drawings and wiring schedule.
 2. As built configuration files.
 3. An Operation & Maintenance Manual.
 4. A list of all equipment provided and its location within the facility. List shall include manufacturer name, model identifier, serial number, and any other pertinent information needed to obtain service, maintenance, and/or replacement.
 5. A list of all subcontractors who performed work for Contractor during installation. List shall include company name, physical company address, phone number, and contact person(s).
 6. Copies of all software, settings and programs used in the control and operation of this system.
 7. Copies of all equipment registration documentation.
 8. Test reports for all new copper and fiber optic cable installed under this scope of work. Test reports shall indicate end to end signal loss does not exceed applicable industry standards.

MSB Response: *MSB understands and complies with the requirements of this section.*

1.6 OPERATION & MAINTENANCE MANUAL

- A. Upon substantial completion but prior to onsite training with the University, Contractor shall provide two (2) print final Operation & Maintenance Manuals (O&M Manuals) and one electronic PDF copy. O&M Manuals shall have tab dividers and shall be logically organized to provide easy access to information without the need to research through entire manual. All documents provided in the O&M Manual shall be written in English and shall provide sufficient detail as to be understood by an individual with basic knowledge of the provided systems. Contents of the O&M Manual shall include, but not be limited to:
1. Table of Contents.
 2. Description / overview of system(s) including key features and operational procedures.
 3. Full start up procedure for all systems equipment and any additional networking components written under the assumption that all equipment was in full powered off mode.
 4. Full shutdown procedure for all systems equipment written under the assumption that the facility is in an extended power failure situation.
 5. Owner's Manuals for all third party and/or "off the shelf" type equipment provided by Contractor; e.g., KVM's, fiber modems, network switches/routers, and UPS battery backups.
 6. Small scale plans showing locations and circuit numbers for all system outlets and receptacles.
 7. Single-line block diagrams showing all major components of the systems.
 8. All third-party equipment and/or "off the shelf" equipment warranties and a notarized system warranty.

MSB Response: *MSB understands and complies with the requirements of this section.*

1.7 EQUIPMENT GENERAL SPECIFICATIONS

- A. All equipment and materials, except University furnished, shall be new and the latest version at the time of proposal submission and shall conform to applicable UL, ULC, CSA or ANSI provisions. Re-manufactured or "B" stock equipment shall not be accepted by the University. Evidence of unauthorized re-manufactured or "B" stock equipment on the project site shall be deemed evidence of the Contractor's failure to perform the work. Contractor shall take care during installation to prevent scratches, dents, chips or disfiguration of equipment and materials supplied. All damaged equipment and/or materials shall be repaired or replaced at the University's discretion. Contractor shall perform either option selected by the University at no additional cost to the University.
- B. All cabling [power and data] is to be labeled at each end of the cable with a description in English OR with a reference to a wire designation on a wiring diagram. Cabling numbers will be provided by James Madison Office of IT. These diagrams must be part of the Project documentation submitted to the University at time of acceptance.
- C. Each device shall meet all of its published manufacturer's specifications. Verify performance as required.
- D. Install all rack mounted equipment with Middle Atlantic Products HP Series truss head screws or approved equal.
- E. Some rack-mounted equipment may require shaft locks, security covers, or removal of knobs; provide and install during Acceptance Testing.
- F. Networking enclosures exposed to the outdoors, shall be of a NEMA 4X rating or better and provide adequate environmental control to ensure long-term equipment operation.
- G. Provide self-adhesive labels at the front of all rack-mounted signal processing equipment. Mount labels on the equipment chassis and attach in a neat and permanent manner. Embossed label shall not be accepted. Label equipment with schematic enumeration reference, and with descriptive information regarding its function or area it is serving. Similarly, provide engraved labels at the rear only of equipment mounted in furniture consoles.
- H. Mounting Hardware exposed to the weather shall be aluminum, brass epoxy painted galvanized steel or stainless steel. Apply corrosion inhibitor to all threaded fittings.
- I. Catwalk Equipment Racks shall be Middle Atlantic Products model MRK-4436, or approved equal, with accessories as noted below. Quantity of racks shall be as required to house all equipment supplied under this scope of work. Any unused rack mounting spaces shall have ventilated (~64%) blank panels to fully enclose the rack assembly. Multiple racks shall be anchored together using appropriate ganging hardware. Standard solid rear door shall be replaced with Middle Atlantic Products model MW-VRD-44 vented rear door.
 - 1. Provide two (2) side panels per individual stand-alone rack or series of racks ganged together. The intent is to have an enclosed rack system. A single stand-alone rack shall have two (2) side panels and a series of three (3) racks ganged together shall also have two (2) side panels. Side panels shall be Middle Atlantic Products model SPN-44-36 or approved equal.
 - 2. Provide Middle Atlantic Products model MW-4QFT-FC integrated fan top, or approved equal, for each rack. Fan shall be thermostatically controlled to ensure in-rack temperatures of less than 68 degrees Fahrenheit.
 - 3. Provide two (2) Middle Atlantic Products model LT-GN-PL gooseneck work lights, or equivalent, for each rack required for this scope of work.

4. Provide Middle Atlantic Products model PDT-2X1020T, or approved equal, in rack vertical power strip. Power strip shall have enough receptacles to accommodate all equipment housed in the associated rack with a minimum of two spare receptacles per rack.
 5. Wall mount enclosures may be used at catwalk level. University to retain all approvals of enclosures.
- J. Any rear mounted rack equipment shall be placed so the equipment does not block access to the back of front mounted equipment.
 - K. Contractor shall exercise care when wiring racks to avoid damaging cables and equipment. Contractor shall install grommets around cut-outs and knock-outs where conduit or chase nipples are not installed.
 - L. Equipment Racks shall have a ground buss installed in each rack. Ground buss shall be insulated from the rack. Attach equipment rack to ground buss at one point using #4 insulated copper wire. Ground any equipment chassis without a three-conductor power cord directly to the buss bar using #12 insulated copper wire. Tie each power receptacle ground contact to the buss bar using #12 insulated copper wire. Interconnect signal cables shall be routed from junction boxes through metallic flexible conduit(s) (2.5 cm to 5 cm diameter) as appropriate. Flexible conduit shall be insulated from racks by approved insulating bushings.
 - M. **MSB Response:** Addendum 2 states all conduit will be provided by the Owner. Please clarify the conduit requirement in section L.
 - N. Power wiring and signal/data wiring shall be installed on opposite sides of rack. Contractor may determine which side is used for power and which side for signal. Method shall be kept the same for entire installation, if multiple racks are required. Contractor shall exercise care when wiring racks to avoid damaging cables and equipment.
 - O. Equipment installed in exterior locations shall be IP67 rated and operating temperature range 0 degrees F to 90 degrees F and survivable from -20 degrees F to 110 degrees F.
 - P. All equipment mounted above seating areas and venue floor is required to be secondarily fastened to structure using aircraft cable and appropriate fasteners. Cable sizing and fasteners to be capable of supporting a minimum of two (2) times the weight of the affixed device.
 - Q. Non-Catwalk MDF and IDF Equipment Racks will be provided by Owner and will be seven foot, two post, 19 inch Chatsworth 55053-503 racks.
 - R. **MSB Response:** *MSB understands and complies except as noted.*

1.8 QUALITY ASSURANCE

- A. All requirements of the latest published editions of the following standards shall apply, unless otherwise noted. In the event of conflict between cited or referenced standards, the more stringent shall govern.
 1. National Electric Code (CE Code)
 2. National Electrical Manufacturers Association (NEMA)
 3. Occupational Safety and Health Administration (OSHA)
 4. Underwriters Laboratories (UL)
 5. Electronic Industries Association (E.I.A.)
 6. Telecommunications Industries Association (T.I.A.)

- B. Review all architectural, civil, structural, mechanical, electrical, and other project documents relative to this work.
- C. Verify all dimensions and site conditions prior to starting work.
- D. Coordinate the specified work with all other trades.
- E. Maintain a competent supervisor and supporting technical personnel, acceptable to the University during the entire installation. Change of supervisor during the project shall not be permitted without prior written approval from the University.
- F. Provide all items not indicated on the drawings or mentioned in the specifications that are necessary, required or appropriate for this work to realize a complete and fully operational system that performs in stable and safe manner.
- G. Review project documentation and continuously make known any conflicts discovered and provide all items necessary to complete this work to the satisfaction of the University without additional expense. In all cases where a device or item or equipment is referred to in singular number or without quantity, each such reference shall apply to as many such devices or items as are required to complete the work.
- H. Provide additional support or positioning members as required for the proper installation and operation of equipment, materials and devices provided as part of this work as approved by the University, without additional cost to the University.
- I. Regularly examine all construction, and the work of others, which may affect Contractors work to ensure proper conditions exist at site for the equipment and devices before their manufacture, fabrication or installation.
- J. Contractor shall be responsible for the proper fitting of the systems, equipment, materials, and devices provided as part of this work.
- K. Promptly notify the University in writing of any difficulties that may prevent proper coordination or timely completion of this work. Failure to do so shall constitute acceptance of construction as suitable in all ways to receive this work, except for defects that may develop in the work of others after its execution.
- L. After installation, submit photographs showing cable entries and terminations within equipment racks, enclosures and pedestals at the job site.
- M. **MSB Response:** *Comply.*

1.9 APPLICABLE STANDARDS

- A. The following standards are applicable to this document and must be adhered to for any installation work performed.
 - 1. TIA/EIA 568-B: Commercial Building Telecommunications Cabling Standard.
 - 2. TIA/EIA TSB-67: Transmission Performance Specifications for UTP Cabling.
 - 3. TIA/EIA 568-A-1: Propagation Delay and Delay Skew for 100 Ohm 4-pair Cable.
 - 4. TIA/EIA 568-B.2.1: Category 6 Final Draft.
 - 5. TIA/EIA-569-A: Commercial Building Standard for Pathways and Spaces.
 - 6. TIA/EIA-606: Administration Standard for Commercial Buildings.

7. TIA/EIA-607: Commercial Building Grounding/Bonding Requirements.
8. ANSI/NFPA-70: National Electrical Code.
9. ANSI/IEEE C-2: National Electrical Safety Code.
10. Pertinent Local Codes and Standards

1.10 HIGHLIGHT REQUIREMENTS

- A. All UTP cables installed:
 1. Shall not exceed 1cm untwist at termination.
 2. Shall not exceed 2cm jacket removal at termination.
 3. Shall maintain 2.5cm minimum bend radius always.
 4. Shall not be stepped-on, kinked, or otherwise disfigured during installation.
 5. Shall be installed, wherever possible, 60cm from sources of EMI such as fluorescent lamps, electrical cables and conduits; when this is impossible, maintain as much separation as possible with a minimum of 15cm.
 6. Shall not be laid directly onto suspended ceiling grid.
 7. Cabling is to be dressed via Velcro ties, nylon cable ties are to be used only at the approval of OIT if and when required.
 8. All 4-pair of each UTP cable shall be terminated onto a single jack or patch panel port; splitting pairs (i.e., 2 pair for voice, 2 pair for data) shall not be allowed.
 9. All cable runs in ceiling areas shall be supported with 25.4 cm bend radius compliant supports every 1.5 meters; cable ties to ceiling grid wire shall not be used as a ceiling support facility.
 10. All conduit sleeves and slots shall have fire stop with appropriate fire-rated materials as designated by building design.
 11. Contractor shall be cognizant of any areas requiring low smoke, zero halogen cabling and institute appropriate products where required.

MSB Response: *Comply.*

END OF PART 1 GENERAL

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS AND PRODUCTS

- A. Network core equipment (routers, switches, etc.) shall consist of Cisco manufactured products. Wireless equipment to include all access points shall consist of Aruba manufactured products.
- B. All connectivity, patch cords, wire management, surface raceway, and identification products used in this installation must meet the standards as specified in section 1.9 of this specification and be compatible with the equipment listed in 2.1.C.1-6.
- C. Following is a listing of required part numbers for use in the installation of structured copper cabling.
 - 1. 6H-272-DB Superior Essex Cat6A Cabling (Plenum)
 - 2. OR-40300548 Ortronics Cat6A Face plates (2 Port) Trac Jack
 - 3. OR-TJ610-68 Ortronics Cat6A Jacks (Single)
 - 4. OR-40300546 Ortronics Cat6A Face plates (4-Port) Trac Jack
 - 5. OR-PHDHJU24 Ortronics 24 Port Flat Modular Patch Panel (Unloaded)HD
 - 6. OR-HDJ6A-45 Ortronics Hgh Density Patchpanel Jacks (Green) Modular
- D. Single Mode and Multimode Fiber Optic Feeder and Riser: University Provided

2.2 CABLING PERFORMANCE SPECIFICATIONS

- A. The UTP cabling system proposed for this project shall meet the following minimum system (cable and hardware combined) industry standard compliance requirements as evidenced by 3rd party verified lab test results (i.e., ETL labs) submitted with proposal. Systems performing below these levels shall not be accepted.
 - 1. NEC/(UL) Specification: CMP/CMR Respectively
 - 2. NEC Articles: 800
 - 3. CEC/C(UL) Specification: CMP/CMR Respectively
 - 4. EU Directive 2011/65/EU (ROHS II)
 - 5. ISO/IEC 11801 Ed 2.1 (2008) Class E: CMR Only
 - 6. EU CE Mark
 - 7. EU Directive 2000/53/EC (ELV)
 - 8. EU Directive 2002/95/EC (RoHS)
 - 9. EU RoHS Compliance
 - 10. EU Directive 2002/96/EC (WEEE)
 - 11. EU Directive 2003/11/EC (BFR)
 - 12. CA Prop 65 (CJ for Wire & Cable)
 - 13. MII Order #39 (China RoHS)
 - 14. Telecommunications Standards: Category 6 - TIA 568.C.2
- B. All fiber optic cable proposed for this installation shall meet or exceed the following industry compliance standards.
 - 1. TIA/EIA-568-C.3

2. ISO/IEC 11801, 2nd Edition
 3. Telcordia GR-409-CORE
 4. RoHS II 2011/65/EU
 5. REACH EC1907-2006
 6. NEC/CEC OFNR/OFN FT.4 (RISER - PVC)
 7. NEC/CEC OFNR/OFN FT.4 (LSZH - FRPE)
 8. NEC/CEC OFNP/OFN FT.6 (PLENUM - PVC or PVDF)
 9. ICEA S-83-596
- C. Fiber optic cable maintenance loops shall be a minimum of three (3) meters at the wiring closet.

2.3 HORIZONTAL CABLE SUBSYSTEMS

- A. Where connectors must be installed into surface mounted raceway, the Contractor shall provide the appropriate faceplate as well as any necessary adapters to facilitate the installation of the connectors specified in this section directly into the raceway. Surface mounted boxes shall not be accepted as mounting devices on surface raceways.
- B. At the wiring closet, each UTP cable shall be terminated onto an approved connector and loaded into an approved modular patch panel or equivalents. All patch panels shall be modular, front-access, high density patch panels. No fixed-port 110-style panels shall be accepted. Contractor shall provide required patch panels ports plus 20 percent for future growth. Patch panel ports provided as excess for future growth need not be populated with connectors. However, all excess ports not populated shall have installed a single blank insert.
- C. A two-rack-space horizontal wire management panel shall be installed for every 48-port patch panel. D-ring wire management systems shall not be accepted.

2.4 BONDING AND GROUNDING

- A. All cabling, racks, and patch panels shall be bonded and grounded in accordance with TIA 942. Specific highlight requirements are listed below:
 1. Telecommunications Grounding Bus bars (TGB) shall be provided by the University
 2. Telecommunications Main Grounding Bus bars (TMGB) shall be provided by the University.
 3. Racks shall be put together with paint piercing grounding washer kits, Panduit part number RGW-12-1 or equivalent.
 4. 2.13 m rack grounding strip kits shall be installed on the rear of each rack installed, one per rack, Panduit part number RGS134-10-1 or equivalent.
 5. Each patch panel shall be installed to the rack utilizing at least one (1) bonding screw.
- B. Maintenance loops for any Category 6A cabling installed shall not be made inside single-gang wall boxes but shall be installed above the stubbed conduit at each outlet location. All maintenance loops at the outlet and at the wiring closet shall be installed in a staggered-loop pattern.
- C. All Category 6 cables shall be tested the final draft of the TIA/EIA Category 6A standard with a Fluke, DTX 1800 or higher, tester and meet or exceed the performance criteria. Test reports evidencing these performance levels shall be provided for each cable link. Test results shall be provided in hard copy and electronic format to the University upon completion of the project.

- D. All fiber optic cables shall be tested the final draft of the TIA/EIA applicable standard with a Fluke, CertiFiber Pro or equivalent, tester and meet or exceed the performance criteria. Test reports evidencing these performance levels shall be provided for each cable link. Test results shall be provided in hard copy and electronic format to the University upon completion of the project.
- E. All cables, outlets, and patch panel ports shall be labeled in accordance with JMU Telecom Specifications using a mechanical hand-held labeler or Panduit PanMark software. No hand-written labels shall be accepted. The University shall provide the numbering sequence upon start of project.

2.5 NETWORKING COMPONENTS AND SERVICES

- A. Reference accompanying pricing proposal sheets (Attachment F) for Excel submittal format.
- B. Pricing proposals must be submitted in this format. No other formats will be considered. Offerors may return a PDF copy of the Excel sheet as confirmation but must provide the Excel file in the USB or CD copy of the submission that accompanies the hard copies.
- C. **MSB Response:** *Comply.*

END OF PART 2 PRODUCTS

PART 3 EXECUTION

3.1 SYSTEMS NARRATIVE DESCRIPTION

A. High Density Wireless Network

1. The high density wireless network shall provide throughput of 11 Mbps per user and coverage for identified areas of the facility, with anticipated 8,300 associated, authenticated, and active fan-based users distributed throughout the facility and surrounding area. These users will access the internet, video streaming, video uploading, social media, custom applications, ticketing application, concessions, merchandise, and view statistics. The 8,300 users of the fan facing wireless solution are not intended to be inclusive of business operations or back of house ("BOH") operations. Contractors are to be cognizant of any operational/enterprise function system loads, understanding that the fan facing deployment performance shall not be impacted by the operational/enterprise functions.
 - a. Accompanying PDF Wi-Fi Exclusion Areas (Attachment E) indicating areas excluded from coverage has been provided. It is the intent for the University to provide wireless coverage in these areas. All other areas are assumed to be provided by the Contractors high-density solution.
 - b. Contractor has been provided facility construction drawings as part of this RFP package for system design. It is expected that these documents in conjunction with the exclusion areas referenced above will provide sufficient detail to provide a functional high-density Wi-Fi design for the venue.
2. User onboarding will occur in a relatively short period of time, during ingress to the arena, the Contractor shall be cognizant and provide solutions to handle the onboarding efficiently. Allowing 8,300 users to authenticate to the high density wireless network within a 30-minute activation window. Anticipated user onboarding time is less than 3 seconds, once splash page activation is completed.
3. The Contractor shall provide a captive portal gateway for user access, to be used at the University's discretion.
4. Contractor is required to provide example of user onboarding experience.
5. The wireless system shall support 5 GHz, bands n, ac, ax draft.
6. Wireless system hardware deployment (access point, repeaters, etc.) is to be of minimal visual impact, providing both an aesthetically pleasing (University's Discretion) and robust deployment. Drawings of currently provided infrastructure and locations are forthcoming to aide in systems design.
7. Seamless roaming- Users able to move through the identified areas, inclusive of, but not limited to, elevator cabs, ramps, and stairwells, without dropping any TCP/UDP connections.

MSB Response: *Based on our experience at other venues, the Fire Marshall in those states has prohibited specific installation of Access Points in stairwells and elevator cabs. MSB will design coverage to 'bleed' into these areas from adjacent locations but a specific, dedicated service cannot be provided. We are open to discussing this point if the State of Virginia Fire Marshall has a different position on this item.*

8. System shall support Various Authentication options to be implemented based on the user experience(s), defined by the University, these includes but are not limited to Ad's for access (both still and video), Social media login (Facebook, Twitter, Google+) Apps for access, pay for access, and roaming authentication through radius integration.
9. Tier offerings to be supported based on data rates and data volume.
10. Captive Portal User Experience shall be customizable based on location, and authentication method.

11. System shall support integration with industry standard programmatic Ad serving platforms to be defined by the University. Solution to include VAST 3.0 player.

MSB Response: *MSB will investigate whether Aruba products fully support this integration. At the time of this response, this is an open item.*

12. System shall support next generation hot spot technologies including, but not limited to, Hot Spot 2.0 EAP-SIM.
13. System shall support Wi-Fi presence-based technology.

MSB Response: *Aruba supports this requirement with the specified hardware. Further discussion is required on whether JMU has another vendors platform in mind to utilize the data or if the Aruba solution is preferred. If Aruba is preferred, then additional hardware and software components are required.*

14. System shall provide API's and web services to access back office syslogs and databases, including, but not limited to, DHCP logs, DNS logs, Web Server logs and Proxy server logs. System shall automatically provide raw user data to the University within 12 hours after an event.

15. System to include management portal with extensive reporting and filtering including, but not limited to:

- a. Unique users
- b. Session times
- c. Revenue
- d. Google analytics
- e. Presence
- f. Domains visited
- g. Trouble tickets
- h. Help desk logs
- i. Device service history
- j. User bandwidth
- k. Device type
- l. User identity
- m. Heat maps

MSB Response: *MSB requests further clarification on the items c, g, h to completely respond to this question.*

16. System shall support indoor mapping.
17. Systems Security:
 - a. Rogue AP detection and mitigation - Rogue AP Mitigation must be performed in all cases in conjunction with JMU Information Technology.
 - b. MITM detection and mitigation
 - c. Captive portal security and the mechanisms in place to prevent credential hijacking

3.2 EXPECTED SYSTEM PERFORMANCE

- A. High Density Wireless Network

1. System proposal is to be all inclusive and turnkey including, but not limited to, all switching, routing, servers, intrusion protection, infrastructure, and networked managed uninterruptable power.
2. It is expected that the Contractor shall base component selection and system design on total occupancy of 8,300 spectators and their multiple associated devices in all public areas including surrounding areas (plazas), elevators, and parking. Additionally, it shall include all back-office operations such as private corporate network that would service arena operations, media (i.e. large groups of media personnel with multiple devices in the event level of the arena), food and beverage, retail, etc.

MSB Response: *Addendum 2 states parking lot coverage is excluded from the scope of this project.*

3. The Contractor is responsible for determination, and verification of the number and type of access points to be deployed. Locations are expected to be a mixture of cable tray, exterior, and finished ceiling, and clear span installations based upon coverage needs.
4. Contractor is required to provide any mounting and or custom enclosures as part of their proposed solution.
5. Contractor is required to determine quantities of SSIDs broadcasted and non-broadcasted, based upon their proposed solution and forthcoming needs of the University. James Madison University in any form, to include JMU, shall not be used in SSID naming conventions. Contractor is required to coordinate with JMU Information Technology for all SSID naming conventions.
6. Contractor is required to determine quantities of VLANs based upon their proposed solution and forthcoming needs of the University.
7. No support for legacy 802.11 standards are required. Contractor shall focus on standards n, ac, ax as the basis for their proposed solution.
8. Contractor shall be cognizant and present means by which to minimize rogue traffic and bandwidth conservation such as, but not restricted to, HTTP caching proxy, blocking external streaming sources, and QoS traffic shaping. Rogue AP Mitigation must be performed in all cases in conjunction with JMU Information Technology.
9. Category based content filtering.
10. The following estimations related to event day usage are for reference only, based on historical data from similar installations and shall not be the basis of the Contractor's proposal. The Contractor is responsible for turnkey system performance and is required to independently determine the actual system load for their proposed system, based upon the University's stated performance requirements. Coverage area is bowl seating, suite areas, business operations, BOH operations, concourses, premium areas, truck dock, media, elevator cabs, POS, parking, exterior plazas, portable show spaces, etc. System shall be engineered to cover all areas of the facility. Scope is inclusive of point of sale solution. Contractor shall be responsible for ensuring that any wireless point of sale solution authenticates and operates and roams seamlessly throughout the facility.

a. Anticipated provided throughput per user	11 Mbps
b. Estimated number of average concurrent connections	5,800
c. Total spectators in anticipated coverage area	8,300

3.3 HIGH DENSITY WIRELESS NETWORK CORE

- A. System proposal is to be all inclusive and turnkey including, but not limited to, all switching, routing, servers, intrusion protection, infrastructure, and network managed uninterruptable power.

- B. System topology is to be redundant with fault detection and notification, as well as, implement redundant hardware power supplies to provide for minimal possibility of system outage.
- C. The Contractor shall provide adequate high density wireless network backbone to maintain the level of throughput required for all services, inclusive of event day wireless.
- D. The Contractor shall assume station cabling is to be of Category 6A UTP or better, providing a minimum of a Gigabit physical copper backbone to all edge devices.
- E. Ancillary networked services supported by high density wireless network, but not restricted to:
 - 1. VoIP
 - 2. AoIP
 - 3. Life Services (Security, Fire, and Mechanical)
 - 4. Video Conferencing
 - 5. Point of Sale
 - 6. Broadcast
 - 7. Audiovisual
 - 8. Ticketing

MSB Response: *Further definition of VoIP, AoIP Life Services and Broadcast video applications is required to validate proper operation with the proposed solution. Due to Wi-Fi operating in an unlicensed frequency band and subject to inference, MSB doesn't recommend operating Life Safety services over wireless infrastructure as the primary means of communication.*

3.4 SOFTWARE ENVIRONMENT

- A. Software Environment: The following applications and features, including, but not limited to, represent current desired capabilities of the University.
 - 1. Management
 - a. RF Performance
 - b. Client RF health
 - c. SNR
 - d. Speed statistics
 - 2. Firewall
 - a. App performance
 - b. Usage by device
 - c. Destinations, WLAN
 - d. Users or roles
 - 3. RF Capacity
 - a. Network-wide AP threshold and usage statistics
 - 4. Anomaly Detection
 - a. Current client count and network usage statistics compared to 40 week rolling average
 - 5. Watched Clients
 - a. SNR, speed and health statistics for VIPs/problem prone clients

6. Client On Boarding
 - a. Captive Portal
 - b. Policy Manager
 - c. Real-time visibility and analysis
 - d. Identity Stores
 - e. Enterprise Data
7. PCI Compliance for POS
 - a. Network Policies
 - b. Device Policies
8. Visitor Engagement
 - a. Mobility Context
 - b. Location Services
 - c. Impact the Customer experience
9. Mobile Engagement Technologies
 - a. Services
 - b. Network
 - c. Applications
10. Virtual Beacons: University preference; Mist Virtual Beacons Application
 - a. Comprehensive Tools

MSB Response: *The proposed network supports beacon technology, but additional discussion is recommended to ensure JMU's use cases for beacons and location based services is fully understood.*

3.5 SSID MANAGEMENT

- A. Smart SSID Management is to be implemented, minimizing the number of SSIDs for management. The University anticipates solution management to provide (1) one broadcasted and accessible fan facing SSID, in conjunction with non-broadcast enterprise SSIDs. Other SSIDs will be specified to support business and event functions. These details will be forthcoming once the Contractor has been awarded.

3.6 WARRANTIES, MAINTENANCE AND LICENSES

- A. The Contractor is required to provide the University with a total cost of ownership broken out by annual cost. An inclusive itemized package encompassing all warranties, licenses, and maintenance contracts on all hardware and software as part of the proposal from the day of system acceptance and sign-off.
- B. Warranty period shall commence on the day of system acceptance and final sign-off. Sign-off will not be awarded until the conclusion of (5) five successful, issue free, consecutive events.

- C. **MSB Response:** *MSB understands this requirement but asks JMU to acknowledge that WiFi networks operate in unlicensed frequency bands and network performance is subject to transmissions from both compliant and non-compliant devices that aren't authorized to operate at the center. MSB cannot be held responsible for network performance issues related to transmissions from unauthorized devices that operate in the center.*

3.7 DATA SYSTEMS

- A. Grounding and Shielding.
- B. Mount and enclose all electrical and electronic equipment in metal enclosures, pedestals or equipment racks.
- C. Use EMT type conduit for all wiring outside of equipment racks except plenum rated wiring above a lay-in ceiling, and outdoor conduits and raceways, where separate insulated ground wiring shall be supplied.

MSB Response: *Addendum no. 2 states pathway will be provided by JMU. We request JMU please clarify this requirement.*

- D. Use flexible conduits and PVC fittings to provide insulated connections of the building's electrical raceways to equipment racks. Mount all equipment racks at the job site in a manner which provides electrical solution from the building structure and electrical raceways.
- E. Wiring Practices.
 - 1. Where specific instructions are not given, perform all wiring in strict adherence to standard systems engineering practices in accordance with the references listed.
 - 2. Group all wiring into the following classifications by power level or signal type:
 - a. Copper Data
 - b. Fiber Data
 - c. AC Power Circuits
- F. Separate wiring of differing classifications by at least fifteen (15) cm, wherever possible. Wherever lines of differing classification must come closer together than fifteen (15) cm, cross them perpendicular to each other.
- G. Neatly harness wires together within racks by power level classification using horizontal and vertical wiring supports as required. Rigidly support all wires with fixed connection points. Leave service loops of sufficient lengths to allow rack hinges or slides to fully extend to facilitate access to rear panel connectors from the front of each rack. Do not use self-adhesive ty-wrap pads for support of cables unless fastened with screws.
- H. All infrastructure conductors installed under this contract for low voltage shall adhere to the following color code:
 - 1. Copper Station Cabling –Yellow.
 - 2. Copper Patch Cords and Network Interconnects – Shall be stranded, pre-molded, and strain relieved, and black in color
- I. Exercise care in wiring to avoid damaging the cables and equipment. Use grommets around cut-outs and knock-outs where conduit or chase nipples are not installed.

- J. Make network connections using approved mechanical connectors. All connectors shall be insulated from mounting plates or panels. Label each connection point with a unique number.
- K. Any required fiber splicing shall utilize the fusion splice method. The maximum allowable loss per fusion splice shall be .05 dB.
- L. Pull mandrel one size smaller than the conduit, through entire length of all underground conduits.
- M. Cable pulling lubrication shall be utilized when pulling cable in conduits.
- N. A dynamometer shall be used to measure pulling tension during long or difficult runs. The dynamometer is to be placed between the cable puller and the pull line to monitor pulling tension. The manufacturer's pulling tension maximum range shall not be exceeded.
- O. Pulling grips suitable for use with fiber cables shall be applied to the ends of the cable. Consult cable manufacturer to determine appropriate pulling grip and method of attachment. Breakaway or fuse links shall be used at the pulling grip. Insure that the correct fuse pin is installed in the fuse link.
- P. The bend radius for all cables shall conform to manufacturer's specifications.

3.8 LABELING

- A. Label products in a logical, legible, and permanent manner corresponding to the Drawings. Wording, format, style, color and arrangement of text shall be subject to the University's approval. Submit samples and labeling schedule for approval. Labeling will be verified at final system commissioning.
- B. Label all wall plates, as well as, connector mounting plates in all boxes using a mechanical hand-held labeler with black letters on a white background.
- C. Label all permanently installed wires on both ends with approved permanent clip-on type or sleeve type markers.
- D. Label access panels and backboards with designations corresponding to the drawings. Where devices are concealed above access ceilings, provide permanent Lamicoid labels, on the ceiling « tees », corresponding to the drawings in finishes and sizes approved by the University.

3.9 ELECTRICAL AND DATA WIRING

- A. The electrical design and installation of all branch circuits by the Contractor shall comply with NEC, State and local codes, as well as University regulations and guidelines.
- B. The Contractor shall provide separate single-line diagrams for each type of signal.
- C. Electrical design and engineering must be reviewed and approved by the University prior to any electrical work by the Contractor.
- D. The Contractor shall be responsible for power distribution from the demarcation points noted on the included electrical drawings. Any additional electrical components required for a complete and fully operational system but not shown on the electrical drawings shall be the responsibility of the Contractor.
- E. Any additional raceway (conduit, cable tray, J hooks) required to provide a complete system for both power and signal/data shall be furnished and installed by Contractor. Any additional raceway required shall have routing of raceway approved by the University prior to installation.

- F. The Contractor shall be responsible for termination and final connection of power to all elements. All secondary electrical panels must be clearly marked with names of the branch circuits controlled by each breaker to aid in troubleshooting or isolating problems. All electrical services, disconnects, and breaker panels are to be labeled with what they control and where they are fed from.
- G. Contractor shall not use wire nuts or electrical tape for any power or signal connection or any part of the work. All connections shall use a proper terminal block and spade terminal, or terminal block and direct connection as required. Covers shall be provided over all high-power terminal blocks to prevent electrical shock.
- H. Any equipment not certified as required shall require on site certification by a listed testing agency. All cost associated with obtaining on site certification shall be the responsibility of the Contractor. Written proof of certification or equivalent shall be required prior to any work being performed on site.
- I. Contractor to provide all required fiber transmitters and receivers. Contractor shall be responsible to terminate and perform final connection of all cables.

3.10AESTHETIC CONSIDERATIONS

- A. At the time of the release of this RFP the University is still developing certain finishes and aesthetic design elements for consideration. Contractor shall assume premium finishes on all elements not yet defined.
- B. Post contract award, the Contractor must provide a comprehensive outline of intended finish details of all system equipment that is to be located in public viewing areas for University approval. Failure to submit these details shall make Contractor responsible for all finishes as required by the University at no additional cost to the University.
- C. The Contractor shall not visibly display its trademarks or insignia on any of the Equipment or structural elements within public view, unless explicitly negotiated with the University.

3.11FINAL ADJUSTMENT AND COMMISSIONING

- A. Schedule a time for the University and Contractor to perform the Final Adjustment and Commissioning. Notify the University at least seven (7) days in advance.
- B. Furnish engineers who are familiar with the system to assist the Contractor during the Final Adjustment and Commissioning.
- C. Record final settings on all equipment and submit with contract closeout documents.

3.12TRAINING

- A. The Contractor, at its own expense, shall provide designated University representatives Owner and maintenance training.
- B. Training shall be performed at the site by a qualified technician and shall occur either during installation of the equipment or immediately thereafter.
- C. The training shall cover the operation, routine maintenance and troubleshooting of systems equipment, and shall be sufficient in duration and detail to provide proficiency in the same to the designated University representatives.

3.13 TESTING AND ACCEPTANCE

- A. Contractor must demonstrate the full capabilities of the provided systems and prove performance meets contractual specifications.
- B. Confirmation shall be required of, but not limited to, the following functions: operation of each system component, including back-up systems, control functionality and integration with existing systems.
- C. Contractor must provide all necessary testing equipment for acceptance.
- D. Upon notice from the Contractor of substantial completion and at a time to be mutually agreed upon, the Contractor shall arrange for the testing of all operations of the systems comprised in scope of work at the time of substantial completion.
- E. The following items must be completed and signed off by an appropriate University official before the University will deem the system "Accepted":
 - 1. (5) five completed events with no equipment or system failures. The on-site presence of a contractor representative capable of mitigating failures is required.
 - 2. The University will not be responsible for any added costs as a result of an unsuccessful acceptance test.
 - 3. Acceptance of the system includes, but is not limited to, the completed installation of all physical components as well as system functionality. Tests of the system shall not occur until after the system has been installed, and all work completed. Testing parameters shall include, but not limited to:
 - a. Contractor to provide metrics from monitoring consoles to substantiate performance:
 - 1) Number of connections
 - 2) Connection device type
 - 3) Authentication time
 - 4) Bandwidth per user
 - 5) Total bandwidth
 - 6) Dropped connections
 - 7) Issues and resolution
 - b. Contractor shall demonstrate with an appropriate University representative present: In-game:
 - 1) Seamless roaming
 - 2) Bandwidth to device per section/area
- F. Document all acceptance testing, calibration and correction procedures described herein. Include the following information:
 - 1. Performance date of the given procedure.
 - 2. Condition of performance of procedure.
 - 3. Type of procedure, and description.
 - 4. Parameters measured and their values, including values measured prior to calibration or correction, as applicable.
 - 5. The names of personnel conducting the procedure.

6. The equipment used to conduct the procedure.
- G. Upon completion of initial tests and adjustments, submit written report of tests to the University along with all documents, diagrams, and recorded drawings required herein.
- H. Final Procedures
 1. Perform all “punch-list” work to correct inadequate performance or unacceptable conditions, as determined by the University, at no additional expense to the University.
 2. Furnish all portable equipment to the University along with complete inventory documentation. All portable equipment shall be presented in the original manufacturers packing, complete with all included instructions, miscellaneous manuals, and additional documents.
 3. Provide new acceptance testing in the same format as initial test reports.
 4. Check, inspect, and if necessary, adjust all systems, equipment, devices and components specified, at the University’s convenience, approximately thirty (30) days after the University’s acceptance at no additional cost to the University.
 5. Upon completion of the Work, the University may elect to verify test data as part of acceptance procedure. Provide personnel and equipment, at the convenience of the University, to reasonably demonstrate system performance and to assist with such tests without additional cost to the University.
 6. Perform wireless propagation survey of final system close out and provide results to the University.

MSB Response: *Comply unless otherwise noted.*

END OF PART 3 EXECUTION

ATTACHMENT H

James Madison University

Information Technology Services Addendum

M S Benbow & Associates Professional Engineering

CONTRACTOR NAME: **Corporation**

PRODUCT/SOLUTION: **Wi-Fi & LAN Network**

Definitions:

- **Agreement:** The “Agreement” includes the contract, this addendum and any additional addenda and attachments to the contract, including the Contractor’s Form.
 - **University:** “University” or “the University” means James Madison University, its trustees, officers and employees.
 - **University Data:** “University Data” is defined as any data that the Contractor creates, obtains, accesses, transmits, maintains, uses, processes, stores or disposes of in performance of the Agreement. It includes all Personally Identifiable Information and other information that is not intentionally made generally available by the University on public websites.
 - **Personally Identifiable Information:** “Personally Identifiable Information” (PII) includes but is not limited to: Any information that directly relates to an individual and is reasonably likely to enable identification of that individual or information that is defined as PII and subject to protection by James Madison University under federal or Commonwealth of Virginia law.
 - **Security Breach:** “Security Breach” means a security-relevant event in which the security of a system or procedure involving University Data is breached, and in which University Data is exposed to unauthorized disclosure, access, alteration, or use.
 - **Service(s):** “Service” or “Services” means any goods or services acquired by the University from the Contractor.
1. **Rights and License in and to University Data:** The parties agree that as between them, all rights including all intellectual property rights in and to University Data shall remain the exclusive property of the University, and Contractor has a limited, nonexclusive license to use the data as provided in the Agreement solely for the purpose of performing its obligations hereunder. The Agreement does not give a party any rights, implied or otherwise, to the other’s data, content, or intellectual property.
 2. **Disclosure:** All goods, products, materials, documents, reports, writings, video images, photographs, or papers of any nature including software or computer images prepared or provided to the Contractor (or its subcontractors) for the University will not be disclosed to any other person or entity without the written permission of the University.
 3. **Data Privacy:**
 - a. Contractor will use University Data only for the purpose of fulfilling its duties under the Agreement and will not share such data with or disclose it to any third party without the prior written consent of the University, except as required by law.
 - b. University Data will not be stored outside the United States without prior written consent from the University.

- c. Contractor will provide access to University Data only to its employees and subcontractors who need to access the data to fulfill obligations under the Agreement. The Contractor will ensure that the Contractor's employees, and subcontractors when applicable, who perform work under the Agreement have received appropriate instruction as to how to comply with the data protection provisions of the Agreement and have agreed to confidentiality obligations at least as restrictive as those contained in this Addendum.
 - i. If the Contractor will have access to the records protected by the Family Educational Rights and Privacy Act (FERPA), Contractor acknowledges that for the purposes of the Agreement it will be designated as a "school official" with "legitimate educational interests" in such records, as those terms have been defined under FERPA and its implementing regulations, and Contractor agrees to abide by the limitations and requirements imposed on school officials. Contractor will use such records only for the purpose of fulfilling its duties under the Agreement for University's and its End Users' benefit, and will not share such data with or disclose it to any third party except as required by law or authorized in writing by the University. Contractor acknowledges that its access to such records is limited to only those directly related to and necessary for the completion of Contractor's duties under the Agreement.
- d. The Contractor shall be responsible and liable for the acts and omissions of its subcontractors, including but not limited to third-party cloud hosting providers, and shall assure compliance with the requirements of the Agreement.

4. Data Security:

- a. Contractor will store and process University Data in accordance with commercial best practices, including appropriate administrative, physical, and technical safeguards, to secure such data from unauthorized access, disclosure, alteration, and use. Such measures will be no less protective than those used to secure Contractor's own data of a similar type, and in no event less than reasonable in view of the type and nature of the data involved.
- b. Contractor will store and process University Data in a secure site and will provide a SOC 2 or other security report deemed sufficient by the University from a third party reviewer along with annual updated security reports. If the Contractor is using a third-party cloud hosting company such as AWS, Rackspace, etc., the Contractor will obtain the security audit report from its hosting company and give the results to the University. The University should not have to request the report directly from the hosting company.
- c. Contractor will use industry-standards and up-to-date security tools, technologies and practices such as network firewalls, anti-virus, vulnerability scans, system logging, intrusion detection, 24x7 system monitoring, and third-party penetration testing in providing services under the Agreement.
- d. Without limiting the foregoing, Contractor warrants that all electronic University Data will be encrypted in transmission (including via web interface) and stored at AES 256 or stronger.

5. Data Authenticity, Integrity and Availability:

- a. Contractor will take reasonable measures, including audit trails, to protect University Data against deterioration or degradation of data quality and authenticity. Contractor shall be responsible for ensuring that University Data, per the Virginia Public Records

Act, is “preserved, maintained, and accessible throughout their lifecycle, including converting and migrating electronic records as often as necessary so that information is not lost due to hardware, software, or media obsolescence or deterioration.”

- b. Contractor will ensure backups are successfully completed at the agreed interval and that restoration capability is maintained for restoration to a point-in-time and/or to the most current backup available.
- c. Contractor will maintain an uptime of 99.99% or greater as agreed to for the contracted services via the use of appropriate redundancy, continuity of operations and disaster recovery planning and implementations, excluding regularly scheduled maintenance time.

6. Employee Background Checks and Qualifications:

- a. Contractor shall ensure that its employees have undergone appropriate background screening and possess all needed qualifications to comply with the terms of the Agreement including but not limited to all terms relating to data and intellectual property protection.
- b. If the Contractor must under this agreement create, obtain, transmit, use, maintain, process, or dispose of the subset of University Data known as Personally Identifiable Information or financial or business data, the Contractor shall perform the following background checks on all employees who have potential to access such data in accordance with the Fair Credit Reporting Act: Social Security Number trace; seven (7) year felony and misdemeanor criminal records check of federal, state, or local records (as applicable) for job related crimes; Office of Foreign Assets Control List (OFAC) check; Bureau of Industry and Security List (BIS) check; and Office of Defense Trade Controls Debarred Persons List (DDTC).

7. Security Breach:

- a. Response: Immediately (within one day) upon becoming aware of a Security Breach, or of circumstances that could have resulted in unauthorized access to or disclosure or use of University Data, Contractor will notify the University, fully investigate the incident, and cooperate fully with the University’s investigation of and response to the incident. Except as otherwise required by law, Contractor will not provide notice of the incident directly to individuals whose Personally Identifiable Information was involved, regulatory agencies, or other entities, without prior written permission from the University.
- b. Liability:
 - i. If Contractor must under this agreement create, obtain, transmit, use, maintain, process, or dispose of the subset of University Data known as Personally Identifiable Information, the following provisions apply. In addition to any other remedies available to the University under law or equity, Contractor will reimburse the University in full for all costs incurred by the University in investigation and remediation of any Security Breach caused by Contractor, including but not limited to providing notification to individuals whose Personally Identifiable Information was compromised and to regulatory agencies or other entities as required by law or contract; providing one year’s credit monitoring to the affected individuals if the Personally Identifiable Information exposed during the breach could be used to commit financial identity theft; and the payment of legal fees, audit costs, fines, and other fees imposed by regulatory agencies or contracting partners as a result of the Security Breach.

- ii. If Contractor will NOT under this agreement create, obtain, transmit, use, maintain, process, or dispose of the subset of University Data known as Personally Identifiable Information, the following provisions apply. In addition to any other remedies available to the University under law or equity, Contractor will reimburse the University in full for all costs reasonably incurred by the University in investigation and remediation of any Security Breach caused by Contractor.

8. Requests for Data, Response to Legal Orders or Demands for Data:

- a. Except as otherwise expressly prohibited by law, Contractor will:
 - i. immediately notify the University of any subpoenas, warrants, or other legal orders, demands or requests received by Contractor seeking University Data;
 - ii. consult with the University regarding its response;
 - iii. cooperate with the University's requests in connection with efforts by the University to intervene and quash or modify the legal order, demand or request; and
 - iv. Upon the University's request, provide the University with a copy of its response.
- b. Contractor will make itself and any employees, contractors, or agents assisting in the performance of its obligations under the Agreement, available to the University at no cost to the University based upon claimed violation of any laws relating to security and/or privacy of the data that arises out of the Agreement. This shall include any data preservation or eDiscovery required by the University.
- c. The University may request and obtain access to University Data and related logs at any time for any reason and at no extra cost.

9. Data Transfer Upon Termination or Expiration:

- a. Contractor's obligations to protect University Data shall survive termination of the Agreement until all University Data has been returned or securely destroyed, meaning taking actions that render data written on media unrecoverable by both ordinary and extraordinary means.
- b. Upon termination or expiration of the Agreement, Contractor will ensure that all University Data are securely transferred, returned or destroyed as directed by the University in its sole discretion within 60 days of termination of the Agreement. Transfer/migration to the University or a third party designated by the University shall occur without significant interruption in service. Contractor shall ensure that such transfer/migration uses facilities, methods, and data formats that are accessible and compatible with the relevant systems of the University or its transferee, and to the extent technologically feasible, that the University will have reasonable access to University Data during the transition.
- c. In the event that the University requests destruction of its data, Contractor agrees to securely destroy all data in its possession and in the possession of any subcontractors or agents to which Contractor might have transferred University data. Contractor agrees to provide documentation of data destruction to the University.
- d. Contractor will notify the University of impending cessation of its business and any contingency plans. This includes immediate transfer of any previously escrowed assets and data and providing the University access to Contractor's facilities to remove and destroy University-owned assets and data. Contractor shall implement its exit plan and take all necessary actions to ensure a smooth transition of service with minimal disruption to the University. The Contractor will also provide, as

applicable, a full inventory and configuration of servers, routers, other hardware, and software involved in service delivery along with supporting documentation, indicating which if any of these are owned by or dedicated to the University. Contractor will work closely with its successor to ensure a successful transition to the new service, with minimal downtime and effect on the University, all such work to be coordinated and performed in advance of the formal, final transition date.

10. Audits:

- a. The University reserves the right in its sole discretion to perform audits of the Contractor to ensure compliance with the terms of the Agreement. Contractor shall reasonably cooperate in the performance of such audits. This provision applies to all agreements under which Contractor must create, obtain, transmit, use, maintain, process, or dispose of University Data.
- b. If Contractor must under the Agreement create, obtain, transmit, use, maintain, process, or dispose of the subset of University Data known as Personally Identifiable Information or financial or business data, Contractor will at its expense conduct or have conducted at least annually a(n):
 - i. American Institute of CPAs Service Organization Controls 2 (SOC 2) audit, or other independent security audit with audit objectives deemed sufficient by the University, which attests to Contractor's security policies, procedures, and controls. Contractor shall also submit such documentation for any third-party cloud hosting provider(s) they may use (e.g. AWS, Rackspace, Azure, etc.) and for all subservice providers or business partners relevant to the Agreement. Contractor shall also provide James Madison University with a designated point of contact for the SOC reports and risks related to the contract. This person shall address issues raised in the SOC reports of the Contractor and its relevant providers and partners, and respond to any follow up questions posed by the University in relation to technology systems, infrastructure, or information security concerns related to the contract.
 - ii. vulnerability scan of Contractor's electronic systems and facilities that are used in any way to deliver electronic services under the Agreement; and
 - iii. formal penetration test performed by qualified personnel of Contractor's electronic systems and facilities that are used in any way to deliver electronic services under the Agreement.
- c. Additionally, Contractor will provide the University upon request the results of the above audits, scans and tests, and will promptly modify its security measures as needed based on those results in order to meet its obligations under the Agreement. The University may require, at University expense, the Contractor to perform additional audits and tests, the results of which will be provided promptly to the University.

11. Compliance:

- a. Contractor will comply with all applicable laws and industry standards in performing services under the Agreement. Any Contractor personnel visiting the University's facilities will comply with all applicable University policies regarding access to, use of, and conduct within such facilities. The University will provide copies of such policies to Contractor upon request.
- b. To the extent applicable to the design and intended use of the service, Contractor warrants that the service it will provide to the University is fully compliant with and will enable the University to be compliant with relevant requirements of all laws,

regulation, and guidance applicable to the University and/or Contractor, including but not limited to: the Family Educational Rights and Privacy Act (FERPA), Health Insurance Portability and Accountability Act (HIPAA), Health Information Technology for Economic and Clinical Health Act (HITECH), Gramm-Leach-Bliley Financial Modernization Act (GLB), Payment Card Industry Data Security Standards (PCI-DSS), Americans with Disabilities Act (ADA), Federal Export Administration Regulations, and Defense Federal Acquisitions Regulations.

12. **No End User Agreements:** Any agreements or understandings, whether electronic, click through, verbal or in writing, between Contractor and University employees or other end users under the Agreement that conflict with the terms of the Agreement, including but not limited to this Addendum, shall not be valid or binding on the University or any such end users.

IN WITNESS WHEREOF, the parties have caused this addendum to be duly executed, intending thereby to be legally bound. In the event of conflict or inconsistency between terms of the Agreement and this Addendum, the terms of this Addendum shall prevail.

JAMES MADISON UNIVERSITY

CONTRACTOR

SIGNATURE: _____

SIGNATURE: _____

PRINTED
NAME: _____

PRINTED NAME: _____

TITLE: _____

TITLE: _____

DATE: _____

DATE: _____

REF#	MFG	MODEL	DESCRIPTION	QTY.	UNIT	EXTENDED
SERVER						
1						\$ -
2						\$ -
3						\$ -
4						\$ -
5						\$ -
6						\$ -
SERVER						\$ -
APPLICATIONS						
7						\$ -
8						\$ -
9						\$ -
10						\$ -
11						\$ -
12						\$ -
APPLICATIONS						\$ -
CORE AND EDGE SWITCHING						
13	Cisco	N77-C7706-B23S2E-R	Cisco Nexus 7706 Bundle (Chassis,2xSUP2E,3xFAB2),No Power Supplies { CORE A }	1	\$82,800.00	\$ 82,800.00
14	Cisco	CON-OSP-7706B23R	SN7C-24X7X4OS Nexus 7706 Bundle - 3 years	3	\$20,164.56	\$ 60,493.68
15	Cisco	N77S2K9-81	Cisco NX-OS Release 8.1 for Nexus 7700 Series	1	\$0.00	\$ -
16	Cisco	N77-C7706-FAN	Nexus 7700 6 slot chassis Fan Tray	3	0	\$ -
17	Cisco	N77-MODULE-BLANK	Nexus 7700 - Module Blank Slot Cover	4	0	\$ -
18	Cisco	N77-AC-3KW	Nexus 7700 - 3.0KW AC Power Supply Module (Cable Included)	4	3220	\$ 12,880.00
19	Cisco	N77-C7706-FAB-2	Nexus 7700 - 6 Slot Chassis 220Gbps/Slot Fabric Module	3	0	\$ -
20	Cisco	N77-EL21K9	Nexus 7700 Enhanced Layer 2 License (FabricPath)	1	\$23,000.00	\$ 23,000.00
21	Cisco	CAB-7513AC	AC POWER CORD NORTH AMERICA (110V)	4	\$0.00	\$ -
22	Cisco	N7K-DP-NOTSURE	N7K or N77 Not Sure Deployment; For Tracking Only	1	\$0.00	\$ -
23	Cisco	N77-SUP2E	Nexus 7700 - Supervisor 2 Enhanced	1	\$0.00	\$ -
24	Cisco	N77-SUP2E	Nexus 7700 - Supervisor 2 Enhanced	1	\$0.00	\$ -
25	Cisco	N77-LAN1K9	Nexus 7700 LAN Enterprise License (L3 protocols)	1	\$13,800.00	\$ 13,800.00
26	Cisco	N77-M348XP-23L=	Nexus 7700 M3-Series 48 Port 10GE	1	\$59,800.00	\$ 59,800.00
27	Cisco	GLC-TE	1000BASE-T SFP transceiver module for Category 5 copper wire	6	\$433.32	\$ 2,599.92
28	Cisco	SFP-10G-LR	10GBASE-LR SFP Module	30	\$3,797.76	\$ 113,932.80
29	Cisco	N77-C7706-CMK=	Nexus 7700 - 6 Slot Chassis Center Mount Kit	2	\$1,035.00	\$ 2,070.00
30	Cisco	N77-C7706-B5K=	Nexus 7700 - 6 Slot Chassis Bottom Support Kit	2	\$690.00	\$ 1,380.00
31	Cisco	N77-C7706-FDK=	Nexus 7700 - 6 Slot Chassis Front Door Kit	2	\$1,482.12	\$ 2,964.24
32	Cisco	N77-C7706-ACC-KIT=	Nexus 7700 - 6 Slot Chassis Accessory Kit	2	\$1,311.00	\$ 2,622.00
33	Cisco	N77-USB-2GB=	Nexus 7700 - USB Flash Memory - 2GB (Expansion Flash)	2	\$1,141.72	\$ 2,283.44
34	Cisco	SFP-10G-AOC2M	Cisco 10GBASE Active Optical SFP+ Cable, 2M	4	\$217.12	\$ 868.48
35						\$ -
36	Cisco	N77-C7706-B23S2E-R	Cisco Nexus 7706 Bundle (Chassis,2xSUP2E,3xFAB2),No Power Supplies { CORE B }	1	\$82,800.00	\$ 82,800.00
37	Cisco	CON-OSP-7706B23R	SN7C-24X7X4OS Nexus 7706 Bundle - 3 years	3	20164.56	\$ 60,493.68
38	Cisco	N77S2K9-81	Cisco NX-OS Release 8.1 for Nexus 7700 Series	1	0	\$ -
39	Cisco	N77-C7706-FAN	Nexus 7700 6 slot chassis Fan Tray	3	0	\$ -
40	Cisco	N77-MODULE-BLANK	Nexus 7700 - Module Blank Slot Cover	4	0	\$ -
41	Cisco	N77-AC-3KW	Nexus 7700 - 3.0KW AC Power Supply Module (Cable Included)	4	\$3,220.00	\$ 12,880.00
42	Cisco	N77-C7706-FAB-2	Nexus 7700 - 6 Slot Chassis 220Gbps/Slot Fabric Module	3	\$0.00	\$ -
43	Cisco	N77-EL21K9	Nexus 7700 Enhanced Layer 2 License (FabricPath)	1	\$23,000.00	\$ 23,000.00
44	Cisco	CAB-7513AC	AC POWER CORD NORTH AMERICA (110V)	4	\$0.00	\$ -
45	Cisco	N7K-DP-NOTSURE	N7K or N77 Not Sure Deployment; For Tracking Only	1	\$0.00	\$ -
46	Cisco	N77-SUP2E	Nexus 7700 - Supervisor 2 Enhanced	1	\$0.00	\$ -
47	Cisco	N77-SUP2E	Nexus 7700 - Supervisor 2 Enhanced	1	\$0.00	\$ -
48	Cisco	N77-LAN1K9	Nexus 7700 LAN Enterprise License (L3 protocols)	1	\$13,800.00	\$ 13,800.00
49	Cisco	N77-M348XP-23L=	Nexus 7700 M3-Series 48 Port 10GE	1	\$59,800.00	\$ 59,800.00

50	Cisco	GLC-TE	1000BASE-T SFP transceiver module for Category 5 copper wire	6	\$433.32	\$ 2,599.92
51	Cisco	SFP-10G-LR	10GBASE-LR SFP Module	30	\$3,797.76	\$ 113,932.80
52	Cisco	N77-C7706-CMK=	Nexus 7700 - 6 Slot Chassis Center Mount Kit	2	\$1,035.00	\$ 2,070.00
53	Cisco	N77-C7706-BSK=	Nexus 7700 - 6 Slot Chassis Bottom Support Kit	2	\$690.00	\$ 1,380.00
54	Cisco	N77-C7706-FDK=	Nexus 7700 - 6 Slot Chassis Front Door Kit	2	\$1,482.12	\$ 2,964.24
55	Cisco	N77-C7706-ACC-KIT=	Nexus 7700 - 6 Slot Chassis Accessory Kit	2	\$1,311.00	\$ 2,622.00
56	Cisco	N77-USB-2GB=	Nexus 7700 - USB Flash Memory - 2GB (Expansion Flash)	2	\$1,141.72	\$ 2,283.44
57	Cisco	SFP-10G-AOC2M	Cisco 10GBASE Active Optical SFP+ Cable, 2M	4	\$217.12	\$ 868.48
58						\$ -
59	Cisco	C9300-48UXM-A	Cisco Catalyst 9300 48-port 2.5G (12 mGig) UPOE, Network Advantage { IDF SWITCHES + EVENT }	20	\$11,987.60	\$ 239,752.00
60	Cisco	CON-SNT-C93A048M	SNTC-8X5XNBD Catalyst 9300 48-port(12 mGig)36 2.5Gbps	20	2,538.73	\$ 50,774.62
61	Cisco	C9300-DNA-A-48	C9300 DNA Advantage, 48-Port Term Licenses	20	\$0.00	\$ -
62	Cisco	C9300-DNA-A-48-3Y	C9300 DNA Advantage, 48-Port, 3 Year Term License	20	\$3,468.40	\$ 69,368.00
63	Cisco	C9300-DNA-A-48	C9300 DNA Advantage, 48-Port Term Licenses	20	\$0.00	\$ -
64	Cisco	CAB-SPWR-30CM	Catalyst Stack Power Cable 30 CM	20	\$87.40	\$ 1,748.00
65	Cisco	PWR-C1-1100WAC	1100W AC Config 1 Power Supply	20	\$0.00	\$ -
66	Cisco	S9300UK9-169	Cisco Catalyst 9300 XE 16.12 UNIVERSAL	20	\$0.00	\$ -
67	Cisco	PWR-C1-1100WAC/2	1100W AC Config 1 Secondary Power Supply	20	\$1,748.00	\$ 34,960.00
68	Cisco	CAB-TA-NA	North America AC Type A Power Cable	40	\$0.00	\$ -
69	Cisco	NETWORK-PNP-LIC	Network Plug-n-Play Connect for zero-touch device deployment	20	\$0.00	\$ -
70	Cisco	STACK-T1-1M	1M Type 1 Stacking Cable	40	\$184.00	\$ 7,360.00
71	Cisco	STACK-T1-50CM	50CM Type 1 Stacking Cable	40	\$92.00	\$ 3,680.00
72	Cisco	C9300-NM-8X	Catalyst 9300 8 x 10GE Network Module	20	\$2,346.00	\$ 46,920.00
73	Cisco	SFP-10G-LR=	10GBASE-LR SFP Module	24	\$3,797.76	\$ 91,146.24
74						\$ -
75	Cisco	C9500-48X-A	Cisco Catalyst 9500 48-port 10G bundle, Network Advantage { DMZ SWITCHES }	2	\$24,288.00	\$ 48,576.00
76	Cisco	CON-SNT-C95048XA	SNTC-8X5XNBD Catalyst 9500 48-port 10G bundle, Networ	2	1748.3404	\$ 3,496.68
77	Cisco	C9500-NW-A	C9500 Network Stack, Advantage	2	\$0.00	\$ -
78	Cisco	C9500-NM-8X	Cisco Catalyst 9500 8 x 10GE Network Module	2	\$3,772.00	\$ 7,544.00
79	Cisco	SWATCH-T	StealthWatch 1 FPS Term License	50	\$0.00	\$ -
80	Cisco	SWATCH-TRK-3Y	ISE BASE Tracker Term 3Y	50	\$0.00	\$ -
81	Cisco	S9500UK9-169	UNIVERSAL	2	\$0.00	\$ -
82	Cisco	ISE-PLS-T	ISE PLS Term License	50	\$0.00	\$ -
83	Cisco	ISE-PLS-TRK-3Y	ISE PLS Tracker Term 3Y	50	\$0.00	\$ -
84	Cisco	PWR-C4-950WAC-R	950W AC Config 4 Power Supply front to back cooling	2	\$0.00	\$ -
85	Cisco	C9500-DNA-40X-P	C9500 DNA Premier, 40X Port , Term License	2	\$0.00	\$ -
86	Cisco	C9500-DNA-P-3Y	C9500 DNA Premier 40X/24Q/48Y4C/32C/32QC ,3Year Term License	2	\$11,914.00	\$ 23,828.00
87	Cisco	ISE-BASE-T	ISE BASE Term License	50	\$0.00	\$ -
88	Cisco	ISE-BASE-TRK-3Y	ISE BASE Tracker Term 3Y	50	\$0.00	\$ -
89	Cisco	PWR-C4-950WAC-R/2	950W AC Config 4 Power Supply front to back cooling	2	\$1,932.00	\$ 3,864.00
90	Cisco	PI-LFAS-T	Prime Infrastructure Lifecycle & Assurance Term - Smart Lic	6	\$0.00	\$ -
91	Cisco	PI-LFAS-AP-T-3Y	PI Dev Lic for Lifecycle & Assurance Term 3Y	6	\$0.00	\$ -
92	Cisco	CAB-TA-NA	North America AC Type A Power Cable	4	\$0.00	\$ -
93	Cisco	SFP-10G-LR	10GBASE-LR SFP Module	10	\$3,797.76	\$ 37,977.60
94	Cisco	SFP-H10GB-CU3M	10GBASE-CU SFP+ Cable 3 Meter	4	\$100.28	\$ 401.12
95	Cisco	NETWORK-PNP-LIC	Network Plug-n-Play Connect for zero-touch device deployment	2	\$0.00	\$ -
96	Cisco	SFP-10G-AOC3M=	10GBASE Active Optical SFP+ Cable, 3M	1	\$217.12	\$ 217.12
97						\$ -
98	Palo Alto	PAN-PA-3260	Palo Alto Security appliance - firewalls	2	\$36,950	\$ 73,899.00
99	Palo Alto	PAN-PA-3260-TP-3YR-HA2	Threat prevention subscription 3 year prepaid for device in an HA pair, PA-3260	2	\$13,099	\$ 26,197.00
100	Palo Alto	PAN-SFP-PLUS-LR	Palo - SFP+ transceiver module - 10 GigE - LR LC	12	\$1,955	\$ 23,460.00
101	Palo Alto	PAN-PA-2RU-RACK4	Rack Mount Kit	2	\$147	\$ 293.25
102	Palo Alto	PAN-SVC-PREM-3260-3YR	Palo Premium Support Service - 3 years	2	\$16,041	\$ 32,081.55
103	Palo Alto		Shipping and Handling	1	\$117	\$ 117.30
CORE AND EDGE SWITCHING						\$ 1,590,650.60
DHCP / DNS SERVICES APPLIANCE						
104	Infoblox	TE-2225-SWBSUB-NS1GD	Trinzic 2225 SoftwareBundle Subscription,DDI and Grid	2	\$ 21,189.63	\$ 42,379.26
105	Infoblox	TE-2205-10GE-HW-AC	Trinzic 2205(Hardware Only)	2	\$ 10,943.11	\$ 21,886.23
106	Infoblox	IB-MNT-PRM	Infoblox PremiumMaintenance-Enterprisefor TE-2205-10GE-HW-AC	2	\$ 1,969.76	\$ 3,939.52
107	Infoblox	IB-POWER-CORD-14G-US	Group B, 14 Gauge	4	\$ -	\$ -

108	Infoblox	IB-SFPPLUS-LR	Long Range Fiber	8	\$	1,099.69	\$	8,797.50
109	infoblox	T-ADJUST-RAIL-400-900-OPT	and 400S series rack rail	2	\$	-	\$	-
110	infoblox		Shipping and Handling	1	\$	175.95	\$	175.95
DHCP / DNS SERVICES APPLIANCE							\$	77,178.45
ENCLOSURES AND UPS								
111	APC	SRT5KRMXLTX	APC Smart-UPS SRT 5000VA RM 208V { 1 per IDF plus 1 spare }	8	\$	3,422.00	\$	27,376.00
112	Chatsworth	12419-736	Chatsworth CUBE-IT 24inW x 30inD x 36in H 19RU #12-24 rails; Tempered Glass door (Catwalk IDF cabinets)	2	\$	801.30	\$	1,602.60
113	APC	AP9571A	APC Rack PDU Basic 1U, 30A, 208V, (10) C13	8	\$	260.00	\$	2,080.00
	Ortronics	SHMC2RU	Horizontal Cable Manager, Single Sided, 19" 2RU	21	\$	60.00	\$	1,260.00
ENCLOSURES AND UPS							\$	31,058.60
MOBILITY CONTROLLER								
114	Hewlett Packard Enterprise	H3EV3E	Aruba 1Y FC NBD Exch 7220 Controller SVC [for JW752A]	2	\$	3,873.59	\$	7,747.19
115	Hewlett Packard Enterprise	H5A55E	Aruba 1Y FC NBD Exch AW DL360 PRO SVC [for JX918A]	1	\$	7,421.67	\$	7,421.67
116	Hewlett Packard Enterprise	H6QE5E	Aruba 1Y FC NBD Exch MM-HW-1K Mob1000SVC [for JY791A]	2	\$	2,732.33	\$	5,464.66
117	Hewlett Packard Enterprise	H8FS9E	Aruba 3 year Foundation Care 24x7 for MM-HW-1K	2	\$	4,544.46	\$	9,088.93
118	Hewlett Packard Enterprise	JW124A	PC-AC-NA North America AC Power Cord	9	\$	3.00	\$	27.00
119	Hewlett Packard Enterprise	JW657A	Aruba PSU-350-AC 7200 Series S3500-24T S3500-48T and S3500-24F 350W AC Power Supply	2	\$	280.80	\$	561.60
120	Hewlett Packard Enterprise	JW752A	Aruba 7220 (US) 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) Controller	2	\$	12,207.12	\$	24,414.24
121	Hewlett Packard Enterprise	JX918A	Aruba AirWave DL360 Professional Edition Hardware Appliance	1	\$	18,192.12	\$	18,192.12
122	Hewlett Packard Enterprise	JY791A	Aruba MM-HW-1K Mobility Master 1000 AP HW Appliance	2	\$	8,616.12	\$	17,232.24
MOBILITY CONTROLLER							\$	90,149.64
ACCESS POINTS AND ANTENNAS								
123	Hewlett Packard Enterprise	H2XW3E	Aruba 1Y FC 24x7 License Cn Bundle SVC [for JW471AAE]	172	\$	45.37	\$	7,804.40
124	Hewlett Packard Enterprise	H2YV3E	Aruba 1Y FC 24x7 Airwave 1 Dev E-LTU SVC [for JW546AAE]	34	\$	11.84	\$	402.45
125	Hewlett Packard Enterprise	H7VF5E	Aruba 3 Year Foundation Care 24x7 (opens a tooltip in a new layer) Education/Retail 7220	2	\$	4,544.46	\$	9,088.93
126	Hewlett Packard Enterprise	H8UA1E	Aruba 3 Year Foundation Care 24x7 Education/Retail Volume T2 (500) License Controller	172	\$	16.87	\$	2,901.20
127	Hewlett Packard Enterprise	JW018A	AP-ANT-45 Dual Band 90x90deg 5dBi 4 Element MIMO 4xRPSMA Pigtail Antenna	16	\$	256.50	\$	4,104.00
128	Hewlett Packard Enterprise	JW022A	AP-ANT-MNT-5 AP-ANT-45 Azimuth and Elevation Adjustable Mount Kit	16	\$	59.40	\$	950.40
129	Hewlett Packard Enterprise	JW046A	AP-220-MNT-W1 Flat Surface Wall/Ceiling Black AP Basic Flat Surface Mount Kit	80	\$	16.20	\$	1,296.00
130	Hewlett Packard Enterprise	JW054A	AP-270-MNT-H1 AP-270 Series Outdoor AP Hanging or Tilt Install Mount Kit	80	\$	16.20	\$	1,296.00
131	Hewlett Packard Enterprise	JW069A	ANT-CBL-2 2m Nm to Nm Flexible Outdoor Rated RF Cable	160	\$	72.90	\$	11,664.00
132	Hewlett Packard Enterprise	JW471AAE	Aruba LIC-ENT Enterprise (LIC-AP LIC-PEF LIC-RFP and LIC-AW) Licence Bundle E-LTU	172	\$	136.80	\$	23,529.60
133	Hewlett Packard Enterprise	JW546AAE	Aruba LIC-AW Aruba Airwave with RAPIDS and VisualRF 1 Device License E-LTU	4	\$	40.50	\$	162.00
134	Hewlett Packard Enterprise	JW828A	Aruba AP-335-CVR-20 20-pk for AP-335 with Holes for LED Indicators White Non-glossy Snap-	3	\$	110.70	\$	332.10
135	Hewlett Packard Enterprise	JX922A	Aruba ClearPass-Airwave DL360 500W Spare Power Supply	1	\$	604.80	\$	604.80
136	Hewlett Packard Enterprise	JX988A	ANT-4x4-5314 5.15-5 9GHz 14dBi 30x30deg Dual Pol MIMO Hi Gain Dir N-Type Outdoor	80	\$	394.20	\$	31,536.00
137	Hewlett Packard Enterprise	JZ023A	Aruba AP-344 (US) Unified AP	16	\$	791.10	\$	12,657.60
138	Hewlett Packard Enterprise	JZ033A	Aruba AP-345 (US) Unified AP	64	\$	668.04	\$	42,754.56
139	Hewlett Packard Enterprise	JZ163A	Aruba AP-374 (US) Outdoor 11ac AP	80	\$	763.80	\$	61,104.00
140	Hewlett Packard Enterprise	JZ183A	Aruba AP-377 (US) Outdoor 11ac AP	12	\$	955.32	\$	11,463.84
ACCESS POINTS AND ANTENNAS							\$	223,651.88
Captive Portal								
141	Hewlett Packard	JZ509A	Aruba ClearPass C2000 DL20 Gen9 HW Appliance	2	\$	6,703.20	\$	13,406.40
142	Hewlett Packard	H9UK6E	Aruba 3Y FC NBD Exch CP C2k DL20 ApplSVC [for JZ509A]	2	\$	3,102.62	\$	6,205.25
143	Hewlett Packard	JX923A	Aruba ClearPass DL20 Spare PSU	2	\$	360.24	\$	720.48
144	Hewlett Packard	JZ405AAE	Aruba ClearPass NL AC 10K CE E-LTU	2	\$	50,160.00	\$	100,320.00
145	Hewlett Packard	HT9B1E	Aruba 3Y FC 24x7 ClearPass NL AC10KCESVC [for JZ405AAE]	2	\$	10,840.49	\$	21,680.98
146	Hewlett Packard	JW470AAE	Aruba ClearPass Guest Custom Skin E-LTU	1	\$	2,052.00	\$	2,052.00
Captive Portal							\$	144,385.10
STRUCTURED CABLE								
150	SUPERIOR ESSEX	6H272D	Cat6A Cabling (Plenum)	8		701	\$	5,608.00
151	ORTRONICS	OR-40300548	Cat6A Face plates (2 Port) Trac Jack	250		2.09	\$	522.50
152	ORTRONICS	OR-TJ610-68	Cat6A Jacks (Single)	500		15.78	\$	7,890.00
153	ORTRONICS	OR-40300546	Cat6A Face plates (4-Port) Trac Jack	250		2.09	\$	522.50
154	ORTRONICS	OR-PHDHJU24	24 Port Flat Modular Patch Panel (Unloaded)HD	37		78	\$	2,886.00

155	ORTRONICS	OR-HDJ6A-45	High Density Patch panel Jacks (Green) Modular	768	17	\$	13,056.00
156	ORTRONICS	MC6A03-06	Patch Cords { 3m for End Devices and IDF Patch Panels }	600	13	\$	7,800.00
						STRUCTURED CABLE	\$ 38,285.00
INSTALLATION, MATERIALS AND LABOR							
157	Integrator	Materials	Materials	1	\$	54,270.00	\$ 54,270.00
158	Integrator	Installation Labor	Installation Labor	1	\$	101,836.00	\$ 101,836.00
159	Integrator	Structured Cable Labor	Per Drop Rate	172	\$	300.00	\$ 51,600.00
160	Integrator	Project Management	Project Management & Construction Management	1	\$	50,000.00	\$ 50,000.00
161	Integrator	Engineering	Engineering	1	\$	86,600.00	\$ 86,600.00
162	Integrator	Configuration	Configuration	1	\$	70,800.00	\$ 70,800.00
163	Integrator	Tuning & Optimization	Tuning & Optimization/ Live Event Support (5 Live Events - Onsite Support)	1	\$	77,400.00	\$ 77,400.00
164	Integrator	Travel and Expenses	Travel and Expenses	1	\$	57,151.00	\$ 57,151.00
						INSTALLATION, MATERIALS AND LABOR	\$ 549,657.00
SUMMARY - BASE NETWORK COST							
						BASE NETWORK COST TOTAL	\$ 2,745,016.27
OPTION 1 : ALL INCLUSIVE (SOLUTION, MANAGED SERVICES, AND ISP)							
Managed Services (SLA to be proposed with pricing). Include total cost of solution and ISP circuits.				Months	Monthly cost	Annual Cost	
	Comcast Business	6Gbps Ethernet Dedicated Internet	Initial Term 2-Year	24	\$ 3,688.00	\$ 88,512.00	
	Comcast Business	6Gbps Ethernet Dedicated Internet	Year 3	12	\$ 3,688.00	\$ 44,256.00	
	Comcast Business	6Gbps Ethernet Dedicated Internet	Year 4	12	\$ 3,688.00	\$ 44,256.00	
	Comcast Business	6Gbps Ethernet Dedicated Internet	Year 5	12	\$ 3,688.00	\$ 44,256.00	
			Year 6	12		\$ -	
	Note - Full Managed Services needs to be discussed. This price is for backhaul only.		Year 7	12		\$ -	
			Year 8	12		\$ -	
			Year 9	12		\$ -	
						SUBTOTAL	\$ 221,280.00
						OPTION 1 : ALL INCLUSIVE (SOLUTION, MANAGED SERVICES, AND ISP)	\$ 2,966,296.27
OPTION 2 : MANAGED SERVICES (MANAGED SERVICES AND ISP ONLY)							
Managed Services (SLA to be proposed with pricing) and ISP circuits.				Months	Monthly Cost	Annual Cost	
			Initial Term 2-Year	24		\$ -	
	N/A		Year 3	12		\$ -	
			Year 4	12		\$ -	
			Year 5	12		\$ -	
			Year 6	12		\$ -	
			Year 7	12		\$ -	
			Year 8	12		\$ -	
			Year 9	12		\$ -	
						OPTION 2 : MANAGED SERVICES (MANAGED SERVICES AND ISP ONLY)	\$ -
OPTION 3: EVENT SUPPORT / EVENT RATE (EVENT SUPPORT ONLY - ASSUMES SEPARATE SOLUTION PURCHASE WITH ISP AND OPERATION BY OWNER)							
Remote Monitoring and Event Support (Assumes 120 events annually) - Assume Remote Event Monitoring Only				1	\$ 720.00	\$ 86,400.00	
						Subtotal	\$ 86,400.00
						OPTION 3: EVENT SUPPORT / EVENT RATE (EVENT SUPPORT ONLY - ASSUMES SEPARATE SOLUTION PURCHASE WITH ISP AND OPERATION BY OWNER)	\$ 86,400.00

Cisco Catalyst 9300 Series Switches

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Built for security, IoT, mobility, and cloud

The Cisco® Catalyst® 9300 Series switches are Cisco's lead stackable enterprise switching platform built for security, IoT, mobility, and cloud. They are the next generation of the industry's most widely deployed switching platform. Catalyst 9300 Series switches form the foundational building block for Software-Defined Access (SD-Access), Cisco's lead enterprise architecture. At up to 480 Gbps, they are the industry's highest-density stacking bandwidth solution with the most flexible uplink architecture. The Catalyst 9300 Series is the first optimized platform for high-density Wi-Fi 6 and 802.11ac Wave2. It sets new maximums for network scale. These switches are also ready for the future, with an x86 CPU architecture and more memory, enabling them to host containers and run third-party applications and scripts natively within the switch.

The Catalyst 9300 Series is designed for Cisco StackWise® technology, providing flexible deployment with support for nonstop forwarding with Stateful Switchover (NSF/SSO), for the most resilient architecture in a stackable (sub-50-ms) solution. The highly resilient and efficient power architecture features Cisco StackPower®, which delivers high-density Cisco Universal Power over Ethernet (Cisco UPOE®) and Power over Ethernet Plus (PoE+) ports. The switches are based on the Cisco Unified Access™ Data Plane 2.0 (UADP) 2.0 architecture which not only protects your investment but also allows a larger scale and higher throughput. A modern operating system, Cisco IOS® XE with programmability offers advanced security capabilities and Internet of Things (IoT) convergence.

The Foundation of Software-Defined access

Advanced persistent security threats. The exponential growth of Internet of Things (IoT) devices. Mobility everywhere. Cloud adoption. All of these require a network fabric that integrates advanced hardware and software innovations to automate, secure, and simplify customer networks. The goal of this network fabric is to enable customer revenue growth by accelerating the rollout of business services.

The Cisco Digital Network Architecture (Cisco DNA) with Software-Defined Access (SD-Access) is the network fabric that powers business. It is an open and extensible, software-driven architecture that accelerates and simplifies your enterprise network operations. The programmable architecture frees your IT staff from time-consuming, repetitive network configuration tasks so they can focus instead on innovation that positively transforms your business. SD-Access enables policy-based automation from edge to cloud with foundational capabilities. These include:

- Simplified device deployment
- Unified management of wired and wireless networks
- Network virtualization and segmentation
- Group-based policies
- Context-based analytics

Cisco DNA software

Cisco DNA Software offers a valuable and flexible way to buy software for the access, WAN, and data center domains. At each stage in the product lifecycle, Cisco DNA Software helps make buying, managing, and upgrading your network and infrastructure software easier. Cisco DNA Software provides:

- Flexible licensing models to smoothly distribute customers' software spending over time
- Investment protection for software purchases through software services-enabled license portability
- Access to updates, upgrades, and new technology from Cisco through Cisco® Software Support Services (SWSS)
- Lower cost of entry with the new Cisco DNA Subscription for Switching model

Cisco DNA lets you manage your entire switching structure as a single, converged component. With one management system and one policy for wired and wireless networks, it offers an efficient way to provide more secure access.

Product overview: Features

Product highlights

- Highest wireless scale for Wi-Fi 6 and 802.11ac Wave 2 access points supported on a single switch with select models
- Cisco UADP 2.0 Application-Specific Integrated Circuit (ASIC) with programmable pipeline and microengine capabilities, along with template-based, configurable allocation of Layer 2 and Layer 3 forwarding, Access Control Lists (ACLs), and Quality of Service (QoS) entries
- x86 CPU complex with 8-GB memory, and 16 GB of flash and external USB 3.0 SSD pluggable storage slot (delivering 120GB of storage with an option SSD drive) to host containers
- USB 2.0 slot to load system images and set configurations
- Up to 480 Gbps of local stackable switching bandwidth
- Deeper buffer and higher scale model options for rich multi-media content delivery applications
- Flexible and dense uplink offerings with 1G, Multigigabit, 10G, 25G, and 40G in the form of fixed or modular uplinks
- Easy transition from 10G to 25G with dual-rate optics
- Flexible downlink options with 1G Copper and Fiber as well as Multigigabit links
- Leading PoE capabilities with up to 384 ports of PoE per stack, 60W Cisco UPOE, and PoE+
- Intelligent Power Management with Cisco StackPower technology, providing power stacking among members for power redundancy
- Line-rate, hardware-based Flexible NetFlow (FNF), delivering flow collection of up to 64,000 flows
- IPv6 support in hardware, providing wire-rate forwarding for IPv6 networks
- Dual-stack support for IPv4/IPv6 and dynamic hardware forwarding table allocations, for ease of IPv4-to-IPv6 migration
- IEEE 802.1ba AV Bridging (AVB) built in to provide a better audio and video experience through improved time synchronization and QoS

- Precision Time Protocol (PTP; IEEE 1588v2) provides accurate clock synchronization with sub-microsecond accuracy making it suitable for distribution and synchronization of time and frequency over network
- Cisco IOS XE, a modern operating system for the enterprise with support for model-driven programmability including NETCONF, RESTCONF, YANG, on-box Python scripting, streaming telemetry, container-based application hosting, and patching for critical bug fixes. The OS also has built-in defenses to protect against runtime attacks
- **SD-Access:** Cisco Catalyst 9300 Series switches form the foundational building block for SD-Access, Cisco's lead enterprise architecture:
 - Policy-based automation from edge to cloud
 - Simplified segmentation and micro-segmentation, with predictable performance and scalability
 - Automation through Cisco DNA Center
 - Policy handled through the Cisco Identity Services Engine (ISE)
 - Network assurance provided through the Cisco DNA Center
 - Faster launch of new business services and significantly improved issue resolution time
- **SD-Access Embedded Wireless:** The Cisco Catalyst 9800 embedded Wireless Controller Software package can be installed on Cisco Catalyst 9300 Series switches to enable wireless controller functionality for distributed branches and small campuses. Once installed, the Catalyst 9800 embedded Wireless Controller running on a Catalyst 9300 Series switch can support up to 200 APs and 4000 Clients (C9300L supports 50 APs / 4000 Clients). A maximum two wireless controllers can be enabled per site on two different Catalyst 9300 Series switches which will increase to scale up to 400 APs and 8000 Wireless Clients (C9300L: 100 APs / 8000 Clients). The Catalyst 9800 embedded Wireless Controller Software package will enable wireless functionality only for SD-Access deployments with two supported topologies:
 - The Catalyst 9800 embedded Wireless Controller Software package can be enabled on Catalyst 9300 Series switches functioning as Co-Located Border and Control Plane
 - C9800 Wireless Software Package can be enabled on Catalyst 9300 Series switches functioning as Fabric in a Box
- **Plug and Play (PnP) enabled:** A simple, secure, unified, and integrated offering to ease new branch or campus device rollouts or updates to an existing network
- **Advanced security**
 - Encrypted Traffic Analytics (ETA): You benefit from the power of machine learning to identify and take actions toward threats or anomalies in your network, including malware detection in encrypted traffic (without decryption) and distributed anomaly detection
 - Support for AES-256 with the powerful MACsec 256-bit encryption algorithm available on all models
 - Trustworthy solutions: Hardware anchored Secure Boot and Secure Unique Device Identification (SUDI) support for Plug and Play, to verify the identity of the hardware and software

Platform details

Switch models and configurations

Models	FRU Power Supply	FRU Fans	Modular Uplinks	Stacking Bandwidth Support	Cisco StackPower	Catalyst 9800 Embedded WLC	SD-Access Support
Modular uplink models (C9300 SKUs)	✓	✓	✓	480 Gbps	✓	Yes (200 APs)	Yes (256 Virtual Networks)
Fixed uplink Models (C9300L SKUs)	✓	✓	X	320 Gbps	X	Yes (50 APs)	Yes (256 Virtual Networks)

The Cisco Catalyst 9300 Series is made up of fourteen modular uplink switch models and fourteen fixed uplink switch models.



Figure 1.
Cisco Catalyst 9300 Series switches

Table 1 lists port scale and power details for the Cisco Catalyst 9300 Series models.

Table 1. Cisco Catalyst 9300 Series switch configurations

Model	Total 10/100/1000, Multigigabit copper or SFP Fiber	Uplink Configuration	Default AC power supply	Available PoE power
Modular uplink models				
C9300-24T	24 Data	Modular Uplinks	350W AC	N/A
C9300-48T	48 Data	Modular Uplinks	350W AC	N/A
C9300-24P	24 POE+	Modular Uplinks	715W AC	445W
C9300-48P	48 POE+	Modular Uplinks	715W AC	437W
C9300-24U	24 Cisco UPOE	Modular Uplinks	1100W AC	830W
C9300-48U	48 Cisco UPOE	Modular Uplinks	1100W AC	822W

Model	Total 10/100/1000, Multigigabit copper or SFP Fiber	Uplink Configuration	Default AC power supply	Available PoE power
C9300-24UX	24 Multigigabit Cisco UPOE (100M, 1G, 2.5G, 5G, or 10 Gbps)	Modular Uplinks	1100W AC	560W
C9300-48UXM	36x 100 Mbps, 1G, 2.5G + 12x Multigigabit (100M, 1G, 2.5G, 5G, or 10 Gbps)	Modular Uplinks	1100W AC	490W
C9300-48UN	48x 5 Gbps UPOE ports (100M, 1G, 2.5G, 5G)	Modular Uplinks	1100W AC	645W
C9300-24UB	24 Cisco UPOE	Modular Uplinks	1100W AC	830W
C9300-24UXB	24 Multigigabit Cisco UPOE (100M, 1G, 2.5G, 5G, or 10 Gbps)	Modular Uplinks	1100W AC	560W
C9300-48UB	48 Cisco UPOE	Modular Uplinks	1100W AC	822W
C9300-24S	24x 1G SFP	Modular Uplinks	715W AC	N/A
C9300-48S	48x 1G SFP	Modular Uplinks	715W AC	N/A
Fixed uplink models				
C9300L-24T-4G	24 Data	4x 1G fixed uplinks	350W AC	N/A
C9300L-24T-4X	24 Data	4x 10G fixed uplinks	350W AC	N/A
C9300L-48T-4G	48 Data	4x 1G fixed uplinks	350W AC	N/A
C9300L-48T-4X	48 Data	4x 10G fixed uplinks	350W AC	N/A
C9300L-24P-4G	24 PoE+	4x 1G fixed uplinks	715W AC	505W
C9300L-24P-4X	24 PoE+	4x 10G fixed uplinks	715W AC	505W
C9300L-48P-4G	48 PoE+	4x 1G fixed uplinks	715W AC	505W
C9300L-48P-4X	48 PoE+	4x 10G fixed uplinks	715W AC	505W
C9300L-48PF-4G	48 PoE+	4x 1G fixed uplinks	1100W AC	890W
C9300L-48PF-4X	48 PoE+	4x 10G fixed uplinks	1100W AC	890W
C9300L-24UXG-4X	24 UPoE 8xmGig	4x 10G fixed uplinks	1100W AC	880W
C9300L-24UXG-2Q	24 UPoE 8xmGig	2x 40G fixed uplinks	1100W AC	722W
C9300L-48UXG-4X	48 UPoE 12xmGig	4x 10G fixed uplinks	1100W AC	675W
C9300L-48UXG-2Q	48 UPoE 12xmGig	2x 40G fixed uplinks	1100W AC	675W

Cisco Catalyst 9300 Series switches (C9300 SKUs) support optional network modules for uplink ports (Figure 2). These field-replaceable network modules with 25G and 40G speeds in the Cisco Catalyst 9300 Series enable greater architectural flexibility and infrastructure investment protection by allowing a nondisruptive migration from 10G to 25G and beyond. The default switch configuration does not include the network module. When you purchase the switch, you can choose from the network modules described in Table 2.



Figure 2.
Cisco Catalyst 9300 Series Network Modules

Table 2. Network module numbers and descriptions

Network module	Description
C9300-NM-4G	Catalyst 9300 Series 4x 1G Network Module
C9300-NM-4M	Catalyst 9300 Series 4x Multigigabit Network Module
C9300-NM-8X	Catalyst 9300 Series 8x 10G Network Module
C9300-NM-2Q	Catalyst 9300 Series 2x 40G Network Module
C9300-NM-2Y	Catalyst 9300 Series 2x 25G Network Module

Please note: Existing Catalyst 3850 network modules are also supported in Cisco Catalyst 9300 Series switches.

For additional details, please read our FAQs:
<https://www.cisco.com/c/dam/en/us/products/collateral/switches/catalyst-9300-series-switches/nb-09-cat-9k-faq-cte-en.pdf>.

Power supplies

Cisco Catalyst 9300 Series switches support dual redundant power supplies. The switches ship with one power supply by default, and the second power supply can be purchased when the switch is ordered or at a later time. If only one power supply is installed, it should always be in power supply bay #1. The switches also ship with three field-replaceable fans.



Figure 3.
Cisco Catalyst 9300 Series Dual Redundant power supplies

Table 3 lists the different power supplies available in these switches and available PoE power.

Table 3. Power supply models

Model	Default power supply	Available PoE power	With 350W Secondary PS	With 715W Secondary PS	With 1100W Secondary PS
C9300-24T	PWR-C1-350WAC***	n/a	n/a	n/a	n/a
C9300-48T	PWR-C1-350WAC***	n/a	n/a	n/a	n/a
C9300-24P	PWR-C1-715WAC***	445W	720W*	720W*	720W*
C9300-48P	PWR-C1-715WAC***	437W	787W	1152W	1440W*
C9300-24U	PWR-C1-1100WAC	830W	1180W	1440W*	1440W*
C9300-48U	PWR-C1-1100WAC	822W	1172W	1537W	1800W**
C9300-24UX	PWR-C1-1100WAC-P	560W	910W	1275W	1440W*
C9300-48UXM	PWR-C1-1100WAC-P	490W	840W	1205W	1590W
C9300-48UN	PWR-C1-1100WAC-P	645W	995W	1360W	1745W
C9300-24UB	PWR-C1-1100WAC	830W	1180W	1440W*	1440W*
C9300-24UXB	PWR-C1-1100WAC-P	560W	910W	1275W	1440W*
C9300-48UB	PWR-C1-1100WAC	822W	1172W	1537W	1800W**
C9300-24S	PWR-C1-715WAC-P	n/a	n/a	n/a	n/a
C9300-48S	PWR-C1-715WAC-P	n/a	n/a	n/a	n/a
C9300L-24T-4G	PWR-C1-350WAC-P	n/a	n/a	n/a	n/a
C9300L-24T-4X	PWR-C1-350WAC-P	n/a	n/a	n/a	n/a
C9300L-48T-4G	PWR-C1-350WAC-P	n/a	n/a	n/a	n/a
C9300L-48T-4X	PWR-C1-350WAC-P	n/a	n/a	n/a	n/a
C9300L-24P-4G	PWR-C1-715WAC-P	505W	720W*	720W*	720W*
C9300L-24P-4X	PWR-C1-715WAC-P	505W	720W*	720W*	720W*
C9300L-48P-4G	PWR-C1-715WAC-P***	505W	855W	1220W	1440W*
C9300L-48P-4X	PWR-C1-715WAC-P***	505W	855W	1220W	1440W*
C9300L-48PF-4G	PWR-C1-1100WAC-P	890W	1240W	1440W	1440W*
C9300L-48PF-4X	PWR-C1-1100WAC-P	890W	1240W	1440W	1440W*
C9300L-24UXG-4X	PWR-C1-1100WAC-P	880W	1230W	1440W	1440W*
C9300L-24UXG-2Q	PWR-C1-1100WAC-P	722W	1072W	1440W	1440W*
C9300L-48UXG-4X	PWR-C1-1100WAC-P***	675W	1025W	1390W	1775W
C9300L-48UXG-2Q	PWR-C1-1100WAC-P***	675W	1025W	1390W	1775W

* Limited by port number and port rating (e.g. 24 PoE+ 30W ports = 720W)

** Limited by design

*** Upgrade options for 715W and 1100W PSU are available

Stacking

Cisco Catalyst 9300 Series switch models are designed for stacking switches as a single virtual switch, enabling customers to have a single management plane and control plane for up to 448 access ports.



Figure 4.

Cisco Catalyst 9300 Series modular uplink models stack (C9300 SKUs) and fixed uplink models stack (C9300L SKUs)

Table 4 lists the supported stacking options.

Table 4. Supported stacking options

Model	Stacking support	Stacking bandwidth support	Optional Stacking hardware	Number of members	Supported stack members
Modular uplink models (C9300 SKUs)	StackWise®-480	480 Gbps	StackWise Cable	8	Other C9300 SKUs with same license level C9300 higher scale SKUs only stack with other like higher scale models
Fixed uplink models (C9300L SKUs)	StackWise-320	320 Gbps	C9300L-STACK-KIT	8	Other C9300L SKUs with same license level

Mixed stacking between 9300 and 9300 higher/increased scale platforms is **not supported**. You cannot stack fixed uplink models (C9300L SKUs) with modular uplink models (C9300 SKUs) or other Catalyst switches, e.g. Cisco Catalyst 3850 and 3650 Series. Any combination of C9300 models can form a stack. Separately, any combination of C9300L models can form a stack.

Catalyst 9300 higher scale SKUs (C9300-24UB, C9300-24UXB, C9300-48UB) need to be stacked with other higher scale models in order to achieve a stack with the higher scale supported by these models.

StackWise cables that are available to configure stacking with Catalyst 9300 Series modular uplink models (C9300 SKUs) come in lengths of 0.5m, 1m and 3m.

The optional StackWise-320 kit for Catalyst 9300 Series fixed uplink models (C9300L SKUs) consists of two stack adapters and a stacking cable. The default stacking cable is 0.5 m, but options of 1m and 3m are also available. Table 5 lists the stacking accessories.

Table 5. Stacking accessories

Model	Description
STACK-T1-50CM	Data stack 50 cm (cable option with C9300 SKUs)
STACK-T1-1M	Data stack 1m (cable option with C9300 SKUs)

Model	Description
STACK-T1-3M	Data stack 3m (cable option with C9300 SKUs)
C9300L-STACK-KIT	Stack kit for C9300L SKUs only: Two data stack adapters and one data stack cable
STACK-T3-50CM	Data stack 50cm cable (default cable with C9300L Stack Kit)
STACK-T3-1M	Data stack 1m cable (cable option with C9300L Stack Kit)
STACK T3-3M	Data stack 3m cable (cable option with C9300L Stack Kit)



Figure 5.
Cisco Catalyst 9300 Series switch stack units

Fan

Cisco Catalyst 9300 Series switches also come with three field-replaceable fans and support (N+1) redundancy. Table 6 lists the fan module part number.

Table 6. Fan modules

Model	Description
FAN-T2=	Fan module

Performance and scalability

Performance and scalability metrics for the Cisco Catalyst 9300 Series are provided in Table 7.

Table 7. Performance specifications

Description	Performance – C9300 modular uplink SKUs	Performance – C9300 higher scale, modular uplink SKUs	Performance: C9300L fixed uplink SKUs
Total number of MAC addresses	32,000	64,000	32,000
Total number of IPv4 routes (ARP plus learned routes)	32,000 (24,000 direct routes and 8000 indirect routes)	64,000	32,000 (24,000 direct routes and 8000 indirect routes)
IPv6 routing entries	16,000	32,000	16,000
Multicast routing scale	8,000	16,000	8,000
QoS scale entries	5,120	18,000	5,120

Description	Performance – C9300 modular uplink SKUs	Performance – C9300 higher scale, modular uplink SKUs	Performance: C9300L fixed uplink SKUs
ACL scale entries	5,120	18,000	5,120
Packet buffer per SKU	16 MB buffer for 24- or 48-port Gigabit Ethernet models 32 MB buffer for 24 and 48-port Multigigabit	32 MB buffer for 24- and 48-port Gigabit Ethernet models 64 MB buffer for 24-port Multigigabit model (24UXB)	16 MB buffer for 24 and 48 port Gigabit Ethernet models
FNF entries	64,000 flow on 24- and 48-port Gigabit Ethernet models 128,000 flows on 24-port Multigigabit	128,000 flow on 24- and 48-port Gigabit Ethernet models 256,000 flows on 24-port Multigigabit	64,000 flow on 24- and 48-port Gigabit Ethernet models
DRAM	8 GB	8 GB	8 GB
Flash	16 GB	16 GB	16 GB
VLAN IDs	4094	4094	4094
Total Switched Virtual Interfaces (SVIs)	1000	1000	1000
Jumbo frames	9198 bytes	9198 bytes	9198 bytes
Total routed ports per Catalyst 9300 Series stack	448	448	416

Table 8. Bandwidth specifications

SKU	Switching capacity	Switching capacity with stacking	Forwarding rate	Forwarding rate with stacking
C9300-24T	208 Gbps	688 Gbps	154.76 Mpps	511.90 Mpps
C9300-48T	256 Gbps	736 Gbps	190.47 Mpps	547.62 Mpps
C9300-24P	208 Gbps	688 Gbps	154.76 Mpps	511.90 Mpps
C9300-48P	256 Gbps	736 Gbps	190.47 Mpps	547.62 Mpps
C9300-24U	208 Gbps	688 Gbps	154.76 Mpps	511.90 Mpps
C9300-48U	256 Gbps	736 Gbps	190.48 Mpps	547.62 Mpps
C9300-24UX	640 Gbps	1120 Gbps	476.19 Mpps	833.33 Mpps
C9300-48UXM	580 Gbps	1060 Gbps	431.54 Mpps	788.69 Mpps
C9300-48UN	640 Gbps	1120 Gbps	476.19 Mpps	833.33 Mpps
C9300-24UB	208 Gbps	688 Gbps	154.76 Mpps	511.90 Mpps
C9300-48UB	256 Gbps	736 Gbps	190.48 Mpps	547.62 Mpps
C9300-24UXB	640 Gbps	1120 Gbps	476.19 Mpps	833.33 Mpps
C9300-24S	208 Gbps	688 Gbps	154.76 Mpps	511.90 Mpps

SKU	Switching capacity	Switching capacity with stacking	Forwarding rate	Forwarding rate with stacking
C9300-48S	256 Gbps	736 Gbps	190.47 Mpps	547.62 Mpps
C9300L-24T-4G	56 Gbps	376 Gbps	41.66 Mpps	279.76 Mpps
C9300L-24T-4X	128 Gbps	448 Gbps	95.23 Mpps	333.33 Mpps
C9300L-48T-4G	104 Gbps	424 Gbps	77.38 Mpps	315.48 Mpps
C9300L-48T-4X	176 Gbps	496 Gbps	130.95 Mpps	369.05 Mpps
C9300L-24P-4G	56 Gbps	376 Gbps	41.66 Mpps	279.76 Mpps
C9300L-24P-4X	128 Gbps	448 Gbps	95.23 Mpps	333.33 Mpps
C9300L-48P-4G	104 Gbps	424 Gbps	77.38 Mpps	315.48 Mpps
C9300L-48P-4X	176 Gbps	496 Gbps	130.95 Mpps	369.05 Mpps
C9300L-48PF-4G	104 Gbps	424 Gbps	77.38 Mpps	315.48 Mpps
C9300L-48PF-4X	176 Gbps	496 Gbps	130.95 Mpps	369.05 Mpps
C9300L-24UXG-4X	272 Gbps	592 Gbps	202.38 Mpps	440.47 Mpps
C9300L-24UXG-2Q	352 Gbps	672 Gbps	261.90 Mpps	500.00 Mpps
C9300L-48UXG-4X	392 Gbps	712 Gbps	291.66 Mpps	529.76 Mpps
C9300L-48UXG-2Q	472 Gbps	792 Gbps	351.19 Mpps	589.28 Mpps

All models are at wire-speed nonblocking performance for both IPv4 and IPv6. The forwarding rates in the table above are measured with 64 byte IPv4 packet sizes.

SD-Access architecture

What if you could give time back to IT? Provide network access in minutes for any user or device to any application – without compromise? SD-Access is the industry’s first policy-based automation from network edge to cloud. Your foundation for your digital network, Cisco SD-Access. Built on the principles of the Cisco DNA, SD-Access provides end-to-end segmentation to keep user, device and application traffic separate without a redesign of the network. It automates user access policy so organizations can make sure the right policies are set for any user or device with any application across the network. This is accomplished with a single network fabric across LAN and WLAN which creates a consistent user experience anywhere without compromising on security.

There are many challenges today in managing the network to drive business outcomes. These limitations are due to manual configuration and fragmented tool offerings. SD-Access provides:

- A transformational management solution that reduces operational expenses and enhances business agility
- Consistent management of wired and wireless network provisioning and policy
- Automated network segmentation and group-based policy
- Contextual insights for fast issue resolution and capacity planning
- Open and programmable interfaces for integration with third-party solutions

For an overview of key use-cases SD-Access addresses, refer to [SD-Access Solution Overview](#).

Platform benefits

Cisco IOS XE opens a completely new paradigm in network configuration, operation, and monitoring through network automation. Cisco's automation solution is open, standards-based, and extensible across the entire lifecycle of a network device. The various automation mechanisms are outlined below.

- **Automated device provisioning** is the ability to automate the process of upgrading software images and installing configuration files on Cisco Catalyst switches when they are being deployed in the network for the first time. Cisco provides both turnkey solutions such as Plug and Play and off-the-shelf tools such as Zero-Touch Provisioning (ZTP) and Preboot Execution Environment (PXE) that enable an effortless and automated deployment.
- **API-driven configuration** is available with modern network switches such as the Cisco Catalyst 9300 Series. It supports a wide range of automation features and provides robust open APIs over NETCONF and RESTCONF and GNMI using YANG data models for external tools, both off-the-shelf and custom built, to automatically provision network resources.
- **Granular visibility** enables model-driven telemetry to stream data from a switch to a destination. The data to be streamed is identified through subscription to a data set in a YANG model. The subscribed data set is streamed to the destination at specified intervals. Additionally, Cisco IOS XE enables the push model. It provides near-real-time monitoring of the network, leading to quick detection and rectification of failures.
- **Seamless software upgrades and patching** supports OS resilience. Cisco IOS XE supports patching, which provides fixes for critical bugs and security vulnerabilities between regular maintenance releases. This support lets you add patches without having to wait for the next maintenance release.

Security

- **Encrypted Traffic Analytics (ETA)** is a unique capability for identifying malware in encrypted traffic coming from the access layer. Since more and more traffic is becoming encrypted, the visibility this feature affords for threat detection is critical for keeping your network secure at different layers.
- **AES-256 MACsec encryption** is the IEEE 802.1AE standard for authenticating and encrypting packets between switches. The Cisco Catalyst 9300 Series switches support 256-bit and 128-bit Advanced Encryption Standard (AES), providing the most secure link encryption.
- **Trustworthy solutions built with Cisco Trust Anchor Technologies** provide a highly secure foundation for Cisco products. With the Catalyst 9300 Series, these technologies enable hardware and software authenticity assurance for supply chain trust and strong mitigation against man-in-the-middle attacks that compromise software and firmware. Trust Anchor capabilities include:
 - **Image signing:** Cryptographically signed images provide assurance that the firmware, BIOS, and other software are authentic and unmodified. As the system boots, the system's software signatures are checked for integrity.

- **Secure Boot:** Cisco Secure Boot technology anchors the boot sequence chain of trust to immutable hardware, mitigating threats against a system's foundational state and the software that is to be loaded, regardless of a user's privilege level. It provides layered protection against the persistence of illicitly modified firmware.
- **Cisco Trust Anchor module:** A tamper-resistant, strong cryptographic, single-chip solution provides hardware authenticity assurance to uniquely identify the product so that its origin can be confirmed to Cisco. This provides assurance that the product is genuine.

Resiliency and high availability

- **StackWise-480:** Cisco Catalyst 9300 Series modular uplink models (C9300 SKUs) support the industry's highest back-panel stacking bandwidth solution (480 Gbps) with StackWise-480. Up to 8 Switches can be configured in a Stackwise-480 with the special connector at the back of the switch using dedicated stack cables.
- **StackWise-320:** The Cisco Catalyst 9300 Series fixed uplink models (C9300L SKUs) support stacking bandwidth solution (320 Gbps) with StackWise-320. Up to 8 Switches can be optionally configured in a Stackwise-320 with the special Stack Kit at the back of the switch using dedicated stack cables.
- **Cisco StackPower:** Cisco StackPower is an innovative power interconnect system that allows the power supplies in a stack to be shared as a common resource among all the switches. This allows you to simply add one extra power supply in any switch of the stack and either provide power redundancy for any of the stack members or simply add more power to the shared pool. Up to 4 switches can be configured in a StackPower stack with the special connector at the back of the switch. However, with the use of XPS-2200 appliance, up to 9 switches can be configured in the StackPower stack. **Cisco StackPower is only supported on the models with modular uplink stack - C9300 SKUs.**



Figure 6.
Cisco Catalyst 9300 Series StackPower

- **High availability:** The Catalyst 9300 Series supports high-availability features, including the following:
 - Cross-stack EtherChannel provides the ability to configure Cisco EtherChannel technology across different members of the stack for high resiliency.
 - IEEE 802.1s Multiple Spanning Tree Protocol (MSTP) provides rapid spanning tree convergence independent of spanning tree timers and also offers the benefit of Layer 2 load balancing and distributed processing.
 - Per-VLAN Rapid Spanning Tree (PVRST+) allows rapid spanning tree (IEEE 802.1w) reconvergence on a per-VLAN spanning tree basis, providing simpler configuration than MSTP. In both MSTP and PVRST+ modes, stacked units behave as a single spanning tree node.
 - Switch-port auto-recovery (“err-disable” recovery) automatically attempts to reactivate a link that is disabled because of a network error.
 - The Catalyst 9300 Series platform delivers the best NSF/SSO resiliency architecture in a stackable solution with sub-50-ms failover.
 - Always-On wireless network with stateful switchover when wireless functionality is enabled on stack of Catalyst 9300 Series switches.

Deep buffer Technology

Cisco Catalyst 9300 higher scale models have a deeper buffer to address the requirements of rich multi-media lossless content delivery and large routing tables in a fixed access solution with a wide range of uplink choices for deployment flexibility.

Flexible Netflow

- **Flexible NetFlow (FNF):** Cisco IOS Software FNF is the next generation in flow visibility technology. It enables optimization of the network infrastructure, reduces operation costs, and improves capacity planning and security incident detection with increased flexibility and scalability. The Catalyst 9300 Series is capable of up to 64,000 flow entries on 48-port and 24 port models and up to 128,000 flow entries on Multigigabit models.

Application visibility and control

- **NBAR2:** Next-Generation Network-Based Application Recognition (NBAR2) enables advanced application classification techniques, accuracy with up to 1400 predefined and well-known application signatures and up to 150 encrypted applications on the Cisco Catalyst 9000 switches. The most popular applications included are Skype, Office 365, Microsoft Lync, Cisco WebEx®, and Facebook, among many others that are predefined and easy to configure. NBAR2 provides the network administrator with an important tool to identify, control, and monitor end-user application usage while helping ensure a quality user experience and securing the network from malicious attacks. NBAR2 leverages FNF to report application performance and activities within the network to any supported NetFlow collector, such as Cisco Prime®, Cisco Stealthwatch®, or any compliant third-party tool.

QoS

- **Superior QoS:** The Cisco Catalyst 9300 Series offers Gigabit Ethernet speeds with intelligent services that keep traffic flowing smoothly, even at 10 times the normal network speed. Industry-leading mechanisms for cross-stack marking, classification, and scheduling deliver superior performance for data, voice, and video traffic at wire speed. Superior QoS includes granular wireless bandwidth management and fair sharing, 802.1p Class of Service (CoS) and Differentiated Services Code Point (DSCP) field classification, Shaped Round Robin (SRR) scheduling, Committed Information Rate (CIR), and eight egress queues per port.

Service discovery

- **Multicast DNS (mDNS) gateway:** This service discovery gateway capability facilitates sharing of services advertised using the Apple mDNS (Bonjour) protocol, such as printers, Apple TVs, and file services across the network. Additionally, the administrator can create policies defining which services can be seen and accessed by the users in the network. This capability facilitates a Bring-Your-Own-Device (BYOD) rollout.

Smart operation

- **WebUI:** WebUI is an embedded GUI-based device-management tool that provides the ability to provision the device, to simplify device deployment and manageability, and to enhance the user experience. It comes with the default image, so there is no need to enable anything or install any license on the device. You can use WebUI to build configurations, and to monitor and troubleshoot the device without having CLI expertise.
- **Efficient switch operation*:** Cisco Catalyst 9300 Series switches provide optimum power saving with Energy Efficient Ethernet (EEE) on the RJ-45 ports and low-power operations for industry best-in-class power management and power consumption capabilities. The ports support reduced power modes so that ports not in use can move into a lower power utilization state. Other efficient switch operation features are as follows:
 - Per-port power consumption command allows customers to specify a maximum power setting on an individual port.
 - Per-port PoE power sensing measures actual power being drawn, enabling more intelligent control of powered devices. The PoE MIB provides proactive visibility into power usage and allows you to set different power-level thresholds.
- **RFID tags:** Catalyst 9300 Series switches have an embedded RFID tag that facilitates easy asset and inventory management using commercial RFID readers.
- **Blue beacon:** Catalyst 9300 Series switches support a blue beacon LED for easy identification of the switch being accessed.

* Energy Efficient Ethernet (EEE) will be fully supported on Multigigabit switches in a future SW release

High-Performance IP routing

The Cisco Express Forwarding hardware routing architecture delivers extremely high-performance IP routing in Cisco Catalyst 9300 Series switches, based on:

- IP unicast routing protocols (including static, Routing Information Protocol Version 1 [RIPv1], RIPv2, RIPng, and Open Shortest Path First [OSPF], Routed Access) are supported for small network routing applications with the Network Essentials stack. Equal-cost routing facilitates Layer 3 load balancing and redundancy across the stack.
- Advanced IP unicast routing protocols (including Full [OSPF], Enhanced Interior Gateway Routing Protocol [EIGRP], Border Gateway Protocol Version 4 [BGPv4], and Intermediate System-to-Intermediate System Version 4 [IS-ISv4]) are supported for load balancing and for constructing scalable LANs. IPv6 routing (using OSPFv3 and BGPv6) is supported in hardware for maximum performance.
- Protocol-Independent Multicast (PIM) for IP multicast routing is supported, including PIM Sparse Mode (PIM SM), and Source-Specific Multicast (SSM).
- IPv6 addressing is supported on interfaces with appropriate show commands for monitoring and troubleshooting.

Audio Video Bridging (AVB)

Starting with Cisco IOS XE Software Release 16.8, the Cisco Catalyst 9300 Series supports the IEEE 802.1 AVB standard. This standard provided the means for highly reliable delivery of low-latency, time-synchronized audio and video streaming services through Layer 2 Ethernet networks. The standard also makes it easier to integrate new services and for AV equipment from different vendors to interoperate.

Benefits

- Improves quality of experience by lowering jitter and latency for time-synchronized delivery of high-quality AV.
- Provides scalability of applications across networked deployments, including expansive and complex AV infrastructure.
- Lowers Total Cost of Ownership (TCO) with reduced cabling (lowers CapEx) and no license fees (lowers OpEx).

For more details about AVB and specific models supported, check <https://www.cisco.com/go/avb>.

Multigigabit Ethernet technology: Cisco Multigigabit Ethernet technology allows you to achieve bandwidth speeds from 1 Gbps to 10 Gbps over traditional Category 5e/6 cabling or above. This technology addresses the need for exponential increases in bandwidth with the enormous growth of 802.11ac Wave 2, to be eclipsed by the growth of Wi-Fi 6 and new wireless applications without having to replace current cabling infrastructure.

Power over ethernet leadership

Cisco Universal Power over Ethernet (Cisco UPOE): PoE removes the need for wall sockets to power each PoE-enabled device and eliminates the cost of additional electrical cabling and circuits that would otherwise be necessary in IP phone and WLAN deployments. Cisco UPOE extends the IEEE PoE+ standard to double the power per port to 60 watts. This facilitates delivery of network power to a broad range of devices requiring higher power, including virtual desktop terminals, IP turrets, compact switches, building management gateways, LED lights, wireless access points, and IP phones.

Catalyst 9300 Series modular uplink (C9300 SKUs) and fixed uplink (C9300L SKUs) models both support Cisco UPoE or PoE+ and PoE, thereby addressing the largest range of network power needs.

Tables 9 and 10 show the power supply combinations required for different PoE needs.

Table 9. Power supply requirements for Catalyst 9300 Series modular uplink PoE/PoE+ models (C9300-xxP SKUs)

	24-port PoE switch	48-port PoE switch
PoE on all ports (15.4W per port)	1 PWR-C1-715WAC/PWR-C1-715WAC-P/PWR-C1-715WDC	1 PWR-C1-1100WAC/PWR-C1-1100WAC-P or 2 PWR-C1-715WAC/PWR-C1-715WAC-P/PWR-C1-715WDC
PoE+ on all ports (30W per port)	1 PWR-C1-1100WAC/PWR-C1-1100WAC-P or 2 PWR-C1-715WAC/PWR-C1-715WAC-P/PWR-C1-715WDC	2 PWR-C1-1100WAC/PWR-C1-1100WAC-P or 1 PWR-C1-1100WAC/PWR-C1-1100WAC-P and 1 PWR-C1-715WAC/PWR-C1-715WAC-P/PWR-C1-715WDC

Table 10. Power supply requirements for Catalyst 9300 Series UPOE models (C9300-xxU/UXM/UN SKUs)

	24-port Cisco UPOE switch	48-port Cisco UPOE switch	48 and 24-port Multigigabit Cisco UPOE switch*
Cisco UPOE (60W per port) & IEEE 802.3bt type3 on all ports (24-port switch) or up to 30 ports (48-port switch)	1 PWR-C1-1100WAC/PWR-C1-1100WAC-P and 1 PWR-C1-715WAC/PWR-C1-715WAC-P/PWR-C1-715WDC	2 PWR-C1-1100WAC/PWR-C1-1100WAC-P	2 PWR-C1-1100WAC/PWR-C1-1100WAC-P

Table 11. Power supply requirements for Catalyst 9300 Series fixed uplink PoE/PoE+ models (C9300L-xxP SKUs)

	24-port PoE switch	48-port PoE switch
PoE on all ports (15.4W per port)	1 PWR-C1-715WAC-P/PWR-C1-715WDC	1 PWR-C1-1100WAC-P or 2 PWR-C1-715WAC-P
PoE+ on all ports (30W per port)	1 PWR-C1-1100WAC-P or 2 PWR-C1-715WAC-P/PWR-C1-715WDC	2 PWR-C1-1100WAC-P or 1 PWR-C1-1100WAC-P and 1 PWR-C1-715WAC-P/PWR-C1-715WDC

- **Perpetual PoE:** With Perpetual PoE, the PoE power is maintained during a switch reload. This is important for IoT endpoints such as PoE-powered lights, so that there is no disruption during switch reboot.
- **Fast PoE:** When power is restored to a switch, PoE starts delivering power to endpoints without waiting for the operating system to fully load, thereby speeding up the time for the endpoint to start up.

* C9300-48UN, C9300-24UX, C9300-48UXM are available with PWR-C1-1100WAC-P Platinum-rated power supply. Platinum-rated power supplies are more efficient, lowering operating power costs

* PWR-C1-1100WAC-UP and PWR-C1-715WAC-UP Platinum-rated power supply upgrade options are available to upgrade the default AC power supply to 1100W or 715W

Software requirements

[Cisco DNA Software for Access Switching](#) is available for the Cisco Catalyst 9300 Series.

Cisco DNA Software for Access Switching offers comprehensive solutions for the enterprise campus and branch offices. Cisco DNA for Access Switching introduces a simpler and more economical way to deploy access, aggregation, and core switches across enterprise campus and branch locations.

The Cisco DNA Subscription for Switching offer delivers an unbound network on an open and extensible architecture to help you navigate the digital journey. This subscription offer simplifies the buying process and includes lower initiation costs and flexible terms. It includes: Cisco DNA Premier with full Cisco DNA capabilities and SD-Access, bundled with ISE Base, ISE Plus, and StealthWatch.

For ordering information for Cisco DNA Software for the Cisco Catalyst 9300 Series, go to <https://www.cisco.com/c/en/us/products/software/one-access/switching-part-numbers.html>.

Cisco Catalyst 9300 Series switches run on Cisco IOS XE 16.5.1a release or later with the following exceptions. Catalyst 9300 Series 1G fiber models (C9300-xxS SKUs) are supported on Cisco IOS XE 16.11.1a release or later. Catalyst 9300 Series fixed uplink models (C9300L SKUs) are supported on Cisco IOS XE 16.11.1b release or later. These software releases includes all the features listed earlier in the Platform Benefits section.

Licensing

Packaging

The Cisco Catalyst 9000 family of switches introduces a new and simplified licensing package in the form of base and add-on licenses.

- **The perpetual licensing** package includes the Network Essentials and Network Advantage licensing options that are tied to the hardware. Between them, the base licensing packages cover switching fundamentals, management automation, troubleshooting, and advanced switching features. These Network licenses are perpetual.
- **The subscription licensing** package includes the Cisco DNA Essentials and Cisco DNA Advantage options. In addition to on-box capabilities, the features available with this package provide Cisco innovations on the switch, as well as on Cisco DNA Center. The Cisco DNA subscription licenses are mandatory at the time of configuration.

License consumption is easily determined by the package itself. While perpetual licenses are always permanent and without an expiration date, subscription licenses have to be purchased for a 3-, 5-, or 7-year term (and hence are also known as term-based licenses). Table 12 shows the combinations of perpetual and subscription licenses that must be purchased.

Table 12. Licensing combinations

	Cisco DNA Essentials	Cisco DNA Advantage	Cisco DNA Premier
Network Essentials	Yes	No	No
Network Advantage	No*	Yes	Yes

* At the time of Cisco DNA license renewal, the Cisco DNA Essentials license can be purchased to be used with Network Advantage

Managing licenses with Smart Accounts: Creating Smart Accounts by using the Cisco Smart Software Manager (SSM) enables you to manage your software licenses from a centralized website. You can set up Cisco SSM to receive daily email alerts and to be notified of expiring subscription licenses that you want to renew.

You must order a Cisco DNA subscription term license in order to purchase a switch. When the license term expires, you can either renew the add-on license to continue using it or deactivate the add-on license and then reload the switch to continue operating with the base license capabilities.

Both the base and add-on licenses are also available for a 90-day evaluation period. An evaluation license is activated temporarily, without purchase. An expired evaluation license cannot be reactivated after reload.

Note: It is not required to deploy Cisco DNA Center just to use one of the above packages.

Table 13 shows the features included in the Network Essentials and Advantage packages.

Table 14 shows the features included in the Cisco DNA Essentials and Advantage packages.

Table 13. Network Essentials and Advantage package features

Features	Network Essentials	Network Advantage
Switch fundamentals Layer 2, Routed Access (RIP, EIGRP Stub, OSPF – 1000 routes), PBR, PIM Stub Multicast (1000 routes)), PVLAN, VRRP, PBR, CDP, QoS, FHS, 802.1X, MACsec-128, CoPP, SXP, IP SLA Responder, SSO	✓	✓
Advanced switch capabilities and scale BGP, EIGRP, HSRP, IS-IS, BSR, MSDP, PIM-BIDIR,* IP SLA, OSPF	X	✓
Network segmentation VRF, VXLAN, LISP, SGT, MPLS, mVPN	X	✓
Automation NETCONF, RESTCONF, gRPC, YANG, PnP Agent, ZTP/Open PnP, GuestShell (On-Box Python)	✓	✓
Telemetry and visibility Model-driven telemetry, sampled NetFlow, SPAN, RSPAN	✓	✓
High availability and resiliency Nonstop Forwarding (NSF), Graceful Insertion and Removal (GIR), Fast Software Upgrade (FSU), Software Patching (CLI Based)	X	✓
IOT integration AVB, PTP, CoAP	X	✓
Security MACsec-256	X	✓

Table 14. Cisco DNA Essentials and Advantage package features (add a section for other software support and add Prime, ISE and Stealthwatch support)

Features	Cisco DNA Essentials	Cisco DNA Advantage	Cisco DNA Premier
Switch features			
Optimized network deployments Cisco DNA Service for Bonjour	X	✓	✓
Advanced telemetry and visibility Full Flexible NetFlow, EEM	✓	✓	✓
Optimized telemetry and visibility ERSPAN, AVC (NBAR2), app hosting (in containers/VMs), Wireshark	X	✓	✓
Advanced security Encrypted Traffic Analytics (ETA)	X	✓	✓
Cisco DNA Center features			
Day-0 network bring-up automation Cisco Network Plug-and-Play application, network settings, device credentials, LAN automation, host onboarding	✓	✓	✓
Element management Discovery, inventory, topology, software image, licensing, and configuration management	✓	✓	✓
Element management Patch management	X	✓	✓
Basic Assurance Health dashboards – Network, Client, Application; switch and wired client health monitoring	✓	✓	✓
SD-Access Policy-based automation and assurance for wired and wireless	X	✓	✓
SD-Access Embedded Wireless C9800 Wireless Software package to enable Wireless Controller Functionality*	X	✓	✓
Network assurance and analytics Global insights, trends, compliance, custom reports; switch 360, wired client 360; fabric and non-fabric insights; app health, app 360, app performance (loss, latency, jitter)	X	✓	✓
Other Software included (can be purchased separately)			
ISE Base	X	X	✓
ISE Plus	X	X	✓
StealthWatch	X	X	✓

* Note: A purchase of Cisco DNA Advantage or Cisco DNA Premier per Access Point is required in order to enable the Wireless Controller functionality on Catalyst Switches

Specifications

Dimensions, Weight, Acoustic, Mean time between failures

The table below shows the dimensions, weights, acoustic and mean time between failures of all models of Cisco Catalyst 9300 Series switches.

Table 15. Model Dimensions, Weight, and Mean Time between failures metrics

General Specifications			
Dimensions (H x W x D) inches			
Model	Chassis only	W/ Default Power Supply	W/ 1100W Power Supply
C9300-24T	1.73 x 17.5 x 16.1	1.73 x 17.5 x 17.7	1.73 x 17.5 x 19.2
C9300-24P	1.73 x 17.5 x 16.1	1.73 x 17.5 x 17.7	1.73 x 17.5 x 19.2
C9300-24U	1.73 x 17.5 x 16.1	1.73 x 17.5 x 19.2	1.73 x 17.5 x 19.2
C9300-24UX	1.73 x 17.5 x 17.1	1.73 x 17.5 x 20.2	1.73 x 17.5 x 20.2
C9300-24UB	1.73 x 17.5 x 16.1	1.73 x 17.5 x 19.2	1.73 x 17.5 x 19.2
C9300-24UXB	1.73 x 17.5 x 17.1	1.73 x 17.5 x 20.2	1.73 x 17.5 x 20.2
C9300-48T	1.73 x 17.5 x 16.1	1.73 x 17.5 x 17.7	1.73 x 17.5 x 19.2
C9300-48P	1.73 x 17.5 x 16.1	1.73 x 17.5 x 17.7	1.73 x 17.5 x 19.2
C9300-48U	1.73 x 17.5 x 16.1	1.73 x 17.5 x 19.2	1.73 x 17.5 x 19.2
C9300-48UXM	1.73 x 17.5 x 19.1	1.73 x 17.5 x 22.2	1.73 x 17.5 x 22.2
C9300-48UN	1.73 x 17.5 x 19.1	1.73 x 17.5 x 22.2	1.73 x 17.5 x 22.2
C9300-48UB	1.73 x 17.5 x 16.1	1.73 x 17.5 x 19.2	1.73 x 17.5 x 19.2
C9300-24S	1.73 X 17.5 X 17.7	1.73 X 17.5 X 19.2	1.73 X 17.5 X 20.7
C9300-48S	1.73 X 17.5 X 17.7	1.73 X 17.5 X 19.2	1.73 X 17.5 X 20.7
C9300L-24T-4G	1.73 X 17.5 X 16.1	1.73 X 17.5 X 17.7	1.73 X 17.5 X 19.2
C9300L-24T-4X	1.73 X 17.5 X 16.1	1.73 X 17.5 X 17.7	1.73 X 17.5 X 19.2
C9300L-48T-4G	1.73 X 17.5 X 16.1	1.73 X 17.5 X 17.7	1.73 X 17.5 X 19.2
C9300L-48T-4X	1.73 X 17.5 X 16.1	1.73 X 17.5 X 17.7	1.73 X 17.5 X 19.2
C9300L-24P-4G	1.73 X 17.5 X 16.1	1.73 X 17.5 X 17.7	1.73 X 17.5 X 19.2
C9300L-24P-4X	1.73 X 17.5 X 16.1	1.73 X 17.5 X 17.7	1.73 X 17.5 X 19.2
C9300L-48P-4G	1.73 X 17.5 X 16.1	1.73 X 17.5 X 17.7	1.73 X 17.5 X 19.2
C9300L-48P-4X	1.73 X 17.5 X 16.1	1.73 X 17.5 X 17.7	1.73 X 17.5 X 19.2
Dimensions (H x W x D) Cms			
C9300-24T	4.4 x 44.5 x 40.9	4.4 x 44.5 x 44.9	4.4 x 44.5 x 48.8
C9300-24P	4.4 x 44.5 x 40.9	4.4 x 44.5 x 44.9	4.4 x 44.5 x 48.8
C9300-24U	4.4 x 44.5 x 40.9	4.4 x 44.5 x 48.8	4.4 x 44.5 x 48.8
C9300-24UX	4.4 x 44.5 x 43.4	4.4 x 44.5 x 51.3	4.4 x 44.5 x 51.3

General Specifications			
C9300-48T	4.4 x 44.5 x 40.9	4.4 x 44.5 x 44.9	4.4 x 44.5 x 48.8
C9300-48P	4.4 x 44.5 x 40.9	4.4 x 44.5 x 44.9	4.4 x 44.5 x 48.8
C9300-48U	4.4 x 44.5 x 40.9	4.4 x 44.5 x 48.8	4.4 x 44.5 x 48.8
C9300-48UXM	4.4 x 44.5 x 48.5	4.4 x 44.5 x 56.4	4.4 x 44.5 x 56.4
C9300-48UN	4.4 x 44.5 x 48.5	4.4 x 44.5 x 56.4	4.4 x 44.5 x 56.4
C9300-24S	4.3 x 44.4 x 44.9	4.3 x 44.4 x 48.8	4.3 x 44.4 x 52.6
C9300-48S	4.3 x 44.4 x 44.9	4.3 x 44.4 x 48.8	4.3 x 44.4 x 52.6
C9300L-24T-4G	4.4 x 44.5 x 40.9	4.4 x 44.5 x 44.9	4.4 x 44.5 x 48.8
C9300L-24T-4X	4.4 x 44.5 x 40.9	4.4 x 44.5 x 44.9	4.4 x 44.5 x 48.8
C9300L-48T-4G	4.4 x 44.5 x 40.9	4.4 x 44.5 x 44.9	4.4 x 44.5 x 48.8
C9300L-48T-4X	4.4 x 44.5 x 40.9	4.4 x 44.5 x 44.9	4.4 x 44.5 x 48.8
C9300L-24P-4G	4.4 x 44.5 x 40.9	4.4 x 44.5 x 44.9	4.4 x 44.5 x 48.8
C9300L-24P-4X	4.4 x 44.5 x 40.9	4.4 x 44.5 x 44.9	4.4 x 44.5 x 48.8
C9300L-48P-4G	4.4 x 44.5 x 40.9	4.4 x 44.5 x 44.9	4.4 x 44.5 x 48.8
C9300L-48P-4X	4.4 x 44.5 x 40.9	4.4 x 44.5 x 44.9	4.4 x 44.5 x 48.8
C9300L-48PF-4G	4.4 x 44.5 x 40.9	4.4 x 44.5 x 48.8	4.4 x 44.5 x 48.8
C9300L-48PF-4X	4.4 x 44.5 x 40.9	4.4 x 44.5 x 48.8	4.4 x 44.5 x 48.8
C9300L-24UXG-4X	4.4 x 44.5 x 40.9	4.4 x 44.5 x 48.8	4.4 x 44.5 x 48.8
C9300L-24UXG-2Q	4.4 x 44.5 x 40.9	4.4 x 44.5 x 48.8	4.4 x 44.5 x 48.8
C9300L-48UXG-4X	4.4 x 44.5 x 40.9	4.4 x 44.5 x 48.8	4.4 x 44.5 x 48.8
C9300L-48UXG-2Q	4.4 x 44.5 x 40.9	4.4 x 44.5 x 48.8	4.4 x 44.5 x 48.8
Weight (with default power supply)			
Model	Pounds	Kilograms	
C9300-24T	16.03	7.27	
C9300-24P	16.33	7.4	
C9300-24U	16.63	7.54	
C9300-24UX	18.18	8.25	
C9300-24UB	16.63	7.54	
C9300-24UXB	18.18	8.25	
C9300-48T	16.43	7.45	
C9300-48P	16.73	7.59	
C9300-48U	17.03	7.72	
C9300-48UXM	20.50	9.34	
C9300-48UN	20.05	9.09	
C9300-48UB	17.03	7.72	

General Specifications		
C9300-24S	16.84	7.64
C9300-48S	17.32	7.86
C9300L-24T-4G	14.93	6.78
C9300L-24T-4X	14.93	6.78
C9300L-48T-4G	15.41	7.0
C9300L-48T-4X	15.41	7.0
C9300L-24P-4G	14.99	6.81
C9300L-24P-4X	14.99	6.81
C9300L-48P-4G	15.46	7.03
C9300L-48P-4X	15.46	7.03
C9300L-48PF-4G	15.48	7.03
C9300L-48PF-4X	15.48	7.03
C9300L-24UXG-4X	15.73	7.13
C9300L-24UXG-2Q	16.01	7.26
C9300L-48UXG-4X	16.86	7.65
C9300L-48UXG-2Q	16.86	7.65
Mean Time Between Failures – MTBF (hours)		
C9300-24T	314,790	
C9300-24P	299,000	
C9300-24U	238,410	
C9300-24UX	214,760	
C9300-24UB	354,300	
C9300-24UXB	288,520	
C9300-48T	305,870	
C9300-48P	277,770	
C9300-48U	227,410	
C9300-48UXM	202,160	
C9300-48UN	198,647	
C9300-48UB	337,170	
C9300-24S	284,130	
C9300-48S	281,920	
C9300L-24T-4G	395,800	
C9300L-24T-4X	387,700	
C9300L-48T-4G	387,860	
C9300L-48T-4X	380,080	

General Specifications	
C9300L-24P-4G	346,940
C9300L-24P-4X	340,710
C9300L-48P-4G	314,140
C9300L-48P-4X	309,020
C9300L-48PF-4G	303,660
C9300L-48PF-4X	298,880
C9300L-24UXG-4X	332,640
C9300L-24UXG-2Q	291,670
C9300L-48UXG-4X	273,820
C9300L-48UXG-2Q	275,010
PWR-C1-350WAC-P	1,335,012 (ranges from 1.3M to 3.1M depending on temperature, input voltage and vendor)
PWR-C1-715WAC-P	1,054,881 (ranges from 1.05M to 2.6M depending on temperature, input voltage and vendor)
PWR-C1-1100WAC-P	1,217,904 (ranges from 1.2M to 2.8M depending on temperature, input voltage and vendor) (investigating an anomaly in MTBF data received from 1 Power Supply vendor – Artesyn)
C9300-NM-2Q	10,778,230
C9300-NM-2Y	7,568,820
C9300-NM-4G	8,953,570
C9300-NM-4M	10,549,060
C9300-NM-8X	7,151,930
FAN-T2	4,521,330
Environmental ranges	
Acoustic noise Measured per ISO 7779 and declared per ISO 9296 Bystander positions operating to an ambient temperature of 25° C	With AC power supply (with 24 PoE+ ports loaded for C9300 SKUs) <ul style="list-style-type: none"> • LpA: 45dB typical, 48 dB max • LwA: 5.6B typical, 5.9B max With AC power supply (with half the number of PoE+ ports loaded for C9300L SKUs) <ul style="list-style-type: none"> • LpA: 44dB typical, 47 dB max • LwA: 5.5B typical, 5.8B max Typical: Noise emission for a typical configuration Maximum: Statistical maximum to account for variation in production

Connectors

Table 16 shows the supported connectors for the Cisco Catalyst 9300 Series.

Table 16. Connectors

Connectors and cabling	<ul style="list-style-type: none"> • 1000BASE-T ports: RJ-45 connectors, 4-pair Cat 5E UTP cabling • Multigigabit-T ports: RJ-45 connectors, 4-pair Cat 5E, Cat 6, Cat 6A UTP cabling • 1000BASE-T SFP-based ports: RJ-45 connectors, 4-pair Cat 5E UTP cabling • SFP transceivers: LC fiber connectors (single-mode or multimode fiber) • SFP+ transceivers: LC fiber connectors (single-mode or multimode fiber)
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	<ul style="list-style-type: none"> • QSFP+ transceivers: MPO and LC fiber connectors (single-mode or multimode fiber) • QSFP+ connector • SFP+ connector • Cisco StackWise stacking ports: copper-based Cisco StackWise cabling • Cisco StackPower: Cisco proprietary power stacking cables • Ethernet management port: RJ-45 connectors, 4-pair Cat 5 UTP cabling • Management console port: RJ-45-to-DB9 cable for PC connections
Power connectors	<ul style="list-style-type: none"> • Customers can provide power to a switch by using the internal power at the back of the switch • Internal power supply connector: The internal power supply is an auto-ranging unit. It supports input voltages between 100 (115 for 1100WAC) and 240 VAC. Use the supplied AC power cord to connect the AC power connector to an AC power outlet

For the latest Cisco transceiver module compatibility information, refer to <https://www.cisco.com/c/en/us/support/interfaces-modules/transceiver-modules/products-device-support-tables-list.html>.

Management and standards support

Table 17 shows management and standards support for the Cisco Catalyst 9300 Series.

Table 17. Management and standards support*

Description	Specification	
Management	BRIDGE-MIB CISCO-BRIDGE-EXT-MIB CISCO-BULK-FILE-MIB CISCO-CABLE-DIAG-MIB CISCO-CALLHOME-MIB CISCO-CEF-MIB CISCO-CIRCUIT-INTERFACE-MIB CISCO-CONFIG-COPY-MIB CISCO-CONFIG-MAN-MIB CISCO-DEVICE-LOCATION-MIB CISCO-DHCP-SNOOPING-MIB CISCO-EIGRP-MIB CISCO-EMBEDDED-EVENT-MGR-MIB CISCO-ENTITY-FRU-CONTROL-MIB CISCO-ENTITY-SENSOR-MIB CISCO-ENTITY-VENDORTYPE-OID-MIB CISCO-ERR-DISABLE-MIB CISCO-FLASH-MIB CISCO-FLOW-MONITOR-MIB CISCO-FTP-CLIENT-MIB CISCO-HSRP-EXT-MIB CISCO-HSRP-MIB CISCO-IETF-BFD-MIB CISCO-IETF-PPVPN-MPLS-VPN-MIB	CISCO-PORT-STORM-CONTROL-MIB CISCO-POWER-ETHERNET-EXT-MIB CISCO-PRIVATE-VLAN-MIB CISCO-PROCESS-MIB CISCO-PRODUCTS-MIB CISCO-RF-MIB CISCO-RTP-METRICS-MIB CISCO-RTTMON-ICMP-MIB CISCO-STACKWISE-MIB CISCO-STP-EXTENSIONS-MIB CISCO-SYSLOG-MIB CISCO-TCP-MIB CISCO-UDLD-MIB CISCO-VLAN-IFTABLE-RELATIONSHIP-MIB ENTITY-MIB HC-ALARM-MIB HC-RMON-MIB IEEE8023-LAG-MIB IF-MIB IP-FORWARD-MIB IP-MIB LLDP-EXT-MED-MIB LLDP-MIB MAU-MIB

Description	Specification	
	CISCO-IETF-PW-MPLS-MIB CISCO-IF-EXTENSION-MIB CISCO-IGMP-FILTER-MIB CISCO-IMAGE-LICENSE-MGMT-MIB CISCO-IMAGE-MIB CISCO-IP-CBR-METRICS-MIB CISCO-IP-STAT-MIB CISCO-IP-TAP-MIB CISCO-IP-URPF-MIB CISCO-IPSEC-FLOW-MONITOR-MIB CISCO-IPSEC-MIB CISCO-IPSEC-PROVISIONING-MIB CISCO-IPSLA-AUTOMEASURE-MIB CISCO-IPSLA-ECHO-MIB CISCO-IPSLA-JITTER-MIB CISCO-L2-CONTROL-MIB CISCO-L2L3-INTERFACE-CONFIG-MIB CISCO-LAG-MIB CISCO-LICENSE-MGMT-MIB CISCO-LOCAL-AUTH-USER-MIB CISCO-MAC-NOTIFICATION-MIB CISCO-MDI-METRICS-MIB CISCO-MEDIA-METRICS-MIB CISCO-MEMORY-POOL-MIB CISCO-MPLS-LSR-EXT-STD-MIB CISCO-NBAR-PROTOCOL- DISCOVERY-MIB CISCO-NHRP-EXT-MIB CISCO-NTP-MIB CISCO-PAGP-MIB CISCO-PORT-SECURITY-MIB	MPLS-L3VPN-STD-MIB MPLS-LSR-STD-MIB MPLS-VPN-MIB OLD-CISCO-CHASSIS-MIB OLD-CISCO-CPU-MIB OLD-CISCO-INTERFACES-MIB OLD-CISCO-IP-MIB OLD-CISCO-MEMORY-MIB OLD-CISCO-SYS-MIB OLD-CISCO-TCP-MIB OLD-CISCO-TS-MIB POWER-ETHERNET-MIB RFC1213-MIB RMON-MIB RMON2-MIB SMON-MIB SNMPv2-MIB SONET-MIB TCP-MIB UDP-MIB
Standards	IEEE 802.1s IEEE 802.1w IEEE 802.1x IEEE 802.1x-Rev IEEE 802.3ad IEEE 802.3ae IEEE 802.3af IEEE 802.3at IEEE 802.3x full duplex on 10BASE-T, 100BASE-TX, and 1000BASE-T ports IEEE 802.1D Spanning Tree Protocol IEEE 802.1p CoS prioritization	RMON I and II standards SNMPv1, v2c, and v3

Description	Specification	
	IEEE 802.1Q VLAN IEEE 802.3 10BASE-T specification IEEE 802.3u 100BASE-TX specification IEEE 802.3ab 1000BASE-T specification IEEE 802.3z 1000BASE-X specification IEEE 802.3bz Multirate 2.5G/5G specification IEEE 802.3an 10G BASE-T specification	

Power supply specifications

Table 18 lists the power specifications for the Cisco Catalyst 9300 Series based on the kind of power supply used.

Table 18. Power specifications

Description	Specification			
	PWR-C1-1100WAC	PWR-C1-715WAC	PWR-C1-350WAC	PWR-C1-715WDC
Power supply rated maximum	1100W	715W	350W	715W
Total output BTU (note: 1000 BTU/hr = 293W)	3793 BTU/hr, 1100W	2465 BTU/hr, 715W	1207 BTU/hr, 350W	2440 BTU/hr
Input-voltage range and frequency	115V to 240 VAC, 50 to 60 Hz	100 to 240 VAC, 50 to 60 Hz	100 to 240 VAC, 50 to 60 Hz	-36V to -72 VDC
Input current	12-6A	10-5A	4-2A	24-12A
Output ratings	-56V at 19.64A	-56V at 12.8A	-56V at 6.25A	-56V at 12.8A
Output holdup time	10 ms minimum at 100VAC	16.7 ms minimum at 100VAC	16.7 ms minimum at 100VAC	2 ms minimum at -48Vdc
Power-supply input receptacles	IEC 320-C16 (IEC60320-C16)	IEC 320-C16 (IEC60320-C16)	IEC 320-C14 (IEC60320-C14)	Right angle barrier style terminal block
Power cord rating	15A	15A	10A	25A@100VDC
Physical specifications	(H x W x D): 1.58 x 3.25 x 13.7 in Weight: 3.1 lb (1.4 kg)	(H x W x D): 1.58 x 3.25 x 12.20 in Weight: 2.6 lb (1.2 kg)	(H x W x D): 1.58 x 3.25 x 12.20 in Weight: 2.3 lb (1.2 kg)	(H x W x D): 1.58 x 3.25 x 12.20 in Weight: 2.2 lb (1kg)

Table 19. Power specifications – platinum rated power supplies

Description	Specification		
	*PWR-C1-1100WAC-P	*PWR-C1-715WAC-P	PWR-C1-350WAC-P
Power supply rated maximum	1100W	715W	350W
Total output BTU (note: 1000 BTU/hr = 293W)	3754 BTU/hr, 1100W	2440 BTU/hr, 715W	1194 BTU/hr, 350W
Input-voltage range and frequency	115V to 240 VAC, 50 to 60 Hz	100 to 240 VAC, 50 to 60 Hz	100 to 240 VAC, 50 to 60 Hz
Input current	12-6A	10-5A	4-2A
Output ratings	-56V at 19.64A	-56V at 12.8A	-56V at 6.25A
Output holdup time	20 ms minimum at 100VAC	20 ms minimum at 100VAC	20 ms minimum at 100VAC
Power-supply input receptacles	IEC 320-C16 (IEC60320-C16)	IEC 320-C16 (IEC60320-C16)	IEC 320-C14 (IEC60320-C14)
Power cord rating	15A	15A	10A
Physical specifications	(H x W x D): 1.58 x 3.25 x 13.7 in Weight: 3.1 lb (1.4 kg)	(H x W x D): 1.58 x 3.25 x 12.20 in Weight: 2.6 lb (1.2 kg)	(H x W x D): 1.58 x 3.25 x 12.20 in Weight: 2.3 lb (1.2 kg)
Operating temperature	Normal operating temperature* and altitudes: <ul style="list-style-type: none"> • -5°C to +45°C, up to 5000 feet (1500m) • -5°C to +40°C, up to 10,000 feet (3000m) * Minimum ambient temperature for cold start is 32°F (0°C) Short-term* exceptional conditions: <ul style="list-style-type: none"> • -5°C to +50°C, up to 5000 feet (1500m) • -5°C to +45°C, up to 10,000 feet (3000m) • -5°C to +45°C, at sea level with single fan failure * Not more than following in one-year period: 96 consecutive hours, or 360 hours total, or 15 occurrences		
Storage temperature	-40° to 158°F (-40° to 70°C)		
Relative humidity operating and nonoperating noncondensing	5% to 90% noncondensing		
Altitude	10,000 ft. (3000 meters), up to 45°C		
EMI and EMC compliance	FCC Part 15 (CFR 47) Class A ICES-003 Class A EN 55032 Class A CISPR 32 Class A AS/NZS 3548 Class A BSMI Class A (AC input models only)		

Description	Specification
	VCCI Class A EN 55024, EN300386, EN 61000-3-2, EN 61000-3-3 EN61000-4-2, EN61000-4-3, EN61000-4-4, EN61000-4-5, EN61000-4-6, EN 61000-6-1
Safety compliance	
LED indicators	“AC OK”: Input power to the power supply is OK “PS OK”: Output power from the power supply is OK

* PWR-C1-1100WAC-UP is available as an PSU upgrade option to 1100W primary PSU

* PWR-C1-715WAC-UP is available as an PSU upgrade option to 715W primary PSU

Power consumption of standalone 9300 Series Switches

Table 20 shows the power consumption of standalone Cisco Catalyst 9300 Series Switches based on Alliance for Telecommunications Industry Solutions (ATIS) testing using Internet Mix (IMIX) distribution stream traffic, with input voltage of 115VAC at 60 Hz and no PoE loading. The values given are the maximum possible power consumption numbers under the respective test scenarios.

Table 20. Power Consumption of Standalone 9300 Series Switches (tested on IOS XE 16.5.1)

				Measured P(W)															
				Half port traffic					Full port traffic					Weighted average P _w	No link	PoE test (no traffic)			
SKU	FEP	Uplink	Input	0.01%/EEE	10%	30%	50%	100%	0.01%/EEE	10%	30%	50%	100%			25%	50%	90%	100%
C9300-24P	715W	Not Installed	115Vac	82.6	91.0	93.4	93.7	93.9	82.0	94.8	95.9	96.1	96.6	93.7	82.9	202.3	325.8	527.5	579.0
			230Vac	81.6	89.8	92.2	92.4	92.6	81.7	93.7	94.6	94.7	95.2	92.6	82.3	199.0	318.2	510.6	559.9
		C9300-NM-4G	115Vac	87.5	93.0	96.5	97.7	98.5	89.8	99.5	102.4	103.0	103.4	98.9	85.4	211.4	334.5	537.8	585.7
			230Vac	86.1	91.3	94.4	95.8	96.6	88.9	98.5	101.5	101.9	102.4	97.9	84.6	207.9	328.0	520.3	568.2
		C9300-NM-4M	115Vac	90.4	100.4	101.6	101.9	102.3	94.1	106.8	107.8	108.2	109.1	105.7	90.8	214.9	337.9	539.4	590.8
			230Vac	89.4	99.1	100.3	100.5	100.7	92.8	106.1	106.5	106.9	107.8	104.9	89.6	211.0	329.7	522.2	571.0
		C9300-NM-2Q	115Vac	88.1	98.6	99.5	99.6	99.9	91.1	104.4	105.2	105.6	106.5	103.3	88.4	212.2	335.2	536.2	586.5
			230Vac	87.1	97.2	98.1	98.3	98.8	90.0	103.3	103.9	104.3	105.2	102.1	87.5	208.0	326.8	519.3	567.6
		C9300-NM-8X	115Vac	90.0	99.4	101.0	101.2	101.6	94.2	107.1	107.9	108.3	109.2	106.0	88.7	215.3	339.6	541.4	591.3
			230Vac	89.0	97.9	99.8	100.0	100.5	93.1	105.8	106.7	107.1	108.1	104.8	87.8	211.7	331.9	524.2	572.3
C9300-24S	715W	C9300-NM-4G	115Vac	99.40	100.30	101.50	102.10	102.50	116.20	117.70	119.10	119.50	119.80	117.76	91.70				
			230Vac	98.00	98.90	99.70	100.60	101.60	114.40	115.80	116.70	117.20	117.70	115.85	90.90				
		C9300-NM-2Q	115Vac	101.90	104.80	105.30	105.40	106.10	117.60	120.50	121.10	121.70	123.10	120.47	85.40				
			230Vac	100.20	103.00	103.50	103.70	104.30	115.70	118.70	119.30	119.50	120.70	118.60	84.40				
		C9300-NM-8X	115Vac	104.60	107.40	108.30	108.50	109.10	121.30	124.10	124.80	125.40	126.40	124.05	85.90				
			230Vac	103.40	105.70	106.40	106.70	107.00	119.40	122.50	122.90	123.20	124.30	122.37	84.60				
		C9300-	115Vac	99.15	101.80	102.50	102.70	103.30	116.60	119.70	120.30	121.00	122.20	119.64	82.10				

				Measured P(W)															
				Half port traffic					Full port traffic					Weighted average Pw	No link	PoE test (no traffic)			
																25%	50%	90%	100%
SKU	FEP	Uplink	Input	0.01%/EEE	10%	30%	50%	100%	0.01%/EEE	10%	30%	50%	100%			25%	50%	90%	100%
C9300-24T		NM-4M	230Vac	97.64	100.30	100.80	101.00	101.60	115.40	118.30	118.90	119.30	120.20	118.20	81.20				
		C9300-NM-2Y	115Vac	101.24	104.48	104.75	104.81	105.42	116.40	119.01	120.31	120.58	121.31	118.98	85.02				
			230Vac	99.17	102.36	102.63	102.85	103.57	114.10	117.42	118.00	118.46	119.62	117.31	83.03				
	350W	Not Installed	115Vac	77.7	86.1	89.1	89.5	89.7	77.5	91.0	91.7	91.9	92.5	89.8	78.1				
			230Vac	77.4	85.4	88.5	88.7	88.8	77.0	89.8	90.7	90.9	91.3	88.7	77.7				
		C9300-NM-4G	115Vac	82.5	88.4	92.1	93.3	94.1	85.9	96.0	98.9	99.7	100.0	95.4	81.2				
			230Vac	81.8	87.6	90.4	92.0	92.9	84.9	94.2	96.9	97.9	98.3	93.7	80.5				
		C9300-NM-4M	115Vac	86.4	96.3	98.0	98.2	98.7	90.2	103.7	104.5	104.9	105.9	102.6	87.0				
			230Vac	85.4	95.1	96.6	96.8	97.3	89.1	102.1	102.9	103.3	104.2	101.0	86.0				
		C9300-NM-2Q	115Vac	84.0	94.7	95.7	95.9	96.1	87.1	101.1	101.7	102.1	103.0	99.9	83.9				
230Vac			83.2	93.6	94.4	94.6	95.1	86.2	99.2	100.1	100.5	101.4	98.1	83.2					
C9300-NM-8X		115Vac	86.3	95.6	97.5	97.8	98.2	90.7	103.9	104.7	105.1	106.1	102.8	85.0					
	230Vac	85.4	94.5	96.2	96.4	97.0	89.7	102.2	103.2	103.6	104.5	101.2	84.3						
C9300-24U	1100W	Not Installed	115Vac	87.4	95.9	99.0	99.2	99.4	87.0	100.8	101.5	101.8	102.3	99.6	87.8	313.7	547.9	940.3	1041.4
			230Vac	85.9	94.7	97.3	97.6	97.8	85.5	98.0	99.6	99.8	100.3	96.9	86.4	306.2	529.1	895.6	988.7
		C9300-NM-4G	115Vac	92.2	97.8	101.2	102.7	103.6	95.4	105.2	108.3	109.0	109.4	104.6	94.4	321.0	554.0	943.5	1045.5
			230Vac	90.6	96.1	99.4	100.9	101.7	93.7	103.4	106.4	107.2	107.6	102.8	93.2	313.5	536.6	901.5	994.6
		C9300-NM-4M	115Vac	96.0	106.2	107.6	107.8	108.4	99.7	113.4	114.2	114.6	115.6	112.3	96.1	325.7	559.0	950.6	1053.0
			230Vac	94.3	104.5	105.8	106.1	106.6	97.9	112.1	112.8	113.2	114.0	110.8	94.4	318.3	541.9	906.2	997.8
		C9300-NM-2Q	115Vac	93.4	103.9	104.8	105.0	105.5	96.5	110.4	111.3	111.5	112.4	109.2	93.4	323.2	555.8	946.7	1048.6
			230Vac	91.8	102.0	103.0	103.3	103.7	94.8	108.7	109.4	109.8	110.6	107.5	91.8	314.9	538.4	902.2	994.5
		C9300-NM-8X	115Vac	95.8	105.4	107.3	107.6	108.1	100.2	114.0	114.8	115.2	116.2	112.8	94.4	324.4	557.7	946.6	1049.0
			230Vac	94.0	103.0	105.1	105.4	106.0	98.4	112.0	113.1	113.5	114.5	110.9	93.2	317.8	541.8	907.7	999.1
C9300-24UB	1100W	Not Installed	115Vac	87.4	95.9	99.0	99.2	99.4	87.0	100.8	101.5	101.8	102.3	99.6	87.8	313.7	547.9	940.3	1041.4
			230Vac	85.9	94.7	97.3	97.6	97.8	85.5	98.0	99.6	99.8	100.3	96.9	86.4	306.2	529.1	895.6	988.7
		C9300-NM-4G	115Vac	92.2	97.8	101.2	102.7	103.6	95.4	105.2	108.3	109.0	109.4	104.6	94.4	321.0	554.0	943.5	1045.5
			230Vac	90.6	96.1	99.4	100.9	101.7	93.7	103.4	106.4	107.2	107.6	102.8	93.2	313.5	536.6	901.5	994.6
		C9300-NM-4M	115Vac	96.0	106.2	107.6	107.8	108.4	99.7	113.4	114.2	114.6	115.6	112.3	96.1	325.7	559.0	950.6	1053.0
			230Vac	94.3	104.5	105.8	106.1	106.6	97.9	112.1	112.8	113.2	114.0	110.8	94.4	318.3	541.9	906.2	997.8
		C9300-NM-2Q	115Vac	93.4	103.9	104.8	105.0	105.5	96.5	110.4	111.3	111.5	112.4	109.2	93.4	323.2	555.8	946.7	1048.6
			230Vac	91.8	102.0	103.0	103.3	103.7	94.8	108.7	109.4	109.8	110.6	107.5	91.8	314.9	538.4	902.2	994.5
		C9300-	115Vac	95.8	105.4	107.3	107.6	108.1	100.2	114.0	114.8	115.2	116.2	112.8	94.4	324.4	557.7	946.6	1049.0

				Measured P(W)															
				Half port traffic					Full port traffic					Weighted average P _W	No link	PoE test (no traffic)			
SKU	FEP	Uplink	Input	0.01%/EEE	10%	30%	50%	100%	0.01%/EEE	10%	30%	50%	100%			25%	50%	90%	100%
		NM-8X	230Vac	94.0	103.0	105.1	105.4	106.0	98.4	112.0	113.1	113.5	114.5	110.9	93.2	317.8	541.8	907.7	999.1
C9300-24UX	1100W	C9300-NM-8X	115Vac	188.0	195.7	196.8	197.4	198.9	208.8	224.6	227.0	228.6	232.0	223.8	168.6	364.2	521.6	784.3	851.4
			230Vac	184.4	192.2	192.9	193.5	195.1	204.6	220.0	222.0	223.5	226.9	219.2	165.3	354.2	505.0	749.7	810.6
C9300-24UXB	1100W	C9300-NM-8X	115Vac	188.0	195.7	196.8	197.4	198.9	208.8	224.6	227.0	228.6	232.0	223.8	168.6	364.2	521.6	784.3	851.4
			230Vac	184.4	192.2	192.9	193.5	195.1	204.6	220.0	222.0	223.5	226.9	219.2	165.3	354.2	505.0	749.7	810.6
C9300-48P	715W	Not Installed	115Vac	90.5	103.2	104.5	104.7	105.2	89.9	104.9	107.8	109.2	110.2	103.9	91.3	206.1	324.1	514.4	563.2
			230Vac	89.4	102.2	103.4	103.6	104.1	88.9	103.7	106.9	108.4	109.3	102.7	89.9	202.9	316.9	500.6	547.5
		C9300-NM-4G	115Vac	95.3	103.5	106.2	108.1	108.8	98.0	112.1	114.9	115.9	116.2	111.1	94.3	215.0	332.6	523.4	572.1
			230Vac	94.0	102.2	105.2	106.9	107.8	96.4	111.3	114.1	115.2	115.5	110.2	93.1	211.2	324.8	509.3	555.8
		C9300-NM-4M	115Vac	98.7	111.5	112.3	112.7	113.5	101.5	119.7	120.5	121.2	122.8	118.2	99.2	219.1	336.5	528.8	576.6
			230Vac	97.1	110.7	111.5	111.9	112.7	100.6	119.2	120.0	120.7	122.3	117.6	97.9	215.5	329.5	514.2	560.5
		C9300-NM-2Q	115Vac	96.9	110.1	110.7	111.0	111.9	99.3	118.2	119.0	119.7	121.5	116.7	97.6	217.4	335.4	527.4	577.8
			230Vac	95.6	109.2	109.7	110.1	111.0	98.1	117.5	118.2	119.0	120.6	115.8	96.0	213.0	326.9	511.9	558.8
		C9300-NM-8X	115Vac	100.5	113.4	114.2	114.6	115.5	106.4	124.5	125.4	126.1	128.0	123.0	99.5	215.1	334.7	520.8	568.8
			230Vac	99.4	112.8	113.5	113.9	114.9	105.3	124.0	124.9	125.6	127.4	122.5	98.4	212.3	327.4	507.4	553.1
C9300-48S	715W	C9300-NM-4G	115Vac	116.30	117.00	118.40	119.10	119.60	149.40	151.10	152.20	152.90	153.50	151.17	93.50				
			230Vac	114.90	115.60	116.70	117.60	118.10	147.10	148.80	150.10	150.30	150.70	148.82	92.10				
		C9300-NM-2Q	115Vac	117.70	121.30	121.80	122.40	124.10	150.60	154.10	155.30	156.30	158.60	154.20	88.00				
			230Vac	116.40	119.70	120.20	120.80	122.10	147.70	151.20	152.70	153.80	156.10	151.34	87.60				
		C9300-NM-8X	115Vac	120.50	123.60	124.30	125.20	126.00	152.80	156.10	157.60	158.60	160.80	156.24	87.40				
			230Vac	119.00	121.90	122.90	123.40	124.40	150.20	153.90	154.90	155.80	158.30	153.97	88.90				
		C9300-NM-4M	115Vac	118.29	121.62	122.36	122.78	124.03	153.80	157.53	158.17	159.28	161.00	157.50	87.53				
			230Vac	117.15	120.62	120.89	121.30	122.35	150.20	153.61	154.60	155.58	157.86	153.69	86.48				
		C9300-NM-2Y	115Vac	114.30	119.20	119.70	120.30	121.50	144.40	152.00	152.80	153.10	156.10	151.65	85.80				
			230Vac	112.00	118.00	118.60	118.90	120.10	142.20	149.20	150.20	151.00	153.40	148.92	83.90				
C9300-48T	350W	Not Installed	115Vac	81.5	94.9	95.7	95.9	96.4	80.8	98.6	100.2	101.3	102.3	97.2	82.2				
			230Vac	80.5	93.7	94.6	94.8	95.3	80.1	97.3	99.5	99.9	100.8	96.0	81.5				
		C9300-NM-4G	115Vac	86.4	94.9	97.8	99.4	100.4	89.3	104.6	107.6	108.6	108.9	103.5	85.7				
			230Vac	85.3	93.8	96.6	98.4	99.1	88.2	103.4	106.2	106.9	107.2	102.3	84.8				
		C9300-NM-4M	115Vac	89.6	103.4	104.2	104.6	105.4	93.0	112.7	113.5	114.1	115.7	111.0	90.6				
			230Vac	89.0	102.0	102.8	103.1	103.9	91.9	111.0	111.8	112.4	114.0	109.4	89.3				
		C9300-	115Vac	88.3	102.4	102.9	103.3	104.2	91.0	110.5	111.3	112.1	113.9	108.9	88.6				

				Measured P(W)															
				Half port traffic					Full port traffic					Weighted average Pw	No link	PoE test (no traffic)			
																25%	50%	90%	100%
SKU	FEP	Uplink	Input	0.01%/EEE	10%	30%	50%	100%	0.01%/EEE	10%	30%	50%	100%						
		NM-2Q	230Vac	87.3	100.9	101.4	101.8	102.7	89.9	108.8	109.6	110.3	112.1	107.2	87.6				
		C9300-NM-8X	115Vac	92.1	105.2	106.1	106.5	107.4	98.6	117.6	118.4	119.1	120.9	116.0	91.0				
			230Vac	91.1	103.9	104.7	105.1	106.0	97.3	115.8	116.6	117.3	119.0	114.3	90.0				
C9300-48U	1100W	Not Installed	115Vac	96.0	110.2	110.9	111.2	111.7	95.6	112.5	114.3	115.9	116.9	111.3	97.0	315.1	544.0	925.9	1023.0
			230Vac	94.8	108.5	109.2	109.4	109.9	94.2	110.0	112.5	114.1	115.0	108.9	95.6	308.6	529.4	889.9	978.8
		C9300-NM-4G	115Vac	97.4	105.8	109.0	110.7	111.0	99.9	115.1	117.8	118.9	119.2	114.0	96.4	319.2	547.3	928.0	1026.3
			230Vac	95.4	103.9	107.4	108.7	110.0	98.8	113.4	116.2	117.0	117.4	112.4	94.9	314.3	535.6	896.0	984.3
		C9300-NM-4M	115Vac	104.4	118.5	119.0	119.5	120.1	107.4	126.8	127.6	128.3	130.0	125.2	104.9	326.2	556.0	938.6	1035.6
			230Vac	102.8	116.0	117.1	117.5	118.2	106.4	124.8	125.5	126.2	127.7	123.2	103.6	320.4	541.4	903.0	991.6
		C9300-NM-2Q	115Vac	102.9	117.2	117.6	118.0	119.0	104.8	123.8	124.6	125.3	127.0	122.2	102.5	324.1	552.4	934.4	1032.6
			230Vac	101.2	114.9	115.5	115.9	117.0	103.9	123.0	123.7	124.4	126.1	121.4	101.7	316.9	537.9	898.2	988.3
		C9300-NM-8X	115Vac	106.7	120.4	121.1	121.5	122.3	112.7	131.5	132.4	133.0	134.8	130.0	105.7	330.0	563.7	941.8	1043.4
			230Vac	105.0	118.5	119.2	119.6	120.2	110.9	129.4	130.2	131.0	132.6	127.9	104.1	324.5	549.0	908.0	998.9
C9300-48UB	1100W	C9300-NM-8X	115Vac	106.7	120.4	121.1	121.5	122.3	112.7	131.5	132.4	133.0	134.8	130.0	105.7	330.0	563.7	941.8	1043.4
			230Vac	105.0	118.5	119.2	119.6	120.2	110.9	129.4	130.2	131.0	132.6	127.9	104.1	324.5	549.0	908.0	998.9
C9300-48UN	1100W	C9300-NM-8X	115Vac	172.9	176.7	178.7	179.8	181.8	193.8	199.8	201.5	203.1	206.9	199.9	159.1	357.3	525.0	803.9	875.1
			230Vac	171.2	174.8	176.8	178.1	179.9	191.7	197.8	199.4	201.0	204.7	197.9	157.9	351.5	512.1	777.0	843.8
C9300-48UXM	1100W	C9300-NM-8X	115Vac	236.2	241.4	246.6	247.8	249.6	253.2	261.5	272.4	278.5	283.0	262.8	219.2	392.3	528.7	750.8	810.1
			230Vac	232.2	237.4	242.5	243.7	245.6	249.0	256.7	267.6	272.9	277.2	258.0	215.7	382.8	515.2	728.0	784.7
C9300L-24P-4G	715W	Integrated	115Vac	62.33	68.39	69.42	70.19	70.99	62.74	74.98	76.05	76.93	77.70	74.02	61.92	203.54	341.71	569.96	627.59
			230Vac	60.91	67.07	68.18	68.91	69.68	61.32	73.88	74.99	75.84	76.58	72.89	60.60	199.69	334.16	552.06	606.54
			115Vac	62.33	68.39	69.42	70.19	70.99	62.74	74.98	76.05	76.93	77.70	74.02	61.92	203.54	341.71	569.96	627.59
			230Vac	60.91	67.07	68.18	68.91	69.68	61.32	73.88	74.99	75.84	76.58	72.89	60.60	199.69	334.16	552.06	606.54
C9300L-24P-4X	715W	Integrated	115Vac	64.32	70.97	72.60	73.02	73.63	69.27	76.96	79.15	79.85	81.00	76.59	64.99	207.17	343.00	569.93	626.15
			230Vac	64.09	69.90	71.75	72.28	72.92	67.80	76.12	78.34	78.78	79.91	75.67	63.70	203.04	336.39	553.25	607.02
			115Vac	64.32	70.97	72.60	73.02	73.63	69.27	76.96	79.15	79.85	81.00	76.59	64.99	207.17	343.00	569.93	626.15
			230Vac	64.09	69.90	71.75	72.28	72.92	67.80	76.12	78.34	78.78	79.91	75.67	63.70	203.04	336.39	553.25	607.02
C9300L-24T-4G	350W	Integrated	115Vac	57.75	63.72	64.67	65.37	66.09	58.39	69.87	70.92	71.74	72.37	68.97	57.30				
			230Vac	56.63	62.65	63.60	64.28	65.02	57.16	68.55	69.59	70.38	70.99	67.65	56.20				
			115Vac	57.75	63.72	64.67	65.37	66.09	58.39	69.87	70.92	71.74	72.37	68.97	57.3				
			230Vac	56.63	62.65	63.60	64.28	65.02	57.16	68.55	69.59	70.38	70.99	67.65	56.2				

				Measured P(W)															
				Half port traffic					Full port traffic					Weighted average P _w	No link	PoE test (no traffic)			
SKU	FEP	Uplink	Input	0.01%/EEE	10%	30%	50%	100%	0.01%/EEE	10%	30%	50%	100%			25%	50%	90%	100%
C9300L-24T-4X	350W	Integrated	115Vac	58.69	65.61	67.13	67.54	68.03	59.12	71.55	73.49	74.06	75.14	70.66	58.13				
			230Vac	57.36	64.19	65.74	65.94	66.41	57.85	70.03	71.96	72.31	73.54	69.17	56.85				
			115Vac	58.69	65.61	67.13	67.54	68.03	59.12	71.55	73.49	74.06	75.14	70.66	58.13				
			230Vac	57.36	64.19	65.74	65.94	66.41	57.85	70.03	71.96	72.31	73.54	69.17	56.85				
C9300L-48P-4G	715W	Integrated	115Vac	69.21	77.07	78.03	78.82	79.86	70.06	86.76	87.97	88.97	90.01	85.41	68.42	213.65	351.15	575.52	632.46
			230Vac	67.90	76.03	76.95	77.76	78.78	68.72	85.61	86.74	87.62	88.63	84.22	67.16	209.87	342.56	556.81	611.08
			115Vac	69.21	77.07	78.03	78.82	79.86	70.06	86.76	87.97	88.94	90.01	85.41	68.42	213.65	351.15	575.52	632.46
			230Vac	67.90	76.03	76.95	77.76	78.78	68.72	85.61	86.74	87.62	88.63	84.22	67.16	209.87	342.56	556.81	611.08
C9300L-48P-4X	715W	Integrated	115Vac	68.05	78.83	80.51	80.97	81.98	69.18	90.03	91.95	92.67	94.13	88.35	68.50	203.00	337.40	559.30	616.70
			230Vac	66.98	77.59	79.12	79.53	80.51	67.76	88.18	90.24	90.79	92.67	86.58	67.40	200.30	331.50	545.00	598.60
			115Vac	68.05	78.83	80.51	80.97	81.98	69.18	90.03	91.95	92.67	94.13	88.35	68.50	203.0	337.4	559.3	616.7
			230Vac	66.98	77.59	79.12	79.53	80.51	67.76	88.18	90.24	90.79	92.67	86.58	67.40	200.3	331.5	545.0	598.6
C9300L-48PF-4G	1100W	Integrated	115Vac	70.41	79.73	81.33	81.58	82.62	71.36	90.17	91.32	92.11	93.00	88.57	69.35	314.03	558.56	973.60	1082.14
			230Vac	68.66	77.95	78.87	79.64	80.56	69.59	87.79	88.87	89.73	90.72	86.27	67.84	306.85	541.37	928.90	1027.83
C9300L-48PF-4X	1100W	Integrated	115Vac	69.68	80.51	82.08	82.50	83.37	71.08	91.01	93.09	94.17	96.27	89.54	69.35	310.72	552.92	965.47	1079.44
			230Vac	68.14	78.81	80.34	80.71	81.61	69.11	88.83	90.73	91.38	93.06	87.28	67.38	305.26	539.36	924.23	1023.56
C9300L-48T-4G	350W	Integrated	115Vac	60.32	69.53	70.41	71.16	72.00	61.57	79.62	80.62	81.44	82.32	78.083	59.47				
			230Vac	59.75	68.45	69.31	70.05	70.81	60.58	78.05	79.06	79.80	80.67	76.564	59.00				
			115Vac	60.32	69.53	70.41	71.16	72.00	61.57	79.62	80.62	81.44	82.32	78.083	59.47				
			230Vac	59.75	68.45	69.31	70.05	70.84	60.58	78.05	79.06	79.80	80.67	76.564	59.00				
C9300L-48T-4X	350W	Integrated	115Vac	63.28	73.75	75.38	75.85	76.86	64.15	83.82	85.53	86.68	88.72	82.34	62.37				
			230Vac	61.91	72.22	73.73	74.13	75.06	62.82	82.21	84.17	84.97	86.77	80.73	60.97				
			115Vac	63.28	73.75	75.38	75.85	76.86	64.15	83.82	85.53	86.68	88.72	82.34	62.37				
			230Vac	61.91	72.22	73.73	74.13	75.06	62.82	82.21	84.17	84.97	86.77	80.73	60.97				

ATIS Testing - 100%				Measured P(W)															
				Half Port Traffic					Full Port Traffic					Weighted Average P _w	No Link	PoE Test (No Traffic)			
SKU	Archer FEP	Uplink	Input	0.01% / EEE	10%	30%	50%	100%	0.01% / EEE	10%	30%	50%	100%			25%	50%	90%	100%
C9300L-48UXG-4X	1100W	Integrated	115Vac	107.79	133.06	135.05	136.80	137.79	108.80	156.13	159.76	160.69	163.14	152.09	107.04	332.8	520.2	835.6	918.4
			230Vac	105.60	130.55	132.50	134.12	135.07	106.04	153.51	157.24	158.19	160.17	149.43	104.56	326.0	505.7	801.0	875.3

ATIS Testing - 100%				Measured P(W)															
				Half Port Traffic					Full Port Traffic					Weighted Average Pw	No Link	PoE Test (No Traffic)			
SKU	Archer FEP	Uplink	Input	0.01% / EEE	10%	30%	50%	100%	0.01% / EEE	10%	30%	50%	100%			25%	50%	90%	100%
C9300L- 24UXG-4X	1100W	Integrated	115Vac	70.90	87.08	88.80	89.32	90.30	71.26	103.11	105.06	105.80	107.58	100.37	70.87	335.16	579.52	996.96	1108.51
			230Vac	69.20	85.22	87.09	87.51	88.40	69.46	100.48	102.39	103.16	104.94	97.82	68.98	326.96	562.27	951.15	1049.47
C9300L- 48UXG-2Q	1100W	Integrated	115Vac	111.73	138.34	140.48	141.17	143.22	112.35	162.30	164.13	165.51	168.68	157.94	111.10	335.47	521.76	835.04	919.11
			230Vac	109.53	135.16	137.16	137.89	139.68	110.21	158.42	161.05	162.32	165.66	154.32	108.86	328.17	507.54	801.77	876.22
C9300L- 24UXG-2Q	1100W	Integrated	115Vac	104.07	121.70	122.67	123.44	125.05	104.41	139.04	140.97	142.77	145.33	136.20	103.78	325.38	526.58	861.27	949.66
			230Vac	100.88	118.72	119.46	120.13	122.11	101.16	135.91	137.68	139.26	143.13	133.15	100.52	317.08	510.67	829.62	909.10

Table 21. Power consumption of standalone 9300 Series Switches with platinum rated power supply (tested on Cisco IOS XE 16.8.1)

				Measured P(W)															
				Half port traffic					Full port traffic					Weighted average Pw	No link	PoE test (no traffic)			
SKU	FEP	Uplink	Input	0.01%/EEE	10%	30%	50%	100%	0.01%/EEE	10%	30%	50%	100%					25%	50%
C9300-24P	715W-P	C9300-NM-8X	115Vac	89.2	94.3	99	100.1	100.7	92	98.9	103.5	105.9	107.1	99	85.8	205.6	324.7	518.9	568.4
			230Vac	86.7	91.8	96.4	97.5	98	89.4	97.1	101.4	103.6	104.5	97	84.1	201.9	318.7	507.2	554.4
C9300-24T	350W-P	C9300-NM-8X	115Vac	83.1	88.2	92.9	94	94.5	85.8	92.9	97.2	99.6	100.4	92.9	80.5				
			230Vac	81.9	86.8	91.3	92.4	92.9	84.4	91.6	95.9	98.2	99	91.6	79.2				
C9300-24U	1100W-P	C9300-NM-8X	115Vac	90.5	95.9	100.5	101.6	102.1	93.3	100.6	104.9	107.2	108.1	100.6	87.9	319.9	549.5	935.3	1034.1
			230Vac	88.1	93.1	97.7	98.8	99.4	92.8	98	102.4	104.6	105.5	98.2	85.4	313.4	535.5	899.7	990.3
C9300-24UX	1100W-P	C9300-NM-8X	115Vac	186.8	191	194.9	197.1	198.9	209	215.4	227.2	230.1	233.1	216.6	165.3	367.5	522.1	776.1	842.3
			230Vac	182.8	186.9	190.6	193	194.1	205	211.2	222.7	225.5	229.8	212.5	162.7	361.1	510.2	752.3	809.9
C9300-48P	715W-P	C9300-NM-8X	115Vac	99.1	105.5	110.8	111.3	112.4	99.6	112.5	118.2	120.1	122.2	112.2	94.7	214.7	336.1	521.5	569.4
			230Vac	97.3	103.7	108.9	109.4	110.4	99	110.3	115.8	118.3	119.5	110.1	92.6	213.9	329.3	509.4	555
C9300-48T	350W-P	C9300-NM-8X	115Vac	89.8	95.4	100.4	101.1	102	90.4	102.4	107.5	109.8	111.8	102.2	85.4				
			230Vac	88.7	94.5	99.4	100.1	101	88.7	101.2	106	108.1	109.9	100.8	83.9				
C9300-48U	1100W-P	C9300-NM-8X	115Vac	168.9	170.6	172.4	176.6	178.5	190.8	194	198.3	200.1	203.9	194.6	147.3	355.4	524.9	804.6	875.4
			230Vac	165.7	167.3	169.2	169.9	171.5	186.5	189.6	193.9	195.7	199.8	190.3	145	348.8	511.7	777.7	844.9
C9300-48UN	1100W-P	C9300-NM-8X	115Vac	172.9	176.7	178.7	179.8	181.8	193.8	199.8	201.5	203.1	206.9	199.9	159.1	357.3	525	803.9	875.1
			230Vac	171.2	174.8	176.8	178.1	179.9	191.7	197.8	199.4	201	204.7	197.9	157.9	351.5	512.1	777	843.8
C9300-48UXM	1100W-P	C9300-NM-8X	115Vac	241	248.1	254.8	256.4	258.9	260.1	269.4	281.6	286.5	291.6	270.7	225.1	394.8	531.4	755	809.5
			230Vac	237.5	243.1	249	250.3	251.1	253.9	261.8	273.9	279.2	283.6	263.2	218.5	386.8	518.1	731.3	785.5

Safety and compliance

Table 22 lists the safety and compliance information for the Cisco Catalyst 9300 Series.

Table 22. Safety and compliance information

Description	Specification
Safety certifications	<ul style="list-style-type: none">• UL 60950-1• CAN/CSA-C222.2 No. 60950-1• EN 60950-1• IEC 60950-1• AS/NZS 60950.1• IEEE 802.3
Electromagnetic emissions certifications	<ul style="list-style-type: none">• 47 CFR Part 15• CISPR22 Class A• EN 300 386 V1.6.1• EN 55022 Class A• EN 55032 Class A• CISPR 32 Class A• EN61000-3-2• EN61000-3-3• ICES-003 Class A• TCVN 7189 Class A• V-3 Class A• CISPR24• EN 300 386• EN55024• TCVN 7317• V-2/2015.04• V-3/2015.04• CNS13438• KN32• KN35• IEC 61000-6-1• EN 61000-6-1 <p>Additional Certifications for C9300L SKUs:</p> <ul style="list-style-type: none">• QCVN 118:2018/BTTTT• CISPR24/25• CISPR 32 Class A• VCCI-CISPR 32 Class A• EN55035
Environmental	Reduction of Hazardous Substances (ROHS) 5

Warranty

Cisco enhanced limited lifetime hardware warranty

The Cisco Catalyst 9300 Series Switches come with a Cisco Enhanced Limited Lifetime hardware Warranty (E-LLW) that includes Next-Business-Day (NBD) delivery of replacement hardware where available and 90 days of 8x5 Cisco Technical Assistance Center (TAC) support.

Your formal warranty statement, including the warranty applicable to Cisco software, appears in the information packet that accompanies your Cisco product. We encourage you to review the warranty statement shipped with your specific product carefully before use.

Cisco reserves the right to refund the purchase price as its exclusive warranty remedy.

For further information about warranty terms, visit <https://www.cisco.com/go/warranty>. Table 23 provides information about the E-LLW.

Table 23. E-LLW details

	Cisco E-LLW
Devices covered	Applies to Cisco Catalyst 9300 Series Switches.
Warranty duration	As long as the original customer owns the product.
End-of-life policy	In the event of discontinuance of product manufacture, Cisco warranty support is limited to 5 years from the announcement of discontinuance.
Hardware replacement	Cisco or its service center will use commercially reasonable efforts to ship a replacement for NBD delivery, where available. Otherwise, a replacement will be shipped within 10 working days after receipt of the Return Materials Authorization (RMA) request. Actual delivery times might vary depending on customer location.
Effective date	Hardware warranty commences from the date of shipment to customer (and in case of resale by a Cisco reseller, not more than 90 days after original shipment by Cisco).
TAC support	Cisco will provide during business hours, 8 hours per day, 5 days per week, basic configuration, diagnosis, and troubleshooting of device-level problems for up to a 90-day period from the date of shipment of the originally purchased Cisco Catalyst 9300 Series product. This support does not include solution or network-level support beyond the specific device under consideration.
Cisco.com access	Warranty allows guest access only to Cisco.com.

Cisco environmental sustainability

Information about Cisco's environmental sustainability policies and initiatives for our products, solutions, operations, and extended operations or supply chain is provided in the "Environment Sustainability" section of Cisco's [Corporate Social Responsibility](#) (CSR) Report.

Reference links to **information about key environmental sustainability topics** (mentioned in the "Environment Sustainability" section of the CSR Report) are provided in the following table:

Sustainability Topic	Reference
Information on product-material-content laws and regulations	Materials
Information on electronic waste laws and regulations, including products, batteries and packaging	WEEE Compliance

Reference links to **product-specific environmental sustainability information** that is mentioned in relevant sections of this data sheet are provided in the following table:

Sustainability Topic	Reference
General	
Eco-Design Compliance (EU ErP Lot, Etc.)	Table AA. Product Compliance
Environmental Certifications (EPEAT, Energy Star, Etc.)	Table BB. Product Compliance or Platform Features/Benefits
Power	
Idle, Typical or Max Product Power	Table CC. Product Specifications
Hardware Enabled Energy Features	Table DD. Platform Features/Benefits
Software Enabled Energy Features	Table EE. Platform Features/Benefits
Power Supply Information	Table FF. Product Specifications
Power Calculator	Table GG. Product Specifications
Material	
Unit Weight	Table HH. Product Specifications
System Weight (Product + Packaging)	Table II. Product Specifications
Recycled Content	Table JJ. Product Specifications

Cisco makes the packaging data available for informational purposes only. It may not reflect the most current legal developments, and Cisco does not represent, warrant or guarantee that it is complete, accurate or up-to-date. This information is subject to change without notice.

Cisco Services

Cisco Services for next-generation Cisco Catalyst 9000 Switches

Achieve infrastructure excellence faster and with less risk. Cisco Catalyst 9000 Services provide expert guidance to help you successfully deploy, manage and support the new Cisco Catalyst 9000 switching family. With unmatched networking expertise, best practices, and innovative tools, we can help you reduce overall upgrade, refresh, and migration costs as you introduce new hardware, software, and protocols into the network. Offering a comprehensive lifecycle of services – from implementation, optimization, technical, and managed services – Cisco experts help you reduce disruption and achieve operational excellence to extract maximum value from your Cisco DNA ready infrastructure.

[Learn more about Cisco Services for Enterprise Networks](#)

Software policy for Cisco Catalyst 9300 Series Switches

Software policy for network stack components

Customers with the Network Essentials Stack and Network Advantage Stack software feature sets are provided with maintenance updates and bug fixes designed to maintain compliance of the software. This includes compliance with published specifications, release notes, and industry standards as long as the original end user continues to own or use the product or up to one year from the end-of-sale date for the product, whichever occurs earlier.

Cisco embedded support for Cisco DNA term components

Cisco Embedded Support delivers the right support for Cisco software products and suites. It will keep your business applications performing as expected and protect your investment. Cisco Embedded Support for the Cisco DNA Essentials and Cisco DNA Advantage term components is included. Cisco Embedded Support provides access to TAC support, major software updates, maintenance and minor software releases, and the Cisco Embedded Support site, for increased productivity with anytime access.

Ordering information

Table 24 lists ordering information for the Cisco Catalyst 9300 Series. To place an order, visit the Cisco Ordering home page at

https://www.cisco.com/en/US/ordering/or13/or8/order_customer_help_how_to_order_listing.html.

Table 24. Ordering information

Switches	
Product number	Product description
C9300-24T-E	Catalyst 9300 24-port modular uplinks data only, Network Essentials
C9300-24T-A	Catalyst 9300 24-port modular uplinks data only, Network Advantage
C9300-24P-E	Catalyst 9300 24-port modular uplinks PoE+, Network Essentials
C9300-24P-A	Catalyst 9300 24-port modular uplinks PoE+, Network Advantage
C9300-24U-E	Catalyst 9300 24-port modular uplinks UPOE, Network Essentials
C9300-24U-A	Catalyst 9300 24-port modular uplinks UPOE, Network Advantage
C9300-24UB-E	Catalyst 9300 higher scale 24-port modular uplinks UPOE, Network Essentials

Switches	
C9300-24UB-A	Catalyst 9300 higher scale 24-port modular uplinks UPOE, Network Advantage
C9300-24UX-E	Catalyst 9300 24-port modular uplinks mGig UPOE, Network Essentials
C9300-24UX-A	Catalyst 9300 24-port modular uplinks mGig UPOE, Network Advantage
C9300-24UXB-E	Catalyst 9300 higher scale 24-port modular uplinks mGig UPOE, Network Essentials
C9300-24UXB-A	Catalyst 9300 higher scale 24-port modular uplinks mGig UPOE, Network Advantage
C9300-48T-E	Catalyst 9300 48-port modular uplinks data only, Network Essentials
C9300-48T-A	Catalyst 9300 48-port modular uplinks data only, Network Advantage
C9300-48P-E	Catalyst 9300 48-port modular uplinks PoE+, Network Essentials
C9300-48P-A	Catalyst 9300 48-port modular uplinks PoE+, Network Advantage
C9300-48U-E	Catalyst 9300 48-port modular uplinks UPOE, Network Essentials
C9300-48U-A	Catalyst 9300 48-port modular uplinks UPOE, Network Advantage
C9300-48UXM-E	Catalyst 9300 48-port modular uplinks 2.5G (12 mGig) UPOE, Network Essentials
C9300-48UXM-A	Catalyst 9300 48-port modular uplinks 2.5G (12 mGig) UPOE, Network Advantage
C9300-48UN-E	Catalyst 9300 48-port modular uplinks 5G UPOE, Network Essentials
C9300-48UN-A	Catalyst 9300 48-port modular uplinks 5G UPOE, Network Advantage
C9300-48UB-E	Catalyst 9300 higher scale 48-port modular uplinks 1G UPOE, Network Essentials
C9300-48UB-A	Catalyst 9300 higher scale 48-port modular uplinks 1G UPOE, Network Advantage
C9300-24S-E	Catalyst 9300 24-port modular uplinks 1G SFP, Network Essentials
C9300-24S-A	Catalyst 9300 24-port modular uplinks 1G SFP, Network Advantage
C9300-48S-E	Catalyst 9300 48-port modular uplinks 1G SFP, Network Essentials
C9300-48S-A	Catalyst 9300 48-port modular uplinks 1G SFP, Network Advantage
C9300L-24T-4G-E	Catalyst 9300 24-port fixed uplinks data only, 4X1G uplinks, Network Essentials
C9300L-24T-4G-A	Catalyst 9300 24-port fixed uplinks data only, 4X1G uplinks, Network Advantage
C9300L-24P-4G-E	Catalyst 9300 24-port fixed uplinks PoE+, 4X1G uplinks, Network Essentials
C9300L-24P-4G-A	Catalyst 9300 24-port fixed uplinks PoE+, 4X1G uplinks, Network Advantage
C9300L-48T-4G-E	Catalyst 9300 48-port fixed uplinks data only, 4X1G uplinks, Network Essentials
C9300L-48T-4G-A	Catalyst 9300 48-port fixed uplinks data only, 4X1G uplinks, Network Advantage
C9300L-48P-4G-E	Catalyst 9300 48-port fixed uplinks PoE+, 4X1G uplinks, Network Essentials
C9300L-48P-4G-A	Catalyst 9300 48-port fixed uplinks PoE+, 4X1G uplinks, Network Advantage
C9300L-48PF-4G-E	Catalyst 9300 48-port fixed uplinks Full PoE+, 4X1G uplinks, Network Essentials
C9300L-48PF-4G-A	Catalyst 9300 48-port fixed uplinks Full PoE+, 4X1G uplinks, Network Advantage
C9300L-24T-4X-E	Catalyst 9300 24-port fixed uplinks data only, 4X10G uplinks, Network Essentials
C9300L-24T-4X-A	Catalyst 9300 24-port fixed uplinks data only, 4X10G uplinks, Network Advantage
C9300L-24P-4X-E	Catalyst 9300 24-port fixed uplinks PoE+, 4X10G uplinks, Network Essentials
C9300L-24P-4X-A	Catalyst 9300 24-port fixed uplinks PoE+, 4X10G uplinks, Network Advantage

Switches	
C9300L-24UXG-4X-E	Catalyst 9300 24-port fixed uplinks UPoE, 8xmGig, 4X10G uplinks, Network Essentials
C9300L-24UXG-4X-A	Catalyst 9300 24-port fixed uplinks UPoE, 8xmGig, 4X10G uplinks, Network Advantage
C9300L-48T-4X-E	Catalyst 9300 48-port fixed uplinks data only, 4X10G uplinks, Network Essentials
C9300L-48T-4X-A	Catalyst 9300 48-port fixed uplinks data only, 4X10G uplinks, Network Advantage
C9300L-48P-4X-E	Catalyst 9300 48-port fixed uplinks PoE+, 4X10G uplinks, Network Essentials
C9300L-48P-4X-A	Catalyst 9300 48-port fixed uplinks PoE+, 4X10G uplinks, Network Advantage
C9300L-48PF-4X-E	Catalyst 9300 48-port fixed uplinks Full PoE+, 4X10G uplinks, Network Essentials
C9300L-48PF-4X-A	Catalyst 9300 48-port fixed uplinks Full PoE+, 4X10G uplinks, Network Advantage
C9300L-48UXG-4X-E	Catalyst 9300 48-port fixed uplinks UPoE, 12xmGig, 4X10G uplinks, Network Essentials
C9300L-48UXG-4X-A	Catalyst 9300 48-port fixed uplinks UPoE, 12xmGig, 4x10G uplinks, Network Advantage
C9300L-24UXG-2Q-E	Catalyst 9300 24-port fixed uplinks UPoE, 8xmGig, 2X40G uplinks, Network Essentials
C9300L-24UXG-2Q-A	Catalyst 9300 24-port fixed uplinks UPoE, 8xmGig, 2x40G uplinks, Network Advantage
C9300L-48UXG-2Q-E	Catalyst 9300 48-port fixed uplinks UPoE, 12xmGig, 2X40G uplinks, Network Essentials
C9300L-48UXG-2Q-A	Catalyst 9300 48-port fixed uplinks UPoE, 12xmGig, 2x40G uplinks, Network Advantage
Network modules	
Product number	Product description
C9300-NM-4G	Catalyst 9300 4 x 1GE Network Module
C9300-NM-4G=	Catalyst 9300 4 x 1GE Network Module, spare
C9300-NM-8X	Catalyst 9300 8 x 10GE Network Module
C9300-NM-8X=	Catalyst 9300 8 x 10GE Network Module, spare
C9300-NM-2Q	Catalyst 9300 2 x 40GE Network Module
C9300-NM-2Q=	Catalyst 9300 2 x 40GE Network Module, spare
C9300-NM-2Y	Catalyst 9300 2 x 25G Network Module
C9300-NM-2Y=	Catalyst 9300 2 x 25G Network Module, spare
C9300-NM-4M	Catalyst 9300 4 x mGig Network Module
C9300-NM-4M=	Catalyst 9300 4 x mGig Network Module, spare
NM-BLANK-T1=	Cisco Catalyst Type 1 Network Module Blank, spare
Storage Module	
Product number	Product description
SSD-120G	Cisco pluggable USB3.0 SSD storage
SSD-120G=	Cisco pluggable USB3.0 SSD storage, spare

Switches

Software licenses for C9300 SKUs

Product number	Product description
C9300-DNA-P-24-3Y	C9300 Cisco DNA Premier, 24-port, 3 Year Term license
C9300-DNA-P-24-5Y	C9300 Cisco DNA Premier, 24-port, 5 Year Term license
C9300-DNA-P-24-7Y	C9300 Cisco DNA Premier, 24-port, 7 Year Term license
C9300-DNA-P-48-3Y	C9300 Cisco DNA Premier, 48-port, 3 Year Term license
C9300-DNA-P-48-5Y	C9300 Cisco DNA Premier, 48-port, 5 Year Term license
C9300-DNA-P-48-7Y	C9300 Cisco DNA Premier, 48-port, 7 Year Term license
C9300-DNA-E-24-3Y	C9300 Cisco DNA Essentials, 24-port, 3 Year Term license
C9300-DNA-E-24-5Y	C9300 Cisco DNA Essentials, 24-port, 5 Year Term license
C9300-DNA-E-24-7Y	C9300 Cisco DNA Essentials, 24-port, 7 Year Term license
C9300-DNA-A-24-3Y	C9300 Cisco DNA Advantage, 24-port, 3 Year Term license
C9300-DNA-A-24-5Y	C9300 Cisco DNA Advantage, 24-port, 5 Year Term license
C9300-DNA-A-24-7Y	C9300 Cisco DNA Advantage, 24-port, 7 Year Term license
C9300-DNA-E-48-3Y	C9300 Cisco DNA Essentials, 48-port, 3 Year Term license
C9300-DNA-E-48-5Y	C9300 Cisco DNA Essentials, 48-port, 5 Year Term license
C9300-DNA-E-48-7Y	C9300 Cisco DNA Essentials, 48-port, 7 Year Term license
C9300-DNA-A-48-3Y	C9300 Cisco DNA Advantage, 48-port, 3 Year Term license
C9300-DNA-A-48-5Y	C9300 Cisco DNA Advantage, 48-port, 5 Year Term license
C9300-DNA-A-48-7Y	C9300 Cisco DNA Advantage, 48-port, 7 Year Term license
C9300-DNA-P-24S-3Y	C9300 1G Fiber Cisco DNA Premier, 24-port, 3 Year Term license
C9300-DNA-P-24S-5Y	C9300 1G Fiber Cisco DNA Premier, 24-port, 5 Year Term license
C9300-DNA-P-24S-7Y	C9300 1G Fiber Cisco DNA Premier, 24-port, 7 Year Term license
C9300-DNA-P-48S-3Y	C9300 1G Fiber Cisco DNA Premier, 48-port, 3 Year Term license
C9300-DNA-P-48S-5Y	C9300 1G Fiber Cisco DNA Premier, 48-port, 5 Year Term license
C9300-DNA-P-48S-7Y	C9300 1G Fiber Cisco DNA Premier, 48-port, 7 Year Term license
C9300-DNA-E-24S-3Y	C9300 1G Fiber Cisco DNA Essentials, 24-port, 3 Year Term license
C9300-DNA-E-24S-5Y	C9300 1G Fiber Cisco DNA Essentials, 24-port, 5 Year Term license
C9300-DNA-E-24S-7Y	C9300 1G Fiber Cisco DNA Essentials, 24-port, 7 Year Term license
C9300-DNA-A-24S-3Y	C9300 1G Fiber Cisco DNA Advantage, 24-port, 3 Year Term license
C9300-DNA-A-24S-5Y	C9300 1G Fiber Cisco DNA Advantage, 24-port, 5 Year Term license
C9300-DNA-A-24S-7Y	C9300 1G Fiber Cisco DNA Advantage, 24-port, 7 Year Term license
C9300-DNA-E-48S-3Y	C9300 1G Fiber Cisco DNA Essentials, 48-port, 3 Year Term license
C9300-DNA-E-48S-5Y	C9300 1G Fiber Cisco DNA Essentials, 48-port, 5 Year Term license
C9300-DNA-E-48S-7Y	C9300 Cisco DNA Essentials, 48-port, 7 Year Term license

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C9300-DNA-A-48S-3Y	C9300 1G Fiber Cisco DNA Advantage, 48-port, 3 Year Term license
C9300-DNA-A-48S-5Y	C9300 1G Fiber Cisco DNA Advantage, 48-port, 5 Year Term license
C9300-DNA-A-48S-7Y	C9300 1G Fiber Cisco DNA Advantage, 48-port, 7 Year Term license
C9300-LIC=	Electronic Cisco DNA Upgrade License for C9300 switches. Note: when upgrading from Cisco DNA Essentials to Cisco DNA Advantage, Network Essentials is also upgraded to Network Advantage
CAT-CDNA-P	Cisco DNA Premier Term Add for Catalyst Switches
Software licenses for C9300L SKUs	
Product number	Product number
C9300L-DNA-P-24-3Y	C9300L Cisco DNA Premier, 24-port, 3 Year Term license
C9300L-DNA-P-24-5Y	C9300L Cisco DNA Premier, 24-port, 5 Year Term license
C9300L-DNA-P-24-7Y	C9300L Cisco DNA Premier, 24-port, 7 Year Term license
C9300L-DNA-P-48-3Y	C9300L Cisco DNA Premier, 48-port, 3 Year Term license
C9300L-DNA-P-48-5Y	C9300L Cisco DNA Premier, 48-port, 5 Year Term license
C9300L-DNA-P-48-7Y	C9300L Cisco DNA Premier, 48-port, 7 Year Term license
C9300L-DNA-E-24-3Y	C9300L Cisco DNA Essentials, 24-port, 3 Year Term license
C9300L-DNA-E-24-5Y	C9300L Cisco DNA Essentials, 24-port, 5 Year Term license
C9300L-DNA-E-24-7Y	C9300L Cisco DNA Essentials, 24-port, 7 Year Term license
C9300L-DNA-A-24-3Y	C9300L Cisco DNA Advantage, 24-port, 3 Year Term license
C9300L-DNA-A-24-5Y	C9300L Cisco DNA Advantage, 24-port, 5 Year Term license
C9300L-DNA-A-24-7Y	C9300L Cisco DNA Advantage, 24-port, 7 Year Term license
C9300L-DNA-E-48-3Y	C9300L Cisco DNA Essentials, 48-port, 3 Year Term license
C9300L-DNA-E-48-5Y	C9300L Cisco DNA Essentials, 48-port, 5 Year Term license
C9300L-DNA-E-48-7Y	C9300L Cisco DNA Essentials, 48-port, 7 Year Term license
C9300L-DNA-A-48-3Y	C9300L Cisco DNA Advantage, 48-port, 3 Year Term license
C9300L-DNA-A-48-5Y	C9300L Cisco DNA Advantage, 48-port, 5 Year Term license
C9300L-DNA-A-48-7Y	C9300L Cisco DNA Advantage, 48-port, 7 Year Term license
C9300L-LIC=	Electronic Cisco DNA Upgrade License for C9300L switches. Note: when upgrading from Cisco DNA Essentials to Cisco DNA Advantage, Network Essentials is also upgraded to Network Advantage

Switches

Power supplies

Product number	Product description
PWR-C1-350WAC=	350WAC power supply spare
PWR-C1-715WAC=	715WAC power supply spare
PWR-C1-715WDC=	715WDC power supply spare
PWR-C1-1100WAC=	1100WAC power supply spare
PWR-C1-350WAC-P=	350WAC Platinum-rated power supply spare
PWR-C1-715WAC-P=	715WAC Platinum-rated power supply spare
PWR-C1-1100WAC-P=	1100WAC Platinum-rated power supply spare
PWR-C1-715WAC-UP	Upgrade to 715WAC Platinum-rated power supply
PWR-C1-1100WAC-UP	Upgrade to 1100WAC Platinum-rated power supply

Cisco StackWise-480 and StackPower cables

Product number	Product description
STACK-T1-50CM=	Cisco StackWise-480 50cm stacking cable spare
STACK-T1-1M=	Cisco StackWise-480 1m stacking cable spare
STACK-T1-3M=	Cisco StackWise-480 3m stacking cable spare
CAB-SPWR-30CM=	Cisco Catalyst 3850 StackPower cable 30cm spare
CAB-SPWR-150CM=	Cisco Catalyst 3850 StackPower cable 150cm spare

Cisco StackWise-320 Accessories

Product number	Product description
C9300L-STACK-KIT	Stack Kit for C9300L SKUs – includes 2 Stack Adaptors and 1 Stack Cable
C9300L-STACK-KIT=	Stack Kit for C9300L SKUs – includes 2 Stack Adaptors and 1 Stack Cable, spare
STACK-T3-50CM	50CM Type 3 Stacking Cable – default with Stack Kit for C9300L SKUs
STACK-T3-50CM=	50CM Type 3 Stacking Cable, spare for C9300L SKUs
STACK-T3-1M	1M Type 3 Stacking Cable for C9300L SKUs
STACK-T3-1M=	1M Type 3 Stacking Cable, spare for C9300L SKUs
STACK-T3-3M	3M Type 3 Stacking Cable for C9300L SKUs
STACK-T3-3M=	3M Type 3 Stacking Cable, spare for C9300L SKUs

Spare power cords

CAB-TA-NA=	AC power cord for Cisco Catalyst (North America)
CAB-TA-AP=	AC power cord for Cisco Catalyst (Australia)
CAB-TA-AR=	AC power cord for Cisco Catalyst (Argentina)
CAB-TA-SW=	AC power cord for Cisco Catalyst (Switzerland)
CAB-TA-UK=	AC power cord for Cisco Catalyst (United Kingdom)
CAB-TA-JP=	AC power cord for Cisco Catalyst (Japan)

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CAB-TA-250VAC-JP=	Japan 250VAC power cord for Cisco Catalyst (Japan)
CAB-TA-EU=	AC power cord for Cisco Catalyst (Europe)
CAB-TA-IT=	AC power cord for Cisco Catalyst (Italy)
CAB-TA-IN=	AC power cord for Cisco Catalyst (India)
CAB-TA-CN=	AC power cord for Cisco Catalyst (China)
CAB-TA-DN=	AC power cord for Cisco Catalyst (Denmark)
CAB-TA-IS=	AC power cord for Cisco Catalyst (Israel)
CAB-ACBZ-12A=	AC power cord for Cisco Catalyst (Brazil), 12A/125V BR-3-20 plug up to 12A
CAB-ACBZ-10A=	AC power cord for Cisco Catalyst (Brazil), 10A/250V BR-3-10 plug up to 10A
CAB-C15-CBN	Cabinet jumper power cord, 250VAC 13A, C14-C15 connectors

Optics online reference

The Cisco Catalyst 9300 Series supports a wide range of optics. Because the list of supported optics is updated on a regular basis, consult the tables available here for the latest QSFP+, SFP+, and SFP compatibility information:

https://www.cisco.com/en/US/products/hw/modules/ps5455/products_device_support_tables_list.html.

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Flexible payment solutions to help you achieve your objectives

Cisco Capital makes it easier to get the right technology to achieve your objectives, enable business transformation and help you stay competitive. We can help you reduce the total cost of ownership, conserve capital, and accelerate growth. In more than 100 countries, our flexible payment solutions can help you acquire hardware, software, services and complementary third-party equipment in easy, predictable payments. [Learn more](#).

Document history

New or revised topic	Described In	Date
Added new SKUs for C9300L – Full PoE+ and mGig SKUs	Content added to all the tables	December 2, 2019
Updates for Brattain Program for C9300 – this is higher buffer and higher scale SKUs	All relevant sections	October 9, 2019
Adding Primary PSU upgrade option for 9300	Table 3: Power supply models	June 20, 2019
Product name change: Cisco ONE to Cisco DNA	Introduction	May 10, 2019
Wi-Fi 6 addition	Product Overview: Features	May 10, 2019
Add: Features	Product Overview: Features	May 10, 2019
Add: Modular uplink models table	Platform Details	May 10, 2019
Edit: Cisco Catalyst 9300 Series modular uplink	Platform Details	May 10, 2019
Edit: Table 1: Cisco Catalyst 9300 Series Switch configurations; uplink configuration add	Platform Details	May 10, 2019
Edit: Table 2: Name change to “Catalyst 9300...”	Platform Details	May 10, 2019
Add: Figure 3: pic for Franklin	Platform Details	May 10, 2019
Edit: Table 3: Power supply models	Platform Details	May 10, 2019
Add: Stacking, Table 4	Platform Details	May 10, 2019
Add: Stacking Accessories, Table 5	Platform Details	May 10, 2019
Edit: Replaced C3850 stack picture with C9300 stack picture	Platform Details	May 10, 2019
Add: Fan, Table 6	Platform Details	May 10, 2019
Edit: Table 7	Performance and Scalability	May 10, 2019
Add: Bandwidth Specifications	Performance and Scalability	May 10, 2019
Add: StackWise-320	Resiliency and High Availability	May 10, 2019

New or revised topic	Described In	Date
Edit: name change from Cisco One to Cisco DNA Software	Software Requirements	May 10, 2019
Edit: text edits	Licensing	May 10, 2019
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Edit: Table 21	Safety and Compliance	May 10, 2019
Edit: Table 23	Ordering Information	May 10, 2019
Added support for SD-Access Embedded Wireless	Added support for SD-Access Embedded Wireless Controller functionality.	Nov 13, 2018
Updated Platinum Power Supply specifications	Platinum rated power supplies available on the C9300 switches.	Oct 5, 2018
Updated availability of SSD card	Availability of 120G storage module for the C9300.	Oct 5, 2018
Updated Product overview	Added Catalyst 9500 high density platforms and updated associated speeds and densities, e.g. Up to 6.4-Tbps switching capacity with up to 2 Bpps of forwarding performance from “3.2 Tbps/1 Bpps” a. 32 port 100G, b. 32 port 40G, c. 48 port 25G. Added Catalyst 9500 mid density platform a. 24 port 25G, b. 16 port 1/10G. Added new optical interfaces – QSFP28, SFP28. Added new power supply options – 650W, 1600W. Added RESCONF support. Stackwise Virtual extended to all Catalyst 9500 platforms.	Mar 31, 2018
Updated Audio Video Bridging	AVB support noted for certain platforms. Corrected references to Catalyst 9000 switches, rather than Catalyst 9000 Series switches. Corrected references to Cisco IOS XE, rather than IOS-XE.	Dec 15, 2017

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Cisco Catalyst 9500 Series Switches

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Built for Security, IoT, and Cloud

The Cisco® Catalyst® 9500 Series switches are the next generation of enterprise-class core and aggregation layer switches, supporting full programmability and serviceability. Based on an x86 CPU, the Cisco Catalyst 9500 Series is Cisco's lead purpose-built fixed core and aggregation enterprise switching platform, built for security, IoT, and cloud. The switches come with a 4-core x86, 2.4-GHz CPU, 16-GB DDR4 memory, and 16-GB internal storage.

The Cisco Catalyst 9500 Series is the industry's first purpose-built 25, 40 and 100 Gigabit Ethernet line of switches targeted for the enterprise campus. These switches deliver unmatched table scale (MAC/route/ACL) and buffering for enterprise applications. The Cisco Catalyst 9500 Series includes nonblocking 40 and 100 Gigabit Ethernet Quad Small Form-Factor Pluggable (QSFP+, QSFP28) and 1, 10 and 25 Gigabit Ethernet Small Form-Factor Pluggable Plus (SFP/SFP+/SFP28) switches with granular port densities that fit diverse campus needs. The switches support advanced routing and infrastructure services (such as Multiprotocol Label Switching [MPLS] Layer 2 and Layer 3 VPNs, Multicast VPN [MVPN], and Network Address Translation [NAT]); Cisco Software-Defined Access capabilities (such as a host tracking database, cross-domain connectivity, and VPN Routing and Forwarding [VRF]-aware Locator/ID Separation Protocol [LISP]); and network system virtualization with Cisco StackWise® virtual technology that are critical for their placement in the campus core. The Cisco Catalyst 9500 Series also supports foundational high-availability capabilities such as patching, Graceful Insertion and Removal (GIR), [Cisco Nonstop Forwarding with Stateful Switchover](#) (NSF/SSO), redundant platinum-rated power supplies, and fans.

The foundation of Software-Defined Access

Advanced persistent security threats. The exponential growth of Internet of Things (IoT) devices. Mobility everywhere. Cloud adoption. All of these require a network fabric that integrates advanced hardware and software innovations to automate, secure, and simplify customer networks. The goal of this network fabric is to enable customer revenue growth by accelerating the rollout of business services.

The Cisco [Digital Network Architecture](#) (Cisco DNA) with Software-Defined Access (SD-Access) is the network fabric that powers business. It is an open and extensible, software-driven architecture that accelerates and simplifies your enterprise network operations. The programmable architecture frees your IT staff from time-consuming, repetitive network configuration tasks so they can focus instead on innovation that positively transforms your business. SD-Access enables policy-based automation from edge to cloud with foundational capabilities. These include:

- Simplified device deployment
- Unified management of wired and wireless networks
- Network virtualization and segmentation
- Group-based policies
- Context-based analytics

The Cisco Catalyst 9500 Series switches form the foundational building block for Software-Defined Access-Cisco's leading enterprise architecture.

Product overview

Product highlights

- Cisco Unified Access™ Data Plane (UADP) Application-Specific Integrated Circuit (ASIC) ready for next-generation technologies with its programmable pipeline, microengine capabilities, and template-based, configurable allocation of Layer 2 and Layer 3 forwarding, Access Control Lists (ACLs), and Quality-of-Service (QoS) entries
- Intel® 2.4-GHz x86 CPU with up to 120 GB of USB 3.0 or up to 960 GB of SATA SSD storage for container-based application hosting
- Up to 6.4-Tbps switching capacity with up to 2 Bpps of forwarding performance
- Up to 32 nonblocking 100 Gigabit Ethernet QSFP28 ports
- Up to 32 nonblocking 40 Gigabit Ethernet QSFP+ ports
- Up to 48 nonblocking 25 Gigabit Ethernet SFP28 ports
- Up to 48 nonblocking 10 Gigabit Ethernet SFP+ ports
- Platinum-rated AC/DC power supplies
- Up to 512,000 Flexible NetFlow (FNF) entries in hardware
- Up to 36 MB of unified buffer per ASIC
- Up to 212,000 routing entries (IPv4/IPv6) for high-end campus core and aggregation deployments
- IPv6 support in hardware, providing wire-rate forwarding for IPv6 networks
- IEEE 802.1ba AV Bridging (AVB) built in to provide a better AV experience through improved time synchronization and QoS
- Precision Time Protocol (PTP; IEEE 1588v2) provides accurate clock synchronization with sub-microsecond accuracy, making it suitable for distribution and synchronization of time and frequency over the network
- Dual-stack support for IPv4/IPv6 and dynamic hardware forwarding table allocations, for ease of IPv4-to-IPv6 migration
- Support for both static and dynamic NAT and Port Address Translation (PAT)
- Scalable routing (IPv4, IPv6, and multicast) tables and Layer 2 tables
- Cisco IOS® XE Software, a modern operating system for the enterprise with support for model-driven programmability, on-box Python scripting, streaming telemetry, container-based application hosting, and patching for critical bug fixes. The OS also has built-in defenses to protect against runtime attacks
- Cisco StackWise® Virtual technology, a network system virtualization technology that increases operational efficiency and boosts nonstop communications and scaled system bandwidth
- Highest wireless scale for Wi-Fi 6 and 802.11ac Wave 2 access points supported on a single switch
- **SD-Access:** With the Cisco Catalyst 9500 Series, you can be part of the future of networking with features that include:
 - Policy-based automation from edge to cloud
 - Segmentation and micro-segmentation made easy, with predictable performance and scalability

- Automation and network assurance through the Cisco DNA Center Appliance
- Faster launch of new business services and significantly improved issue resolution time
- SD-Access Embedded Wireless: The Cisco Catalyst 9800 embedded wireless controller software package can be installed on Cisco Catalyst 9500 Series Switches to enable wireless controller functionality for distributed branches and small campuses. Once installed, the embedded wireless controller running on a Cisco Catalyst 9500 Series Switch can support up to 200 APs and 4000 clients. A maximum of two wireless controllers can be enabled per site on two different Cisco Catalyst 9500 Series Switches, which will increase the scale up to 400 APs and 8000 wireless clients per site.
- The Cisco Catalyst 9800 embedded wireless controller software package will enable wireless functionality only for SD-Access deployments, with two supported topologies:
 - It can be enabled on Cisco Catalyst 9500 Series Switches functioning as a co-located border and control plane.
 - It can be enabled on Cisco Catalyst 9500 Series Switches functioning as fabric in a box.
- **Cisco Plug and Play (PnP) enabled:** A simple, secure, unified, and integrated offering to ease new branch or campus device rollouts or updates to an existing network
- **Advanced security:**
 - Encrypted Traffic Analytics (ETA): You benefit from the power of machine learning to identify and take actions toward threats or anomalies in your network, including malware detection in encrypted traffic and distributed anomaly detection. Additionally, ETA is able to detect vulnerable implementations in encrypted traffic
 - Support for AES-256 with the powerful MACsec 256-bit encryption algorithm available on all models
 - Trustworthy solutions: Secure Unique Device Identification (SUDI) support for Plug and Play, enabling tamper-proof device identity capability, which secures zero-touch provisioning by allowing your device to show a certificate to the server to be able to get onto your network

Platform details

Switch models and configurations

All switches ship with the 650W/950W/1600W AC power supply as default

Figures 1 through 8 show the Cisco Catalyst 9500 Series Switches



Figure 1.
C9500-32C: Cisco Catalyst 9500 Series high-performance switch with 32x 100 Gigabit Ethernet



Figure 2.
C9500-32QC: Cisco Catalyst 9500 Series high-performance switch with 32x 40 or 16x100 Gigabit Ethernet



Figure 3.
C9500-48Y4C: Cisco Catalyst 9500 Series high-performance switch with 48x 1/10/25G Gigabit Ethernet + 4x 40/100G Uplink



Figure 4.
C9500-24Y4C: Cisco Catalyst 9500 Series high-performance switch with 24x 1/10/25G Gigabit Ethernet + 4x 40/100G Uplink



Figure 5.
C9500-24Q: Cisco Catalyst 9500 Series switch with 24x 40G Gigabit Ethernet



Figure 6.
C9500-12Q: Cisco Catalyst 9500 Series switch with 12x 40G Gigabit Ethernet



Figure 7.
C9500-40X: Cisco Catalyst 9500 Series switch with 40x 1/10G Gigabit Ethernet



Figure 8.
C9500-16X: Cisco Catalyst 9500 Series switch with 16x 1/10G Gigabit Ethernet

Table 1 shows the Cisco Catalyst 9500 Series configurations

Table 1. Cisco Catalyst 9500 Series configurations and port density

Model	Description	1G port density	10G port density	25G port density	40G port density	100G Port density	10G port density with breakout cable	25G port density with breakout cable
C9500-32C	Cisco Catalyst 9500 Series high-performance 32-port 100 Gigabit Ethernet switch with QSFP28	–	–	–	32 (64)	32 (64)	96	96
C9500-32QC	Cisco Catalyst 9500 Series high-performance 32-port 40 Gigabit Ethernet switch with QSFP+	–	–	–	32 (64)	16 (32)	–	–
C9500-48Y4C	Cisco Catalyst 9500 Series high-performance 48-port 1/10/25G Gigabit Ethernet switch with SFP28	48 (96)	48 (96)	48 (96)	4 (8)	4 (8)	–	–
C9500-24Y4C	Cisco Catalyst 9500 Series high-performance 24-port 1/10/25G Gigabit Ethernet switch with SFP28	24 (48)	24 (48)	24 (48)	4 (8)	4 (8)	–	–
C9500-24Q	Cisco Catalyst 9500 Series 24-port 40 Gigabit Ethernet switch with QSFP+	–	–	–	24 (48)	–	96	–
C9500-12Q	Cisco Catalyst 9500 Series 12-port 40 Gigabit Ethernet switch with QSFP+	–	–	–	12 (24)	–	48	–
C9500-40X	Cisco Catalyst 9500 Series 40-port 1/10 Gigabit Ethernet Switch with SFP/SFP+	48 (96)	48 (96)	–	2 (4)	–	8	–
C9500-16X	Cisco Catalyst 9500 Series 16-port 1/10 Gigabit Ethernet switch with SFP/SFP+	24 (48)	24 (48)	–	2 (4)	–	8	–

All numbers in the above table are for the standalone switch, except where indicated in parentheses () for StackWise Virtual:

**with uplink module.

Network modules

The Cisco Catalyst 9500 Series Switches support optional network modules for uplink ports on some of the configurations.

The default switch configuration does not include the network module. When you purchase the switch, you can choose from the network modules described in Tables 2 and 3.

Table 2. Network module numbers and descriptions

Network module	Description
C9500-NM-8X	Cisco Catalyst 9500 Series Network Module 8-port 1/10 Gigabit Ethernet with SFP/SFP+
C9500-NM-2Q	Cisco Catalyst 9500 Series Network Module 2-port 40 Gigabit Ethernet with QSFP+

Table 3. Network module matrix

Model	C9500-NM-8X	C9500-NM-2Q
C9500-32C	No	No
C9500-32QC	No	No
C9500-48Y4C	No	No
C9500-24Y4C	No	No
C9500-24Q	No	No
C9500-12Q	No	No
C9500-40X	Yes	Yes
C9500-16X	Yes	Yes

Figures 9 and 10 show the available network modules



Figure 9. Cisco Catalyst 9500 Series network module 8-port 1/10 Gigabit Ethernet with SFP/SFP+



Figure 10. Cisco Catalyst 9500 Series network module 2-port 40 Gigabit Ethernet with QSFP+

Accessories

The Cisco Catalyst 9500 Series Switches support optional accessories.

The default switch configuration does not include the accessories – these need to be selected during configuration.

Table 4. Accessories and descriptions

Product number	Description
C9500-ACCKITH-19I=	Accessory Kit for Cisco Catalyst 9500 Series – High-End – 19" rack mount
C9500-ACCKITH-23I=	Accessory Kit for Cisco Catalyst 9500 Series – High-End – 23" rack mount
C9500-4PTH-KIT=	Extension rails and brackets for four-point mounting for Cisco Catalyst 9500 Series – High-End
C9500-ACC-KIT-19I=	Accessory Kit for Cisco Catalyst 9500 Series – 19" rack mount
C9500-ACC-KIT-23I=	Accessory Kit for Cisco Catalyst 9500 Series – 23" rack mount
C9500-4PT-KIT=	Extension rails and brackets for four-point mounting for Cisco Catalyst 9500 Series
SSD-120G	Cisco pluggable USB3.0 SSD storage – 120 GB
C9K-F1-SSD-240G	Cisco pluggable SSD storage – 240 GB
C9K-F1-SSD-480G	Cisco pluggable SSD storage – 480 GB
C9K-F1-SSD-960G	Cisco pluggable SSD storage – 960 GB

Table 5. Accessory matrix

Model	C9500-ACCKITH-19I=	C9500-ACCKITH-23I=	C9500-4PTH-KIT=	C9K-F1-SSD-240G	C9500-ACC-KIT-19I=	C9500-ACC-KIT-23I=	C9500-4PT-KIT=	SSD-120G	C9K-F1-SSD-240G	C9K-F1-SSD-480G	C9K-F1-SSD-960G
C9500-32C	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes
C9500-32QC	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes
C9500-48Y4C	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes
C9500-24Y4C	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes
C9500-24Q	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No
C9500-12Q	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No
C9500-40X	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No
C9500-16X	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No

Figure 11 shows the 240-GB SSD storage.



Figure 11.
240-GB SSD storage

Power supplies and fan tray

The Cisco Catalyst 9500 Series Switches support dual 1+1 redundant power supplies. The switches ship with one power supply by default. The second power supply can be purchased at the time the switch is ordered or at a later time. If only one power supply is installed, it should always be in power supply bay #1.

The switches also ship with up to five field-replaceable variable-speed fans. These have front-to-back airflow and can operate with up to one individual fan failure. The fan trays support fan-tray Online Insertion and Removal (OIR) and can support a maximum fan speed of up to 24,000 rpm.

Table 6 shows the maximum fans and fan trays for each configuration.

Table 6. Fan and fan tray matrix

Model	FAN-T4-R (Max # of fans)	C9K-T1-FANTRAY (Max # of fans)
C9500-32C	Yes (5)	No
C9500-32QC	No	Yes (4)
C9500-48Y4C	No	Yes (4)
C9500-24Y4C	No	Yes (4)
C9500-24Q	Yes (5)	No
C9500-12Q	Yes (5)	No
C9500-40X	Yes (5)	No
C9500-16X	Yes (5)	No

Figures 12 through 14 show the power supplies available for the Cisco Catalyst 9500 Series



Figure 12.
950W AC power supply



Figure 13.
650W AC power supply



Figure 14.
1600W AC power supply

Tables 7 and 8 provides more details on the Cisco Catalyst 9500 Series power supplies

Table 7. Power supply specifications

Power supply feature	PWR-C4-950WAC-R	PWR-C4-950WDC-R	C9K-PWR-650WAC-R	C9K-PWR-930WDC-R	C9K-PWR-1600WAC-R	C9K-PWR-1600WDC-R
Power max rating	950W	950W	650W	930W	1600W	1600W
Input-voltage range and frequency	AC 90 to 264 VAC, 47 to 63 Hz	-36Vdc~ -72Vdc	AC 90VAC to 264VAC, 47 to 63 Hz	DC -40VDC to -72VDC	AC 90VAC to 140VAC and 180VAC to 264VAC 47 to 63 Hz	DC -40VDC to -72VDC
Power supply efficiency	94%	91% at 48Vin, 50% load	94% (Typ)	92% (Typ)	94% (Typ)	92% (Typ)
Input current	AC 10A at 115VAC, 5 A at 230VAC	22.6A @ 48Vin, 950W	AC 6.8A Max at 115VAC, 3.4 A Max at 230VAC (when full loading)	DC 23A max at -48VDC (when full loading)	AC 10.5A Max at 115VAC (1050W), 7.8 A Max at 230VAC (1600W)	DC 40A max at -48VDC (when full loading)
Output ratings	12V at 79A, 12V at 3A	950W	12Vmain at 54A, 12Vsb at 3A	12Vmain at 54A, 12Vsb at 3A	12Vmain at 133A, 12Vsb at 3A	12Vmain at 133A, 12Vsb at 3A
Output holdup time	AC = 10 ms at maximum load	1ms	AC = 20 ms minimum for system	AC = 8 ms minimum for system	AC = 20 ms minimum for system	AC = 5 ms minimum for system

Power supply feature	PWR-C4-950WAC-R	PWR-C4-950WDC-R	C9K-PWR-650WAC-R	C9K-PWR-930WDC-R	C9K-PWR-1600WAC-R	C9K-PWR-1600WDC-R
Power-supply input receptacles	AC IEC 60320 C16		AC IEC 60320 C14	Molex Minifit 44540-1001	AC IEC 60320 C16	Amphenol C10-638976-000
Power cord rating	AC 15A	DC 40A	AC 10A	DC 40A	AC 15A	DC 70A

Table 8. BTU Details for 9500 Power Supplies

Total output BTU (Note: 1000 BTU/hr = 293W) - Model	C9K-PWR-1600WAC-R	C9K-PWR-1600WDC-R	C9K-PWR-650WAC-R	C9K-PWR-930WDC-R	PWR-C4-950WAC-R	PWR-C4-950WDC-R
C9500-32C	1064	1087	N/A	N/A	N/A	N/A
C9500-32QC	N/A	N/A	532	544	N/A	N/A
C9500-48Y4C	N/A	N/A	544	544	N/A	N/A
C9500-24Y4C	N/A	N/A	426	435	N/A	N/A
C9500-24Q	N/A	N/A	N/A	N/A	2900	2976
C9500-12Q	N/A	N/A	N/A	N/A	1536	1562
C9500-40X with 10G NM	N/A	N/A	N/A	N/A	1467	1451
C9500-40X with 40G NM	N/A	N/A	N/A	N/A	1365	1376
C9500-16X with 10G NM	N/A	N/A	N/A	N/A	941	967
C9500-16X with 40G NM	N/A	N/A	N/A	N/A	904	930

Table 9 shows the power supplies supported in the Cisco Catalyst 9500 Series Switches

Table 9. Power supply matrix

Model	C9K-PWR-1600WAC-R	C9K-PWR-1600WDC-R	C9K-PWR-650WAC-R	C9K-PWR-930WDC-R	PWR-C4-950WAC-R	PWR-C4-950WDC-R
C9500-32C	Yes	Yes	No	No	No	No
C9500-32QC	No	No	Yes	Yes	No	No
C9500-48Y4C	No	No	Yes	Yes	No	No
C9500-24Y4C	No	No	Yes	Yes	No	No
C9500-24Q	No	No	No	No	Yes	Yes
C9500-12Q	No	No	No	No	Yes	Yes

Model	C9K-PWR-1600WAC-R	C9K-PWR-1600WDC-R	C9K-PWR-650WAC-R	C9K-PWR-930WDC-R	PWR-C4-950WAC-R	PWR-C4-950WDC-R
C9500-40X	No	No	No	No	Yes	Yes
C9500-16X	No	No	No	No	Yes	Yes

Switch performance

Table 10 shows performance specifications for the Cisco Catalyst 9500 Series Switches

Table 10. Performance specifications

Performance numbers for all switch models	C9500-24Q	C9500-12Q	C9500-40X	C9500-16X	C9500-32C	C9500-32QC	C9500-48Y4C	C9500-24Y4C
ASIC	UADP 2.0				UADP 3.0			
Switching capacity	Up to 1920 Gbps	Up to 960 Gbps	Up to 960 Gbps	Up to 480 Gbps	Up to 6.4 Tbps**	Up to 3.2 Tbps**	Up to 3.2 Tbps**	Up to 2.0Tbps**
Forwarding rate	Up to 1440 Mpps	Up to 720 Mpps	Up to 720 Mpps	Up to 360 Mpps	Up to 2 Bpps	Up to 1 Bpps	Up to 1 Bpps	Up to 1 Bpps
Total number of MAC addresses	Up to 64,000*				Up to 82,000*			
Total number of IPv4 routes (Address Resolution Protocol [ARP] plus learned routes)	Up to 64,000 indirect* Up to 80,000 host*				Up to 212,000 indirect + direct* Up to 90,000 host/ARP*			
Total number of IPv6 routes	Up to 32,000 indirect* Up to 40,000 host*				Up to 212,000 indirect + direct* Up to 90,000 host*			
Total number of IPv4 Multicast routes	Up to 32,000*				Up to 32,000*			
Total number of IPv6 Multicast routes	Up to 16,000*				Up to 32,000*			
QoS ACL scale	Up to 18000*				Up to 16000*			
Security ACL scale	Up to 18000*				Up to 27000*			
FNF entries	Up to 512,000*				Up to 98,000*			
DRAM	16 GB				16 GB			
Flash	16 GB				16 GB			
VLAN IDs	4094				4094			

Performance numbers for all switch models	C9500-24Q	C9500-12Q	C9500-40X	C9500-16X	C9500-32C	C9500-32QC	C9500-48Y4C	C9500-24Y4C
Total Switched Virtual Interfaces (SVIs)	1000				1000			
Jumbo frame	9198 bytes				9216 bytes			

* Varies based on selected flexible ASIC template.

** Line rate for 187byte packet size and above.

By host routes, it means any /32 routes, including those are learned indirectly (such as over OSPF or other routing protocols).

This does not mean that it can install 80,000 directly connected clients (/32) for attached VLANs/SVIs. In other words, directly connected routes in engineering term means, any /32 prefix (that includes clients attached to switch's own VLAN/SVI and those /32 prefixes learned over any routing protocols as well).

An indirectly connected route is a route with a prefix other than /32.

Important note

UADP 2.0 based C9500-12Q, C9500-24Q, C9500-40X, and C9500-16X support 32,000 adjacency in hardware. So essentially, they can support up to ~32,000 directly attached clients (including all adjacency) in their own VLAN/SVI.

UADP 3.0 based C9500-32C, 32QC, 24Y4C, and 48Y4C support 80,000 adjacency for SVI, with SDM template of distribution and 90,000 direct routes for all supported templates when a Layer 3 routed port is used.

Flexible ASIC templates

Flexible ASIC templates enable universal deployments by leveraging the UADP's ability to create resources to optimize table sizes for different places in the network. Based on how the switch is used in the network, an appropriate flexible ASIC template may be selected to configure the switch for specific features.

The following flexible ASIC templates are supported on the Cisco Catalyst 9500 Series.

- Distribution: Maximizes system resources for MAC and security
- Core: Maximizes system resources for unicast and multicast routing
- SDA: Maximizes system resources to support fabric deployment
- NAT: Maximizes system resources for Layer 3 and NAT to support collapsed core WAN deployments

Table 11 describes the ASIC templates

Table 11. ASIC template descriptions

Template numbers for models C9500-32C, C9500-32QC, C9500-24Y4C, C9500-48Y4C	Distribution template	Core template	NAT template	SDA template
IPv4/IPv6(LPM/Host)	114,000	212,000	212,000	212,000
Multicast route(IPv4/IPv6)	16,000	32,000	32,000	32,000
IGMP/MLD snooping	2,000	2,000	2,000	2,000
MAC address	82,000	32,000	32,000	32,000
SGT label	32,000	32,000	32,000	32,000
NetFlow/ASIC	98,000	64,000	64,000	64,000
Security ACL	27,000*	27,000*	20,000*	27,000*
QoS ACL	16,000*	16,000*	8,000*	16,000*
PBR/NAT	3,000	3,000	15,500	2000
Tunnel/MACsec	3000	3000	2000	3000
LISP	1000	1000	1000	2000
SPAN	1000	1000	1000	1000
STP Instances	1000	1000	1000	1000
Control Plane Policing (CoPP)	1000	1000	1000	1000
NetFlow ACL	1000 ingress, 1000 egress	1000 ingress, 1000 egress	1000 ingress, 1000 egress	1000 ingress, 1000 egress

*ACL allocation is configurable between ingress, egress, IPv4, non IPv4

Template numbers for models C9500-12Q, C9500-24Q, C9500-40X, C9500-16X	Distribution template	Core template	SDA template	NAT template
IPv4/IPv6 LPM	64,000 / 32,000	64,000 / 32,000	64,000 / 32,000	64,000 / 32,000
IPv4/IPv6 host	48,000 / 24,000	32,000 / 16,000	80,000 / 40,000	48,000 / 24,000
IPv4/ IPv6 Multicast route	16,000 / 8,000	32,000 / 16,000	16,000 / 8,000	32,000 / 16,000
IGMP/MLD snooping	16,000	16,000	16,000	16,000
MAC address	64,000	16,000	16,000	16,000
SGT label	8000	8000	8000	8000

Template numbers for models C9500-12Q, C9500-24Q, C9500-40X, C9500-16X	Distribution template	Core template	SDA template	NAT template
NetFlow/ASIC	128,000	128,000	128,000	128,000
Security ACL	18,000	18,000	18,000	18,000
QoS ACL	18,000	18,000	18,000	3000
PBR/NAT	2000	2000	2000	16,000
Tunnel/MACsec	1000	1000	1000	1000
LISP	1000	1000	1000	1000
SPAN	1000	1000	1000	1000
STP instances	256	256	256	256
CoPP	1000	1000	1000	1000
NetFlow ACL	1000 ingress, 2000 egress	1000 ingress, 2000 egress	1000 ingress, 2000 egress	1000 ingress, 2000 egress

Cisco SD-Access architecture

Enterprises are in search of ways to transform their operations to add digital capabilities that enhance service delivery and asset management. Cisco SD-Access provides this transformational shift in building and managing networks. It provides faster, easier, and improved business efficiency with investment protection for enhanced business outcomes. By decoupling network functions from hardware, SD-Access helps ensure policy compliance, allows you to launch new business services faster, and improves issue resolution times significantly. At the same time, it is open and extensible and can significantly reduce your operational expenses.

Cisco SD-Access enables policy-based automation from edge to cloud with foundational capabilities. These include simplified device deployment, unified management of wired and wireless networks, network virtualization and segmentation, group-based policies, and context-based analytics. With these fundamental features in place, key use cases can now be orchestrated. These use cases include user mobility, secure segmentation, user onboarding and policies, IoT integration, guest access, context-based troubleshooting, and data center and cloud integration.

Cisco StackWise Virtual

StackWise Virtual is an advanced stacking technology that supports both core and distribution deployments through multiple topologies. It provides higher scale for system virtualization at the network layer. The Cisco Catalyst 9500 Series with Network Advantage License supports StackWise Virtual with a 2-node topology.

StackWise Virtual in the distribution layer of the network interacts with the access and core layer switches as if it were a single logical switch. An access/core switch connects to both switches of the StackWise Virtual switch using one logical port channel called a Multichassis EtherChannel (MEC). The MEC enables the StackWise Virtual switches to provide redundancy and load balancing on the port channel.

This capability enables a loop-free Layer 2 network topology, since the StackWise Virtual switches are treated as one logical switch for both access and core switches. The StackWise Virtual switch also simplifies the Layer 3 network topology by presenting itself as one logical switch, thus reducing the number of routing peers in the network.

Platform benefits

Cisco IOS XE

The Cisco Catalyst 9500 Series opens a completely new paradigm in network configuration, operation, and monitoring through network automation. Cisco's automation solution is open, standards-based, and extensible across the entire lifecycle of a network device. The various mechanisms that bring about network automation are outlined below, based on a device lifecycle.

- **Automated device provisioning:** This is the ability to automate the process of upgrading software images and installing configuration files on Cisco Catalyst switches when they are being deployed in the network for the first time. Cisco provides both turnkey solutions such as Plug and Play and off-the-shelf tools such as Zero-Touch Provisioning (ZTP) and Preboot Execution Environment (PXE) that enable an effortless and automated deployment.
- **API-driven configuration:** Modern network switches such the Cisco Catalyst 9500 Series support a wide range of automation features and provide robust open APIs over Network Configuration Protocol (NETCONF) and RESTCONF using YANG data models for external tools, both off-the-shelf and custom built, to automatically provision network resources.
- **Granular visibility:** Model-driven telemetry provides a mechanism to stream data from a switch to a destination. The data to be streamed is driven through subscription to a data set in a YANG model. The subscribed data set is streamed out to the destination at configured intervals. Additionally, Cisco IOS XE enables the push model, which provides near-real-time monitoring of the network, leading to quick detection and rectification of failures.
- **Seamless software upgrades and patching:** To enhance OS resilience, Cisco IOS XE supports patching, which provides fixes for critical bugs and security vulnerabilities between regular maintenance releases. This support allows customers to add patches without having to wait for the next maintenance release.

Security

- **Encrypted Traffic Analytics (ETA)*:** ETA is a unique capability for identifying malware in encrypted traffic coming from the access layer. Since more and more traffic is becoming encrypted, the visibility this feature provides related to threat detection is critical for keeping your network secure at different layers.
- **Advanced Encryption Standard (AES)-256 MACsec encryption:** AES is the IEEE 802.1AE standard for authenticating and encrypting packets between switches and endpoints. The Cisco Catalyst 9500 Series Switches support 256-bit and 128-bit AES on all ports at all speeds, providing the most secure link encryption (switch to switch).
- **Trustworthy solutions:** Cisco Trust Anchor Technologies provide a highly secure foundation for Cisco products. In the Cisco Catalyst 9500 Series, these trustworthy solutions enable hardware and software authenticity assurance for supply chain trust and strong mitigation against man-in-the-middle attacks on software and firmware.

- **Image signing:** Cryptographically signed images provide assurance that the firmware, BIOS, and other software are authentic and unmodified. As the system boots, the system's software signatures are checked for integrity.
- **Object group ACLs (ipv4 and ipv6):** Object groups for ACLs allow the classification of users, devices, or protocols into groups and apply those groups to ACLs to create access control policies for those groups. This feature allows the use of object groups instead of individual IP addresses, protocols, and ports, which are used in conventional ACLs.
- **Secure Boot:** Cisco Secure Boot technology anchors the boot sequence chain of trust to immutable hardware, mitigating threats against a system's foundational state and the software that is to be loaded, regardless of a user's privilege level. It provides layered protection against the persistence of illicitly modified firmware.
- **Cisco Trust Anchor module:** A tamper-resistant, strong cryptographic, single-chip solution provides hardware authenticity assurance to uniquely identify the product so that its origin can be confirmed to Cisco, providing assurance that the product is genuine.

Resiliency and high availability

- **Cisco StackWise Virtual:** StackWise Virtual is an advanced stacking technology that supports both core and distribution deployments. It provides higher scale for system virtualization at the network layer. The Cisco Catalyst 9500 Series with Network Advantage License supports StackWise Virtual with a 2-node topology.
- **Software Maintenance Upgrades (SMUs):** The SMU is a package that can be installed on a system to provide a patch fix or security resolution to a released image. SMUs allow you to address the network issue quickly while reducing the time and scope of the testing required. The Cisco IOS XE platform internally validates the SMU compatibility and does not allow you to install noncompatible SMUs. All SMUs are integrated into the subsequent Cisco IOS XE Software maintenance releases.
- **Graceful Insertion and Removal (GIR):** GIR isolates a switch from the network in order to perform debugging or an upgrade operation. By using the switch maintenance mode, GIR can systematically eject a Cisco Catalyst 9500 Series Switch from the network with zero or minimal disruption to the network service. When a switch is in maintenance mode, it is isolated from the active forwarding paths in the network. Maintenance tasks, such as real-time debugging, hardware replacement, or software upgrade/downgrade, can be performed without affecting the production traffic. When maintenance tasks are completed, the GIR function places the switch back into the network without impact.
- **Flexlink+:** Flexlink+ allows the setting up of active and backup interfaces or port channels, which can provide Layer 2 failover redundancy without the use of Spanning Tree Protocol (STP). Flexlink+ is currently supported on the C9500-12Q, C9500-24Q, C9500-40X, and C9500-16X models.
- **MKA High Availability:** MKA sessions are now SSO-aware. In the event of failure of the active switch, the standby switch takes over the existing MKA sessions in a minimally disruptive switchover.

Flexible NetFlow

- **Flexible NetFlow (FNF):** Cisco IOS® Software FNF is the next generation in flow visibility technology, allowing optimization of the network infrastructure, reducing operation costs, and improving capacity planning and security incident detection with increased flexibility and scalability. The Cisco Catalyst 9500 Series is capable of up to 512,000 flow entries.

Application visibility and control

- **Next-Generation Network Based Application Recognition (NBAR2):** NBAR2 enables advanced application classification techniques, accuracy with up to 1400 predefined and well-known application signatures and up to 150 encrypted applications on the Cisco Catalyst 9000 Series. Some of the most popular applications included are Skype, Office 365, Microsoft Lync, Cisco WebEx®, and Facebook. Many others are already predefined and easy to configure. NBAR2 provides the network administrator with an important tool to identify, control, and monitor end-user application usage while helping ensure a quality user experience and securing the network from malicious attacks. It uses FNF to report application performance and activities within the network to any supported NetFlow collector, such as Cisco Prime®, Cisco Stealthwatch®, or any compliant third-party tool. NBAR2 is currently supported on the C9500-12Q, C9500-24Q, C9500-40X, and C9500-16X models.

Audio video bridging

- **Audio Video Bridging (AVB):** With Cisco IOS XE Software Release 16.8, selected models of the Cisco Catalyst 9500 Series now support the IEEE 802.1 AVB standard. This standard enables highly reliable delivery of low-latency, time-synchronized AV streaming services through Layer 2 Ethernet networks. The standard also makes it easier to integrate new services and for AV equipment from different vendors to interoperate. Whether the AV endpoint connections are analog or are inflexible digital one to one, the network transport enables many-to-many transparent plug-and-play connections for multiple AV endpoints. AVB is currently supported on the C9500-12Q, C9500-24Q, C9500-40X, and C9500-16X models.

Benefits

- Improves quality of experience by lowering jitter and latency for time-synchronized delivery of high-quality AV.
- Provides scalability of applications across networked deployments, including expansive and complex AV infrastructure.
- Lowers Total Cost of Ownership (TCO) with reduced cabling (lowers CapEx) and no license fees (lowers OpEx).

* AVB is supported on the C9500-12Q, C9500-24Q, C9500-40X, and C9500-16X models. For more details about AVB, refer to <https://www.cisco.com/go/avb>.

Superior QoS

QoS technologies are a set of tools and techniques for managing network resources and are considered the key enabling technologies for the transparent convergence of voice, video, and data networks. QoS on the Cisco Catalyst 9500 Series consists of classification and marking, policing and markdown, scheduling, shaping, and queuing functions. A modular QoS command-line framework provides consistent platform-independent and flexible configuration behavior. The 9500 Series also supports 2-level hierarchical or nested policies.

Subinterfaces

Layer 3 interfaces forward IPv4 and IPv6 packets to another device using static or dynamic routing protocols. You can use Layer 3 interfaces for IP routing and inter-VLAN routing of Layer 2 traffic. Subinterfaces can also be created on Layer 3 port channels.

MPLS is supported on Layer 3 subinterfaces.

BGP EVPN with VXLAN

Virtual Extensible LAN (VXLAN) Border Gateway Protocol (BGP) Ethernet VPN (EVPN)

VXLAN is a network overlay that allows layer 2 segments to be stretched across an IP core. All the benefits of layer 3 topologies are thereby available with VXLAN. The overlay protocol is VXLAN and BGP uses EVPN as the address family for communicating end host MAC and IP addresses.

Service discovery

- **Multicast DNS (mDNS) gateway:** This service discovery gateway capability facilitates the sharing of services advertised using the Apple mDNS (Bonjour) protocol (such as printers, Apple TVs and file services across the network). Additionally, the administrator can create policies defining which services can be seen and accessed by the users in the network. This capability facilitates a Bring-Your-Own-Device (BYOD) rollout.

Smart operation

- **Bluetooth ready:** The Cisco Catalyst 9500 Series has hardware support to connect a Bluetooth dongle to your switch, enabling you to use this wireless interface as a management port. This port functions as an IP management interface and can be used for configuration and troubleshooting using the WebUI or the Command-Line Interface (CLI), and to transfer images and configurations.
- **WebUI:** WebUI is an embedded GUI-based device-management tool that provides the ability to provision the device, to simplify device deployment and manageability and to enhance the user experience. WebUI comes with the default image. There is no need to enable anything or install any license on the device. You can use WebUI to build a day-1 configuration and from then on monitor and troubleshoot the device without having to know how to use the CLI.
- **RFID tags:** The Cisco Catalyst 9500 Series switches have an embedded RFID tag that facilitates easy asset and inventory management using commercial RFID readers.
- **Blue beacon:** The Cisco Catalyst 9500 Series Switches support a blue beacon LED for easy identification of the switch being accessed.

High-performance IP routing

- IP routing protocols provide the fundamental infrastructure for the delivery of advanced IP services across the Cisco Catalyst 9500 Series. Whether based on Internet Engineering Task Force (IETF) standards or Cisco innovations, these protocols enable Cisco to offer the broadest portfolio of IP routing technologies. All share industry-leading scalability, availability, manageability, fast convergence, and high-performance capabilities.
- IP unicast routing protocols (including static; Routing Information Protocol version 1 [RIPv1], version 2 [RIPv2], and next generation [RIPng]; and Open Shortest Path First [OSPF] routed access) are supported for small network routing applications with the Network Essentials stack.

- Advanced IP unicast routing protocols (such as OSPF, Enhanced Interior Gateway Routing Protocol [EIGRP], Border Gateway Protocol Version 4 [BGPv4], and Intermediate System-to-Intermediate System Version 4 [IS-ISv4]) are supported for load balancing and for constructing scalable LANs. IPv6 routing (using OSPFv3 and EIGRPv6) is supported in hardware for maximum performance.
- Protocol-Independent Multicast (PIM) for IP multicast routing is supported, including PIM Sparse Mode (PIM SM), bidirectional PIM, and Source-Specific Multicast (SSM).
- IPv6 addressing is supported on interfaces with appropriate show commands for monitoring and troubleshooting.
- Seamless MPLS integrates multiple networks into a single MPLS domain. This removes the need for service-specific configurations in network transport nodes.

Software requirements

- The Cisco Catalyst 9500 Series Switches run on Cisco IOS XE Software version 16.5.1a or later. This software release includes all the features listed earlier in the Platform Benefits section. Table 12 lists the minimum software requirements for the switch models.

Table 12. Minimum software requirements

Model	Description	Minimum software requirement
C9500-32C	Cisco Catalyst 9500 Series 32-port 40/100 Gigabit Ethernet with QSFP+/QSFP28	Cisco IOS XE Software Release 16.8.1a
C9500-32QC	Cisco Catalyst 9500 Series 32-port 40 Gigabit Ethernet with QSFP+ / 16-port 100 Gigabit Ethernet with QSFP28	Cisco IOS XE Software Release 16.8.1a
C9500-48Y4C	Cisco Catalyst 9500 Series high-performance 48-port 1/10/25G Gigabit Ethernet switch with SFP/SFP+/SFP28	Cisco IOS XE Software Release 16.8.1a
C9500-24Y4C	Cisco Catalyst 9500 Series high-performance 24-port 1/10/25G Gigabit Ethernet switch with SFP/SFP+/SFP28	Cisco IOS XE Software Release 16.8.1a
C9500-24Q	Cisco Catalyst 9500 Series 24-port 40 Gigabit Ethernet with QSFP+	Open Cisco IOS XE Software Release 16.5.1a
C9500-12Q	Cisco Catalyst 9500 Series 12-port 40 Gigabit Ethernet with QSFP+	Open Cisco IOS XE Software Release 16.6.1
C9500-40X	Cisco Catalyst 9500 Series 40-port 1/10 Gigabit Ethernet with SFP/SFP+	Open Cisco IOS-XE Software Release 16.6.1
C9500-16X	Cisco Catalyst 9500 Series 16-port 1/10 Gigabit Ethernet with SFP/SFP+	Open Cisco IOS-XE Software Release 16.8.1

Licensing

Packaging

The Cisco Catalyst 9000 family introduced new packaging that includes vastly simplified base network packages (Network Essentials and Network Advantage) and term-based software packages (Cisco DNA Premier, Cisco DNA Advantage and Cisco DNA Essentials). The Cisco DNA packages, in addition to on-box capabilities, also unlock additional functionality in Cisco DNA Center, enabling controller-based software-defined automation in your network.

For information about feature support on specific models, please refer to the Cisco Feature Navigator (<https://cfn.cloudapps.cisco.com/ITDIT/CFN/jsp/index.jsp>) and the Cisco Catalyst 9500 Series Release Notes.

License consumption is further simplified to following two combinations:

Essentials: This consists of Perpetual Network Essentials and a term-based (3-, 5-, or 7-year) Cisco DNA Essentials package.

Advantage: This consists of Perpetual Network Advantage and a term-based (3-, 5-, or 7-year) Cisco DNA Advantage package.

Note that it is not required to deploy Cisco DNA Center just to use one of the above packages. Refer to <https://www.cisco.com/c/dam/en/us/products/collateral/software/one-wireless-subscription/q-and-a-c67-739601.pdf> for additional details about the Essentials and Advantage packages.

Table 13. Network Essentials and Advantage package features

Features	Network Essentials	Network Advantage
Switch fundamentals Layer 2, Routed Access (RIP, EIGRP Stub, OSPF – Up to 1000 routes), PBR, PIM Stub Multicast (up to 1000 routes), PVLAN, VRRP, PBR, CDP, QoS, FHS, 802.1x, Macsec-128, CoPP, SXP, IP SLA Responder, SSO	✓	✓
Advanced switch capabilities and scale BGP, EIGRP, HSRP, IS-IS, BSR, MSDP, PIM SM, PIM SSM, PIM-BIDIR*, IP SLA, OSPF	x	✓
Network segmentation VRF, VXLAN, LISP, SGT, MPLS, mVPN	x	✓
Automation NETCONF, RESTCONF, gRPC, YANG, PnP Agent, ZTP/Open PnP, GuestShell (On-Box Python)	✓	✓
Telemetry and visibility Model-driven telemetry, sampled NetFlow, SPAN, RSPAN	✓	✓
High availability and resiliency NSF, GIR, * ISSU, StackWise Virtual	x	✓
IoT integration AVB, * PTP, Constrained Application Protocol (CoAP)*	x	✓
Security MACsec-256	x	✓

Table 14. Cisco DNA Essentials and Advantage package features

Features	Cisco DNA Essentials	Cisco DNA Advantage	Cisco DNA Premier
Switch features			
Optimized network deployments Cisco DNA Service for Bonjour	X	✓	✓
Advanced telemetry and visibility Full Flexible NetFlow, EEM	✓	✓	✓
Optimized telemetry a visibility ERSPAN, AVC (NBAR2), App Hosting (in Containers/VMs), Wireshark	X	✓	✓
Advanced security Encrypted Traffic Analytics (ETA)*	X	✓	✓
Cisco DNA Center features			
Day 0 network bring-up automation Cisco Network Plug-n-Play application, network settings, device credentials, LAN Automation, Host onboarding	✓	✓	✓
Element management Discovery, inventory, topology, software image, licensing, and configuration management	✓	✓	✓
Element management Patch Management	X	✓	✓
Basic Assurance Health Dashboards – Network, Client, Application; Switch and Wired Client Health Monitoring	✓	✓	✓
SD-Access Policy-based Automation and Assurance for Wired and Wireless	X	✓	✓
SD-Access Embedded Wireless Cisco Catalyst 9800 wireless software package to enable wireless controller functionality**	X	✓	✓
Network assurance and analytics Global Insights, Trends, Compliance, Custom Reports; Switch 360, Wired Client 360; Fabric and Non-Fabric Insights; App Health, App 360, App Performance (Loss, Latency, Jitter)	X	✓	✓

*Feature will be available in future software releases

**Note: A purchase of Cisco DNA Advantage or Cisco DNA Premier per access point is required in order to enable the wireless controller functionality on Cisco Catalyst switches.

Specifications

Dimensions, physical specifications, weight, and mean time between failures (MTBF)

Table 15 lists the dimensions, physical specifications, weight, and MTBF for the Cisco Catalyst 9500 Series Switches

Table 15. Dimensions, physical specifications, weight, and MTBF

Description	Specifications							
SKU	C9500-32C	C9500-32QC	C9500-48YC	C9500-24YC	C9500-12Q	C9500-24Q	C9500-40X	C9500-16X
Dimensions (H x W x D)	1.73 x 17.5 x 21.2 in	1.73 x 17.5 x 18.0 in			1.73 x 17.5 x 21.52 in			
Rack Units (RU)	1 RU							
Chassis with 2 power supplies and built-In fan	25.64 lb (11.63 kg)	21.85lb (9.91 kg)	21.96 lb (9.96 kg)	20.99 lb (9.52 kg)	25.75 lb (11.68 kg)			23.6 lb (10.7 kg)
Input voltage	90 to 264 VAC*				90 to 264 VAC*			
Operating temperature	32° to 104°F (0° to 40°C)				32° to 104°F (0° to 40°C)			
Storage temperature	-4° to 149°F (-20° to 65°C)				-4° to 149°F (-20° to 65°C)			
Relative humidity operating and nonoperating noncondensing	Ambient (noncondensing) operating: 5% to 90% Ambient (noncondensing) nonoperating and storage: 5% to 95%							
NEBS criteria levels	NEBS: <ul style="list-style-type: none">• Normal operating temperature range: 5C to 40C (up to 1829 meters (6000 ft)• Short term operating temperature range: -5C to 55C• Normal Relative Humidity range: 5% to 85%• Short term Relative Humidity range: 5% to 93%• Operating Altitude: up to 1829 m (6000 ft) at 55C• ETSI 300-019 Requirements are covered under GR-63-CORE with some deviations.• SR-3580 NEBS level 3 (GR-63-CORE, to current issue, GR-1089-CORE, to current issue							
Altitude	Operation up to 13,000 feet at 40° C				Operation up to 6000 feet at 55° C and 13,000 feet at 45° C			
MTBF (hours)	212,820	307,200	316,960	336,780	276,430	230,770	277,310	315,790

* Minimum input voltage is 90VAC, and maximum input voltage is 264VAC.

Optics/transceivers modules

The link below has the matrix of supported optics/transceivers for the Cisco Catalyst 9500 Series.

For the latest Cisco Optics/transceivers modules compatibility information, refer to

<https://tmgmatrix.cisco.com/>

Management and standards support

Table 16 shows management and standards support for the Cisco Catalyst 9500 Series

Table 16. Management and standards support

Description	Cisco Catalyst 9500	Cisco Catalyst 9500 High Performance
Management	BRIDGE-MIB	BGP4-MIB
	CISCO-BRIDGE-EXT-MIB	BRIDGE-MIB
	CISCO-BULK-FILE-MIB	CISCO-ACCESS-ENVMON-MIB
	CISCO-CABLE-DIAG-MIB	CISCO-AUTH-FRAMEWORK-MIB
	CISCO-CALLHOME-MIB	CISCO-BGP4-MIB
	CISCO-CEF-MIB	CISCO-BRIDGE-EXT-MIB
	CISCO-CIRCUIT-INTERFACE-MIB	CISCO-BULK-FILE-MIB
	CISCO-DEVICE-LOCATION-MIB	CISCO-CABLE-DIAG-MIB
	CISCO-DHCP-SNOOPING-MIB	CISCO-CALLHOME-MIB
	ENTITY-VENDORTYPE-OID-MIB	CISCO-CDP-MIB
	CISCO-EIGRP-MIB	CISCO-CEF-MIB
	CISCO-EMBEDDED-EVENT-MGR-MIB	CISCO-CLASS-BASED-QOS-MIB
	CISCO-ENTITY-FRU-CONTROL-MIB	CISCO-CONFIG-COPY-MIB
	CISCO-ENTITY-SENSOR-MIB	CISCO-CONFIG-MAN-MIB
	CISCO-RTTMON-ICMP-MIB	CISCO-CONTEXT-MAPPING-MIB
	CISCO-802-TAP-MIB	CISCO-DATA-COLLECTION-MIB
	CISCO-ACCESS-ENVMON-MIB	CISCO-DHCP-SNOOPING-MIB
	CISCO-DATA-COLLECTION-MIB	CISCO-EIGRP-MIB
	CISCO-DYNAMIC-ARP-INSPECTION-MIB	CISCO-EMBEDDED-EVENT-MGR-MIB
	CISCO-ENERGYWISE-MIB	CISCO-ENHANCED-IMAGE-MIB
	CISCO-ENHANCED-IMAGE-MIB	CISCO-ENHANCED-MEMPOOL-MIB
	CISCO-ENHANCED-MEMPOOL-MIB	CISCO-ENTITY-ASSET-MIB
	CISCO-ENTITY-ASSET-MIB	CISCO-ENTITY-EXT-MIB
	CISCO-ENTITY-DIAG-MIB	CISCO-ENTITY-FRU-CONTROL-MIB
	CISCO-ENTITY-EXT-MIB	CISCO-ENTITY-SENSOR-MIB
	CISCO-ENTITY-PERFORMANCE-MIB	CISCO-ENTITY-VENDORTYPE-OID-MIB
	CISCO-ENTITY-QFP-MIB	CISCO-ENVMON-MIB
	CISCO-ENVMON-MIB	CISCO-ERR-DISABLE-MIB
	CISCO-ETHER-CFM-MIB	CISCO-FLASH-MIB
	ENTITY-MIB	CISCO-FTP-CLIENT-MIB
	CISCO-ERR-DISABLE-MIB	CISCO-HSRP-EXT-MIB
	CISCO-CONFIG-COPY-MIB	CISCO-HSRP-MIB
	CISCO-FLOW-MONITOR-MIB	CISCO-IETF-BFD-MIB
	CISCO-FTP-CLIENT-MIB	CISCO-IETF-DHCP-SERVER-EXT-MIB
	CISCO-HSRP-EXT-MIB	CISCO-IETF-DHCP-SERVER-MIB
	CISCO-HSRP-MIB	CISCO-IETF-ISIS-MIB
	CISCO-IETF-BFD-MIB	CISCO-IETF-PPVPN-MPLS-VPN-MIB
	CISCO-IETF-PPVPN-MPLS-VPN-MIB	CISCO-IF-EXTENSION-MIB

Description	Cisco Catalyst 9500	Cisco Catalyst 9500 High Performance
	CISCO-IETF-PW-MPLS-MIB CISCO-IF-EXTENSION-MIB CISCO-IGMP-FILTER-MIB CISCO-IMAGE-LICENSE-MGMT-MIB CISCO-IP-TAP-MIB CISCO-CONFIG-MAN-MIB CISCO-IP-CBR-METRICS-MIB CISCO-IP-STAT-MIB CISCO-IP-URPF-MIB CISCO-L2L3-INTERFACE-CONFIG-MIB CISCO-LAG-MIB CISCO-LICENSE-MGMT-MIB CISCO-LOCAL-AUTH-USER-MIB CISCO-MEDIA-METRICS-MIB CISCO-MAC-AUTH-BYPASS-MIB CISCO-MAC-NOTIFICATION-MIB CISCO-MDI-METRICS-MIB CISCO-FLASH-MIB CISCO-OSPF-MIB CISCO-MEMORY-POOL-MIB CISCO-MPLS-LSR-EXT-STD-MIB CISCO-NBAR-PROTOCOL-DISCOVERY-MIB CISCO-NHRP-EXT-MIB CISCO-NTP-MIB CISCO-PAGP-MIB CISCO-PORT-SECURITY-MIB CISCO-PORT-STORM-CONTROL-MIB CISCO-POWER-ETHERNET-EXT-MIB CISCO-PRIVATE-VLAN-MIB CISCO-PROCESS-MIB CISCO-PRODUCTS-MIB CISCO-RF-MIB CISCO-RTP-METRICS-MIB CISCO-STP-EXTENSIONS-MIB CISCO-SYSLOG-MIB CISCO-TCP-MIB CISCO-UDLD-MIB CISCO-VLAN-IFTABLE-RELATIONSHIP-MIB HC-RMON-MIB IF-MIB CISCO-HC-RMON-MIB IEEE8021-LAG-MIB LLDP-EXT-MED-MIB	CISCO-IGMP-FILTER-MIB CISCO-IMAGE-LICENSE-MGMT-MIB CISCO-IMAGE-MIB CISCO-IP-CBR-METRICS-MIB CISCO-IP-STAT-MIB CISCO-IP-URPF-MIB CISCO-IPMROUTE-MIB CISCO-IPSLA-AUTOMEASURE-MIB CISCO-IPSLA-ECHO-MIB CISCO-IPSLA-JITTER-MIB CISCO-L2-CONTROL-MIB CISCO-L2L3-INTERFACE-CONFIG-MIB CISCO-LAG-MIB CISCO-LICENSE-MGMT-MIB CISCO-LISP-EXT-MIB CISCO-LOCAL-AUTH-USER-MIB CISCO-MAC-AUTH-BYPASS-MIB CISCO-MAC-NOTIFICATION-MIB CISCO-MEMORY-POOL-MIB CISCO-MPLS-LSR-EXT-STD-MIB CISCO-NHRP-EXT-MIB CISCO-NTP-MIB CISCO-OSPF-MIB CISCO-OSPF-TRAP-MIB CISCO-PAE-MIB CISCO-PAGP-MIB CISCO-PIM-MIB CISCO-PING-MIB CISCO-PKI-MIB CISCO-PORT-SECURITY-MIB CISCO-PORT-STORM-CONTROL-MIB CISCO-PRIVATE-VLAN-MIB CISCO-PROCESS-MIB CISCO-PRODUCTS-MIB CISCO-RESILIENT-ETHERNET-PROTOCOL-MIB CISCO-RTTMON-ICMP-MIB CISCO-RTTMON-IP-EXT-MIB CISCO-RTTMON-MIB CISCO-RTTMON-RTP-MIB CISCO-SNMP-TARGET-EXT-MIB CISCO-STP-EXTENSIONS-MIB CISCO-SYSLOG-MIB CISCO-TCP-METRICS-MIB

Description	Cisco Catalyst 9500	Cisco Catalyst 9500 High Performance
	IP-FORWARD-MIB IP-MIB HC-ALARM-MIB RFC1213-MIB LLDP-MIB MAU-MIB MPLS-L3VPN-STD-MIB MPLS-LSR-STD-MIB MPLS-VPN-MIB OLD-CISCO-CHASSIS-MIB OLD-CISCO-CPU-MIB OLD-CISCO-INTERFACES-MIB OLD-CISCO-IP-MIB OLD-CISCO-SYS-MIB OLD-CISCO-TCP-MIB OLD-CISCO-TS-MIB OLD-CISCO-MEMORY-MIB CISCO-POWER-ETHERNET-MIB CISCO-RMON2-MIB CISCO-RMON-MIB SNMPv2-MIB UDP-MIB CISCO-IMAGE-MIB CISCO-STACKWISE-MIB SMON-MIB SONET-MIB TCP-MIB CISCO-IPSEC-FLOW-MONITOR-MIB CISCO-IPSEC-MIB CISCO-IPSEC-PROVISIONING-MIB CISCO-IPSLA-AUTOMEASURE-MIB CISCO-IPSLA-ECHO-MIB CISCO-IPSLA-JITTER-MIB CISCO-L2-CONTROL-MIB	CISCO-TCP-MIB CISCO-TRUSTSEC-INTERFACE-MIB CISCO-TRUSTSEC-MIB CISCO-TRUSTSEC-POLICY-MIB CISCO-TRUSTSEC-SERVER-MIB CISCO-TRUSTSEC-SXP-MIB CISCO-UDLD-MIB CISCO-VLAN-IFTABLE-RELATIONSHIP-MIB CISCO-VLAN-MEMBERSHIP-MIB CISCO-VRF-MIB CISCO-VTP-MIB ENTITY-MIB ENTITY-STATE-MIB EtherLike-MIB HC-ALARM-MIB HC-RMON-MIB IEEE8021-PAE-MIB IEEE8023-LAG-MIB IF-MIB IGMP-STD-MIB IP-FORWARD-MIB IP-MIB IPMROUTE-STD-MIB LISP-MIB LLDP-EXT-MED-MIB LLDP-MIB MAU-MIB MPLS-L3VPN-STD-MIB MPLS-LDP-GENERIC-STD-MIB MPLS-LDP-MIB MPLS-LSR-STD-MIB MPLS-VPN-MIB MSDP-MIB NHRP-MIB NOTIFICATION-LOG-MIB NTPv4-MIB OLD-CISCO-CHASSIS-MIB OLD-CISCO-CPU-MIB OLD-CISCO-INTERFACES-MIB OLD-CISCO-IP-MIB OLD-CISCO-MEMORY-MIB OLD-CISCO-SYS-MIB

Description	Cisco Catalyst 9500	Cisco Catalyst 9500 High Performance
		OLD-CISCO-SYSTEM-MIB OLD-CISCO-TCP-MIB OLD-CISCO-TS-MIB OSPF-MIB OSPF-TRAP-MIB OSPFV3-MIB PIM-MIB RFC1213-MIB RMON-MIB RMON2-MIB SNMP-COMMUNITY-MIB SNMP-FRAMEWORK-MIB SNMP-MPD-MIB SNMP-NOTIFICATION-MIB SNMP-PROXY-MIB SNMP-TARGET-MIB SNMP-USM-MIB SNMP-VIEW-BASED-ACM-MIB SNMPv2-MIB TCP-MIB UDP-MIB CISCO-802-TAP-MIB CISCO-TAP2-MIB CISCO-IP-TAP-MIB
Standards	IEEE 802.1s IEEE 802.1w IEEE 802.1x IEEE 802.3ae for 10G SKU IEEE 802.3ae, IEEE 802.3ba on the 40G SKU IEEE 802.1x-Rev IEEE 802.3ad IEEE 802.3x full duplex on 10BASE-T, 100BASE-TX, and 1000BASE-T ports IEEE 802.1D Spanning Tree Protocol IEEE 802.1p Class-of-service (CoS) prioritization IEEE 802.1Q VLAN IEEE 802.3 10BASE-T specification IEEE 802.3u 100BASE-TX specification IEEE 802.3ab 1000BASE-T specification IEEE 802.3z 1000BASE-X specification RMON I and II standards SNMPv1, SNMPv2c, and SNMPv3	

Safety and compliance

Table 17 lists the safety and compliance information for the Cisco Catalyst 9500 Series

Table 17. Safety and compliance information

Description	Specification
Safety certifications	<p>C9500-12Q, C9500-24Q, C9500-40X, C9500-16X</p> <ul style="list-style-type: none">• UL 60950-1• CAN/CSA-C22.2 No. 60950-1• EN 60950-1• IEC 60950-1• AS/NZS 60950-1• GB4943 <p>C9500-32C, C9500-32QC, C9500-24Y4C, C9500-48Y4C</p> <ul style="list-style-type: none">• IEC 60950-1 plus Am1, Am2 Am9, Am10, Am11, Am12 and all deviations and differences• AS/NZS 60950.1.2011• CAN/CSA-C22.2 No. 60950-1-07• GB 4943-95• EN 60950-1; 2006 plus Am1, Am 2, Am9, Am10, Am11, Am12 and all deviations and differences• NOM-019-SCFI-1998• UL 60950-1, Second Edition
EMI and EMC compliance	<p>47 CFR Part 15 Class A</p> <p>CNS13438: 2006 Class A</p> <p>EN 300 386 V1.6.1</p> <p>EN61000-3-2: 2014</p> <p>EN61000-3-3: 2013</p> <p>ICES-003 Issue 6: 2016 Class A</p> <p>KN 32: 2015 Class A</p> <p>TCVN 7189: 2009 Class A</p> <p>EN 55032:2012/ AC:2013 Class A</p> <p>EN 55032:2015 Class A</p> <p>CISPR 32 Edition 2 Class A</p> <p>V-2/2015.04 Class A</p> <p>V-3/2015.04 Class A</p> <p>CISPR24: 2010 + A1: 2015</p> <p>EN 300 386 V1.6.1</p> <p>EN55024: 2010 + A1: 2015</p> <p>KN35: 2015</p> <p>TCVN 7317: 2003</p>

Warranty

Cisco Enhanced Limited Lifetime Hardware Warranty

The Cisco Catalyst 9500 Series Switches come with an Enhanced Limited Lifetime Warranty (E-LLW) that includes Next-Business-Day (NBD) delivery of replacement hardware where available and 90 days of 8x5 Cisco Technical Assistance Center (TAC) support. Your formal warranty statement, including the warranty applicable to Cisco software, appears in the information packet that accompanies your Cisco product. We encourage you to carefully review the warranty statement shipped with your specific product before use. Cisco reserves the right to refund the purchase price as its exclusive warranty remedy. For further information about warranty terms, visit <https://www.cisco.com/go/warranty>.

Table 18 provides information about the E-LLW

Table 18. E-LLW details

	Cisco E-LLW
Devices covered	Applies to Cisco Catalyst 9500 Series Switches.
Warranty duration	As long as the original customer owns the product.
End-of-life policy	In the event of discontinuance of product manufacture, Cisco warranty support is limited to 5 years from the announcement of discontinuance.
Hardware replacement	Cisco or its service center will use commercially reasonable efforts to ship a replacement for NBD delivery, where available. Otherwise, a replacement will be shipped within 10 working days after receipt of the Return Materials Authorization (RMA) request. Actual delivery times might vary depending on customer location.
Effective date	Hardware warranty commences from the date of shipment to customer (and in case of resale by a Cisco reseller, not more than 90 days after original shipment by Cisco).
TAC support	Cisco will provide during business hours, 8 hours per day, 5 days per week, basic configuration, diagnosis, and troubleshooting of device-level problems for up to a 90-day period from the date of shipment of the originally purchased Cisco Catalyst 9500 Series product. This support does not include solution or network-level support beyond the specific device under consideration.
Cisco.com access	Warranty allows guest access only to Cisco.com.

Cisco environmental sustainability

Information about Cisco's environmental sustainability policies and initiatives for our products, solutions, operations, and extended operations or supply chain is provided in the "Environment Sustainability" section of Cisco's [Corporate Social Responsibility](#) (CSR) Report.

Reference links to information about key environmental sustainability topics (mentioned in the "Environment Sustainability" section of the CSR Report) are provided in the following table:

Sustainability topic	Reference
Information on product material content laws and regulations	Materials
Information on electronic waste laws and regulations, including products, batteries, and packaging	WEEE compliance

Cisco makes the packaging data available for informational purposes only. It may not reflect the most current legal developments, and Cisco does not represent, warrant, or guarantee that it is complete, accurate, or up to date. This information is subject to change without notice.

Cisco and partner services

Cisco and partner services offer various personalized services to enable IoT, cloud and secure networks. You can purchase advanced services designed to meet your business needs and help you maintain high-quality network performance while controlling operational costs. Please refer to Table 19 for more information on Cisco's Technical Services available for the Cisco Catalyst 9500 Series Switches.

Table 19. Technical Services

Cisco Technical Services
Cisco Smart Net Total Care® Service <ul style="list-style-type: none">• Around-the-clock, global access to the Cisco TAC• Unrestricted access to the extensive Cisco.com knowledge base and tools• NBD, 8x5x4, 24x7x4, and 24x7x2 advance hardware replacement and onsite parts replacement and installation available• Ongoing operating system software updates within the licensed feature set¹• Proactive diagnostics and real-time alerts on Smart Call Home-enabled devices
Cisco Smart Foundation Service <ul style="list-style-type: none">• NBD advance hardware replacement as available• Access during business hours to Small and Medium-sized Business (SMB) TAC (access levels vary by region)• Access to Cisco.com SMB knowledge base• Online technical resources through Smart Foundation portal• Operating system software bug fixes and patches
Cisco SP Base Service <ul style="list-style-type: none">• Around-the-clock, global access to the Cisco TAC• Registered access to Cisco.com• NBD, 8x5x4, 24x7x4, and 24x7x2 advance hardware replacement; return to factory option available²• Ongoing operating system software updates¹
Cisco Focused Technical Support Services <ul style="list-style-type: none">• Three levels of premium, high-touch services are available:<ul style="list-style-type: none">◦ Cisco High-Touch Operations Management Service◦ Cisco High-Touch Technical Support Service◦ Cisco High-Touch Engineering Service• Valid Cisco Smart Net Total Care or SP Base contracts are required on all network equipment

¹ Cisco operating system updates include the following: maintenance releases, minor updates, and major updates within the licensed feature set.

² Advance hardware replacement is available in various service-level combinations. For example, 8x5xNBD indicates that shipment will be initiated during the standard 8-hour business day, 5 days a week (the generally accepted business days within the relevant region), with NBD delivery. Where NBD is not available, same-day shipping is provided. Restrictions apply. For details, review the appropriate service descriptions.

[Learn more about available services.](#)

Software policy for Cisco Catalyst 9500 Series Switches

Cisco DNA Software for Access Switching is available for the Cisco Catalyst 9500.

Cisco DNA Software for Access Switching offers comprehensive solutions for the enterprise campus and branch offices. Cisco DNA for Access Switching introduces a simpler and more economical way to deploy access, aggregation, and core switches across enterprise campus and branch locations.

The Cisco DNA Subscription for Switching offer delivers an unbound network on an open and extensible architecture to help you navigate the digital journey. This subscription offer simplifies the buying process and includes lower initiation costs and flexible terms. It includes: Cisco DNA Premier with full Cisco Digital Network Architecture (Cisco DNA) capabilities and Cisco Software-Defined Access (SD-Access).

For ordering information for Cisco DNA Software for the Cisco Catalyst 9500 Series, go to <https://www.cisco.com/c/en/us/products/software/one-access/switching-part-numbers.html>.

Software policy for network stack components

Customers with the Network Essential Stack and Network Advantage Stack software feature sets will be provided with maintenance updates and bug fixes. These are designed to maintain compliance of the software with published specifications, release notes, and industry standards as long as the original end user continues to own or use the product or for up to one year from the end-of-sale date for the product, whichever occurs earlier.

Cisco Embedded Support for Cisco DNA term components

Cisco Embedded Support delivers the right support for Cisco software products and suites. It will keep your business applications performing as expected and protect your investment. Cisco Embedded Support for the Cisco DNA Essentials and Cisco DNA Advantage term components is included as part of the switch value. Embedded Support provides access to TAC support, major software updates, maintenance and minor software releases, and the Cisco Software Support site, for increased productivity with anytime access.

Table 20. Cisco DNA Term Support on the 9500 Series

Model	C9500-DNA-A-3Y/5Y/7Y or C9500-DNA-E-3Y/5Y/7Y	C9500-DNA-L-A-3Y/5Y/7Y or C9500-DNA-L-E-3Y/5Y/7Y
C9500-32C	Yes	No
C9500-32QC	Yes	No
C9500-48Y4C	Yes	No
C9500-24Y4C	No	Yes
C9500-24Q	Yes	No
C9500-12Q	No	Yes
C9500-40X	Yes	No
C9500-16X	No	Yes

Ordering information

To place an order, visit the Cisco Ordering home page at:

https://www.cisco.com/en/US/ordering/or13/or8/order_customer_help_how_to_order_listing.html.

Table 21 lists ordering information for the Cisco Catalyst 9500 Series

Table 21. Ordering information

Product number	Product description
C9500-32C-E	Cisco Catalyst 9500 Series high performance 32-port 100G switch, NW Ess. License
C9500-32C-A	Cisco Catalyst 9500 Series high performance 32-port 100G switch, NW Adv. License
C9500-32QC-E	Cisco Catalyst 9500 Series high performance 32-port 40G switch, NW Ess. License
C9500-32QC-A	Cisco Catalyst 9500 Series high performance 32-port 40G switch, NW Adv. License
C9500-48Y4C-E	Cisco Catalyst 9500 Series high performance 48-port 25G switch, NW Ess. License
C9500-48Y4C-A	Cisco Catalyst 9500 Series high performance 48-port 25G switch, NW Adv. License
C9500-24Y4C-E	Cisco Catalyst 9500 Series high performance 24-port 1/10/25G switch, NW Ess. License
C9500-24Y4C-A	Cisco Catalyst 9500 Series high performance 24-port 1/10/25G switch, NW Adv. License
C9500-24Q-E	Cisco Catalyst 9500 24-port 40G switch, NW Ess. License
C9500-24Q-A	Cisco Catalyst 9500 24-port 40G switch, NW Adv. License
C9500-12Q-E	Cisco Catalyst 9500 12-port 40G switch, NW Ess. License
C9500-12Q-A	Cisco Catalyst 9500 12-port 40G switch, NW Adv. License
C9500-40X-E	Cisco Catalyst 9500 40-port 10G switch, NW Ess. License
C9500-40X-A	Cisco Catalyst 9500 40-port 10G switch, NW Adv. License
C9500-16X-E	Cisco Catalyst 9500 16-port 10G switch, NW Ess. License
C9500-16X-A	Cisco Catalyst 9500 16-port 10G switch, NW Adv. License
C9500-NM-2Q	Cisco Catalyst 9500 2 x 40GE Network Module
C9500-NM-8X	Cisco Catalyst 9500 8 x 10GE Network Module
C9500-NM-2Q=	Cisco Catalyst 9500 2 x 40GE Network Module Spare
C9500-NM-8X=	Cisco Catalyst 9500 8 x 10GE Network Module Spare
C9500-48X-A	Cisco Catalyst 9500 40-port 10G switch, 8 x 10GE Network Module, NW Adv. License
C9500-48X-E	Cisco Catalyst 9500 40-port 10G switch, 8 x 10GE Network Module, NW Ess. License
C9500-24X-A	Cisco Catalyst 9500 16-port 10G switch, 8 x 10GE Network Module, NW Adv. License

Product number	Product description
C9500-24X-E	Cisco Catalyst 9500 16-port 10G switch, 8 x 10GE Network Module, NW Ess. License
C9500-16X-2Q-A	Cisco Catalyst 9500 16-port 10G switch, 2 x 40GE Network Module, NW Adv. License
C9500-16X-2Q-E	Cisco Catalyst 9500 16-port 10G switch, 2 x 40GE Network Module, NW Ess. License
C9500-40X-2Q-A	Cisco Catalyst 9500 40-port 10G switch, 2 x 40GE Network Module, NW Adv. License
C9500-40X-2Q-E	Cisco Catalyst 9500 40-port 10G switch, 2 x 40GE Network Module, NW Ess. License
Cisco DNA License Upgrade	Upgrade from Essentials to Advantage
C9500-LIC=	Electronic SW License for C9500 Switches
Cisco DNA Term Licenses	
C9500-DNA-P *	C9500 C1 Advantage Term, High-port density: Includes Term Licenses for Cisco DNA Advantage, 25 ISE Base & 25 ISE Plus Endpoints, 25 Stealthwatch Flows (including Virtual Flow Collector & Management Console). Requires separate purchase of ISE appliance/ISE VM and Cisco DNA Center appliance
C9500-DNA-P-3Y	C9500 C1 Advantage, High-port density, 3Y Term - DNA, 25 ISE PLS and ISE BASE, 25 SWATCH
C9500-DNA-P-5Y	C9500 Cisco DNA Premier, High-port density, 5Y Term - DNA, 25 ISE PLS and ISE BASE, 25 SWATCH
C9500-DNA-P-7Y	C9500 Cisco DNA Premier, High-port density, 7Y Term - DNA, 25 ISE PLS and ISE BASE, 25 SWATCH
C9500-DNA-L-P *	C9500 Cisco DNA Premier Term, Low-port density: Includes Term Licenses for Cisco DNA Advantage, 25 ISE Base & 25 ISE Plus Endpoints, 25 Stealthwatch Flows (including Virtual Flow Collector & Management Console). Requires separate purchase of ISE appliance/ISE VM and Cisco DNA Center appliance
C9500-DNA-L-P-3Y	C9500 Cisco DNA Premier, Low-port density, 3Y Term - DNA, 25 ISE PLS and ISE BASE, 25 SWATCH
C9500-DNA-L-P-5Y	C9500 Cisco DNA Premier, Low-port density, 5Y Term - DNA, 25 ISE PLS and ISE BASE, 25 SWATCH
C9500-DNA-L-P-7Y	C9500 Cisco DNA Premier, Low-port density, 7Y Term - DNA, 25 ISE PLS and ISE BASE, 25 SWATCH
C9500-DNA-P-L *	C9500 Cisco DNA Premier Add-On Term: Includes Term Licenses for 25 ISE Base & 25 ISE Plus Endpoints, 25 Stealthwatch Flows (including Virtual Flow Collector & Management Console). Requires separate purchase of ISE appliance/ISE VM and Cisco DNA Center appliance
C9500-DNA-P-AA	C9500 Cisco DNA Premier Add-On 3Y Term - 25 ISE PLS and ISE BASE, 25 SWATCH
C9500-DNA-P-AA	C9500 Cisco DNA Premier Add-On 5Y Term - 25 ISE PLS and ISE BASE, 25 SWATCH
C9500-DNA-P-AA	C9500 Cisco DNA Premier Add-On 7Y Term - 25 ISE PLS and ISE BASE, 25 SWATCH
C9500-DNA-E-3Y	Catalyst 9500 NW & Cisco DNA Essentials. license (3Y) for 24Q, 40X, 32C, 32QC, 48Y4C SKU

Product number	Product description
C9500-DNA-E-5Y	Catalyst 9500 NW & Cisco DNA Essentials. license (5Y) for 24Q, 40X, 32C, 32QC, 48Y4C SKU
C9500-DNA-E-7Y	Catalyst 9500 NW & Cisco DNA Essentials. license (7Y) for 24Q, 40X, 32C, 32QC, 48Y4C SKU
C9500-DNA-A-3Y	Catalyst 9500 NW & Cisco DNA Advantage license (3Y) for 24Q, 40X, 32C, 32QC, 48Y4C SKU
C9500-DNA-A-5Y	Catalyst 9500 NW & Cisco DNA Advantage license (5Y) for 24Q, 40X, 32C, 32QC, 48Y4C SKU
C9500-DNA-A-7Y	Catalyst 9500 NW & Cisco DNA Advantage license (7Y)
C9500-DNA-L-E-3Y	Catalyst 9500 NW & Cisco DNA Essentials. low port density license (3Y) for 12Q, 16X, 24Y4C SKU
C9500-DNA-L-E-5Y	Catalyst 9500 NW & Cisco DNA Essentials. low port density license (5Y) for 12Q, 16X, 24Y4C SKU
C9500-DNA-L-E-7Y	Catalyst 9500 NW & Cisco DNA Essentials. low port density license (7Y) for 12Q, 16X, 24Y4C SKU
C9500-DNA-L-A-3Y	Catalyst 9500 NW & Cisco DNA Advantage low port density license (3Y) for 12Q, 16X, 24Y4C SKU
C9500-DNA-L-A-5Y	Catalyst 9500 NW & Cisco DNA Advantage low port density license (5Y) for 12Q, 16X, 24Y4C SKU
C9500-DNA-L-A-7Y	Catalyst 9500 NW & Cisco DNA Advantage low port density license (7Y) for 12Q, 16X, 24Y4C SKU
Power supplies, cables, and fan for the Cisco Catalyst 9500 Series	
C9K-PWR-1600WAC-R	1600W AC Power Supply
C9K-PWR-650WAC-R	650W AC Power Supply
C9K-PWR-1600WDC-R	1600W DC Power Supply
C9K-PWR-930WDC-R	930W DC Power Supply
C9K-PWR-1600WACR/2	1600W AC Power Supply, Redundant
C9K-PWR-650WAC-R/2	650W AC Power Supply, Redundant
C9K-PWR-1600WDCR/2	1600W DC Power Supply, Redundant
C9K-PWR-930WDC-R/2	930W DC Power Supply, Redundant
C9K-PWR-C4-BLANK	Catalyst 9500 power supply blank cover
C9K-PWR-C5-BLANK	Catalyst 9500 power supply blank cover
C9K-T1-FANTRAY	Catalyst 9500 fan tray
FAN-T4-R	Catalyst 9500 Type 4 front to back cooling Fan
PWR-C4-950WAC-R	950W AC Config 4 Power Supply front to back cooling
PWR-C4-950WAC-R/2	950W AC Config 4 Power Supply front to back cooling, Redundant

Product number	Product description
PWR-C4-BLANK	Catalyst 9500 power supply blank cover
CAB-C15-CBN-JP	Japan Cabinet Jumper Power Cord, 250 VAC 12A, C14-C15
CAB-TA-250V-JP	Japan 250V AC Type A Power Cable
CAB-TA-AP	Australia AC Type A Power Cable
CAB-TA-AR	Argentina AC Type A Power Cable
CAB-TA-DN	Denmark AC Type A Power Cable
CAB-TA-EU	Europe AC Type A Power Cable
CAB-TA-IN	India AC Type A Power Cable
CAB-TA-IS	Israel AC Type A Power Cable
CAB-TA-IT	Italy AC Type A Power Cable
CAB-TA-SW	Switzerland AC Type A Power Cable
CAB-TA-UK	United Kingdom AC Type A Power Cable
CAB-TA-NA	North America AC Type A Power Cable
CAB-C15-CBN	Cabinet Jumper Power Cord, 250 VAC 13A, C14-C15 Connectors
CAB-TA-JP	Japan AC Type A Power Cable
Spare accessory and rack mount kits for the Cisco Catalyst 9500 Series	
C9500-ACCKITH-19I=	Accessory Kit for Cisco Catalyst 9500 Series – High-End – 19" rack mount
C9500-ACCKITH-23I=	Accessory Kit for Cisco Catalyst 9500 Series – High-End – 23" rack mount
C9500-4PTH-KIT=	Extension rails and brackets for four-point mounting for Cisco Catalyst 9500 Series – High-End
C9500-ACC-KIT-19I=	Accessory Kit for Cisco Catalyst 9500 Series – 19" rack mount
C9500-ACC-KIT-23I=	Accessory Kit for Cisco Catalyst 9500 Series – 23" rack mount
C9500-4PT-KIT=	Extension rails and brackets for four-point mounting for Cisco Catalyst 9500 Series

* Cisco DNA Premier midcycle refresh SKUs can be found under C1-CAT-ADD-T.

For ordering information for Cisco DNA Software for the Cisco Catalyst 9500 Series Switches, go to <https://www.cisco.com/c/en/us/products/software/one-access/switching-part-numbers.html>.

Optics support

The Cisco Catalyst 9500 Series supports a wide range of optics. Because the list of supported optics is updated on a regular basis, please consult the tables available here for the latest compatibility information: <https://www.cisco.com/c/en/us/support/interfaces-modules/transceiver-modules/products-device-support-tables-list.html>.

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Document history

New or revised topic	Described In	Date
Added NEBS Certification details, 16.11.1 features, VLAN ID correction, SDM template corrections, SVL	Page 13 , 14 , 15 , 22 , 23 , 24	April 16, 2019
Cisco Catalyst 9500 Series spec change	Updated Page 3	January 11 th 2019
Product highlights changes (switching capacity and ports spec changes)	Updated Page 4	January 11 th 2019
Cisco Catalyst 9500 Series configurations and port density spec changes	Updated Page 7	January 11 th 2019
Performance spec changes	Updated Page 13	January 11 th 2019
Text changes to “Important Note”	Updated Page 14	January 11 th 2019
Text changes to “Cisco StackWise Virtual”	Updated Page 16	January 11 th 2019
Text changes to “Trustworthy systems” and “Cisco StackWise Virtual”	Updated Page 18	January 11 th 2019
Added text for Layer 3 Subinterface and BGP EVPN with VXLAN	Updated Page 20	January 11 th 2019
Deleted text for “High-performance IP routing” and spec edits to “Minimum software requirements”	Updated Page 22	January 11 th 2019
Text changes to “Licensing” and spec edits to “Network Essentials and Advantage Package Features”	Updated Page 23	January 11 th 2019
Text changes to “Cisco DNA Essentials and Advantage Package Features”	Updated Page 24	January 11 th 2019
Added product numbers for “Cisco Catalyst 9500 Series”	Updated Page 33	January 11 th 2019
Deleted product numbers for “Cisco Catalyst 9500 Series”	Updated Page 34	January 11 th 2019
Product highlights changes (switching capacity and ports spec changes)	Updated Page 4	January 11 th 2019
Updates to Table 1	Updated Table 1	August 15 th 2018
Added clearer description of SKUs, Updated date for Tables 1, 10, 11	Updated SKU descriptions, Table 11 data , Table 10 data , Table 1 Footnotes	July 3 rd 2018
Added clearer descriptions of host routes and scale adjacency in hardware	Updated Table 10 Footnotes	June 1 st 2018

New or revised topic	Described In	Date
Added Catalyst 9500 high density platforms and updated associated speeds and densities, e.g. Up to 6.4-Tbps switching capacity with up to 2 Bpps of forwarding performance from “3.2 Tbps/1 Bpps” a. 32 port 100G, b. 32 port 40G, c. 48 port 25G. Added Catalyst 9500 mid density platform a. 24 port 25G, b. 16 port 1/10G. Added new optical interfaces – QSFP28, SFP28. Added new power supply options – 650W, 1600W. Added RESCONF support. StackWise Virtual extended to all Catalyst 9500 platforms.	Updated Product Overview	Mar 31 st 2018
AVB support noted for certain platforms. Corrected references to Catalyst 9000 switches, rather than Catalyst 9000 Series switches. Corrected references to Cisco IOS XE, rather than IOS-XE.	Updated Audio Video Bridging	Dec 15 th 2017

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Cisco Nexus 7700 Switches Data Sheet

Product Overview

The Cisco Nexus[®] 7000 Series Switches are the foundation of the Cisco[®] Unified Fabric solution. Designed to meet the requirements of mission-critical data centers, these switches deliver exceptional availability, outstanding scalability, and the proven and comprehensive Cisco NX-OS Software data center switching feature set.

The Cisco Nexus 7700 Switches are the latest extension to the Cisco Nexus 7000 Series modular switches. With more than 83 terabits per second (Tbps) of overall switching capacity, the Cisco Nexus 7700 Switches delivers the highest-capacity 10, 40, and 100 Gigabit Ethernet ports in the industry, with up to 768 native 10-Gbps ports, 384 40-Gbps ports, or 192 100-Gbps ports. This high system capacity is designed to meet the scalability requirements of the largest cloud environments.

The Cisco Nexus 7700 switches (Figure 1) have operational and feature consistency with the existing Cisco Nexus 7000 Series Switches, using common system architecture, the same application-specific integrated circuit (ASIC) technology, and the same proven Cisco NX-OS Software releases.

Figure 1. Cisco Nexus 7700 Switches



Features and Benefits

Powered by Cisco NX-OS, the Cisco Nexus 7700 switches deliver a comprehensive set of features with nonstop operations in four chassis form factors:

- Cisco Nexus 7700 2-Slot Switch: A 2-slot switch with two front-accessible module slots with front-to-back airflow and an integrated cable management system
- Cisco Nexus 7700 6-Slot Switch: A 6-slot switch with six front-accessible module slots with front-to-back airflow and an integrated cable management system

- Cisco Nexus 7700 10-Slot Switch: A 10-slot switch with 10 front-accessible module slots with front-to-back airflow and an integrated cable management system
- Cisco Nexus 7700 18-Slot Switch: An 18-slot switch with 18 front-accessible module slots and front-to-back airflow with integrated cable management system

All Cisco Nexus 7000 Series chassis use a passive mid-plane architecture, providing physical connectors and copper traces for interconnecting the fabric modules and I/O modules for direct data transfer. All inter-module switching is performed via crossbar fabric ASICs on the individual I/O modules and fabric modules.

A scalable, fully distributed fabric architecture uses up to six fabric modules to deliver up to 1.32 Tbps per slot of bandwidth in the Cisco Nexus 7700 6-, 10-, and 18-slot switches on day one. In case of the Cisco Nexus 7700 2-slot chassis, the fabric modules are not required since it uses a single I/O module. The midplane design on the 2-, 6-, 10-, and 18-slot chassis supports flexible technology upgrades as your needs change, providing ongoing investment protection. Future fabric modules will allow higher bandwidth capabilities on the platform.

Cisco Nexus 7700 2-Slot Switch

- The Cisco Nexus 7700 2-Slot Switch, with one I/O module slots, supports up to 48 x 1 and 10 Gigabit Ethernet ports, 24 x 40 Gigabit Ethernet ports, or 12 x 100 Gigabit Ethernet ports, to meet the demands of small campus and data center deployments in a compact 3 rack units (RU) footprint.
- The Cisco Nexus 7700 2-Slot Switch has one dedicated half-slot supervisor.
- The Cisco Nexus 7700 2-slot chassis does not include any fabric modules as it has a single module only. The system is capable of supporting all current and future Cisco Nexus 7700 modules at full line-rate switching capacity.
- Front-to-back airflow helps ensure that the Cisco Nexus 7702 addresses the requirement for hot-aisle and cold-aisle deployments, to help provide efficient cooling.
- The system uses one fan tray for cooling. The fan tray is composed of three independent variable-speed fans that automatically adjust to the ambient temperature, helping to reduce power consumption in well-managed facilities while supporting optimum operation of the switch.
- The system supports an optional door and air filter to help ensure clean airflow through the system. The addition of the air filter satisfies Network Equipment Building Standards (NEBS) requirements.
- The Cisco Nexus 7700 2-Slot Switch can have up to two 3- or 3.5-kilowatt (KW) power supplies. The redundant power supply configuration provides more flexibility in power redundancy configuration.
- The I/O module, supervisor module, and power supplies are accessible from the front, and the fan tray is accessible from the back of the chassis.
- The I/O module, supervisor module, and power supplies are inter-changeable across all Cisco Nexus 7700 chassis.

Cisco Nexus 7700 6-Slot Switch

- The Cisco Nexus 7700 6-Slot Switch, with up to four I/O module slots, supports up to 192 x 1 and 10 Gigabit Ethernet ports, 96 x 40 Gigabit Ethernet ports, and 48 x 100 Gigabit Ethernet ports, meeting the demands of small to medium data center deployments in a compact 9 Rack Units (RU) footprint.
- The Cisco Nexus 7700 6-Slot Switch has two dedicated half-slot supervisors to provide full redundancy, stateful supervisor switchover, and hitless In-Service Software Upgrade (ISSU) capabilities.

- The Cisco Nexus 7706 has six fabric module slots to provide simultaneously active fabric channels to each of the I/O and supervisor modules. Through the parallel forwarding fabric architecture, the Cisco Nexus 7706 can achieve 10.5 Tbps of forwarding capacity or more.
- Front-to-back airflow helps ensure that the Cisco Nexus 7706 addresses the requirement for hot-aisle and cold-aisle deployments to help provide efficient cooling.
- The system uses three redundant fan trays for cooling. Each fan tray is composed of independent variable-speed fans that automatically adjust to the ambient temperature, helping reduce power consumption in well-managed facilities while helping enable optimum operation of the switch. The system also allows hot swapping of fan trays without negatively affecting the system.
- The system supports an optional door and air filter to help ensure clean airflow through the system. The addition of the air filter satisfies Network Equipment Building Standards (NEBS) requirements.
- The Cisco Nexus 7700 6-Slot Switch can have up to four 3- or 3.5-(kW) power supplies. The smaller power supply configuration provides more flexibility and greater control in power provisioning. The four power supply bays are designed for future growth.
- I/O modules, supervisor modules, and power supplies are accessible from the front, and fabric modules and fan trays are accessible from the back of the chassis.

Cisco Nexus 7700 10-Slot Switch

- The Cisco Nexus 7700 10-Slot Switch, with up to eight I/O module slots, supports up to 384 x 1 and 10 Gigabit Ethernet ports, 192 x 40 Gigabit Ethernet ports, and 96 x 100 Gigabit Ethernet ports, to meet the demands of large data center deployments.
- The Cisco Nexus 7700 10-Slot Switch has two dedicated half-slot supervisors to provide full redundancy, stateful supervisor switchover, and hitless In-Service Software Upgrade (ISSU) capabilities.
- The Cisco Nexus 7710 has six fabric module slots to provide simultaneously active fabric channels to each of the I/O and supervisor modules. Through the parallel forwarding fabric architecture, the Cisco Nexus 7710 can achieve 21 Tbps of forwarding capacity or more.
- Front-to-back airflow helps ensure that the Cisco Nexus 7710 addresses the requirement for hot-aisle and cold-aisle deployments to help provide efficient cooling.
- The system uses three redundant fan trays for cooling. Each fan tray is composed of independent variable-speed fans that automatically adjust to the ambient temperature, to help reduce power consumption in well-managed facilities while helping to enable optimum operation of the switch. The system also allows hot swapping of fan trays without negatively affecting the system.
- The system supports an optional door and air filter to promote clean airflow through the system. The addition of the air filter satisfies Network Equipment Building Standards (NEBS) requirements.
- The Cisco Nexus 7700 10-Slot Switch can have up to eight 3- or 3.5-(kW) power supplies. The smaller power supply configuration provides more flexibility and greater control in power provisioning. The eight power supply bays are designed for future growth, and most common configurations do not require the use of all power supply units for redundant power configurations.
- I/O modules, supervisor modules, and power supplies are accessible from the front, and fabric modules and fan trays are accessible from the back of the chassis.

Cisco Nexus 7700 18-Slot Switch

- The Cisco Nexus 7700 18-Slot Switch, with up to 16 I/O module slots, supports up to 768 x 1 and 10 Gigabit Ethernet ports, 384 x 40 Gigabit Ethernet ports, and 192 x 100 Gigabit Ethernet ports, to meet the demands of the largest data center deployments.
- The Cisco Nexus 7700 18-Slot Switch has two dedicated half-slot supervisors to provide full redundancy, stateful supervisor switchover, and hitless In-Service Software Upgrade (ISSU) capabilities.
- The Cisco Nexus 7700 18-Slot Switch has six fabric module slots to provide simultaneously active fabric channels to each of the I/O and supervisor modules. Through the parallel forwarding fabric architecture, the Cisco Nexus 7700 18-Slot Switch can achieve 42 Tbps of forwarding capacity or more.
- Front-to-back airflow helps ensure that the Cisco Nexus 7700 18-Slot Switch addresses the requirement for hot-aisle and cold-aisle deployments to support efficient cooling.
- The system uses three redundant fan trays for cooling. Each fan tray is composed of independent variable-speed fans that automatically adjust to the ambient temperature, to reduce power consumption in well-managed facilities while helping to enable optimum operation of the switch. The system also allows hot swapping of fan trays without negatively affecting the system.
- The system supports an optional door and air filter to help ensure clean airflow through the system. The addition of the air filter satisfies NEBS requirements.
- The Cisco Nexus 7700 18-Slot Switch can have up to sixteen 3- or 3.5-kW power supplies. The smaller power supply configuration provides more flexibility and greater control in power provisioning. The 16 power supply bays are designed for future growth, and most common configurations do not require the use of all power supply units for redundant power configurations.
- I/O modules, supervisor modules, and power supplies are accessible from the front, and fabric modules and fan trays are accessible from the back of the chassis.

Common Components on Cisco Nexus 7700 Switches

All Cisco Nexus 7700 Switches have the following components:

- An integrated cable management system, custom designed for the 2-, 6-, 10-, and 18-slot switches, supports the cabling requirements of a fully configured system at either or both sides of the switch, providing outstanding flexibility. All system components can easily be removed with the cabling in place, providing ease of maintenance with no disruption.
- A series of LEDs at the top of the chassis (except in case of the Cisco Nexus 7700 2-slot chassis) provides a clear summary of the status of the major system components, alerting operators to the need to conduct further investigation. These LEDs report the power supply, fan, fabric, supervisor, and I/O module status.

Energy-Efficient Design

The Cisco Nexus 7700 Switches use 3.5-kW and 3-kW power supplies that are 96 and 90 percent efficient or greater, so less power is dissipated as heat, and more power is available for the system to use than with typical power supplies. These high-efficiency power supplies allow smaller power configuration and provide flexible power provisioning.

The fan trays in the switches have variable speed fans that adjust to compensate for changing thermal characteristics and use less power at typical operating conditions. Standard fan trays are included as part of the Nexus 7700 2-, 6-, 10-, and 18-slot chassis. The Nexus 7700 6-, 10-, and 18-slot chassis also support optional generation 2 fan trays. All fan trays provide NEBS compliance in combination with the rest of the components of the chassis for specific system configurations. Additionally, the generation 2 fan trays provide NEBS Level-3 acoustic compliance and short term operation at 55C for the Nexus 7700 6-, 10-, and 18-slot chassis if configured with the Nexus 7700 M3 100G I/O modules or future I/O modules.

Consolidation of multiple switches to Cisco Nexus 7700 Switches is made possible by the high density of ports on the switches combined with high-performance device virtualization, comprehensive reliability, and availability features. This consolidation capability provides multiple benefits such as reduced power, cooling, and space requirements to save on costs.

Product Specifications

Table 1 lists the product specifications for the Cisco Nexus 7700 Switches.

Table 1. Product Specifications

Item	Specification			
	Cisco Nexus 7700 2-Slot Chassis	Cisco Nexus 7700 6-Slot Switch	Cisco Nexus 7700 10-Slot Switch	Cisco Nexus 7700 18-Slot Switch
Port count	48 x 10 Gbps, 24 x 40 Gbps, and 12 x 100 Gbps	192 x 10 Gbps, 96 x 40 Gbps, and 48 x 100 Gbps	384 x 10 Gbps, 192 x 40 Gbps, and 96 x 100 Gbps	768 x 10 Gbps, 384 x 40 Gbps, and 192 x 100 Gbps
Product compatibility	<ul style="list-style-type: none"> Supports all Cisco Nexus 7700 switch modules except the following: N77-F248XP-23E Does not use fabric modules 	<ul style="list-style-type: none"> Supports all Cisco Nexus 7700 Series Supervisor and I/O modules Supports Cisco Nexus 7700 Series Fabric-2 modules 	<ul style="list-style-type: none"> Supports all Cisco Nexus 7700 Series Supervisor and I/O modules Supports Cisco Nexus 7700 Series Fabric-2 modules 	<ul style="list-style-type: none"> Supports all Cisco Nexus 7700 Series Supervisor and I/O modules Supports Cisco Nexus 7700 Series Fabric-2 modules
Software compatibility	Cisco NX-OS Software Release 7.2 or later	Cisco NX-OS Software Release 6.2.6 or later	Cisco NX-OS Software Release 6.2.2 or later	Cisco NX-OS Software Release 6.2.2 or later
Options	<ul style="list-style-type: none"> Door air filter Lockable front module doors 	<ul style="list-style-type: none"> Door air filter Lockable front module doors 	<ul style="list-style-type: none"> Door air filter Lockable front module doors 	<ul style="list-style-type: none"> Door air filter Lockable front module doors Power supply center cable management
System forwarding capacity	No fabric modules All I/O modules are line rate	21 Tbps	42 Tbps	83 Tbps
Max local switching capacity	1.2 Tbps	1.2 Tbps	1.2 Tbps	1.2 Tbps
Max inter-slot switching capacity	n/a	1.2 Tbps	1.2 Tbps	1.2 Tbps
Reliability and availability	Online insert ion and removal (OIR) of redundant power supplies	OIR of all redundant components: supervisor and fabric modules, power supplies, and fan trays	OIR of all redundant components: supervisor and fabric modules, power supplies, and fan trays	OIR of all redundant components: supervisor and fabric modules, power supplies, and fan trays
MIBs	Supports Simple Network Management Protocol Version 3 (SNMPv3), v2c, and v1 (see Cisco NX-OS Software release notes for details about specific MIB support)	Supports SNMPv3, v2c, and v1 (see Cisco NX-OS Software release notes for details about specific MIB support)	Supports SNMPv3, v2c, and v1 (see Cisco NX-OS Software release notes for details about specific MIB support)	Supports SNMPv3, v2c, and v1 (see Cisco NX-OS Software release notes for details about specific MIB support)
Network management	Cisco Data Center Network Manager (DCNM)	Cisco Data Center Network Manager (DCNM)	Cisco Data Center Network Manager (DCNM)	Cisco Data Center Network Manager (DCNM)

Item	Specification			
Programming interfaces	<ul style="list-style-type: none"> • XML • Scriptable command-line interface (CLI) • Cisco DCNM web services • Python • Tool Command Language (TCL) • Cisco IOS® Embedded Event Manager (EEM) • Cisco One Platform Kit (OnePK™) • OpenFlow 	<ul style="list-style-type: none"> • XML • Scriptable CLI • Cisco DCNM web services • Python • TCL • Cisco IOS EEM • Cisco OnePK • OpenFlow 	<ul style="list-style-type: none"> • XML • Scriptable CLI • Cisco DCNM web services • Python • TCL • Cisco IOS EEM • Cisco OnePK • OpenFlow 	<ul style="list-style-type: none"> • XML • Scriptable CLI • Cisco DCNM web services • Python • TCL • Cisco IOS EEM • Cisco OnePK • OpenFlow
Physical specifications	<ul style="list-style-type: none"> • Required rack space: 3RU • 2-slot switch: 1 dedicated supervisor module and 1 I/O module • No fabric modules • 2 power supply slots • Dimensions (H x W x D): 5.15 x 17.3 x 29.1 in. (13.08 x 43.9 x 73.9 cm) • Chassis depth, including cable management and chassis doors, is 35.1 in. (89.15 cm) • Unit is rack-mountable in a standard 19-inch (482.6-mm) EIA rack; unit is also 2-post rack-mountable • Weight <ul style="list-style-type: none"> ◦ Chassis only: 37.5 lb (17 kg) ◦ Fan Tray: 13.5 lb (6.1 kg) • Supports 3-kW AC and DC and 3.5-kW HV AC/DC power supplies 	<ul style="list-style-type: none"> • Required rack space: 9RU • 6-slot switch: 2 dedicated supervisor modules and 4 I/O modules • 6 fabric module slots • 4 power supply slots • Dimensions (H x W x D): 15.6 x 17.3 x 32 in. (39.62 x 43.9 x 81.3 cm) • Chassis depth, including cable management and chassis doors, is 38 in. (96.52 cm) • Additional depth with Generation 2 fan tray is 1.75 in. (4.5 cm) • Unit is rack-mountable in a standard 19-inch (482.6-mm) EIA rack; unit is also 2-post rack-mountable • Weight <ul style="list-style-type: none"> ◦ Chassis only: 145 lb (65.8 kg) ◦ Fabric Module: 5.6 lb (2.5 kg) ◦ Fan Tray: 5.3 lb (2.4 kg) ◦ Fan Tray (Generation 2): 7.75 lb (3.5 kg) • Supports 3-kW AC and DC and 3.5-kW HV AC/DC power supplies 	<ul style="list-style-type: none"> • Required rack space: 14RU • 10-slot switch: 2 dedicated supervisor modules and 8 I/O modules • 6 fabric module slots • 8 power supply slots • Dimensions (H x W x D): 24.35 x 17.3 x 34 in. (61.85 x 43.9 x 86.4 cm) • Chassis depth, including cable management and chassis doors, is 40 in. (101.6 cm) • Additional depth with Generation 2 fan tray is 1.75 in. (4.5 cm) • Unit is rack-mountable in a standard 19-inch (482.6-mm) EIA rack • Weight <ul style="list-style-type: none"> ◦ Chassis only: 160 lb (72.6 kg) ◦ Fabric Module: 11 lb (5.0 kg) ◦ Fan Tray: 8.5 (3.9 kg) ◦ Fan Tray (Generation 2): 12 lb (5.4 kg) • Supports 3-kW AC and DC and 3.5-kW HV AC/DC power supplies 	<ul style="list-style-type: none"> • Required rack space: 26RU • 18-slot switch: 2 dedicated supervisor modules and 16 I/O modules • 6 fabric module slots • 16 power supply slots • Dimensions (H x W x D): 45.25 x 17.3 x 35 in. (114.9 x 43.9 x 88.9 cm) • Chassis depth, including cable management and chassis doors, is 41 in. (104.1 cm) • Additional depth with Generation 2 fan tray is 1.75 in. (4.5 cm) • Unit is rack-mountable in a standard 19-inch (482.6-mm) EIA rack • Weight <ul style="list-style-type: none"> ◦ Chassis only: 300 lb (136.0 kg) ◦ Fabric Module: 20 lb (9.1 kg) ◦ Fan Tray: 13.5 lb (6.1 kg) ◦ Fan Tray (Generation 2): 17.75 lb (8.1 kg) • Supports 3-kW AC and DC and 3.5-kW HV AC/DC power supplies
Environmental specifications	<ul style="list-style-type: none"> • Airflow direction: Front to back • Operating temperature: 32 to 104°F (0 to 40°C) • Operational relative humidity: 5 to 90%, noncondensing • Operating altitude: -500 to 13,123 ft. (agency certified 0 to 6500 ft.) • Seismic: Zone 4 per GR63 	<ul style="list-style-type: none"> • Airflow direction: Front to back • Operating temperature: 32 to 104°F (0 to 40°C) • Operational relative humidity: 5 to 90%, noncondensing • Operating altitude: -500 to 13,123 ft. (agency certified 0 to 6500 ft.) • Seismic: Zone 4 per GR63 	<ul style="list-style-type: none"> • Airflow direction: Front to back • Operating temperature: 32 to 104°F (0 to 40°C) • Operational relative humidity: 5 to 90%, noncondensing • Operating altitude: -500 to 13,123 ft. (agency certified 0 to 6500 ft.) • Seismic: Zone 4 per GR63 	<ul style="list-style-type: none"> • Airflow direction: Front to back • Operating temperature: 32 to 104°F (0 to 40°C) • Operational relative humidity: 5 to 90%, noncondensing • Operating altitude: -500 to 13,123 ft. (agency certified 0 to 6500 ft.) • Seismic: Zone 4 per GR63

Item	Specification			
	<ul style="list-style-type: none"> • Floor loading: 24 lbs per sq. ft. • Operational vibration • GR63, Section 5.4.2 • ETS 300 019-1-3, Class 3.1, Section 5.5 • Storage altitude: -1000 to 30,000 ft. • Storage temperature: -40 to 158°F (-40 to 70°C) • Storage relative humidity: 5 to 95%, noncondensing • Heat dissipation: Maximum 6650 BTUs per hour (actual dissipation will be lower, depending on the chassis configuration) 	<ul style="list-style-type: none"> • Floor loading: 92 lbs per sq. ft. • Operational vibration • GR63, Section 5.4.2 • ETS 300 019-1-3, Class 3.1, Section 5.5 • Storage altitude: -1000 to 30,000 ft. • Storage temperature: -40 to 158°F (-40 to 70°C) • Storage relative humidity: 5 to 95%, noncondensing • Heat dissipation: Maximum 26,280 BTUs per hour (actual dissipation will be lower, depending on the chassis configuration) 	<ul style="list-style-type: none"> • Floor loading: 122 lbs per sq. ft. • Operational vibration • GR63, Section 5.4.2 • ETS 300 019-1-3, Class 3.1, Section 5.5 • Storage altitude: -1000 to 30,000 ft. • Storage temperature: -40 to 158°F (-40 to 70°C) • Storage relative humidity: 5 to 95%, noncondensing • Heat dissipation: Maximum 52,500 BTUs per hour (actual dissipation will be lower, depending on the chassis configuration) 	<ul style="list-style-type: none"> • Floor loading: 230 lbs per sq. ft. • Operational vibration • GR63, Section 5.4.2 • ETS 300 019-1-3, Class 3.1, Section 5.5 • Storage altitude: -1000 to 30,000 ft. • Storage temperature: -40 to 158°F (-40 to 70°C) • Storage relative humidity: 5 to 95%, noncondensing • Heat dissipation: Maximum 96,160 BTUs per hour (actual dissipation will be lower, depending on the chassis configuration)
Regulatory compliance	<ul style="list-style-type: none"> • EMC compliance • FCC Part 15 (CFR 47) (USA) Class A • ICES-003 (Canada) Class A • EN55022 (Europe) Class A • CISPR22 (International) Class A • AS/NZS CISPR22 (Australia and New Zealand) Class A • VCCI (Japan) Class A • KN22 (Korea) Class A • CNS13438 (Taiwan) Class A • CISPR24 • EN55024 • EN50082-1 • EN61000-3-2 • EN61000-3-3 • EN61000-6-1 • EN300 386 			
Environmental standards	<ul style="list-style-type: none"> • NEBS criteria levels[*] <ul style="list-style-type: none"> ◦ SR-3580 NEBS Level 3 (GR-63-CORE and GR-1089-CORE) • Verizon NEBS compliance[*] <ul style="list-style-type: none"> ◦ Telecommunications Carrier Group (TCG) checklist • Century Link NEBS requirements[*] <ul style="list-style-type: none"> ◦ Telecommunications Carrier Group (TCG) checklist • ATT NEBS requirements[*] <ul style="list-style-type: none"> ◦ ATT TP76200 level 3 • ETSI[*] <ul style="list-style-type: none"> ◦ ETSI 300 019-2-1, Class 1.2 storage ◦ ETSI 300 019-2-2, Class 2.3 transportation ◦ ETSI 300 019-2-3, Class 3.2 stationary use <p>[*] Validation in progress</p>			
Safety	<ul style="list-style-type: none"> • UL/CSA/IEC/EN 60950-1 • AS/NZS 60950 			
Warranty	Cisco Nexus 7700 Switches come with the standard Cisco 1-year limited hardware warranty			

^{*} Based on Nexus 7700 Series Fabric 2 Modules

Software Requirements

All Cisco Nexus 7000 Series Switches are supported by Cisco NX-OS Software and Cisco Data Center Network Manager. Check Cisco NX-OS Software release notes (<http://www.cisco.com/c/en/us/support/switches/nexus-7000-series-switches/products-release-notes-list.html>) and Cisco DCNM release notes (<http://www.cisco.com/c/en/us/support/cloud-systems-management/prime-data-center-network-manager/products-release-notes-list.html>) for details.

For the latest information about recommended releases, see http://www.cisco.com/en/US/docs/switches/datacenter/sw/nx-os/recommended_releases/recommended_nx-os_releases.html.

Ordering Information

To place an order, visit the [Cisco Ordering webpage](#). To download software, visit the [Cisco Software Center](#). Table 2 provides ordering information.

Table 2. Ordering Information

Product Name	Part Number
System	
Cisco Nexus 7700 Switches 2-Slot Chassis, including fan tray, no power supply	N77-C7702
Cisco Nexus 7700 Switches 2-Slot Chassis, including fan tray, no power supply spare	N77-C7702=
Cisco Nexus 7700 Switches 2-Slot Fan Tray	N77-C7702-FAN
Cisco Nexus 7700 Switches 2-Slot Fan Tray Spare	N77-C7702-FAN=
Cisco Nexus 7700 Switches 6-Slot Chassis, including fan trays, no power supply	N77-C7706
Cisco Nexus 7700 Switches 6-Slot Chassis, including fan trays, no power supply spare	N77-C7706=
Cisco Nexus 7700 Switches 6-Slot Fan Tray	N77-C7706-FAN
Cisco Nexus 7700 Switches 6-Slot Fan Tray Spare	N77-C7706-FAN=
Cisco Nexus 7700 Switches 6-Slot Fan Tray (Generation 2)	N77-C7706-FAN-2
Cisco Nexus 7700 Switches 6-Slot Fan Tray (Generation 2) Spare	N77-C7706-FAN-2=
Cisco Nexus 7700 Switches 10-Slot Chassis, including fan trays, no power supply	N77-C7710
Cisco Nexus 7700 Switches 10-Slot Chassis, including fan trays, no power supply spare	N77-C7710=
Cisco Nexus 7700 Switches -10-Slot Fan Tray	N77-C7710-FAN
Cisco Nexus 7700 Switches -10-Slot Fan Tray Spare	N77-C7710-FAN=
Cisco Nexus 7700 Switches -10-Slot Fan Tray (Generation 2)	N77-C7710-FAN-2
Cisco Nexus 7700 Switches -10-Slot Fan Tray (Generation 2) Spare	N77-C7710-FAN-2=
Cisco Nexus 7700 Switches 18-Slot Chassis, including fan trays, no power supply	N77-C7718
Cisco Nexus 7700 Switches 18-Slot Chassis, including fan trays, no power supply spare	N77-C7718=
Cisco Nexus 7700 Switches -18-Slot Fan Tray	N77-C7718-FAN
Cisco Nexus 7700 Switches -18-Slot Fan Tray Spare	N77-C7718-FAN=
Cisco Nexus 7700 Switches -18-Slot Fan Tray (Generation 2)	N77-C7718-FAN-2
Cisco Nexus 7700 Switches -18-Slot Fan Tray (Generation 2) Spare	N77-C7718-FAN-2=
Cisco Nexus 7700 Switches 2-Slot Accessories	
Cisco Nexus 7702 Center Mount Kit (for 2-post rack mounting)	N77-C7702-CMK
Cisco Nexus 7702 Center Mount Kit (for 2-post rack mounting) Spare	N77-C7702-CMK=
Cisco Nexus 7702 Front Door Air Filter Spare	N77-C7702-FDAFLT=
Cisco Nexus 7702 Front Air Filter Kit Spare	N77-C7702-AFLT=
Cisco Nexus 7702-Rack Mount Kit Spare	N77-C7702-RMK=

Product Name	Part Number
Cisco Nexus 7702 Cable Management Kit Spare	N77-C7702-CAB=
Cisco Nexus 7702 Front Door Kit Spare	N77-C7702-FDK=
Cisco Nexus 7702 Accessory Kit Spare	N77-C7702-ACC-KIT=
Cisco Nexus 7702 Shipping Package Spare	N77-C7702-SHPPKG=
Cisco Nexus 7700 Switches 6-Slot Accessories	
Cisco Nexus 7706 Center Mount Kit (for 2-post rack mounting)	N77-C7706-CMK
Cisco Nexus 7706 Center Mount Kit (for 2-post rack mounting) Spare	N77-C7706-CMK=
Cisco Nexus 7706 Front Door Air Filter Spare	N77-C7706-FDAFLT=
Cisco Nexus 7706 Front & Side Air Filter	N77-C7706-AFLT
Cisco Nexus 7706 Front & Side Air Filter Spare	N77-C7706-AFLT=
Cisco Nexus 7706-Rack Mount Kit Spare	N77-C7706-RMK=
Cisco Nexus 7706 Cable Management and Top LED Kit Spare	N77-C7706-CAB-TOP=
Cisco Nexus 7706 Front Door Kit	N77-C7706-FDK
Cisco Nexus 7706 Front Door Kit Spare	N77-C7706-FDK=
Cisco Nexus 7706 Bottom Support Kit Spare	N77-C7706-BSK=
Cisco Nexus 7706 Accessory Kit Spare	N77-C7706-ACC-KIT=
Cisco Nexus 7706 Shipping Package Spare	N77-C7706-SHPPKG=
Cisco Nexus 7700 Switches 10-Slot Accessories	
Cisco Nexus 7710 Front Door Air Filter Spare	N77-C7710-FDAFLT=
Cisco Nexus 7710 Front & Side Air Filter	N77-C7710-AFLT
Cisco Nexus 7710 Front & Side Air Filter Spare	N77-C7710-AFLT=
Cisco Nexus 7710-Rack Mount Kit Spare	N77-C7710-RMK=
Cisco Nexus 7710 Cable Management and Top LED Kit Spare	N77-C7710-CAB-TOP=
Cisco Nexus 7710 Front Door Kit	N77-C7710-FDK
Cisco Nexus 7710 Front Door Kit Spare	N77-C7710-FDK=
Cisco Nexus 7710 Bottom Support Kit Spare	N77-C7710-BSK=
Cisco Nexus 7710 Accessory Kit Spare	N77-C7710-ACC-KIT=
Cisco Nexus 7710 Shipping Package Spare	N77-C7710-SHPPKG=
Cisco Nexus 7700 Switches 18-Slot Accessories	
Cisco Nexus 7718 Power Cable Management	N7K-C7718-PCM
Cisco Nexus 7718 Power Cable Management Spare	N7K-C7718-PCM=
Cisco Nexus 7718 Front Door Air Filter Spare	N77-C7718-FDAFLT=
Cisco Nexus 7718 Front & Side Air Filter	N77-C7718-AFLT
Cisco Nexus 7718 Front & Side Air Filter Spare	N77-C7718-AFLT=
Cisco Nexus 7718-Rack Mount Kit Spare	N77-C7718-RMK=
Cisco Nexus 7718 Cable Management and Top LED Kit Spare	N77-C7718-CAB-TOP=
Cisco Nexus 7718 Front Door Kit	N77-C7718-FDK
Cisco Nexus 7718 Front Door Kit Spare	N77-C7718-FDK=
Cisco Nexus 7718 Bottom Support Kit Spare	N77-C7718-BSK=
Cisco Nexus 7718 Accessory Kit Spare	N77-C7718-ACC-KIT=
Cisco Nexus 7718 Shipping Package Spare	N77-C7718-SHPPKG=
Blank Panel Covers	
Cisco Nexus 7700 Switches Supervisor Blank Slot Cover	N77-SUP-BLANK
Cisco Nexus 7700 Switches Supervisor Blank Slot Cover Spare	N77-SUP-BLANK=
Cisco Nexus 7700 Switches Module Blank Slot Cover	N77-MODULE-BLANK

Product Name	Part Number
Cisco Nexus 7700 Switches Module Blank Slot Cover Spare	N77-MODULE-BLANK=
Cisco Nexus 7700 Switches 3 KW Power Supply Blank Slot Cover with Handle	N77-3KPS-BLANK-H
Cisco Nexus 7700 Switches 3 KW Power Supply Blank Slot Cover with Handle Spare	N77-3KPS-BLANK-H=

Service and Support

Cisco offers a wide range of services to help accelerate your success in deploying and optimizing the Cisco Nexus 7700 in your data center. Our innovative services are delivered through a unique combination of people, processes, tools, and partners, and are focused on helping you increase operation efficiency and improve your data center network. Cisco Advanced Services use an architecture-led approach to help you align your data center infrastructure with your business goals and provide long-term value. Cisco Smart Net Total Care™ Service helps you resolve mission-critical problems with direct access at any time to Cisco network experts and award-winning resources. With this service, you can take advantage of the Cisco Smart Call Home service capability, which offers proactive diagnostic information and real-time alerts for your Cisco Nexus 7700 switches. Spanning the entire network lifecycle, Cisco Services helps increase investment protection, optimize network operations, provide migration support, and strengthen your IT expertise. For more information about Cisco Data Center Services, visit <http://www.cisco.com/go/dcservices>.

Cisco Capital

Financing to Help You Achieve Your Objectives

Cisco Capital can help you acquire the technology you need to achieve your objectives and stay competitive. We can help you reduce CapEx. Accelerate your growth. Optimize your investment dollars and ROI. Cisco Capital financing gives you flexibility in acquiring hardware, software, services, and complementary third-party equipment. And there's just one predictable payment. Cisco Capital is available in more than 100 countries. [Learn more](#).

For More Information

For more information about the Cisco Nexus 7700 switches, visit the product homepage at <http://www.cisco.com/go/nexus> or contact your account representative.



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Purpose-built Appliance

Remote Management

- Lights Out Management, IPMI 2.0
- Unit-identification button/LED
- Real-time system environmental and fault monitoring
- SNMP monitoring with Infoblox MIBS

High Availability

- Redundant power supplies
- Redundant disks
- Redundant cooling fans
- Power supply field-replaceable unit
- Disk field-replaceable unit
- Fan field-replaceable unit
- ECC RAM

Power Efficiency

- Lower power consumption
- Supports for the Go Green initiative

Advanced Requirements

- Top-quality, enterprise-class, and energy-efficient components
- Custom-designed chassis to meet U.S. Government security requirements
- Service-provider options with high-performance DNS caching, NEBS compliance and DC power
- Optical and copper SFP interfaces
- Expansion slots

Trinzic Appliances Deliver Next Level Networking

In a digitally driven and globally connected world, the use of mobile devices and applications across diverse physical, virtual, and cloud infrastructure is skyrocketing. With Infoblox Next Level Networking, you gain a platform that provides all the capabilities you need to more easily control, secure, and analyze your network—and make your network not just an asset but a differentiator. Trinzic are purpose-built high-performance appliances that form the foundation of core network services for any organization to deliver Next Level Networking.



All models can be deployed individually or in a high-availability (HA) pair distributed architecture, leveraging Infoblox Grid™ for optimal service resiliency.

Appliance-based delivery of IP network services and reporting has become a recommended industry best practice for any size organization. Appliances are inherently more reliable, manageable, scalable, and secure than software running on general-purpose servers whose well-understood operating systems are more easily compromised.

The 8XX, 14XX, 22XX, and 40X5 series of Trinzic appliances support Lights Out Management (LOM) for remote site communication and management, feature a Unit Identification button/LED, and utilize the latest technology for achieving energy efficiency.

A Scalable Family of Hardware and Software Appliances

The Trinzic appliance family offers a wide range of models that are designed to deliver the performance, capacity, and availability required in each unique environment, from the smallest branch office to the largest enterprise or service provider network.

The Trinzic appliance family offers deployment flexibility. Appliances can be deployed as physical appliances or virtual appliances on-premise. Alternatively, they can also be deployed as virtual appliances in public clouds, such as Amazon Web Services and Microsoft Azure.

In a virtualized environment, servers are created, moved and shutdown frequently. IT workload increases to configure and manage IP assignments and DNS records. Infoblox DNS, DHCP, and IPAM solutions provide management automation to reduce administrative effort and eliminate human errors that can cause application availability problems.



Infoblox Trinzic DDI Appliances

DATASHEET

Virtual Appliances

- Virtual appliances supported on various hypervisor and cloud platforms
- Save power by reducing the number of servers and physical appliances
- Lower TCO by saving hardware, power, cooling and real-estate costs
- Deploy easily using your standard virtualization practices

The Trinzic 8X5 series appliances are designed for remote and branch locations. The Trinzic 14X5 series is for larger remote and branch locations, as well as small-to-medium sized organizations. The Trinzic 40X5 series is for use by large enterprises and carriers.

Performance Specification								
	Trinzic 815	Trinzic 825	Trinzic 1415	Trinzic 1425	Trinzic 2215	Trinzic 2225	Trinzic 4015 / 4025	Trinzic 4030 / 10G
DNS Queries per Second*	6K	22.5K	45K	75K	90K	200K	300K	5M
DHCP Leases per Second*	90	150	300	450	550	900	1400	N/A
Hardware Redundancy	N/A		Optional second power supply Hot-swappable redundant Field-replaceable hard disk		Hot-swappable, redundant power supplies, fans, and four disks RAID-10			
Virtual Appliances Supported	Yes		Yes		Yes			

* The stated performance numbers were derived in an Infoblox test environment. Actual performance in live production environments may be different.



Infoblox Trinzic DDI Appliances

DATASHEET



Trinzic 2225

The **Trinzic 2225** appliance is designed to serve medium and large enterprises in headquarters and regional office environments. Trinzic 2225 utilizes the latest energy-efficient technology, supports a Unit Identification button/LED, and has IPMI 2.0-compliant Lights Out Management (LOM) for IPv4. For high availability and uptime, Trinzic 2225 supports field-replaceable hard drive, power supply, and fans. Trinzic 2225 supports redundant power supplies and hard drives (RAID 10). Trinzic 2225 also offers a choice of AC or DC power.

Trinzic 2225	
Network Interfaces	<ul style="list-style-type: none"> • Two 10/100/1000 Base-T Ethernet (LAN ports) • One 10/100/1000 Base-T Ethernet (HA port) • One 10/100/1000 Base-T Ethernet (MGMT port) • Optional: Four 1GE SFP or 1GE/10GE SFP+ interfaces*
Lights Out Management (LOM)	<ul style="list-style-type: none"> • One 10/100/1000 Base-T Ethernet LOM port; IPMI 2.0 compliant • Supports IPv4
Serial Port	DB-9 (9600/8n1, Xon/Xoff)
USB Ports	One USB 3.0/2.0 compliant (reserved for future use)
LCD Panel	N/A
Unit Identification	Front and back
AC Power Supply	<ul style="list-style-type: none"> • Two hot-swappable PSUs • Input voltage: 100-240 VAC switchable, 50-60 Hz • Output power: 600W
DC Power Supply	<ul style="list-style-type: none"> • Two hot-swappable PSUs • Input voltage: -44V to -65V; 600W
Chassis Ground	Included (ground lug)
Disk and Fans	<ul style="list-style-type: none"> • Six hot-swappable, redundant fans • Four hot-swappable, redundant disks RAID-10 • System on flash
Operating Temperature	<ul style="list-style-type: none"> • 41°F to 95°F (5°C to 35°C) • 5% to 95% relative humidity, non-condensing
Storage Temperature	<ul style="list-style-type: none"> • -40°F to 122°F (-40°C to 50°C) • 5% to 95% relative humidity, non-condensing
Dimensions and Weight	<ul style="list-style-type: none"> • Enclosure: 2U, rack mountable • Height: 88 mm (3.46 in.); 2 rack units • Width: 441 mm (17.36 in.) • Depth: 547 mm (21.54 in.) • Weight: Approximately 29 lbs (13.15 kg)
Rail Kit	Choice of 2-post, up-to-600 mm 4-post, or 600-900 mm 4-post
Certifications	<ul style="list-style-type: none"> • Safety: FCC, CE, TUV, CB, VCCI, C-Tick, KCC, CCC, NOM, BIS, and EAC • Environmental: WEEE and RoHS
Support	Standard warranty includes 90-day software support with one-year hardware support; upgradable

Trinzic 2225 Virtual Appliances

Hypervisors and Cloud Platforms Supported	ESXi, Hyper-V, KVM, AWS, MS Azure
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* All models do not support SFPs. Please check for appropriate models that support it.

PA-3200 SERIES

Palo Alto Networks PA-3200 Series next-generation firewalls—comprising the PA-3260, PA-3250, and PA-3220—are targeted at high-speed internet gateway deployments. PA-3200 Series appliances secure all traffic, including encrypted traffic, using dedicated processing and memory for networking, security, threat prevention, and management.

Key Security Features

Classifies all applications, on all ports, all the time

- Identifies the application, regardless of port, SSL/SSH encryption, or evasive technique employed.
- Uses the application, not the port, as the basis for all your safe enablement policy decisions: allow, deny, schedule, inspect, and apply traffic-shaping.
- Categorizes unidentified applications for policy control, threat forensics, or App-ID™ technology development.

Enforces security policies for any user, at any location

- Deploys consistent policies to local and remote users running on Windows®, macOS®, Linux, Android®, or Apple iOS platforms.
- Enables agentless integration with Microsoft Active Directory® and Terminal Services, LDAP, Novell eDirectory™, and Citrix.
- Easily integrates your firewall policies with 802.1X wireless, proxies, network access control, and any other source of user identity information.

Prevents known and unknown threats

- Blocks a range of known threats—including exploits, malware, and spyware—across all ports, regardless of common evasion tactics employed.
- Limits the unauthorized transfer of files and sensitive data, and safely enables non-work-related web surfing.
- Identifies unknown malware, analyzes it based on hundreds of malicious behaviors, and then automatically creates and delivers protection.



The controlling element of the PA-3200 Series is PAN-OS®, which natively classifies all traffic, inclusive of applications, threats, and content, and then ties that traffic to the user regardless of location or device type. The application, content, and user—in other words, the elements that run your business—then serve as the basis of your security policies, resulting in improved security posture and reduced incident response time.

Table 1: PA-3200 Series Performance and Capacities

	PA-3260	PA-3250	PA-3220
Firewall throughput (HTTP/appmix) ¹	7.9/10 Gbps	5.3/6.6 Gbps	4.3/5.0 Gbps
Threat Prevention throughput (HTTP/appmix) ²	3.6/4.4 Gbps	2.4/3.0 Gbps	2.0/2.4 Gbps
IPsec VPN throughput ³	4.8 Gbps	3.2 Gbps	2.7 Gbps
Max sessions	3M	2M	1M
New sessions per second ⁴	114,000	82,000	57,000
Virtual systems (base/max) ⁵	1/6	1/6	1/6

1. Firewall throughput is measured with App-ID and logging enabled using 64 KB HTTP/appmix transactions.

2. Threat Prevention throughput is measured with App-ID, IPS, antivirus, anti-spyware, WildFire, file blocking, and logging enabled, utilizing 64 KB HTTP/appmix transactions.

3. IPsec VPN throughput is measured with 64 KB HTTP transactions and logging enabled.

4. New sessions per second measured with application-override utilizing 1 byte HTTP transactions.

5. Adding virtual systems over base quantity requires a separately purchased license.

Table 2: PA-3200 Series Networking Features
Interface Modes
L2, L3, tap, virtual wire (transparent mode)
Routing
OSPFv2/v3 with graceful restart, BGP with graceful restart, RIP, static routing
Policy-based forwarding
Point-to-point protocol over Ethernet (PPPoE)
Multicast: PIM-SM, PIM-SSM, IGMP v1, v2, and v3
Bidirectional Forwarding Detection (BFD)
SD-WAN
Path quality measurement (jitter, packet loss, latency)
Initial path selection (PBF)
Dynamic path change
IPv6
L2, L3, tap, virtual wire (transparent mode)
Features: App-ID, User-ID, Content-ID, WildFire, and SSL Decryption
SLAAC
IPsec VPN
Key exchange: manual key, IKEv1, and IKEv2 (pre-shared key, certificate-based authentication)
Encryption: 3DES, AES (128-bit, 192-bit, 256-bit)
Authentication: MD5, SHA-1, SHA-256, SHA-384, SHA-512
VLANs
802.1Q VLAN tags per device/per interface: 4,094/4,094
Aggregate interfaces (802.3ad), LACP
Network Address Translation
NAT modes (IPv4): static IP, dynamic IP, dynamic IP and port (port address translation)
NAT64, NPTv6
Additional NAT features: dynamic IP reservation, tunable dynamic IP and port oversubscription
High Availability
Modes: active/active, active/passive
Failure detection: path monitoring, interface monitoring

Table 3: PA-3200 Series Hardware Specifications
I/O
PA-3260: (12) 10/100/1000, (8) 1G/10G SFP/SFP+, (4) 40G QSFP+
PA-3250: (12) 10/100/1000, (8) 1G/10G SFP/SFP+
PA-3220: (12) 10/100/1000, (4) 1G SFP, (4) 1G/10G SFP/SFP+
Management I/O
(1) 10/100/1000 out-of-band management port, (2) 10/100/1000 high availability, (1) 10G SFP+ high availability, (1) RJ-45 console port, (1) Micro USB
Storage Capacity
240 GB SSD
Power Supply (Avg/Max Power Consumption)
Redundant 650-watt AC or DC (180/240)
Max BTU/hr
819
Input Voltage (Input Frequency)
AC: 100–240 VAC (50–60 Hz)
DC: -48 V @ 4.7 A, -60 V @ 3.8 A
Max Current Consumption
AC: 2.3 A @ 100 VAC, 1.0 A @ 240 VAC
DC: -48 V @ 4.7 A, -60 V @ 3.8 A
Mean Time Between Failure (MTBF)
14 years
Rack Mount (Dimensions)
2U, 19" standard rack (3.5" H x 20.53" D x 17.34" W)
Weight (Stand-Alone Device/As Shipped)
29 lbs / 41.5 lbs
Safety
TUV CB report and TUV NRTL
EMI
FCC Class A, CE Class A, VCCI Class A
Certifications
See https://www.paloaltonetworks.com/company/certifications.html
Environment
Operating temperature: 32° to 122° F, 0° to 50° C
Non-operating temperature: -4° to 158° F, -20° to 70° C
Humidity tolerance: 10% to 90%
Maximum altitude: 10,000 ft / 3,048 m
Airflow: front to back

To view additional information about the features and associated capacities of the PA-3200 Series, please visit www.paloaltonetworks.com/products.



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DATA SHEET

ARUBA 340 SERIES WIRELESS ACCESS POINTS

Very high performance 802.11ac Wave 2
(Wi-Fi 5) APs with dual-5 GHz and multi-gig
Ethernet support

The Aruba 340 series access points provide the fastest 802.11ac gigabit data speeds and superb user experience for mobile devices and applications in a digital workplace. Designed with an integrated, 802.3bz Compliant, HPE SmartRate multi-gig Ethernet port to eliminate wired bottlenecks, these APs offer unmatched wireless performance and capacity. The unique and flexible dual-5 GHz architecture of the 340 series offers a way to double 5 GHz capacity where needed, without compromise or restrictions.

Thanks to Aruba's advanced ClientMatch technology, the 340 series can automatically detect and classify 802.11ac Wave 2 capable mobile devices. This allows ClientMatch to automatically group Wave 2 capable devices onto a single Wave 2 radio so that performance benefits of multi-user MIMO can be realized — without the adverse effects of slower 802.11ac and traditional 802.11n capable mobile devices. This means increased network capacity and a boost in network efficiency.

With maximum data rates of 2,166 Mbps in the 5 GHz band¹ and 800 Mbps in the 2.4 GHz band (for an aggregate peak data rate of 3.0 Gbps in dual-band mode and 4.3 Gbps in dual-5 GHz mode), the 340 series APs deliver a best-in-class, next-generation 802.11ac Wi-Fi infrastructure that is ideal for lecture halls, auditoriums, public venues, and high-density office environments.

These high performance and high density 340 Series 802.11ac access points support up to 160 MHz channel bandwidth (VHT160), and 4 spatial streams (4SS) for both SU- and MU-MIMO communications.

aruba



KEY FEATURES

- Designed with an integrated, 802.3bz compliant, HPE SmartRate multi-gig Ethernet port to eliminate wired bottlenecks
- Maximum data rates of 2,166 Mbps in the 5 GHz band and 800 Mbps in the 2.4 GHz band (for an aggregate peak data rate of 3.0 Gbps in dual-band and 4.3 Gbps in dual-5GHz)
- Includes integrated Bluetooth Low Energy (BLE) radio, for advanced location and indoor wayfinding
- Participates in Aruba's Dynamic Segmentation solution

IOT PLATFORM CAPABILITIES

Like all Aruba Wi-Fi 6 APs, the 340 Series provides integrated Bluetooth capabilities to enable Meridian and IoT-based location services, asset tracking, and mobile engagement services. For expanded use cases, an IoT expansion radio can be added to support the Zigbee protocol. These features allow organizations to leverage the AP as an IoT platform, which eliminates the need for an overlay infrastructure and additional IT resources.

¹ Initially, the 5 GHz radio will be limited to 1,733 Mbps. The proprietary extension (1024-QAM support) to enable MCS10 and MCS11 and rates up to 2,166 Mbps will be introduced in a later SW release. Please check SW release notes for this upgrade. With 1,733 Mbps, the aggregate peak numbers drop to 2.5 Gbps (dual-radio) and 3.5 Gbps (dual-5 GHz).

UNIQUE BENEFITS

- Unified AP – deploy with or without controller
 - The 340 Series APs can be deployed in either controller-based (ArubaOS) or controllerless (InstantOS) deployment mode
- Dual Radio 4x4 802.11ac access point with Multi-User MIMO (wave 2)
 - Supports up to 2,166 Mbps per radio in the 5 GHz band (with 4SS/VHT80 or 2SS/VHT160 clients) and up to 800 Mbps in the 2.4 GHz band (with 4SS/VHT40 clients)
 - Antenna polarization diversity (fixed) for optimized RF performance
- Optional dual-5 GHz mode supported, where the 2.4 GHz radio is converted to a second 5 GHz radio
 - Both 5 GHz radios providing full coverage, doubling the performance and capacity
 - Unlike competitive solutions, the 340 Series is designed to isolate the two 5 GHz transmitters for higher performance
 - Conversion can be manual/fixed, or automatic and dynamic (software controlled, under-the hood), based on system-wide capacity and load in both bands
- HPE SmartRate uplink Ethernet port (E0)
 - Supports up to 2.5 Gbps with NBase-T and IEEE 802.3bz Ethernet compatibility
 - Backwards compatible with 100/1000Base-T
- Hitless PoE failover between both Ethernet ports
- Built-in Bluetooth Low-Energy (BLE) radio
 - Enables location-based services with BLE-enabled mobile devices receiving signals from multiple Aruba Beacons at the same time
 - Enables asset tracking when used with Aruba Asset Tags
- Advanced Cellular Coexistence (ACC)
 - Minimizes interference from 3G/4G cellular networks, distributed antenna systems and commercial small cell/femtocell equipment
- Quality of service for unified communications applications
 - Supports priority handling and policy enforcement for unified communication apps, including Skype for Business with encrypted videoconferencing, voice, chat and desktop sharing
- Aruba AppRF technology leverages deep packet inspection to classify and block, prioritize, or limit bandwidth for thousands of applications in a range of categories
- Best-in-class RF Management
 - Integrated AirMatch technology manages the 2.4-GHz and 5-GHz radio bands and actively optimizes the RF environment including channel width, channel selection and transmit power
 - Adaptive Radio Management (ARM) technology provides airtime fairness and ensures that APs stay clear of all sources of RF interference to deliver reliable, high-performance WLANs
- Spectrum analysis
 - Capable of part-time or dedicated air monitoring, the spectrum analyzer remotely scans the 2.4 GHz and 5 GHz radio bands to identify sources of RF interference from HT20 through VHT160 operation
- Aruba Secure Infrastructure
 - Device assurance: Use of Trusted Platform Module (TPM) for secure storage of credentials and keys as well as secure boot
 - Integrated wireless intrusion protection² offers threat protection and mitigation, and eliminates the need for separate RF sensors and security appliances
 - IP reputation and security services identify, classify, and block malicious files, URLs and IPs, providing comprehensive protection against advanced online threats
 - SecureJack-capable for secure tunneling of wired Ethernet traffic
- Intelligent Power Monitoring (IPM)
 - Enables the AP to continuously monitor and report its actual power consumption and optionally make autonomous decisions to disable certain capabilities based on the amount of power available to the unit
 - Software configurable to disable capabilities in certain orders. For the 340 Series Access Points, by default, the USB interface will be the first feature to turn off if the AP power consumption exceeds the available power budget

CHOOSE YOUR OPERATING MODE

The Aruba 340 Series APs offer a choice of deployment and operating modes to meet your unique management and deployment requirements:

- The 340 Series AP is a unified AP that supports both controller-based and controller-less deployment modes, providing maximum flexibility.
- Controller-based mode – When deployed in conjunction with an Aruba Mobility Controller, Aruba 340 Series APs

²Not supported in dual-5 GHz mode

offer centralized configuration, data encryption, policy enforcement and network services, as well as distributed and centralized traffic forwarding.

- Controller-less (Instant) mode – The controller function is virtualized in a cluster of APs in Instant mode. As the network grows and/or requirements change, Instant deployments can easily migrate to controller-based mode.
- Remote AP (RAP) mode for branch deployments
- Air monitor (AM)² for wireless IDS, rogue detection and containment
- Spectrum analyzer (SA)², dedicated or hybrid, for identifying sources of RF interference
- Secure enterprise mesh portal or point

For large installations across multiple sites, the Aruba Activate service significantly reduces deployment time by automating device provisioning, firmware upgrades, and inventory management. With Aruba Activate, the Instant APs are factory-shipped to any site and configure themselves when powered up.

SPECIFICATIONS

Hardware Variants

- AP-344: External antenna models
- AP-345: Internal antenna models

Wi-Fi Radio Specifications

- AP type: Indoor, dual radio, 5 GHz 802.11ac 4x4 MIMO and 2.4 GHz 802.11n 4x4 MIMO
 - The 2.4 GHz radio supports all 802.11ac rates as well (proprietary extension)
- Software-configurable dual radio supports:
 - Dual-radio mode: 5 GHz (Radio 0) and 2.4 GHz (Radio 1)
 - Dual-5 GHz mode: upper 5 GHz (Radio 0) and lower 5 GHz (Radio 1)
- 5 GHz:
 - Four spatial stream Single User (SU) MIMO for up to 1,733 Mbps wireless data rate to individual 4SS VHT80 or 2SS VHT160 client devices
 - Four spatial stream Multi User (MU) MIMO for up to 1,733 Mbps wireless data rate to up to four 1SS or two 2SS MU-MIMO capable client devices simultaneously
 - Peak data rate increases to 2,166 Mbps when using 1024-QAM modulation (proprietary extension)

- 2.4 GHz:
 - Four spatial stream Single User (SU) MIMO for up to 600 Mbps wireless data rate to individual 4SS HT40 client devices, and up to 800 Mbps to individual 4SS VHT40 devices (proprietary extension)
- Support for up to 256 associated client devices per radio, and up to 16 BSSIDs per radio
- Supported frequency bands (country-specific restrictions apply):
 - 2.400 to 2.4835 GHz
 - 5.150 to 5.250 GHz³
 - 5.250 to 5.350 GHz³
 - 5.470 to 5.725 GHz⁴
 - 5.725 to 5.850 GHz⁴
- Available channels: Dependent on configured regulatory domain
- Dynamic frequency selection (DFS) optimizes the use of available RF spectrum
- Supported radio technologies:
 - 802.11b: Direct-sequence spread-spectrum (DSSS)
 - 802.11a/g/n/ac: Orthogonal frequency-division multiplexing (OFDM)
- Supported modulation types:
 - 802.11b: BPSK, QPSK, CCK
 - 802.11a/g/n/ac: BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM, 1024-QAM (proprietary extension)
- Transmit power: Configurable in increments of 0.5 dBm
- Maximum (aggregate, conducted total) transmit power (limited by local regulatory requirements):
 - 2.4 GHz band: +24 dBm (18 dBm per chain)⁵
 - 5 GHz band: +24 dBm (18 dBm per chain)⁵
 - Note: Conducted transmit power levels exclude antenna gain. For total (EIRP) transmit power, add antenna gain.
- Advanced Cellular Coexistence (ACC) minimizes the impact of interference from cellular networks
- Maximum ratio combining (MRC) for improved receiver performance
- Cyclic delay/diversity (CDD/CSD) for improved downlink RF performance
- Short guard interval for 20 MHz, 40 MHz, 80 MHz and 160 MHz channels
- Space-time block coding (STBC) for increased range and improved reception
- Low-density parity check (LDPC) for high-efficiency error correction and increased throughput
- Transmit beam-forming (TxBF) for increased signal reliability and range

² Not supported in dual-5 GHz mode

³ Not supported on radio 0 in dual-5 GHz mode

⁴ Not supported on radio 1 in dual-5 GHz mode

⁵ Reduced by 2 dB in dual-5 GHz mode

- Supported data rates (Mbps):
 - 802.11b: 1, 2, 5.5, 11
 - 802.11a/g: 6, 9, 12, 18, 24, 36, 48, 54
 - 802.11n: 6.5 to 600 (MCS0 to MCS31)
 - 802.11ac: 6.5 to 1,733 (MCS0 to MCS9, NSS = 1 to 4 for VHT20/40/80, NSS = 1 to 2 for VHT160)⁶
 - 802.11ac: 1,950 and 2,166 (MCS10 and MCS11, NSS = 1 to 4 for VHT20/40/80, NSS = 1 to 2 for VHT160)⁶
 - 802.11n high-throughput (HT) support: HT20/40
 - 802.11ac very high throughput (VHT) support: VHT20/40/80/160
 - 802.11n/ac packet aggregation: A-MPDU, A-MSDU

Wi-Fi Antennas

- AP-344: External antenna models. Two sets of four RP-SMA antenna connectors:
 - Primary: A0 – A3, connected to chains 0 through 3 respectively on each associated radio
 - » With AP in dual-radio mode: dual-band interfaces, diplexing signals to/from radio 0 (full 5 GHz) and radio 1 (2.4 GHz)
 - » With AP in dual-5 GHz mode: 5 GHz interfaces from radio 0 (upper 5 GHz)
 - Secondary: B0 – B3, connected to chains 0 through 3 respectively
 - » With AP in dual-radio mode: not used
 - » With AP in dual-5 GHz mode: 5 GHz interfaces from radio 1 (lower 5 GHz)
 - Total internal losses between radio and external connectors:
 - » With AP in dual-radio mode: 2.0 dB for 5 GHz, 2.0 dB for 2.4 GHz
 - » With AP in dual-5 GHz mode: 2.0 dB for upper 5 GHz, 1.7 dB for lower 5 GHz
- AP-345: Internal antenna models. A total of eight internal omni-directional downtilt antennas
 - Radio 1: four cross-polarized dual-band downtilt omni-directional antennas for 4x4 MIMO with peak antenna gain of 5.8dBi (2.4 GHz) and 5.6dBi (5 GHz) per antenna.
 - » With AP in dual-radio mode: used for 2.4 GHz only
 - » With AP in dual-5 GHz mode: used for lower 5 GHz only

- Radio 0: four cross-polarized 5 GHz downtilt omni-directional antennas for 4x4 MIMO with peak antenna gain of 5.5dBi per antenna
 - » With AP in dual-radio mode: used for full 5 GHz only
 - » With AP in dual-5 GHz mode: used for upper 5 GHz only
- All internal antennas are optimized for horizontal ceiling mounted orientation of the AP. The downtilt angle for maximum gain is roughly 30 degrees.
- Combining the patterns of all antennas per radio, the peak gain of the average (effective) pattern is:
 - » Radio 1: 3.1dBi in 2.4 GHz and 2.2dBi in 5 GHz
 - » Radio 0: 2.7dBi in 5 GHz

Other Interfaces

- One HPE SmartRate port (RJ-45, maximum negotiated speed 2.5 Gbps)
 - Auto-sensing link speed (100/1000/2500BASE-T) and MDI/MDX
 - 2.5 Gbps speed complies with NBase-T and 802.3bz specifications
 - PoE-PD: 48Vdc (nominal) 802.3at PoE
 - 802.3az Energy Efficient Ethernet (EEE)
- One 10/100/1000BASE-T Ethernet network interface (RJ-45)
 - Auto-sensing link speed and MDI/MDX
 - PoE-PD: 48Vdc (nominal) 802.3at PoE
 - 802.3az Energy Efficient Ethernet (EEE)
- Link aggregation (LACP) support between both network ports for redundancy and increased capacity
- DC power interface, accepts 1.35/3.5-mm center-positive circular plug with 9.5-mm length
- USB 2.0 host interface (Type A connector)
- Bluetooth Low Energy (BLE) radio
 - Up to 4 dBm transmit power (class 2) and -91 dBm receive sensitivity
 - Integrated vertically polarized omnidirectional antenna with roughly 30 degrees downtilt and peak gain of 4.9 dBi (AP-345) or 3.1 dBi (AP-344)
- Visual indicators (tri-color LEDs): for System and Radio status
- Reset button: factory reset, LED mode control (normal/off)
- Serial console interface (proprietary, μ USB physical jack)
- Kensington security slot

⁶Proprietary extension; shown rates shown are for the highest NSS only; additional rates for lower NSS values are supported as well.

Power Sources and Consumption

- The AP supports direct DC power and Power over Ethernet (PoE)
- When both power sources are available, DC power takes priority over PoE
- Power sources are sold separately
- Direct DC source: 48Vdc nominal, +/- 5%
- Power over Ethernet (PoE): 48Vdc (nominal) 802.3af/802.3at compliant source
- When powered by a direct DC power source, the AP will operate without restrictions
- When powered by PoE and with the IPM feature enabled, the AP will start up in unrestricted mode, but it may apply restrictions depending on the PoE budget and actual power. What IPM restrictions to apply, and in what order, is programmable.
- When powered by PoE with the IPM feature disabled, the AP will apply some fixed restrictions:
 - The USB interface is disabled when using an 802.3at PoE power source
 - The USB interface and second Ethernet port (E1 if E0 is used, otherwise E0) are disabled, and both radios are restricted to 2x2 operation (AP in dual-radio mode) or 1x1 operation (AP in dual-5 GHz mode) when using an 802.3af PoE power source
- Maximum (worst-case) power consumption:
 - DC powered: 20.0W (AP in dual-radio mode), 22.8W (AP in dual-5 GHz mode)
 - PoE powered (802.3at): 21.9W (AP in dual-radio mode), 25.1W (AP in dual-5 GHz mode)
 - PoE powered (802.3af): 13.5W
 - All numbers above are without an external USB device connected. When sourcing the full 5W power budget to such a device, the incremental (worst-case) power consumption for the AP is up to 6W (DC) or 6.6W (PoE)
- Maximum (worst-case) power consumption in idle mode: 11W (DC or PoE)

Mounting

- The AP ships with two (black) mounting clips to attach to a 9/16-inch or 15/16-inch flat T-bar drop-tile ceiling
- Several optional mount kits are available to attach the AP to a variety of surfaces; see the Ordering Information section below for details

Mechanical

- Dimensions and weight (unit, excluding mount accessories):
 - 22.5 cm (W) x 22.4 cm (D) x 5.2 cm (H)
8.9" (W) x 8.9" (D) x 2.0" (H)
 - 1.05 kg or 2.31 lbs
- Dimensions and weight (shipping):
 - 33.9 cm (W) x 29 cm (D) x 8.8 cm (H)
13.3" (W) x 11.4" (D) x 3.5" (H)
 - 1.65 kg or 3.63 lbs

Environmental

- Operating:
 - Temperature: 0° C to +50° C (+32° F to +122° F)
 - Humidity: 5% to 93% non-condensing
- Storage and transportation:
 - Temperature: -40° C to +70° C (-40° F to +158° F)

Reliability

- MTBF: 640khrs (73yrs) at +25C operating temperature

Regulatory

- FCC/ISED
- CE Marked
- RED Directive 2014/53/EU
- EMC Directive 2014/30/EU
- Low Voltage Directive 2014/35/EU
- UL/IEC/EN 60950
- EN 60601-1-1, EN60601-1-2
- EN 50155 (AP-345)

For more country-specific regulatory information and approvals, please see your Aruba representative.

Regulatory Model Numbers

- AP-344: APIN0344
- AP-345: APIN0345

Certifications

- CB Scheme Safety, cTUVus
- UL2043 plenum rating
- Wi-Fi Alliance certified 802.11a/b/g/n, ac
- WPA, WPA2 and WPA3 – Enterprise with CNSA option, Personal (SAE), Enhanced Open (OWE)
- Wi-Fi CERTIFIED™ ac (with wave 2 features)
- Passpoint® (Release 2) with ArubaOS and Instant 8.3+

WARRANTY

- Limited lifetime warranty

MINIMUM OPERATING SYSTEM SOFTWARE

- ArubaOS & Aruba InstantOS 8.3.0.0

RF PERFORMANCE TABLE

	Maximum transmit power (dBm) per transmit chain ⁶	Receiver sensitivity (dBm) per receive chain ⁶
802.11b 2.4 GHz		
1 Mbps	18	-97
11 Mbps	18	-88
802.11g 2.4 GHz		
6 Mbps	18	-94
54 Mbps	16	-76
802.11n HT20 2.4 GHz		
MCS0/8/16/24	18	-94
MCS7/15/23/31	14	-74
802.11n HT40 2.4 GHz		
MCS0/8/16/24	18	-91
MCS7/15/23/31	14	-71
802.11a 5GHz		
6 Mbps	18	-92
54 Mbps	16	-74
802.11n HT20 5 GHz		
MCS0/8/16/24	18	-92
MCS7/15/23/31	14	-71
802.11n HT40 5 GHz		
MCS0/8/16/24	18	-89
MCS7/15/23/31	14	-68
802.11ac VHT20 5 GHz		
MCS0	18	-92
MCS9	12	-66
MCS11 ⁷	10	-60
802.11ac VHT40 5 GHz		
MCS0	18	-89
MCS9	12	-63
MCS11 ⁷	10	-57
802.11ac VHT80 5 GHz		
MCS0	18	-86
MCS9	12	-60
MCS11 ⁷	10	-54
802.11ac VHT160 5 GHz		
MCS0	18	-81
MCS9	12	-55
MCS11 ⁷	10	-49

Note: Table shows the maximum hardware capability of the AP (excluding antenna and MIMO/MRC gain). Actual maximum transmit power may be limited below these numbers to ensure compliance with local regulatory requirements.

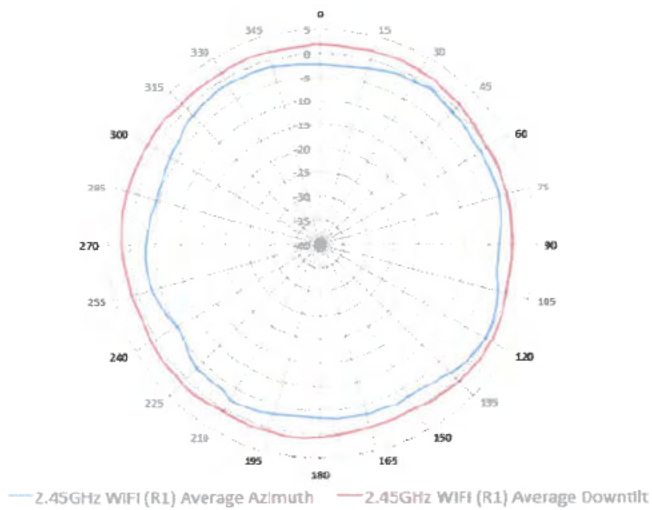
⁶In dual-5GHz mode, all 5GHz numbers are degraded by 2dB

⁷Proprietary extension

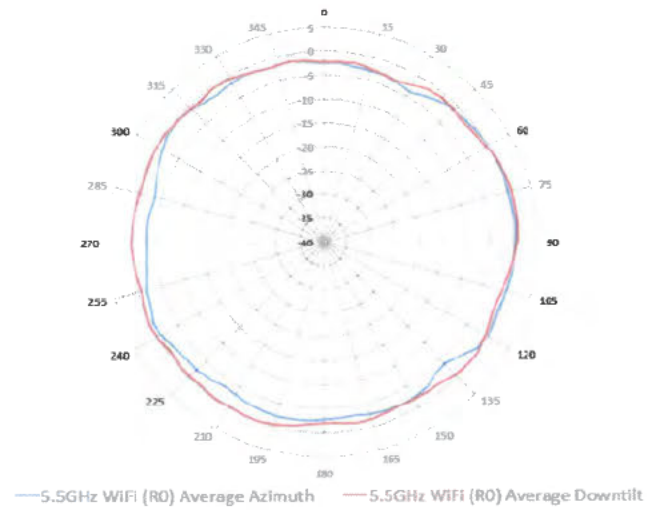
ANTENNA PATTERN PLOTS

Horizontal planes (top view, AP facing forward)

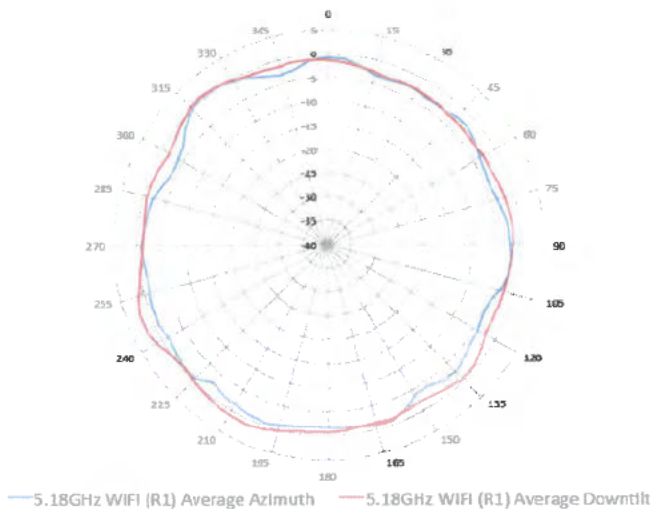
Showing both azimuth (0 degrees) and 30 degrees downtilt patterns



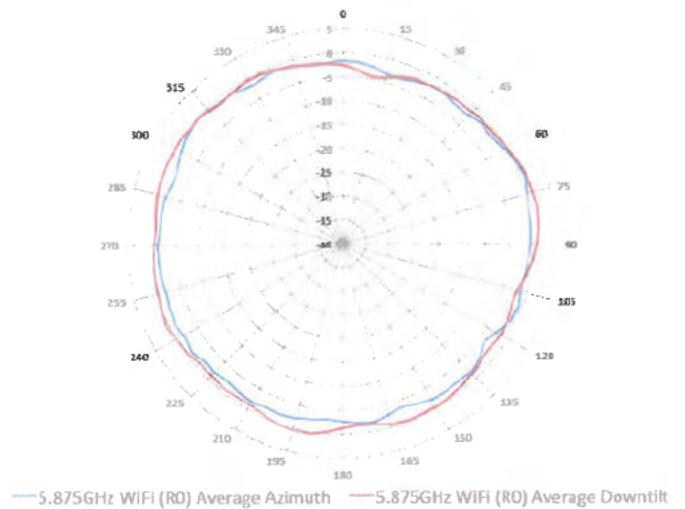
2.45GHz Wi-Fi (dual-radio mode, radio 1)



5.5GHz Wi-Fi (dual-radio mode, radio 0)



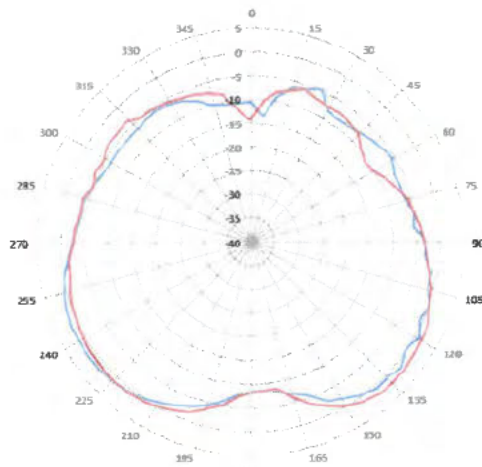
5.18GHz Wi-Fi (dual-5GHz mode, radio 1)



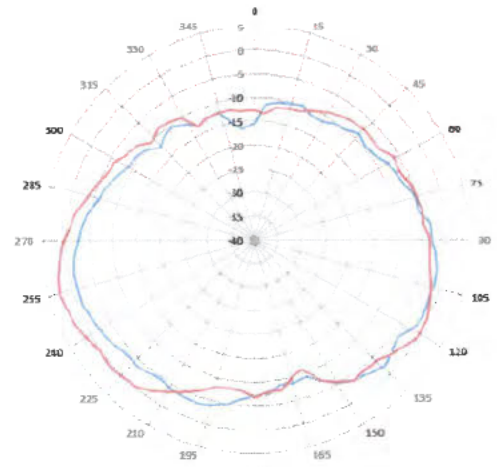
5.875GHz Wi-Fi (dual-5GHz mode, radio 0)

Elevation planes (side view, AP facing down)

Showing side view with AP rotated both 0 and 90 degrees



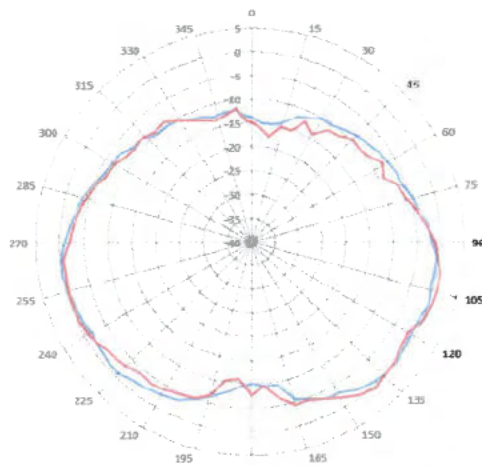
— 2.45GHz WiFi (R1) Average Elevation 0 — 2.45GHz WiFi (R1) Average Elevation 90



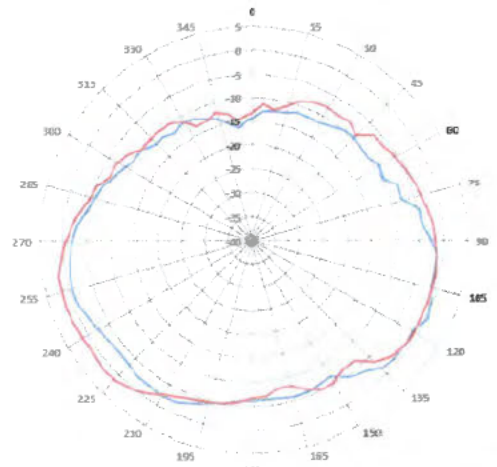
— 5.5GHz WiFi (R0) Average Elevation 0 — 5.5GHz WiFi (R0) Average Elevation 90

2.45GHz Wi-Fi (dual-radio mode, radio 1)

5.5GHz Wi-Fi (dual-radio mode, radio 0)



— 5.18GHz WiFi (R1) Average Elevation 0 — 5.18GHz WiFi (R1) Average Elevation 90



— 5.875GHz WiFi (R0) Average Elevation 0 — 5.875GHz WiFi (R0) Average Elevation 90

5.18GHz Wi-Fi (dual-5GHz mode, radio 1)

5.875GHz Wi-Fi (dual-5GHz mode, radio 0)

ORDERING INFORMATION

Part Number	Description
Aruba 340 Series Campus Access Points	
JZ021A	Aruba AP-344 (RW) Dual 4x4:4 MU-MIMO Radio Antenna Connectors Smart Rate Unified Campus AP
JZ022A	Aruba AP-344 (RW) TAA Dual 4x4:4 MU-MIMO Radio Antenna Connectors Smart Rate Unified Campus AP
JZ023A	Aruba AP-344 (US) Dual 4x4:4 MU-MIMO Radio Antenna Connectors Smart Rate Unified Campus AP
JZ024A	Aruba AP-344 (US) TAA Dual 4x4:4 MU-MIMO Radio Antenna Connectors Smart Rate Unified Campus AP
JZ025A	Aruba AP-344 (JP) Dual 4x4:4 MU-MIMO Radio Antenna Connectors Smart Rate Unified Campus AP
JZ026A	Aruba AP-344 (JP) TAA Dual 4x4:4 MU-MIMO Radio Antenna Connectors Smart Rate Unified Campus AP
JZ027A	Aruba AP-344 (IL) Dual 4x4:4 MU-MIMO Radio Antenna Connectors Smart Rate Unified Campus AP
JZ028A	Aruba AP-344 (IL) TAA Dual 4x4:4 MU-MIMO Radio Antenna Connectors Smart Rate Unified Campus AP
JZ029A	Aruba AP-344 (EG) Dual 4x4:4 MU-MIMO Radio Antenna Connectors Smart Rate Unified Campus AP
JZ030A	Aruba AP-344 (EG) TAA Dual 4x4:4 MU-MIMO Radio Antenna Connectors Smart Rate Unified Campus AP
JZ031A	Aruba AP-345 (RW) Dual 4x4:4 MU-MIMO Radio Internal Antennas Smart Rate Unified Campus AP
JZ032A	Aruba AP-345 (RW) TAA Dual 4x4:4 MU-MIMO Radio Internal Antenna Smart Rate Unified Campus AP
JZ033A	Aruba AP-345 (US) Dual 4x4:4 MU-MIMO Radio Internal Antennas Smart Rate Unified Campus AP
JZ031ACM	Aruba CM AP-345 (RW) Dual 4x4:4 MU-MIMO Radio Internal Antennas Smart Rate Unified Campus AP
JZ033ACM	Aruba CM AP-345 (US) Dual 4x4:4 MU-MIMO Radio Internal Antennas Smart Rate Unified Campus AP
JZ034A	Aruba AP-345 (US) TAA Dual 4x4:4 MU-MIMO Radio Internal Antenna Smart Rate Unified Campus AP
JZ035A	Aruba AP-345 (JP) Dual 4x4:4 MU-MIMO Radio Internal Antennas Smart Rate Unified Campus AP
JZ036A	Aruba AP-345 (JP) TAA Dual 4x4:4 MU-MIMO Radio Internal Antenna Smart Rate Unified Campus AP
JZ037A	Aruba AP-345 (IL) Dual 4x4:4 MU-MIMO Radio Internal Antennas Smart Rate Unified Campus AP
JZ038A	Aruba AP-345 (IL) TAA Dual 4x4:4 MU-MIMO Radio Internal Antenna Smart Rate Unified Campus AP
JZ039A	Aruba AP-345 (EG) Dual 4x4:4 MU-MIMO Radio Internal Antennas Smart Rate Unified Campus AP
JZ040A	Aruba AP-345 (EG) TAA Dual 4x4:4 MU-MIMO Radio Internal Antenna Smart Rate Unified Campus AP
Mount Kits – Spares	
JW044A	AP-220-MNT-C1 2x Ceiling Grid Rail Adapter for Basic Flat Rails Mount Kit
JW044ACM	Aruba CM AP-220-MNT-C1 2x Ceiling Grid Rail Adapter for Basic Flat Rails Mount Kit
Mount Kits – Accessories	
JW045A	AP-220-MNT-C2 Kit with two suspended ceiling grid rail adapters for Interlude and Silhouette style rails
JX961A	AP-MNT-CM1 Industrial grade indoor Access Point metal suspended ceiling rail mount kit
JW046A	AP-220-MNT-W1 Flat surface wall/ceiling basic flat surface AP mount kit (black)
JW045ACM	Aruba CM AP-220-MNT-C2 2x Ceiling Grid Rail Adapter for Interlude and Silhouette Mt Kit
JX961ACM	Aruba CM AP-MNT-CM1 Metal Suspended Ceiling Rail Mount Kit
JW046ACM	Aruba CM AP-220-MNT-W1 Flat Surface Wall/Ceiling Black AP Basic Flat Surface Mount Kit
JW047ACM	Aruba CM AP-220-MNT-W1W Flat Surface Wall/Ceiling White AP Basic Flat Surface Mount Kit
JY706ACM	Aruba CM AP-220-MNT-W3 White Low Profile Box Style Secure Large AP Flat Surface Mount Kit
Q9U25ACM	Aruba CM AP-MNT-W4 White Low Profile Basic AP Flat Surface Mount Kit
JW047A	AP-220-MNT-W1W Flat surface wall/ceiling basic flat surface AP mount kit (white)
JY706A	AP-220-MNT-W3 Low profile box style secure large flat surface AP mount kit (white)
Q9U25A	AP-MNT-W4 White Low Profile Basic AP Flat Surface Mount Kit

ORDERING INFORMATION

Part Number	Description
Cosmetic Covers	
JW828A	AP-335-CVR-20 Kit of 20 snap-on covers for AP-335 & AP-345. Plain white, non-glossy, with holes for LED indicators
JW828ACM	Aruba CM AP-335-CVR-20 20-pk White Non-glossy Snap-on Covers
Power Accessories	
JW629A	PD-9001GR-AC POE midspan injector, 10/100/1000 802.3at (30W)
JX991A	AP-AC-48V36C AC-to-DC Power Adapter (48V/36W)
JW629ACM	Aruba CM PD-9001GR-AC 802.3at PoE+ 10/100/1000 Ethernet Indoor Rated Midspan Injector
JX991ACM	Aruba CM AP-AC-48V36C 48V/36W AC/DC desktop style power adapter with type C connector
R3K01ACM	Aruba CM AP-AC2-48C 48V/50W AC/DC desktop style power adapter with type C connector
R3K01A	48V/50W AC/DC power adapter type C
Other Accessories	
JY728A	AP-CBL-SERU Micro-USB TTL3.3V to USB2.0 AP Console Adapter Cable
JY728ACM	Aruba CM AP-CBL-SERU AP console adapter cable for custom micro-USB console port
Antennas	See the 340 Series Ordering Guide for compatible options and the Aruba website for specs

Note: All hardware SKUs can be managed by Aruba Central. Central Managed (CM) SKUs are used for simplified ordering within US and Canada only.

For more ordering information, please refer to the [ordering guide](#).

DATA SHEET

ARUBA 360 SERIES OUTDOOR ACCESS POINTS

Entry level outdoor and warehouse connectivity with Wi-Fi 5 (802.11ac Wave 2)



Multi-functional 360 Series 802.11ac Wave 2 outdoor access points deliver cost-effective wireless connectivity to mobile and IoT devices in a wide range of outdoor and warehouse environments.

With a maximum aggregate data rate of 1.2 Gbps (1.167 Gbps), the 360 Series comes with multi-user MIMO (MU-MIMO), 4 spatial streams (4SS), and optional 160MHz channel bandwidth (VHT160) to quickly add performance and capacity to existing or wireless networks.

EXTREME WEATHER RESILIENCY

Able to survive in harsh outdoor environments and provide connectivity in warehouses and distribution centers, the 360 Series can withstand exposure to high and low temperature extremes, wind speeds up to 165 mph, and tolerate persistent moisture, precipitation, and dust and salt sprays for extended periods of time. All electrical interfaces include industrial strength surge protection.

MU-MIMO AWARE CLIENT OPTIMIZATION

The 360 Series includes Aruba's patented ClientMatch technology to eliminate sticky client issues while optimizing 802.11ac Wave 2 performance. These APs continuously gather session performance metrics to steer mobile devices to the best-available AP - even while users roam. With MU-MIMO awareness, ClientMatch can group MU-MIMO capable devices together to increase network capacity and efficiency. ClientMatch also participates in Aruba's AI-powered Mobility solution.

IOT-READY

Like all Aruba Wi-Fi 6 APs, the 360 Series includes an integrated Bluetooth Low Energy radio to simplify the deployment and management of location services, asset tracking services, security solutions and IoT sensors. This allows organizations to leverage the 360 Series as an IoT platform, which eliminates the need for an overlay infrastructure and additional IT resources.

KEY FEATURES

- Deliver gigabit Wi-Fi to outdoor and extreme environments.
- 1.2 Gbps of maximum throughput
- WPA3 and Enhanced Open security
- Patented ClientMatch technology resolves sticky client issues and optimizes Wave 2 performance
- AI-powered AirMatch automates RF optimization
- IoT-ready with integrated Bluetooth Low Energy (BLE)
- Participates in Aruba's Dynamic Segmentation solution

ARUBA SECURE INFRASTRUCTURE

The Aruba 360 Series includes components of Aruba's 360 Secure Fabric to help protect user authentication and wireless traffic. Select capabilities include:

WPA3 and Enhanced Open

Support for stronger encryption and authentication is provided via the latest version of WPA for enterprise protected networks.

Enhanced Open offers seamless new protection for users connecting to open networks where each session is automatically encrypted to protect user passwords and data on guest networks.

WPA2-MPSK

MPSK enables simpler passkey management for WPA2 devices - should the Wi-Fi password on one device or device type change, no additional changes are needed for other devices. Requires ClearPass Policy Manager.

VPN Tunnels

In Remote AP (RAP) and IAP-VPN deployments, the Aruba 360 Series can be used to establish a secure SSL/IPSec VPN tunnel to a Mobility Controller that is acting as a VPN concentrator.

Trusted Platform Module (TPM)

For enhanced device assurance, all Aruba APs have an installed TPM for secure storage of credentials and keys, and boot code.

SIMPLE AND SECURE ACCESS

To simplify policy enforcement, the Aruba 360 Series uses Aruba's policy enforcement firewall (PEF) feature to encapsulate all traffic from the AP to the Mobility Controller (or Gateway) for end-to-end encryption and inspection. Policies are applied based on user role, device type, applications, and location. This reduces the manual configuration of SSIDs, VLANs and ACLs. PEF also serves as the underlying technology for Aruba Dynamic Segmentation.

FLEXIBLE OPERATION AND MANAGEMENT

A unique feature of Aruba APs is the ability to operate in either controllerless (Instant) or controller-based mode.

Controller-less (Instant) mode

In controllerless mode, one AP serves as a virtual controller for the entire network. Learn more about Instant mode in this technology brief.

Mobility Controller mode

For optimized network performance, roaming and security, APs tunnel all traffic to a mobility controller for centrally managed traffic forwarding and segmentation, data encryption, and policy enforcement. Learn more in the ArubaOS datasheet.

Management options

Available management solutions include Aruba Central (cloud-managed) or Aruba AirWave – a multi-vendor on-premises management solution.

For large installations across multiple sites, APs can be factory-shipped and can be activated with Zero Touch Provisioning through Aruba Central or AirWave. This reduces deployment time, centralizes configuration, and helps manage inventory.

ADDITIONAL FEATURES

Zero Touch Provisioning

APs can be factory-shipped and zero-touch provisioned through Aruba Central or AirWave using a cloud-based service to reduce deployment time, centralize configuration, and manage inventory.

Advanced Cellular Coexistence (ACC)

Minimizes interference from 3G/4G LTE cellular networks, distributed antenna systems (DAS), and commercial small cell or femtocell equipment

Hardened, industrial design

Extends the temperature range capabilities of indoor access points for environments that lack heating and cooling. It also provides sealed connector interfaces to protect against dust and moisture

AP-360 SERIES SPECIFICATION

- AP-365
 - 2.4-GHz (300 Mbps max) and 5-GHz (867 Mbps max) radios, each with 2x2 MIMO and integrated omni-directional antennas.
- AP-367
 - 2.4-GHz (300 Mbps max) and 5-GHz (867 Mbps max) radios, each with 2x2 MIMO and integrated directional antennas.

WIRELESS RADIO SPECIFICATIONS

- AP type: outdoor, dual radio, 5 GHz 802.11ac and 2.4 GHz 802.11n
- 2x2 MIMO with two spatial streams and up to 1,266 Mbps wireless data rate
- Supported frequency bands (country-specific restrictions apply):
 - 2.4000 GHz to 2.4835 GHz
 - 5.150 GHz to 5.250 GHz
 - 5.250 GHz to 5.350 GHz
 - 5.470 GHz to 5.725 GHz
 - 5.725 GHz to 5.875 GHz
- Available channels: Dependent upon configured regulatory domain
- Dynamic Frequency Selection (DFS) compliant to radar coexistence requirements
- Supported radio technologies:
 - 802.11b: Direct-sequence spread-spectrum (DSSS)
 - 802.11a/g/n/ac: Orthogonal frequency-division multiplexing (OFDM)
 - 802.11n/ac: 2x2 MU-MIMO with up to two spatial streams
- Supported modulation types:
 - 802.11b: BPSK, QPSK, CCK
 - 802.11a/g/n: BPSK, QPSK, 16-QAM, 64-QAM
 - 802.11ac: BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM
- Transmit power: Configurable in increments of 0.5 dBm

- Maximum (conducted aggregate) transmit power (limited by local regulatory requirements):
 - 2.4-GHz band: +26 dBm (23 dBm per chain)
 - 5-GHz bands: +25 dBm (22 dBm per chain)
- Maximum EIRP (limited by local regulatory requirements):
 - 2.4 GHz band
 - > 365 28.7 dBm EIRP
 - > 367 32.3 dBm EIRP
 - 5 GHz Band
 - > 365 29.3 dBm EIRP
 - > 367 31.5 dBm EIRP
- Advanced cellular coexistence (ACC) feature to effectively deal with interference from cellular systems
- Maximum ratio combining (MRC) for improved receiver performance
- Cyclic delay diversity (CDD) for improved downlink RF performance
- Short guard interval for 20-MHz, 40-MHz and 80-MHz channels
- Space-time block coding (STBC) for increased range and improved reception
- Low-density parity check (LDPC) for high-efficiency error correction and increased throughput
- Transmit beam-forming (TxBF) for increased reliability in signal delivery
- 802.11ac wave 2 MU-MIMO
- Supported data rates (Mbps):
 - 802.11b: 1, 2, 5.5, 11
 - 802.11a/g: 6, 9, 12, 18, 24, 36, 48, 54
 - 802.11n: 6.5 to 300 (MCS0 to MCS15)
 - 802.11ac: 6.5 to 867 (MCS0 to MCS9, NSS = 1 to 2)
- 802.11n high-throughput (HT) support: HT 20/40
- 802.11ac very high throughput (VHT) support: VHT 20/40/80
- 802.11n/ac packet aggregation: A-MPDU, A-MSDU Power
- Maximum power consumption: 12.5 watts
- Power over Ethernet (PoE): 48 Vdc (nominal) 802.3af-compliant source

ANTENNAS

Supports 802.11ac TxBF which provides an effectively infinite variety of antenna patterns

- AP-365: Integrated Omni antennas (H and V polarized)
 - 2.7 dBi @ 2.4 GHz
 - 4.3 dBi @ 5.x GHz
- AP-367: Integrated Directional antennas (+/-45 polarized)
 - 6.3 dBi @ 2.4 GHz (90° Vertical x 90° Horizontal)
 - 6.5 dBi @ 5.x GHz (90° Vertical x 100° Horizontal)

OTHER INTERFACES

- One 10/100/1000BASE-T Ethernet network interfaces (RJ-45)
 - Auto-sensing link speed and MDI/MDX
 - 802.3az Energy Efficient Ethernet (EEE)
 - PoE-PD: 802.3af PoE
- Serial console interface (micro USB)
- Reset button
- Visual indicator (LED):
 - Power/system status

MOUNTING

- Ordered separately
- Optional mounting kits:
 - AP-270-MNT-V1: Outdoor AP long mount kit for pole/wall mounting. Reduces impact of obstruction by pole or extends away from corner
 - AP-270-MNT-V2: Outdoor AP short mount kit for pole/wall mounting
 - AP-270-MNT-H1: Outdoor AP mount kit for hanging from inclined/horizontal structures
 - AP-270-MNT-H2: Outdoor AP flush mount kit for hanging from inclined/horizontal structures

MECHANICAL

- Dimensions/weight (unit, excluding mount accessories):
 - 165mm (W) x 165mm (D) x 110mm (H),
6.5" (W) x 6.5" (D) 4.3" (H)
 - 807g/1.78lbs (AP-365)
 - 815g/1.80lbs (AP-367)
- Dimensions/weight (shipping):
 - 198mm (W) x 200mm (D) x 128mm (H),
7.8" (W) x 7.9" (D) x 5.0" (H)
 - 1,115g/2.46lbs (AP-365)
 - 1,123g/2.48lbs (AP-367)

ENVIRONMENTAL

- Operating:
 - Temperature: -40° C to +55° C (-40° F to +131° F) ambient in full sun
 - Humidity: 5% to 95% non-condensing
- Max Elevation 3000m
- Storage and transportation:
 - Temperature: -40° C to +70° C (-40° F to +158° F)
 - EN 300 019 Storage and Transportation
- Shock, vibration, and earthquake
 - IEC 60068-2-64/-27/-6

- Weather resistance
 - Wind Survivability: Up to 165 mph
 - IP66/67
 - ASTM B117-07A: Salt spray testing per UL50 NEMA 4x
 - EN 300 019 Environmental testing
 - » Non-weather protected locations
 - » Full solar exposure

REGULATORY/COMPLIANCE

- FCC/Industry of Canada
- CE Marked
- RED Directive 2014/53/EU
- EMC Directive 2014/30/EU
- Low Voltage Directive 2014/35/EU
- EN 300 328
- EN 301 489
- EN 301 893
- UL/IEC/EN 60950
- EN 60601-1-1, EN60601-1-2
- AP-365:
 - EN 50121-1
 - EN 50121-3-2
 - EN 50121-4
 - EN-50155

For more country-specific regulatory information and approvals, please see your Aruba representative.

REGULATORY MODEL NUMBERS

- AP-365: APEX0365
- AP-367: APEX0367

CERTIFICATIONS

- CB Scheme Safety, cTUVus
- Wi-Fi CERTIFIED™ a,b,g,n
- Wi-Fi CERTIFIED™ ac (with wave 2 features)
- WPA, WPA2 and WPA3 – Enterprise with CNSA option, Personal (SAE), Enhanced Open (OWE)

WARRANTY

- Limited lifetime warranty

MINIMUM OPERATING SYSTEM

SOFTWARE VERSION

- Unified ArubaOS and InstantOS 6.5.2.0 and 8.2.0

RF PERFORMANCE TABLE

	Maximum transmit power (dBm) per transmit chain	Receiver sensitivity (dBm) per receive chain
802.11b 2.4 GHz		
1 Mbps	23.0	-91.0
11 Mbps	18.0	-88.0
802.11g 2.4 GHz		
6 Mbps	23.0	-91.0
54 Mbps	18.0	-73.0
802.11n HT20 2.4 GHz		
MCS0/8	23.0	-91.0
MCS7/15	18.0	-72.0
802.11n HT40 2.4 GHz		
MCS0/8	18.0	-88.0
MCS7/15	18.0	-69.0
802.11ac VHT20 2.4 GHz		
MCS0 Nss1&Nss2	23.0	-91.0
MCS8 Nss1&Nss2	18.0	-67.0
802.11ac VHT40 2.4 GHz		
MCS0 Nss1&Nss2	18.0	-88.0
MCS9 Nss1&Nss2	17.0	-63.0
802.11a VHT80 5 GHz		
6 Mbps	22.0	-91.0
54 Mbps	20.0	-74.0
802.11n HT20 5 GHz		
MCS0/8	22.0	-91.0
MCS7/15	20.0	-72.0
802.11n HT40 5 GHz		
MCS0/8	22.0	-88.0
MCS7/15	20.0	-69.0
802.11ac VHT20 5 GHz (SU-MIMO)		
MCS0 Nss1&Nss2	22.0	-91.0
MCS8 Nss1&Nss2	19.0	-68.0
802.11ac VHT40 5 GHz (SU-MIMO)		
MCS0 Nss1&Nss2	22.0	-87.0
MCS9 Nss1&Nss2	19.0	-63.0
802.11ac VHT80 5 GHz (SU-MIMO)		
MCS0 Nss1&Nss2	22.0	-85.0
MCS9 Nss1&Nss2	19.0	-59.0

Note: please check with your country manager for regional product schedules.

ORDERING INFORMATION

Part Number	Description
AP-360 Series Access Points	
JX963A	Aruba AP-365 (EG) 802.11n/ac Dual 2x2:2 Radio Integrated Omni Antenna Outdoor AP
JX964A	Aruba AP-365 (IL) 802.11n/ac Dual 2x2:2 Radio Integrated Omni Antenna Outdoor AP
JX965A	Aruba AP-365 (JP) 802.11n/ac Dual 2x2:2 Radio Integrated Omni Antenna Outdoor AP
JX966A	Aruba AP-365 (RW) 802.11n/ac Dual 2x2:2 Radio Integrated Omni Antenna Outdoor AP
JX967A	Aruba AP-365 (US) 802.11n/ac Dual 2x2:2 Radio Integrated Omni Antenna Outdoor AP
JX968A	Aruba AP-365 (RW) TAA 802.11n/ac Dual 2x2:2 Radio Integrated Omni Antenna Outdoor AP
JX969A	Aruba AP-365 (US) TAA 802.11n/ac Dual 2x2:2 Radio Integrated Omni Antenna Outdoor AP
JX970A	Aruba AP-367 (EG) 802.11n/ac Dual 2x2:2 Radio Integrated Directional Antenna Outdoor AP
JX971A	Aruba AP-367 (IL) 802.11n/ac Dual 2x2:2 Radio Integrated Directional Antenna Outdoor AP
JX972A	Aruba AP-367 (JP) 802.11n/ac Dual 2x2:2 Radio Integrated Directional Antenna Outdoor AP
JX973A	Aruba AP-367 (RW) 802.11n/ac Dual 2x2:2 Radio Integrated Directional Antenna Outdoor AP
JX974A	Aruba AP-367 (US) 802.11n/ac Dual 2x2:2 Radio Integrated Directional Antenna Outdoor AP
JX975A	Aruba AP-367 (RW) TAA 802.11n/ac Dual 2x2:2 Radio Integrated Direct Antenna Outdoor AP
JX976A	Aruba AP-367 (US) TAA 802.11n/ac Dual 2x2:2 Radio Integrated Direct Antenna Outdoor AP
JX966ACM	Aruba CM AP-365 (RW) 802.11n/ac Dual 2x2:2 Integ Omni Antenna Outdoor AP
JX967ACM	Aruba CM AP-365 (US) 802.11n/ac Dual 2x2:2 Integ Omni Antenna Outdoor AP
JX973ACM	Aruba CM AP-367 (RW) 802.11n/ac Dual 2x2:2 Integ Directional Antenna Outdoor AP
JX974ACM	Aruba CM AP-367 (US) 802.11n/ac Dual 2x2:2 Integ Directional Antenna Outdoor AP
AP-360 Series Accessories	
JW627A	PD-3501G-AC 15.4W 802.3af PoE 10/100/1000Base-T Ethernet Midspan Injector
JW630A	PD-9001GO-DC 30W 802.3at PoE+ 10/100/1000 12-24V DC in Outdoor Surge Prot Midspan Injector
JW700A	PD-9001GO-NA 30W 802.3at PoE+ 10/100/1000 Outdoor Surge Prot NA Power Cord Midspan Injector
JW701A	PD-9001GO-INTL 30W 802.3at PoE+ 10/100/1000 Outdoor Surge Prot Intl Power Cord injector
JW052A	AP-270-MNT-V1 AP-270 Series Outdoor Pole/Wall Long Mount Kit
JW053A	AP-270-MNT-V2 AP-270 Series Outdoor Pole/Wall Short Mount Kit
JW054A	AP-270-MNT-H1 AP-270 Series Outdoor AP Hanging or Tilt Install Mount Kit
JW055A	AP-270-MNT-H2 AP-270 Series Access Flush Wall or Ceiling Mount

Note: All hardware SKUs can be managed by Aruba Central. Central Managed (CM) SKUs are used for simplified ordering within US and Canada only.

DATA SHEET

ARUBA 370 SERIES OUTDOOR ACCESS POINTS

High performance Wi-Fi 5 (802.11ac Wave 2) for outdoor environments

Weatherproof and temperature-hardened, the Aruba 370 Series Access Points deliver multi-gigabit Wi-Fi to outdoor and environmentally challenging locations.

With a maximum aggregate data rate of over 2 Gbps (2.4GHz: 300Mbps; 5GHz: 1,733 Mbps), the 370 Series comes with multi-user MIMO (MU-MIMO), 4 spatial streams (4SS), and optional 160MHz channel bandwidth (VHT160) to quickly add performance and capacity to existing or new wireless networks.

EXTREME WEATHER RESILIENCY

Able to survive in harsh outdoor environments, the 370 Series can withstand exposure to high and low temperature extremes, windspeeds up to 165 mph, and tolerate persistent moisture, precipitation, and dust and salt sprays for extended periods of time. All electrical interfaces include industrial strength surge protection.

MU-MIMO AWARE CLIENT OPTIMIZATION

The 370 Series includes Aruba's patented ClientMatch technology to eliminate sticky client issues while optimizing 802.11ac Wave 2 performance. These APs continuously gather session performance metrics to steer mobile devices to the best-available AP - even while users roam. With MU-MIMO awareness, ClientMatch can group MU-MIMO capable devices together to increase network capacity and efficiency. ClientMatch also participates in Aruba's AI-powered Mobility solution.

IOT-READY

Like all Aruba Wi-Fi 6 APs, the 370 Series includes an integrated Bluetooth Low Energy radio to simplify the deployment and management of location services, asset tracking services, security solutions and IoT sensors. This allows organizations to leverage the 360 Series as an IoT platform, which eliminates the need for an overlay infrastructure and additional IT resources.



KEY FEATURES

- Deliver gigabit Wi-Fi to outdoor and extreme environments.
- 2 Gbps of maximum throughput
- WPA3 and Enhanced Open security
- Patented ClientMatch technology resolves sticky client issues and optimizes Wave 2 performance
- AI-powered AirMatch automates RF optimization
- IoT-ready with integrated Bluetooth Low Energy (BLE)
- Participates in Aruba's Dynamic Segmentation solution.

ARUBA SECURE INFRASTRUCTURE

The Aruba 370 Series includes components of Aruba's 360 Secure Fabric to help protect user authentication and wireless traffic. Select capabilities include:

WPA3 and Enhanced Open

Support for stronger encryption and authentication is provided via the latest version of WPA for enterprise protected networks.

Enhanced Open offers seamless new protection for users connecting to open networks where each session is automatically encrypted to protect user passwords and data on guest networks.

WPA2-MPSK

MPSK enables simpler passkey management for WPA2 devices - should the Wi-Fi password on one device or device type change, no additional changes are needed for other devices. Requires ClearPass Policy Manager.

VPN Tunnels

In Remote AP (RAP) and IAP-VPN deployments, the 370 Series can be used to establish a secure SSL/IPSec VPN tunnel to a Mobility Controller that is acting as a VPN concentrator.

Trusted Platform Module (TPM)

For enhanced device assurance, all Aruba APs have an installed TPM for secure storage of credentials and keys, and boot code.

SIMPLE AND SECURE ACCESS

To simplify policy enforcement, the Aruba 370 Series uses Aruba's policy enforcement firewall (PEF) feature to encapsulate all traffic from the AP to the Mobility Controller (or Gateway) for end-to-end encryption and inspection. Policies are applied based on user role, device type, applications, and location. This reduces the manual configuration of SSIDs, VLANs and ACLs. PEF also serves as the underlying technology for Aruba Dynamic Segmentation.

FLEXIBLE OPERATION AND MANAGEMENT

A unique feature of Aruba APs is the ability to operate in either controllerless (Instant) or controller-based mode.

Controller-less (Instant) mode

In controllerless mode, one AP serves as a virtual controller for the entire network. Learn more about Instant mode in this technology brief.

Mobility Controller mode

For optimized network performance, roaming and security, APs tunnel all traffic to a mobility controller for centrally managed traffic forwarding and segmentation, data encryption, and policy enforcement. Learn more in the ArubaOS datasheet.

Management options

Available management solutions include Aruba Central (cloud-managed) or Aruba AirWave – a multi-vendor on-premises management solution.

For large installations across multiple sites, APs can be factory-shipped and can be activated with Zero Touch Provisioning through Aruba Central or AirWave. This reduces deployment time, centralizes configuration, and helps manage inventory.

ADDITIONAL FEATURES

Zero Touch Provisioning

APs can be factory-shipped and zero-touch provisioned through Aruba Central or AirWave using a cloud-based service to reduce deployment time, centralize configuration, and manage inventory.

Advanced Cellular Coexistence (ACC)

Minimizes interference from 3G/4G LTE cellular networks, distributed antenna systems (DAS), and commercial small cell or femtocell equipment

Hardened, industrial design

Extends the temperature range capabilities of indoor access points for environments that lack heating and cooling. It also provides sealed connector interfaces to protect against dust and moisture

ARUBA 370 SERIES SPECIFICATIONS

- AP-374
 - 5 GHz 802.11ac 4x4 MU-MIMO (1,733 Mbps max rate)
 - » Four Nf connectors for external antenna operation
 - 2.4 GHz 802.11n 2x2 MIMO (300 Mbps max rate) radios
 - » Two Nf connectors for external antenna operation at 2.4 GHz.
- AP-375
 - 5 GHz 802.11ac 4x4 MU-MIMO (1,733 Mbps max rate)
 - » Internal Omni Antennas 4.6 dBi
 - 2.4 GHz 802.11n 2x2 MIMO (300 Mbps max rate) radios
 - » Internal Omni Antennas 4.0 dBi
- AP-377
 - 5 GHz 802.11ac 4x4 MU-MIMO (1,733 Mbps max rate)
 - » Internal 80°H x 80°V Directional Antennas 6.3 dBi
 - 2.4 GHz 802.11n 2x2 MIMO (300 Mbps max rate) radios
 - » Internal 80°H x 80°V Directional Antennas 6.4 dBi

WI-FI RADIO SPECIFICATIONS

- AP type: Outdoor hardened, dual radio, 5 GHz 802.11ac 4x4 MIMO and 2.4 GHz 802.11n 2x2 MIMO
- Software-configurable dual radio supports 5 GHz (Radio 0) and 2.4 GHz (Radio 1)
- 5 GHz: Four spatial stream Multi User (MU) MIMO for up to 1,733 Mbps wireless data rate to up to three MU-MIMO capable client devices simultaneously
- 5 GHz: Four spatial stream Single User (SU) MIMO for up to 1,733 Mbps wireless data rate to individual 4x4 VHT80 or 2x2 VHT160 client devices
- 2.4 GHz: Two spatial stream Single User (SU) MIMO for up to 300 Mbps wireless data rate to individual 2x2 HT40 client devices
- Support for up to 256 associated client devices per radio, and up to 16 BSSIDs per radio

- Supported frequency bands (country-specific restrictions apply):
 - 2.400 to 2.4835 GHz
 - 5.150 to 5.250 GHz
 - 5.250 to 5.350 GHz
 - 5.470 to 5.725 GHz
 - 5.725 to 5.850 GHz
 - 5.825 to 5.875 GHz
- Available channels: Dependent on configured regulatory domain.
- Dynamic frequency selection (DFS) maximizes the use of available RF spectrum.
- Supported radio technologies:
 - 802.11b: Direct-sequence spread-spectrum (DSSS)
 - 802.11a/g/n/ac: Orthogonal frequency-division multiplexing (OFDM)
- Supported modulation types:
 - 802.11b: BPSK, QPSK, CCK
 - 802.11a/g/n/ac: BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM
- Transmit power: Configurable in increments of 0.5 dBm
- Maximum (conducted) transmit power (limited by local regulatory requirements):
 - 2.4 GHz band: +25 dBm per chain, +28dBm aggregate (2x2)
 - 5 GHz band: +22 dBm per chain, +28dBm aggregate (4x4)
 - Note: conducted transmit power levels exclude antenna gain.
- Maximum EIRP (limited by local regulatory requirements):
 - 2.4 GHz band:
 - » 374: 28 + Antenna Gain
 - » 375: 32 dBm EIRP
 - » 377: 34.4 dBm EIRP
 - 5 GHz band:
 - » 374: 28 + Antenna Gain + TxBF Gain
 - » 375: 35.6 dBm EIRP
 - » 377: 36 dBm EIRP
- Advanced Cellular Coexistence (ACC) minimizes interference from cellular networks.
- Maximum ratio combining (MRC) for improved receiver performance.
- Cyclic delay/shift diversity (CDD/CSD) for improved downlink RF performance.
- Short guard interval for 20-MHz, 40-MHz, 80-MHz and 160-MHz channels.
- Space-time block coding (STBC) for increased range and improved reception.

- Low-density parity check (LDPC) for high-efficiency error correction and increased throughput.
- Transmit beam-forming (TxBF) for increased signal reliability and range.
- Supported data rates (Mbps):
 - 802.11b: 1, 2, 5.5, 11
 - 802.11a/g: 6, 9, 12, 18, 24, 36, 48, 54
 - 802.11n (2.4GHz): 6.5 to 300 (MCS0 to MCS15)
 - 802.11n (5GHz): 6.5 to 600 (MCS0 to MCS31)
 - 802.11ac: 6.5 to 1,733 (MCS0 to MCS9, NSS = 1 to 4 for VHT20/40/80, NSS = 1 to 2 for VHT160)
- 802.11n high-throughput (HT) support: HT 20/40
- 802.11ac very high throughput (VHT) support: VHT 20/40/80/160
- 802.11n/ac packet aggregation: A-MPDU, A-MSDU

POWER

- Worst-case power consumption from the AP: 23W
- Power sources sold separately
- Power over Ethernet (PoE+): 802.3at-compliant
- AC Power: 100-240 Volt 50/60Hz AC

OTHER INTERFACES

- One 10/100/1000BASE-T Ethernet network interfaces (RJ-45)
 - Auto-sensing link speed and MDI/MDX
 - 802.3az Energy Efficient Ethernet (EEE)
- One 1000BASE-X SFP Port
- Bluetooth Low Energy (BLE) radio
 - Up to 4 dBm transmit power (class 2) and -91 dBm receive sensitivity
- Visual indicator (multi-color LED): For system and radio status
- Reset button: Factory reset (during device power up)
- Micro USB console interface
- Kensington security slot

MOUNTING

- AP-270-MNT-V1
- AP-270-MNT-V2
- AP-270-MNT-H1
- AP-270-MNT-H2

MECHANICAL

AP-374

Dimensions/weight (excluding mount):

- 23 cm (W) x 24 cm (D) x 19 cm (H) with aesthetic cover
- 9.0" (W) x 9.4" (D) x 7.5" (H)
- 2.7 kg/6 lbs
- 23 cm (W) x 24 cm (D) x 14 cm (H) without aesthetic cover
- 9.0" (W) x 9.4" (D) x 5.5" (H)
- 2.4 kg/5.3 lbs

AP-375

Dimensions/weight (excluding mount):

- 23 cm (W) x 24 cm (D) x 27 cm (H)
- 9.0" (W) x 9.4" (D) x 10.6" (H)
- 2.4 kg/5.3 lbs

AP-377

Dimensions/weight (excluding mount):

- 23 cm (W) x 22 cm (D) x 13 cm (H)
- 9.0" (W) x 8.7" (D) x 5.1" (H)
- 2.1 kg/4.6 lbs

ENVIRONMENTAL

- Operating:
 - Temperature: -40° C to +65° C (-40° F to +149° F)
 - Humidity: 5% to 95% non-condensing
- Storage and transportation:
 - Temperature: -40° C to +70° C (-40° F to +158° F)
- Operating Altitude: 3,000 m
- Water and Dust
 - IP66/67
- Salt Tolerance
 - Tested to ASTM B117-07A Salt Spray 200hrs
- Wind Survival: Up to 165 Mph
- Shock and Vibration ETSI 300-19-2-4

REGULATORY

- FCC/ISED
- CE Marked
- RED Directive 2014/53/EU
- EMC Directive 2014/30/EU
- Low Voltage Directive 2014/35/EU
- UL/IEC/EN 60950
- EN 60601-1-1, EN60601-1-2

For more country-specific regulatory information and approvals, please see your Aruba representative.

REGULATORY MODEL NUMBERS

- AP-374: APEX0374
- AP-375: APEX0375
- AP-377: APEX0377

CERTIFICATIONS

- CB Scheme Safety, cTUVus
- UL2043 plenum rating
- Wi-Fi Alliance certified 802.11a/b/g/n
- WPA, WPA2 and WPA3 – Enterprise with CNSA option, Personal (SAE), Enhanced Open (OWE)
- Wi-Fi CERTIFIED™ ac (with wave 2 features)
- Passpoint® (Release 2) with ArubaOS and Instant 8.3+

WARRANTY

- Limited lifetime warranty

MINIMUM OPERATING SYSTEM SOFTWARE

- ArubaOS & Aruba InstantOS 8.3.0.0

RF PERFORMANCE TABLE

	Maximum transmit power (dBm) per transmit chain	Receiver sensitivity (dBm) per receive chain
802.11b 2.4 GHz		
1 Mbps	25	-95
2 Mbps	25	-93
5.5 Mbps	25	-90
11 Mbps	25	-88
802.11g 2.4 GHz		
6 Mbps	25	-93
54 Mbps	19	-75
802.11n HT20 2.4 GHz		
MCS0/8	25	-93
MCS7/15	18	-71
802.11n HT40 2.4 GHz		
MCS0/8	22	-90
MCS7/15	18	-68
802.11a 5 GHz		
6 Mbps	22	-93
54 Mbps	19	-75
802.11n HT20 5 GHz		
MCS0/8	22	-93
MCS7/15	18	-71
802.11n HT40 5 GHz		
MCS0/8	22	-90
MCS7/15	18	-68
802.11ac VHT20 5 GHz		
MCS0	22	-93
MCS9	16	-68
802.11ac VHT40 5 GHz		
MCS0	22	-90
MCS9	15	-63
802.11ac VHT80 5 GHz		
MCS0	22	-87
MCS9	15	-61
802.11ac VHT160 5 GHz		
MCS0	22	-86
MCS9	15	-57

Maximum capability of the hardware provided (excluding antenna gain). Maximum transmit power is limited by local regulatory settings.

ORDERING INFORMATION

Part Number	Description
Aruba 370 Series Unified Outdoor Access Points	
JZ162A	Aruba AP-374 (RW) 802.11n/ac Dual 2x2:2/4x4:4 Radio 6xNf Connectors Outdoor AP
JZ163A	Aruba AP-374 (US) 802.11n/ac Dual 2x2:2/4x4:4 Radio 6xNf Connectors Outdoor AP
JZ159A	Aruba AP-374 (EG) 802.11n/ac Dual 2x2:2/4x4:4 Radio 6xNf Connectors Outdoor AP
JZ160A	Aruba AP-374 (IL) 802.11n/ac Dual 2x2:2/4x4:4 Radio 6xNf Connectors Outdoor AP
JZ161A	Aruba AP-374 (JP) 802.11n/ac Dual 2x2:2/4x4:4 Radio 6xNf Connectors Outdoor AP
JZ172A	Aruba AP-375 (RW) 802.11n/ac Dual 2x2:2/4x4:4 Radio Integrated Omni Antenna Outdoor AP
JZ173A	Aruba AP-375 (US) 802.11n/ac Dual 2x2:2/4x4:4 Radio Integrated Omni Antenna Outdoor AP
JZ169A	Aruba AP-375 (EG) 802.11n/ac Dual 2x2:2/4x4:4 Radio Integrated Omni Antenna Outdoor AP
JZ170A	Aruba AP-375 (IL) 802.11n/ac Dual 2x2:2/4x4:4 Radio Integrated Omni Antenna Outdoor AP
JZ171A	Aruba AP-375 (JP) 802.11n/ac Dual 2x2:2/4x4:4 Radio Integrated Omni Antenna Outdoor AP
JZ182A	Aruba AP-377 (RW) 802.11n/ac Dual 2x2:2/4x4:4 Radio Integrated Directional Antenna Outdoor AP
JZ183A	Aruba AP-377 (US) 802.11n/ac Dual 2x2:2/4x4:4 Radio Integrated Directional Antenna Outdoor AP
JZ179A	Aruba AP-377 (EG) 802.11n/ac Dual 2x2:2/4x4:4 Radio Integrated Directional Antenna Outdoor AP
JZ180A	Aruba AP-377 (IL) 802.11n/ac Dual 2x2:2/4x4:4 Radio Integrated Directional Antenna Outdoor AP
JZ181A	Aruba AP-377 (JP) 802.11n/ac Dual 2x2:2/4x4:4 Radio Integrated Directional Antenna Outdoor AP
Aruba 370 Series Unified Outdoor Access Points TAA	
JZ167A	Aruba AP-374 (RW) TAA 802.11n/ac Dual 2x2:2/4x4:4 Radio 6xNf Connectors Outdoor AP
JZ168A	Aruba AP-374 (US) TAA 802.11n/ac Dual 2x2:2/4x4:4 Radio 6xNf Connectors Outdoor AP
JZ164A	Aruba AP-374 (EG) TAA 802.11n/ac Dual 2x2:2/4x4:4 Radio 6xNf Connectors Outdoor AP
JZ165A	Aruba AP-374 (IL) TAA 802.11n/ac Dual 2x2:2/4x4:4 Radio 6xNf Connectors Outdoor AP
JZ166A	Aruba AP-374 (JP) TAA 802.11n/ac Dual 2x2:2/4x4:4 Radio 6xNf Connectors Outdoor AP
JZ177A	Aruba AP-375 (RW) TAA 802.11n/ac Dual 2x2:2/4x4:4 Radio Integrated Omni Antenna Outdoor AP
JZ178A	Aruba AP-375 (US) TAA 802.11n/ac Dual 2x2:2/4x4:4 Radio Integrated Omni Antenna Outdoor AP
JZ174A	Aruba AP-375 (EG) TAA 802.11n/ac Dual 2x2:2/4x4:4 Radio Integrated Omni Antenna Outdoor AP
JZ175A	Aruba AP-375 (IL) TAA 802.11n/ac Dual 2x2:2/4x4:4 Radio Integrated Omni Antenna Outdoor AP
JZ176A	Aruba AP-375 (JP) TAA 802.11n/ac Dual 2x2:2/4x4:4 Radio Integrated Omni Antenna Outdoor AP
JZ187A	Aruba AP-377 (RW) TAA 802.11n/ac Dual 2x2:2/4x4:4 Radio Integ Directional Antenna Outdoor AP
JZ188A	Aruba AP-377 (US) TAA 802.11n/ac Dual 2x2:2/4x4:4 Radio Integ Directional Antenna Outdoor AP
JZ184A	Aruba AP-377 (EG) TAA 802.11n/ac Dual 2x2:2/4x4:4 Radio Integ Directional Antenna Outdoor AP
JZ185A	Aruba AP-377 (IL) TAA 802.11n/ac Dual 2x2:2/4x4:4 Radio Integ Directional Antenna Outdoor AP
JZ186A	Aruba AP-377 (JP) TAA 802.11n/ac Dual 2x2:2/4x4:4 Radio Integ Directional Antenna Outdoor AP
JZ172ACM	Aruba CM AP-375 (RW) 802.11n/ac Dual 2x2:2/4x4:4 Integ Omni Antenna Outdoor AP
JZ173ACM	Aruba CM AP-375 (US) 802.11n/ac Dual 2x2:2/4x4:4 Integ Omni Antenna Outdoor AP
JZ182ACM	Aruba CM AP-377 (RW) 802.11n/ac Dual 2x2:2/4x4:4 Integ Directional Antenna Outdoor AP
JZ183ACM	Aruba CM AP-377 (US) 802.11n/ac Dual 2x2:2/4x4:4 Integ Directional Antenna Outdoor AP

Note: All hardware SKUs can be managed by Aruba Central. Central Managed (CM) SKUs are used for simplified ordering within US and Canada only.

DATA SHEET

ARUBA OUTDOOR MIMO ANTENNA

ANT-4x4-5314

ANT-4x4-5314 is a multi polarized antenna with 30° H x 30° V beamwidths. This antenna is well suited for coverage along a street, spot coverage, or for covering a seating section in stadiums and other large public venues. It is also ideal for point-to-point connections. The narrower beamwidth reduces the zone where interference may be received.



FREQUENCY/MAX GAIN

- 4.9 – 6.0 GHz (14dBi)

DIMENSIONS

- 260 x 260 x 30 mm (7.5 x 7.5 x 1.2 inches)

POLARIZATION

- H, V, and Dual Slant 45

WEIGHT

- 1200 g (2.6 lbs)

BEAMWIDTH

- Horiz Plane: 30°
- Vert Plane: 30°

HOUSING

- Backplate: Aluminum
- Radome: Plastic

IMPEDANCE

- 50 ohms

CONNECTORS

- N-type female x4 (RF cables not included)

MAXIMUM INPUT POWER

- 6 Watts

OPERATING TEMPERATURE

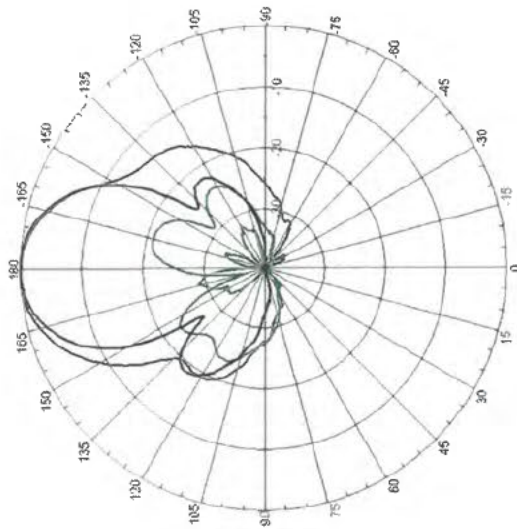
- -45°C to +65°C

VSWR

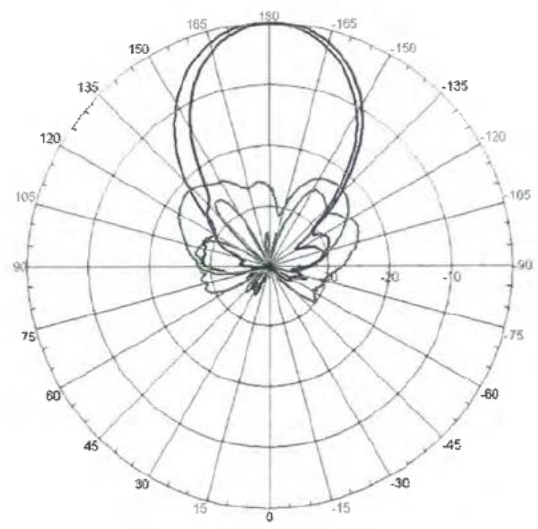
- 2:1 max

INSTALLATION HARDWARE

- Mount kit for wall and pole included.



Vertical (5.47 GHz)



Horizontal (5.47 GHz)

ORDERING INFORMATION

Part Number	Description
JX988A	ANT-4x4-5314 5.15-5.9GHz 14dBi 30x30deg Dual Pol MIMO Hi Gain Dir N-Type Outdoor Antenna



a Hewlett Packard
Enterprise company

www.arubanetworks.com

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1.844.473.2782 | T: 1.408.227.4500 | FAX: 1.408.227.4550 | INFO@ARUBANETWORKS.COM

DS_ANT-4x4-5314_120116

DATA SHEET

ARUBA OUTDOOR 4X4 MIMO ANTENNA

JW015A

AP-ANT-45 is a multi-polarized antenna with nominal 90° H x 90° V beamwidths. This antenna is well suited for 2.4 and 5 GHz sector coverage for access.

FREQUENCY/GAIN

- 4.9-6.0 GHz/5.5 dBi
- 2.4-2.5 GHz/4.5 dBi

DIMENSIONS

- 200 mm x 200 mm x 40 mm

POLARIZATION

- +/-45° +/-135°

WEIGHT

- 590 g

BEAMWIDTH

- Horiz Plane: 90° Vert Plane: 90° @ 2.4 GHz
- Horiz Plane: 90° Vert Plane: 90° @ 5.x GHz

HOUSING

- Housing: Aluminum
- Radome: Plastic

IMPEDANCE

- 50 ohms

CONNECTION

- 75 cm RPSMA terminated pigtails

MAXIMUM INPUT POWER

- 6 watts

OPERATING TEMPERATURE

- -40° C to +65° C

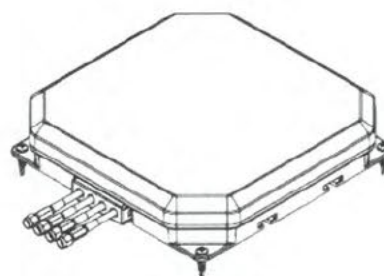


VSWR

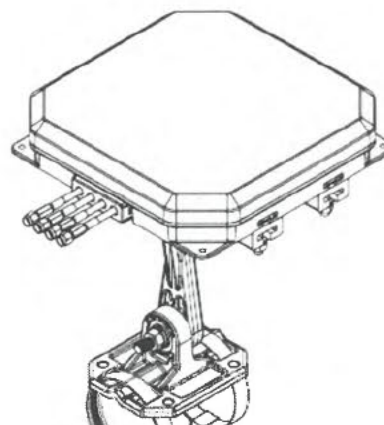
- 2:1 max

INSTALLATION HARDWARE

- Wall mount anchors provided
- Optional AP-ANT-MNT-5 bracket purchased separately



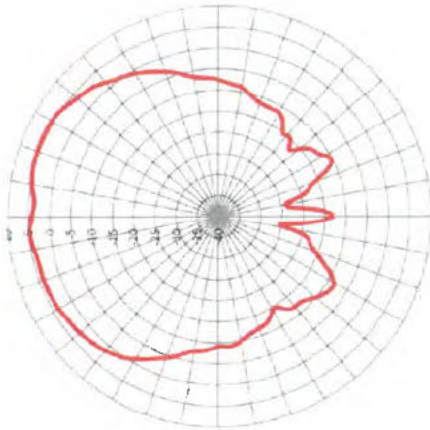
Wall mount



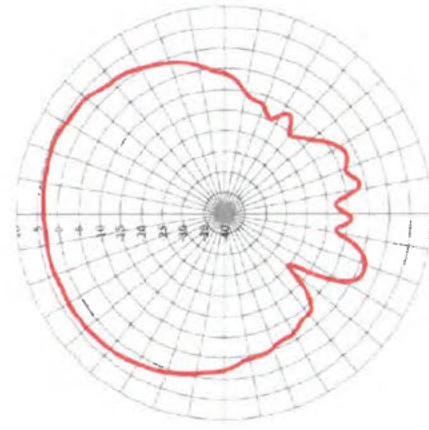
With Pole Mount Kit (AP-ANT-MNT-5)

ANTENNA PATTERN PLOTS

Vertical patterns

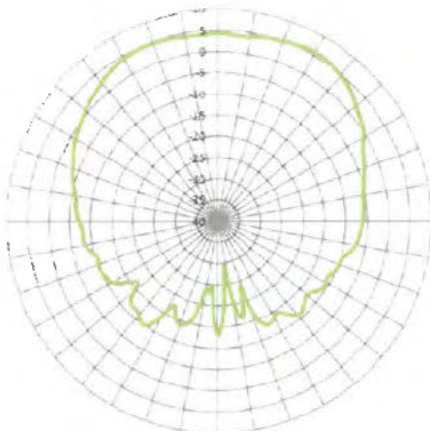


5.x GHz

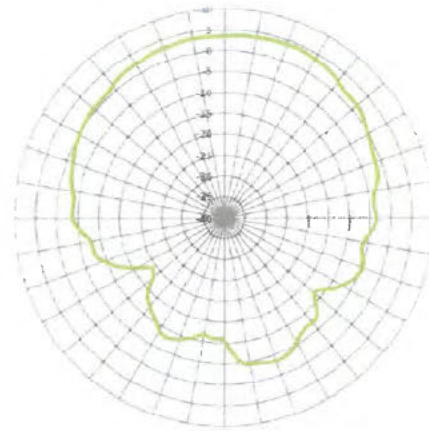


2.4 GHz

Horizontal patterns



5.x GHz



2.4 GHz

ORDERING INFORMATION

Part Number	Description
JW018A	AP-ANT-45 Dual Band 90x90deg 5dBi 4 Element MIMO 4xRPSMA Pigtail Antenna
JW022A	AP-ANT-MNT-5 AP-ANT-45 Azimuth and Elevation Adjustable Mount Kit

DATA SHEET

ARUBA 7200 SERIES MOBILITY CONTROLLERS

Improved network performance, visibility, and control

Aruba 7200 Series Mobility Controllers enhance WLAN performance for high performance, high density enterprise requirements. The 7200 Series centralizes all control functionality for individual Aruba access points (APs) to improve AP utilization, security, and client roaming. Ideally suited for large campuses and high density environments, the 7200 Series can be deployed using Zero Touch Provisioning (ZTP) to simplify deployment.

SIMPLE AND SECURE ACCESS

The 7200 Series serves a key role in Dynamic Segmentation, providing Aruba's Policy Enforcement Firewall (PEF) to enforce policies based on user role, device type, application, and network location - and simplifying and securing wired and wireless network access. Traffic is encapsulated in GRE tunnels for complete encryption all the way from an AP or switch. This feature can be enabled with the ArubaOS PEF license and eliminates the need to manually configure SSIDs, VLANs or ACLs for each new client on the network.

HIGH PERFORMANCE AND RELIABILITY

Each 7200 Series provides connectivity for up to 32,728 concurrent users or client devices, 2,048 access points and over 2 million active firewall sessions. With up to 80 virtual CPUs and 100Gbps of maximum throughput to perform Policy Enforcement Firewall (PEF) features, the 7200 Series are in a class of their own -- ideal for the most demanding enterprise, college, and large public venue requirements.



KEY FEATURES

- Support for new Wi-Fi 6 (802.11ax), WPA3 and Enhanced Open - and existing standards
- Patented ClientMatch technology can now group together Wi-Fi 6-capable devices
- Dynamic Segmentation enforces wired and wireless access policies to simplify and secure the network
- Application awareness for 3,000+ applications without additional hardware
- Built in AI-powered wireless/RF optimization
- Unifies policy enforcement for WLAN, LAN and WAN traffic

For enhanced resiliency and availability, the 7200 Series can be clustered together in a network managed by Aruba Mobility Master.



Front: 7205



Back: 7205



Front: 7210/7220/7240/7240XM



Back: 7210/7220/7240/7240XM



Front: 7280



Back: 7280

24/7 MISSION-CRITICAL NETWORKING

Aruba's unique, patented wireless technologies are based on AI-powered machine learning algorithms and integrated directly into ArubaOS. Adaptive Radio Management, AirMatch and ClientMatch (now enhanced with Wi-Fi 6 grouping) provide RF optimization techniques to improve user experience and network health based on changing environmental conditions, correct for noisy or congested RF and resolve sticky client issues during user roaming. RFProtect provides advanced spectrum analysis and wireless intrusion protection (WIPS/WIDS) to help identify and mitigate Wi-Fi and non-Wi-Fi sources of interference, as well as containment of potential security risks. Learn more about Aruba's software features on the ArubaOS datasheet.

When deployed with the Aruba Mobility Master, the 7200 Series can be joined to a controller cluster to increase scale, improve reliability using enhanced High Availability (HA), adopt configurations seamlessly based on hierarchy, support Live Upgrades to reduce maintenance windows and share licenses from a global licensing pool. The 7200 Series also serves a key, policy enforcement role in Aruba's 360 Secure Fabric. For network management, Aruba AirWave provides real-time monitoring, reporting and Wi-Fi location services.

Learn more about the 7200 Series Mobility Controller features in the ArubaOS datasheet.

SD-WAN DEPLOYMENT

For organizations that are now managing multiple WAN connections, the 7200 Series can be connected to Aruba's SD-WAN fabric right out of the box. SD-WAN is a rich WAN management solutions that is used to simplify management of traffic entering and exiting branch sites. Please refer to the SD-WAN datasheet for more information.

MICROSOFT FEATURES

Aruba's integration with Microsoft enables unique application intelligence that detects Microsoft 365, Teams and Skype for Business traffic and then prioritizes them over less critical applications. Through management interfaces on ArubaOS, Aruba Central, and Aruba AirWave, IT can visualize call quality metrics such as MOS, latency, jitter, and packet loss for additional insight.

ENHANCED CAPABILITIES:

Wi-Fi 6 (802.11ax) enhanced with ClientMatch

The latest Wi-Fi standard brings enhanced performance, speed, and efficiency with key features such as OFDMA, 1024-QAM, and bidirectional MU-MIMO. Combined with Aruba's patented ClientMatch technology, 802.11ax clients will now be grouped together to optimize the multi-user experience.

Enhanced wireless security

Support for WPA3 brings stronger encryption and authentication methods, while Enhanced Open brings automatic security to open networks. New WPA2-MPSK feature enables simpler passkey management for WPA2 devices – should the Wi-Fi password on one device need to be changed, no additional key changes are needed for other devices on the network.

Dynamic Segmentation

To simplify and better secure wired and wireless network access, the 7200 Series can enforce per-user and device roles across wired and wireless networks by integrating with ClearPass Policy Manager. This ensures consistent policy regardless of user role and device type, and eliminates the need to configure unnecessary SSIDs, ACLs, VLANs and subnets at every node in the network.

Policy Enforcement Firewall

Enabled by the PEF license, wired and wireless user and application traffic can be tunneled to a stateful firewall on the 7200 Series through GRE tunnels for inspection. Policies are then enforced based on user role, device type, application and location – as described in Dynamic Segmentation.

Application visibility and control

Enabled by the PEF license, application visibility with Deep Packet Inspection (DPI) technology evaluates and optimizes performance and Quality of Service policies for over 3,000 applications – even for encrypted or hidden traffic.

Web content filtering

WebCC is an add-on subscription-based feature that classifies websites by content category and rates them by reputation. It can also block, apply QoS, bandwidth-limit, mirror, and log web content.

Unified Communications and Collaboration (UCC)

Visualize and troubleshoot networks based on call quality metrics such as MOS, latency, jitter and packet loss. Supported applications include: Teams, Skype for Business, Wi-Fi Calling, Facetime, SIP, Jabber, Spark and more.

Zero Touch Provisioning

The 7200 Series can be factory-shipped and deployed onsite with cloud-based Aruba Activate. For network-specific requirements, settings can be applied based on hierarchical configuration.

Integrated VPN services

With support for IPSec/SSL VPNs, Aruba Remote APs (RAPs) and Aruba VIA VPN users can establish encrypted sessions without any additional hardware required.

Third-party security integration

For advanced malware or antivirus protection, the 7200 Series can assume the role of an on-premises agent of centrally-hosted firewalls such as those provided by Palo Alto Networks and Check Point Software.

PERFORMANCE AND CAPACITY

Features	7205	7210	7220	7240XM	7280
Maximum campus or remote AP licenses	256	512	1,024	2,048	2,048
Maximum concurrent users/devices	8,192	16,384	24,576	32,768	32,768
Maximum VLANs	4,096	4,096	4,096	4,096	4,096
Active firewall sessions	1 million (M)	2M	2M	2M	2M
Concurrent GRE tunnels	4,096	8,192	16,384	32,768	32,768
Concurrent IPsec sessions	8,192	16,384	24,576	32,768	32,768
Concurrent SSL sessions	4,096	8,192	8,192	8,192	8,192
Firewall throughput (Gbps)	12	20	40	40	100
Wired Bridged Throughput (Gbps)	12	20	40	40	100
Encrypted throughput 3DES (Gbps)	5	7	25	28	57
Encrypted throughput AES-CBC-256 (Gbps)	5	7	22	30	46
Encrypted throughput AES-CCM (Gbps)	5	7	20	29	75
Encrypted throughput AES-GCM-256 (Gbps)	5	7	26	35	70

INTERFACES AND INDICATORS

Features	7205	7210	7220	7240XM	7280
Form factor/footprint	1xRU	1xRU	1xRU	1xRU	1xRU
10/100/1000BASE-T	4xCombo	2xCombo	2xCombo	2xCombo	-
1000BASE-X					
10G Ports (10G or 1G supported)	2xSFP+	4xSFP+	4xSFP+	4xSFP+	8xSFP+
40G Ports	-	-	-	-	2xQSFP+
USB 2.0	2	1	1	1	1
Management/status LEDs	Yes	Yes	Yes	Yes	Yes
LINK/ACT and status LEDs	Yes	Yes	Yes	Yes	Yes
LCD panel and navigation buttons	Yes	Yes	Yes	Yes	Yes
Console port	Micro USB, RJ-45	Mini USB, RJ-45	Mini USB, RJ-45	Mini USB, RJ-45	Micro USB, RJ-45
Out-of-band management port	Yes	No	No	No	Yes

PHYSICAL

Features	7205	7210	7220	7240XM	7280
Dimensions (HxWxD)	(H) 4.4 cm x (W) 44.2 cm x (D) 33.4 cm (1.75" x 17.38" x 13.13")	(H) 4.4 cm x (W) 44.5 cm x (D) 44.5 cm (1.75" x 17.5" x 17.5")			(H) 4.4 cm x (W) 44.2 cm x (D) 40.1 cm (1.73" x 17.40" x 15.79")
Weight	4.95 kg (10.19 lbs.)		7.45 kg (16.43 lbs.)		7.9 kg (17.41 lbs)
MTBF (Hours)	129,597 (@40C)	106,536 (@40C)	113,751 (@40C)	116,590 (@40C)	281,896 (@45C)

ENVIRONMENTAL RANGE

Features	7205	7210	7220	7240XM	7280
Operating Temperature	0° C to 40° C				
Storage Temperature	-40° C to 70° C				
Humidity/Storage Humidity	10% to 95%, NC	5% to 95%, NC	5% to 95%, NC	5% to 95%, NC	5% to 95%, NC
Operating Altitude	10,000 feet				
Acoustic Noise ¹	49 dBA		52.9 dBA		47.1 dBA
Maximum Heat Dissipation (BTU/hour)	260	375	427	563	819
Maximum Power Consumption	75.2W	110W	125W	165W	240W
Power Source	Internal power supply		350-watt AC or DC power supply		550-watt power supply

¹Sound power per ETSI 300 753 in accordance with ISO 7779

POWER ADAPTER AND SUPPLY SPECIFICATIONS

Features	350-watt AC	350-watt DC	550-watt
Input voltage range	100 VAC to 240 VAC	DC -48V to DC -60V	100 VAC to 240 VAC
Output Voltage	+12VDC, 29.16A	+12VDC, 29.16A	+12VDC, 29.16A
Input frequency	50-60 Hz	50-60 Hz	50-60 Hz
AC line input current (steady state)	5 - 2.5A	5 - 2.5A	7.1 - 3.4A
Operating Temperature	-5o to +55o C	-5o to +55o C	-5o to +55o C
Cooling	Internal fan (Air flow rear to front)	Internal fan (Air flow rear to front)	819 Internal fan (Air flow rear to front)
Weight	1.3 kg (2.8 lbs)	1.3 kg (2.8 lbs)	0.87 kg (1.9 lbs)

REGULATORY AND SAFETY COMPLIANCE

Features	7205	7210	7220	7240XM	7280
Regulatory SKU information	ARCN7205	ARCNO100	ARCNO101	ARCNO102	ARCNO103
Minimum ArubaOS Release	6.4.3.0	6.2.0.0	6.2.0.0	6.4.4.0	6.5.4.0 or 8.3.0.0
Regulatory and Safety Compliance	802.11ax (Wi-Fi 6), AOS 8.4; Wi-Fi CERTIFIED WPA3™, AOS 8.4; Wi-Fi CERTIFIED Enhanced Open™, AOS 8.4				
	FCC Part 15 Class A CE				
	Industry Canada Class A				
	VCCI Class A (Japan)				
	EN 55022 Class A (CISPR 22 Class A), EN 61000-3, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-8, EN 61000-4-11, EN 55024, AS/NZS 3548				
Telco	UL 60950, EN60950				
	CAN/CSA 22.2 #60950				
	CE mark, cTUVus, CB, C-tick, Anatel, NOM, MIC				
			Common Language Equipment Identifier (CLEI) Code		

SERVICE AND WARRANTY INFORMATION

- Hardware: 1 year parts/labor, can be extended with support contract
- Software: 90 days, can be extended with support contract

ORDERING INFORMATION

Part Number	Description
Aruba 7205 Series Mobility Controllers	
JW735A	Aruba 7205 (RW) 2-port 10GBASE-X (SFP+) Controller
JW736A	Aruba 7205 (US) 2-port 10GBASE-X (SFP+) Controller
JW737A	Aruba 7205 (JP) 2-port 10GBASE-X (SFP+) Controller
JY852A	Aruba 7205 (EG) 2x 10GBASE-X SFP+ Controller
JW738A	Aruba 7205 (IL) FIPS/TAA-compliant 2-port 10GBASE-X (SFP+) Controller
JW739A	Aruba 7205 (RW) FIPS/TAA-compliant 2-port 10GBASE-X (SFP+) Controller
JW740A	Aruba 7205 (US) FIPS/TAA-compliant 2-port 10GBASE-X (SFP+) Controller
JW741A	Aruba 7205 (JP) FIPS/TAA-compliant 2-port 10GBASE-X (SFP+) Controller
JW742A	Aruba 7205 (IL) FIPS/TAA-compliant 2-port 10GBASE-X (SFP+) Controller

ORDERING INFORMATION

Part Number	Description
Aruba 7210 Series Mobility Controllers	
JW743A	Aruba 7210 (RW) 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) Controller
JW744A	Aruba 7210 (US) 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) Controller
JY853A	Aruba 7210 (EG) 4x 10GBase-x SFP/SFP+ Controller
JW645A	Aruba 7210DC (RW) 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) 350W DC Pwr Cntrlr
JW646A	Aruba 7210DC (US) 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) 350W DC Pwr Cntrlr
JW745A	Aruba 7210 (RW) FIPS/TAA 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) Controller
JW746A	Aruba 7210 (US) FIPS/TAA 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) Controller
JW747A	Aruba 7210 (IL) 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) Controller
JW647A	Aruba 7210DC (IL) 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) 350W DC Pwr Cntrlr
JW748A	Aruba 7210 (IL) FIPS/TAA 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP)
JW749A	Aruba 7210 (JP) 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) Controller
JW648A	Aruba 7210DC (JP) 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) 350W DC Pwr Cntrlr
JW750A	Aruba 7210 (JP) FIPS/TAA 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) Controller
Aruba 7220 Series Mobility Controllers	
JW751A	Aruba 7220 (RW) 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) Controller
JW752A	Aruba 7220 (US) 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) Controller
JW649A	Aruba 7220DC (RW) 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) 350W DC Pwr Cntrlr
JW650A	Aruba 7220DC (US) 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) 350W DC Pwr Cntrlr
JW753A	Aruba 7220 (RW) FIPS/TAA 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) Controller
JW754A	Aruba 7220 (US) FIPS/TAA 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP)
JW755A	Aruba 7220 (IL) 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) Controller
JW651A	Aruba 7220DC (IL) 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) 350W DC Pwr Cntrlr
JW756A	Aruba 7220 (IL) FIPS/TAA 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP)
JW757A	Aruba 7220 (JP) 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) Controller
JW652A	Aruba 7220DC (JP) 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) 350W DC Pwr Cntrlr
JW758A	Aruba 7220 (JP) FIPS/TAA 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP)

ORDERING INFORMATION

Part Number	Description
Aruba 7240XM Series Mobility Controllers	
JW784A	Aruba 7240XM (US) 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) Controller
JW830A	Aruba 7240XM (US) FIPS/TAA 16GB DRAM 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) Controller
JY854A	Aruba 7240XM (EG) 4x 10GBase-x SFP/SFP+ Controller
JW675A	Aruba 7240XMDC (US) 16GB DRAM 4p 10GBase-X /SFP+ 2p Dual Pers (10/100/1000 or SFP) DC Pwr Cntrlr
JW783A	Aruba 7240XM (RW) 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) Controller
JW829A	Aruba 7240XM (RW) FIPS/TAA 16GB DRAM 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) Controller
JW674A	Aruba 7240XMDC (RW) 16GB DRAM 4p 10GBase-X /SFP+ 2p Dual Pers (10/100/1000 or SFP) DC Pwr Cntrlr
JW786A	Aruba 7240XM (IL) 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) Controller
JW832A	Aruba 7240XM (IL) FIPS/TAA 16GB DRAM 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) Controller
JW677A	Aruba 7240XMDC (IL) 16GB DRAM 4p 10GBase-X /SFP+ 2p Dual Pers (10/100/1000 or SFP) DC Pwr Cntrlr
JW785A	Aruba 7240XM (JP) 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) Controller
JW831A	Aruba 7240XM (JP) FIPS/TAA 16GB DRAM 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) Controller
JW676A	Aruba 7240XMDC (JP) 16GB DRAM 4p 10GBase-X /SFP+ 2p Dual Pers (10/100/1000 or SFP) DC Pwr Cntrlr
Aruba 7240 to 7240XM Series Upgrades	
JW834A	Aruba 7240XM (US) 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) Cntrlr 16GB Upgrade
JW838A	Aruba 7240XM (US) FIPS/TAA 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) Cntrlr 16GB Upgrade
JW842A	Aruba 7240XMDC (US) 4p 10GBase-X/SFP+ 2p Dual Pers (10/100/1000 or SFP) DC Pwr Cntrlr 16GB Upgrade
JW833A	Aruba 7240XM (RW) 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) Cntrlr 16GB Upgrade
JW837A	Aruba 7240XM (RW) FIPS/TAA 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) Cntrlr 16GB Upgrade
JW841A	Aruba 7240XMDC (RW) 4p 10GBase-X /SFP+ 2p Dual Pers (10/100/1000 or SFP) DC Pwr Cntrlr 16GB Upgrade
JW836A	Aruba 7240XM (IL) 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) Cntrlr 16GB Upgrade
JW840A	Aruba 7240XM (IL) FIPS/TAA 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) Cntrlr 16GB Upgrade
JW844A	Aruba 7240XMDC (IL) 4p 10GBase-X /SFP+ 2p Dual Pers (10/100/1000 or SFP) DC Pwr Cntrlr 16GB Upgrade
JW835A	Aruba 7240XM (JP) 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) Cntrlr 16GB Upgrade
JW839A	Aruba 7240XM (JP) FIPS/TAA 4p 10GBase-X (SFP+) 2p Dual Pers (10/100/1000BASE-T or SFP) Cntrlr 16GB Upgrade
JW843A	Aruba 7240XMDC (JP) 4p 10GBase-X/SFP+ 2p Dual Pers (10/100/1000 or SFP) DC Pwr Cntrlr 16GB Upgrade

ORDERING INFORMATION

Part Number	Description
Aruba 7280 Series Mobility Controllers	
JX910A	Aruba 7280 (US) 2x40GbE and 8x10GBASE-X (SFP+) Controller
JX911A	Aruba 7280 (RW) 2x40GbE and 8x10GBASE-X (SFP+) Controller
JX912A	Aruba 7280 (JP) 2x40GbE and 8x10GBASE-X (SFP+) Controller
JX913A	Aruba 7280 (IL) 2x40GbE and 8x10GBASE-X (SFP+) Controller
JX914A	Aruba 7280 (US) FIPS/TAA-compliant 2x40GbE and 8x10GBASE-X (SFP+) Controller
JX915A	Aruba 7280 (RW) FIPS/TAA-compliant 2x40GbE and 8x10GBASE-X (SFP+) Controller
JX916A	Aruba 7280 (JP) FIPS/TAA-compliant 2x40GbE and 8x10GBASE-X (SFP+) Controller
JX917A	Aruba 7280 (IL) FIPS/TAA-compliant 2x40GbE and 8x10GBASE-X (SFP+) Controller
JZ077A	Aruba 7280 (EG) 2x40GbE and 8x10GBASE-X (SFP+) Controller
JZ078A	Aruba 7280 (EG) FIPS/TAA-compliant 2x40GbE and 8x10GBASE-X (SFP+) Controller
Controller Accessories	
Aruba 7205/7280 Series Wall/Rack Mount	
JW083A	Aruba SPR-WL2-MNT 7205/7280 - Wall/Rack Mount
Aruba 7210/7220/7240/7240XM Series Wall/Rack Mount	
JW109A	Aruba SPR-WL-MNT 7210/7220/7240/7240XM - Wall/Rack Mount
Aruba 7210/7220/7240/7240XM Redundant Power Supplies and Fan Tray	
JW657A	Aruba PSU-350-AC 7200 Series S3500-24T S3500-48T and S3500-24F 350W AC Power Supply
JW658A	Aruba PSU-350-DC 7200 Series Mobility Controllers 350W DC (-48V DC) Power Supply
JW111A	Aruba HW-7200-FT 7200 Series Fan Tray
Aruba 7280 Redundant Power Supply and Fan Tray	
JZ012A	PSU-550-AC 550W AC Power Supply
JZ013A	Aruba HW-7280-FT 7280 Series Fan Tray

ORDERING INFORMATION

Part Number		7205	7210	7220	7240XM	7280
Transceivers						
JW087A	Aruba 1000BASE-LX LC Connector SFP XCVR	X	X	X	X	X
JW088A	Aruba 1000BASE-SX LC Connector SFP XCVR	X	X	X	X	X
JW089A	Aruba 1000BASE-T RJ45 Connector SFP XCVR	X	X	X	X	X
JW149A	SFP-EX 1000BASE-EX LC SFP XCVR	X	X	X	X	X
JW150A	SFP-ZX 1000BASE-ZX LC SFP XCVR	X	X	X	X	
J4859D	Aruba 1G SFP LC LX 10km SMF Transceiver	X ¹	X ¹	X ¹	X ¹	X ¹
J4858D	Aruba 1G SFP LC SX 500m OM2 MMF Transceiver	X ¹	X ¹	X ¹	X ¹	X ¹
J4860D	Aruba 1G SFP LC LH 70km SMF Transceiver	X ²	X ²	X ²	X ²	X ²
J8177D	Aruba 1G SFP RJ45 T 100m Cat5e Transceiver	X ¹	X ¹	X ¹	X ¹	X ¹

X: Supported transceiver

¹Default minimum ArubaOS software version is 6.5.3.0 and 8.1.0.0

²Minimum ArubaOS software version is 6.5.4.7 and 8.4.0.0

ORDERING INFORMATION

Part Number		7205	7210	7220	7240XM	7280
Transceivers						
JW092A	Aruba 10GBASE-LR LC Connector SFP+ XCVR	X	X	X	X	X
JW091A	Aruba 10GBASE-SR LC Connector SFP+ XCVR	X	X	X	X	X
JW090A	Aruba 10GBASE-LRM LC Connector SFP+ XCVR	X	X	X	X	X
JW100A	SFP+ Direct Attach 0.5M Cable	X	X	X	X	X
JW101A	SFP+ Direct Attach 1M Cable	X	X	X	X	X
JW102A	SFP+ Direct Attach 3M Cable	X	X	X	X	X
JW103A	SFP+ Direct Attach 5M Cable	X	X	X	X	X
JW104A	SFP+ Direct Attach 7M Cable	X	X	X	X	X
JW147A	SFP-10GE-ER 10G LC Cnctr SFP+ XCVR	X	X	X	X	X
JW148A	SFP-10GE-ZR 10G LC Cnctr SFP+ XCVR	X	X	X	X	X
J9150D	Aruba 10G SFP+ LC SR 300m OM3 MMF Transceiver	X ¹	X ¹	X ¹	X ¹	X ¹
JG151E	Aruba 10G SFP+ LC LR 10km SMF Transceiver	X ¹	X ¹	X ¹	X ¹	X ¹
J9152D	Aruba 10G SFP+ LC LRM 220m OM2 MMF Transceiver	X ¹	X ¹	X ¹	X ¹	X ¹
J9153D	Aruba 10G SFP+ LC ER 40km SMF Transceiver	X ¹	X ¹	X ¹	X ¹	X ¹
J9281D	Aruba 10G SFP+ to SFP+ 1m DAC Cable	X ¹	X ¹	X ¹	X ¹	X ¹
J9283D	Aruba 10G SFP+ to SFP+ 3m DAC Cable	X ¹	X ¹	X ¹	X ¹	X ¹
J9285D	Aruba 10G SFP+ to SFP+ 7m DAC Cable	X ¹	X ¹	X ¹	X ¹	X ¹
JH231A	HPE X142 40G QSFP+ MPO SR4 Transceiver					X ¹
JH232A	HPE X142 40G QSFP+ LC LR4 SM Transceiver					X ¹
JH233A	HPE X142 40G QSFP+ MPO eSR4 300M XCVR					X ¹
JH234A	HPE X242 40G QSFP+ to QSFP+ 1m DAC Cable					X ¹
JH235A	HPE X242 40G QSFP+ to QSFP+ 3m DAC Cable					X ¹
JH236A	HPE X242 40G QSFP+ to QSFP+ 5m DAC Cable					X ¹
JH678A	HPE X140 40G QSFP+ LC BIDI 150m MM C-TRX					X ¹
JH700A	HPE X240 QSFP+ 4x10G SFP+DAC Reman C-Cbl					X ¹
JG329A	HPE X240 QSFP+ 4x10G SFP+ 1m DAC Cable					X ¹
JG331A	HPE X240 QSFP+ 4x10G SFP+ 5m DAC Cable					X ¹
JH231A	HPE X142 40G QSFP+ MPO SR4 Transceiver					X ¹
JH232A	HPE X142 40G QSFP+ LC LR4 SM Transceiver					X ¹
JH233A	HPE X142 40G QSFP+ MPO eSR4 300M XCVR					X ¹
JH234A	HPE X242 40G QSFP+ to QSFP+ 1m DAC Cable					X ¹
JH235A	HPE X242 40G QSFP+ to QSFP+ 3m DAC Cable					X ¹
JH236A	HPE X242 40G QSFP+ to QSFP+ 5m DAC Cable					X ¹
JL308A	Aruba 40G QSFP+ LC BIDI 150m MMF XCVR					X ¹

X: Supported transceiver

¹Default minimum ArubaOS software version is 6.5.3.0 and 8.1 0.0

²Minimum ArubaOS software version is 6.5.4.7 and 8.4.0.0

For additional information on the Aruba 7200 Series Mobility Controllers please refer to:

- ArubaOS Network Operating System Data Sheet (and licenses)
- 7200 Series Data Sheet
- **7200 Series Ordering Guide**
- SD-WAN Data Sheet (and licenses)

DATA SHEET

ARUBA MOBILITY MASTER

Enhanced scale and reliability for Aruba Mobility Controllers

Extended maintenance windows, network upgrades and unplanned outages can mean hundreds or even thousands of hours of lost productivity yearly. More than ever, network infrastructure is mission-critical, and to meet these demands, the Aruba Mobility Master delivers the full capabilities of the ArubaOS network operating system to scale to today's enterprise needs.

The Mobility Master enables high scale and reliability, managing up to 100,000 clients, 10,000 access points (APs) and 1,000 controllers/gateways. It also provides simplified deployment with dynamic license management, configuration hierarchy and a choice of virtual or x86 hardware appliances.

SIMPLE AND SECURE ACCESS

The Mobility Master serves a key role in Dynamic Segmentation, providing a single management layer for all controllers acting as policy enforcement agents. Policy enforcement is provided by a Policy Enforcement Firewall embedded within each controller, and utilizes information on user roles, device type, applications, and network location to simplify and secure wired and wireless network access. This feature can be enabled with the ArubaOS PEF license and eliminates the need to manually configure SSIDs, VLANs or ACLs for each new client on the network.

24/7 MISSION-CRITICAL NETWORKING

The Mobility Master is deployed as a master controller for any combination of Aruba 7000 Series or 7200 Series Mobility Controllers and Mobility Controller Virtual Appliances. It is managed by Aruba AirWave for system-wide monitoring, reporting and Wi-Fi location services. Mobility Master increases scale by joining Aruba controllers to a Controller Cluster, improves reliability using enhanced high availability (HA), adopts configurations seamlessly based on hierarchy, and reduces or eliminates maintenance windows by enabling Live Upgrades.



KEY FEATURES

- Manage up to 10,000 access points for large campus requirements
- Support for new 802.11ax (Wi-Fi 6), WPA3 and Enhanced Open – and existing standards
- Dynamic Segmentation enforces wired and wireless access policies to simplify and secure the network
- Application awareness for 3,000+ applications without additional hardware
- Built-in AI-powered wireless/RF optimization
- Automate deployment with Zero Touch Provisioning and hierarchical configuration

ArubaOS provides unique and patented AI-powered machine learning Adaptive Radio Management features such as AirMatch and ClientMatch (now enhanced with 802.11ax grouping) for automatic RF optimization. These features improve the network's performance based on changing environmental conditions, noisy or congested RF and resolve sticky client issues during user roaming. RFProtect provides advanced spectrum analysis and wireless intrusion protection (WIPS/WIDS) to help identify and mitigate Wi-Fi and non-Wi-Fi sources of interference to contain potential security risks. Learn more about Aruba's software features on the ArubaOS datasheet.

In Figure 1 we have 8 clients spread out evenly across 3 controllers. In Figure 2, in the event of a failure of the Controllers 1 and 2 all 8 clients move over to controller 3 – making sure users are not affected from the controller failure.

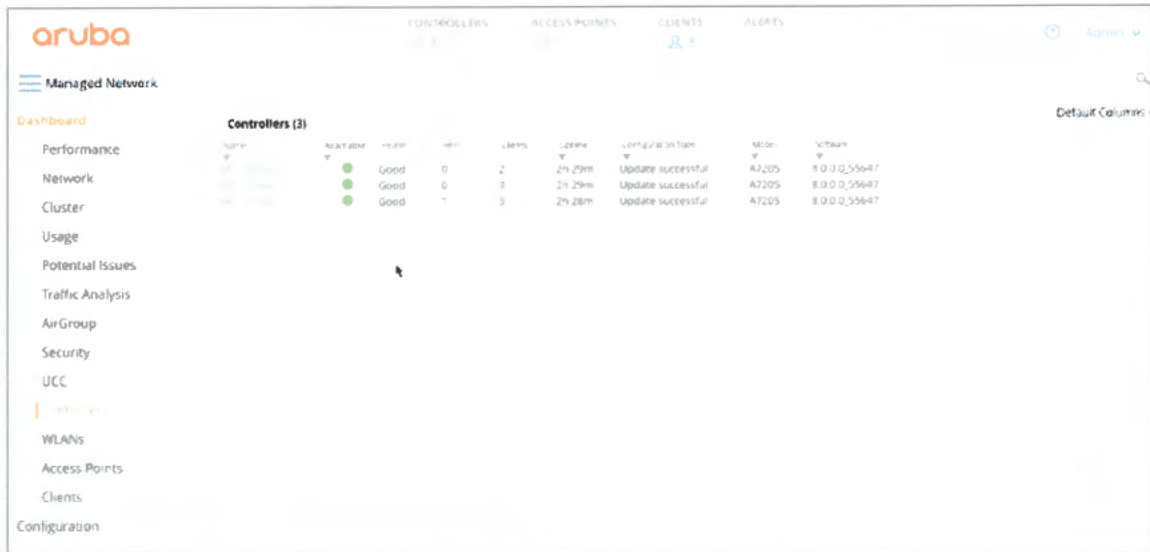


Figure 1: Clients are load balanced between controllers



Figure 2: Clients failed over to one controller in the event of a failure

MICROSOFT FEATURES

Aruba's integration with Microsoft enables unique application intelligence that detects Office 365, Teams and Skype for Business traffic and then prioritizes them over less critical applications. Through management interfaces on ArubaOS, Aruba Central, and Aruba AirWave, IT can visualize call quality metrics such as MOS, latency, jitter, and packet loss for additional insight.

ENHANCED CAPABILITIES

AirMatch

As an enhancement of Adaptive Radio Management, AirMatch automates network-wide RF channels, channel width, and transmits power to optimize the highest density environments. By utilizing AI-powered machine learning algorithms, AirMatch proactively learns and acclimates the network based on changing environmental conditions and system capacity.

AirMatch Benefits:

Even channel assignment	Provides even distribution of radios across available channels, interference mitigation and maximized system capacity
Dynamic channel width adjustment	Dynamically adjusts between 20 MHz, 40 MHz and 80 MHz to match the density of your environment
Automatic transmit power adjustment	Examines the entire WLAN coverage and automatically adjusts the transmit power of APs to ensure the best coverage and user experience

Hierarchical configuration and improved visibility

ArubaOS 8, running on the Mobility Master, uses a centralized, multi-tiered architecture that consolidates all deployment models (e.g. all-master, single-master/multiple-local, and multiple-master/local) with a single approach. Network configurations can be made and distributed from the Mobility Master automatically to all Mobility Controllers to eliminate onsite configuration (See Figure 3).

Licensing pools

The Mobility Master enables licensing pools to dynamically manage licenses based on site requirements. By default, all managed devices (e.g. controller) share a global pool of licenses; however, ArubaOS also allows individual controllers access to a dedicated pool of licenses.

Live Upgrade and multiple version support

With Mobility Master, ArubaOS 8 can be upgraded alongside active user sessions – eliminating the need for planned maintenance windows or downtime. Each Controller Cluster or individual service modules (AppRF, AirGroup, ARM, etc.) can also be selectively upgraded without impacting the rest of the network.

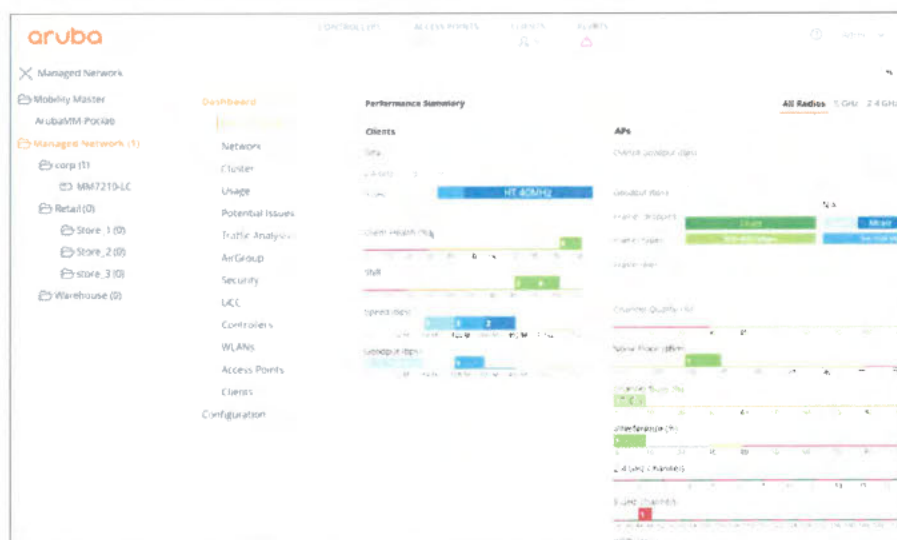


Figure 3: ArubaOS dashboard

Hitless Failover and automated load balancing

Within a Controller Cluster, user sessions and AP traffic are load balanced to optimize network utilization during peak periods and maximize availability during unplanned outages (Figure 1). This also means that users won't notice any impact to voice calls, video streaming or data transfers in an unlikely event that a controller loses connectivity (Figure 2).

Seamless Layer 2 and Layer 3 roaming

Users can roam between floors, buildings or across the entire network without any re-authentication, change to their IP address, or loss of firewall state.

Application customization

AppRF brings rich application visibility and control with deep packet inspection into over 2,600+ applications. In ArubaOS 8, custom applications and categories can now be defined directly by the network administrator.

Enhanced Wi-Fi security

Support for WPA3 brings stronger encryption and authentication methods, while Enhanced Open brings automatic encryption security to open networks. New WPA2-MPSK feature enables simpler passkey management for WPA2 devices – should the Wi-Fi password on one device need to be changed; no additional key changes are needed for other devices on the network.

Dynamic Segmentation

The Mobility Master centrally maintains up-to-date policies from Aruba's ClearPass policy management system, which are then locally enforced by each controller cluster in the network. Policies are based on role and applied uniformly across WLAN and LAN – eliminating the need to configure per-switch ACLs, VLANs, and subnets.

MultiZone

The same AP infrastructure can now terminate two different SSIDs on two different Aruba controllers while maintaining complete separation and security for all networks, policies, management and visibility. This is ideal for multi-tenancy requirements where multiple companies or groups reside at a single site or for an enterprise that requires multiple secure networks (See Figure 4).

Northbound APIs (NBAPI)

The Mobility Master includes a full set of NBAPIs that enable deep visibility into the network. NBAPIs provide RF health metrics, app utilization, device type and user data in an easy-to-integrate format. 3rd party applications can receive this information for improved visibility and monitoring.

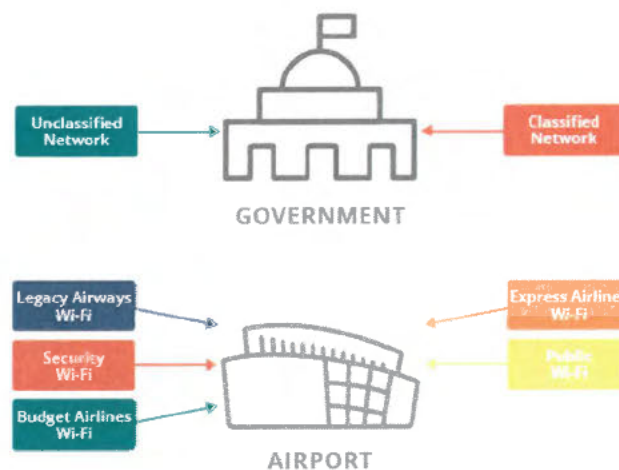


Figure 4: MultiZone use cases

In an airport where we have multiple tenants (e.g. an airline, airport security, and public network), each has deployed their own Aruba controller while sharing the same APs. Because each AP tunnels traffic to the appropriate controller, ArubaOS 8 maintains complete separation of data. This level of granularity extends to high security use cases, whereby multiple classified and non-classified networks can also utilize the same APs.

MOBILITY MASTER MODELS AND CAPACITIES

Mobility Master Virtual Appliance	MM-VA-50	MM-VA-500	MM-VA-1K	MM-VA-5K	MM-VA-10K
Number of Devices	50	500	1,000	5,000	10,000
Number of Clients	500	5,000	10,000	50,000	100,000
Number of Controllers	5	50	100	500	1,000
Supported Platforms	VMWare ESXi, Microsoft Hyper-V, or open source KVM				

Mobility Master Hardware Appliance*	MM-HW-1K	MM-HW-5K	MM-HW-10K
Number of Devices	1,000	5,000	10,000
Number of Clients	10,000	50,000	100,000
Number of Controllers	100	500	1,000

*Mobility Master hardware appliance is a x86-based hardware.

	7200 Series	7000 Series	RAPs
Mobility Domain Cluster Size	12	4	4

MOBILITY MASTER HARDWARE APPLIANCE TECHNICAL SPECIFICATIONS

Interfaces and Indicators

Mobility Master Hardware Appliance	MM-HW-1K	MM-HW-5K	MM-HW-10K
Form factor/footprint		1xRU	
Gigabit Ethernet ports (SFP or 10G SFP+)		2	
USB 3.0		Yes (1)	
Console port		Yes (RJ-45)	
Out-of-band management port		Yes	
Management/status LEDs		Yes	
LINK/ACT and status LEDs		Yes	

Dimensions and Weight

Mobility Master Hardware Appliance	MM-HW-1K	MM-HW-5K	MM-HW-10K
Dimensions (H x W x D)	4.4 cm (H) x 44.2 cm (W) x 40.1 cm (D) (1.73" x 17.40" x 15.79")		
Weight	7.2 kg (15.87 lbs)		
MTBF (hours, @ 45C)	238,020	235,835	229,445

Environmental			
Mobility Master Hardware Appliance	MM-HW-1K	MM-HW-5K	MM-HW-10K
Operating Temperature	0°C to 40°C (32°F to 104°F)		
Storage Temperature	-40°C to 70°C (-40°F to 158°F)		
Operating Humidity	10% to 90% (RH) non-condensing		
Storage Humidity	10% to 95% (RH) non-condensing		
Operating Altitude	Up to 10,000 feet		
Maximum Power Consumption	120W*		
Acoustic Noise – Sound Pressure ¹	57 dBA**		
Acoustic Noise – Sound Power ¹	64.4 dBA***		

¹Sound power per ETSI 300 753; Sound pressure per ISO 7779

*Ubuntu running all cores, memory test, 10G traffic, this may vary by 10% based on software configuration

**Measured at rear center

***Nominal fan speed at room temperature

Power Supply Specifications ²			
Mobility Master Hardware Appliance	MM-HW-1K	MM-HW-5K	MM-HW-10K
Input voltage range	100-240V AC		
Output Voltage	+12V DC		
Input frequency	50-60 Hz		
AC line input current (steady state)	6.0A max		

²Dual 400-watt load shared redundant configuration

REGULATORY AND SAFETY COMPLIANCE

Description	Specification
Certifications	<ul style="list-style-type: none"> FCC Part 15 Class A CE Industry Canada Class A VCCI Class A (Japan) EN 55032 Class A (CISPR 32 Class A), EN 61000-3, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-8, EN 61000-4-11, EN 55024, AS/NZS 3548 UL 60950, EN60950 CAN/CSA 22.2 #60950 CE mark, cTUVus, CB, C-tick, Anatel, NOM, MIC
Regulatory SKU information	ARCNNMMHW
Minimum ArubaOS Release	MM-HW-1K, AOS 8.1; MM-HW-5K, AOS 8.1; MM-HW-10K, AOS 8.1
	Wi-Fi CERTIFIED WPA3, AOS 8.4; Wi-Fi CERTIFIED Enhanced Open, AOS 8.4; Wi-Fi 6 (802.11ax), AOS 8.4; Wi-Fi CERTIFIED 802.11ad, AOS 8.4

SERVICE AND WARRANTY INFORMATION

- Hardware: 1 year parts/ labor, can be extended with support contract
- Software: 90 days, can be extended with support contract

ORDERING INFORMATION

Part Number	Description
Aruba Mobility Master Virtual Appliance	
JZ106AAE	Aruba MM-VA-50 Mobility Master Virtual Appliance with Support for up to 50 Devices E-LTU
JY895AAE	Aruba MM-VA-500 Mobility Master Virtual Appliance with Support for up to 500 Devices E-LTU
JY896AAE	Aruba MM-VA-1K Mobility Master Virtual Appliance with Support for up to 1,000 Devices E-LTU
JY897AAE	Aruba MM-VA-5K Mobility Master Virtual Appliance with Support for up to 5,000 Devices E-LTU
JY898AAE	Aruba MM-VA-10K Mobility Master Virtual Appliance with Support for up to 10,000 Devices E-LTU
JZ395AAE	Aruba MM-VA-50-F1 Mobility Master Virtual Appliance FIPS/TAA with Support for 50 Devices E-LTU
JZ376AAE	Aruba MM-VA-500-F1 Mobility Master Virtual Appliance FIPS/TAA with Support for 500 Devices E-LTU
JZ377AAE	Aruba MM-VA-1K-F1 Mobility Master Virtual Appliance FIPS/TAA with Support for 1,000 Devices E-LTU
JZ378AAE	Aruba MM-VA-5K-F1 Mobility Master Virtual Appliance FIPS/TAA with Support for 5,000 Devices E-LTU
JZ379AAE	Aruba MM-VA-10K-F1 Mobility Master Virtual Appliance FIPS/TAA with Support 10,000 Devices E-LTU
Aruba Mobility Master Hardware Appliance and Accessories	
JY791A	Aruba MM-HW-1K Mobility Master Hardware Appliance with Support for up to 1,000 Devices
JY792A	Aruba MM-HW-5K Mobility Master Hardware Appliance with Support for up to 5,000 Devices
JY793A	Aruba MM-HW-10K Mobility Master Hardware Appliance with Support for up to 10,000 Devices
JZ396A	Aruba MM-HW-1K-F1 Mobility Master Hardware Appliance FIPS/TAA with Support for up to 1,000 Devices
JZ397A	Aruba MM-HW-5K-F1 Mobility Master Hardware Appliance FIPS/TAA with Support for up to 5,000 Devices
JZ398A	Aruba MM-HW-10K-F1 Mobility Master Hardware Appliance FIPS/TAA with Support for up to 10,000 Devices
JY986A	MMPSU-400-AC 400W AC Spare Power Supply for Mobility Master Hardware Appliance – Order region specific power cord
JZ072A	MM-FT Spare Fan Tray for Mobility Master Hardware Appliance
JW107A	Aruba SPR-RK-MNT Spare Rack Mount

Aruba Mobility Master Hardware Appliance Transceivers

Part Number	Description	MM-HW-xK
JW087A	Aruba 1000BASE-LX LC Connector SFP XCVR	X
JW088A	Aruba 1000BASE-SX LC Connector SFP XCVR	X
JW089A	Aruba 1000BASE-T RJ45 Connector SFP XCVR	X
J4859D	Aruba 1G SFP LC LX 10km SMF Transceiver	X ¹
J4858D	Aruba 1G SFP LC SX 500m OM2 MMF Transceiver	X ¹
J4860D	Aruba 1G SFP LC LH 70km SMF Transceiver	X ²
J8177D	Aruba 1G SFP RJ45 T 100m Cat5e Transceiver	X ¹
JW092A	Aruba 10GBASE-LR LC Connector SFP+ XCVR	X
JW091A	Aruba 10GBASE-SR LC Connector SFP+ XCVR	X
JW090A	Aruba 10GBASE-LRM LC Connector SFP+ XCVR	X
JW100A	SFP+ Direct Attach 0.5M Cable	X
JW101A	SFP+ Direct Attach 1M Cable	X
JW102A	SFP+ Direct Attach 3M Cable	X
JW104A	SFP+ Direct Attach 7M Cable	X
J9150D	Aruba 10G SFP+ LC SR 300m OM3 MMF Transceiver	X ¹
J9151D	Aruba 10G SFP+ LC LR 10km SMF Transceiver	X ¹
J9152D	Aruba 10G SFP+ LC LRM 220m OM2 MMF Transceiver	X ¹
J9281D	Aruba 10G SFP+ to SFP+ 1m DAC Cable	X ¹
J9283D	Aruba 10G SFP+ to SFP+ 3m DAC Cable	X ¹
J9285D	Aruba 10G SFP+ to SFP+ 7m DAC Cable	X ¹

Note:

X: Supported transceiver

¹Default minimum ArubaOS software version is 8.1.0.0

²Minimum ArubaOS software version is 8.4.0.0

For additional information on Aruba WLAN products, please refer to:

- ArubaOS network operating system Data Sheet (and licenses)
- Mobility Master and Controllers
- Access Points



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DATA SHEET

ARUBA AIRWAVE

On premises IT operations management for multi-vendor campus networks

Aruba AirWave is a scalable, full featured management solution for multi-vendor wired and wireless networks. Organizations gain the visibility, control and troubleshooting tools required to fully manage today's distributed enterprise environments.

AirWave integrates configuration and deployment and real-time visibility and control for comprehensive management and troubleshooting. This provides a flexible platform for maintaining the reliability and performance of Aruba access points, controllers, switches, and selected multi-vendor devices.

STREAMLINED CONFIGURATION AND DEPLOYMENT

AirWave utilizes configuration groups, assigned templates, and step by step workflows to simplify device configuration. Entire config files can be imported, compared, assigned and archived. Modifying and using smaller segments of configuration files across groups of devices is also supported.

These capabilities allow IT to quickly add, modify and deploy devices across distributed locations, while saving time and minimizing mistakes. Aruba's Zero-Touch Provisioning (ZTP) can be used to automatically push configuration files to devices to further simplify the deployment process. Integrated auditing is also provided for security and change management.

REAL-TIME VISIBILITY AND CONTROL

AirWave provides detailed health and analytics dashboards to monitor critical applications and services, including:

- **Network Health** – used to view client usage, monitoring and configuration compliance, alert summaries and other selected statistics.

KEY FEATURES

- Unified Wired and Wireless Network Management
- Simplified Deployment Models
- Broad Visibility and Control
- Proactive Troubleshooting
- Physical and Virtual Appliances
- Enhanced Security and App Visibility
- **Traffic Analysis** – helps to monitor application usage and policy enforcement across the entire network. Tracks web categories, client destinations and relative trust levels. Details are displayed by network, roles, device type and users.
- **UCC Analytics** – a consolidated view of how VoIP applications are performing displays MOS scores, and potential RF performance and capacity issues.

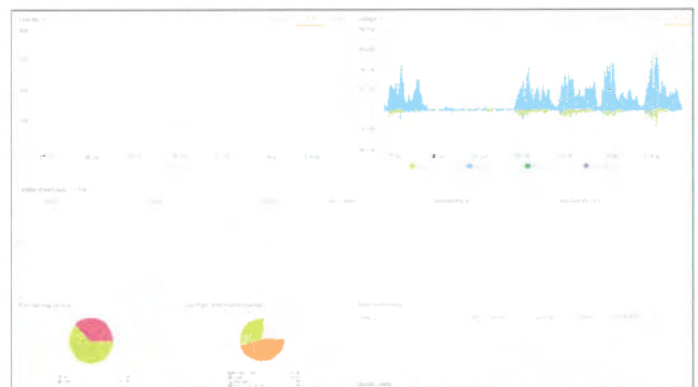


Figure 1: Aruba AirWave Dashboard

For detailed device visibility, simply click a chart or graph to drill-down from any network level view, or locate and select a device for a configuration summary and details on connected clients, neighbors, alerts and related events.

When looking at switch information, additional visibility into key values of individual and stacked switches is provided. This includes port status, PoE consumption, VLAN assignment, device and neighbor connections, power status and trends, alerts and events and which troubleshooting actions can be performed.

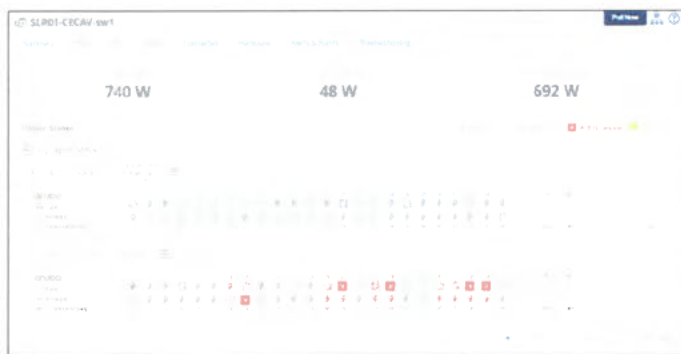


Figure 2: Aruba AirWave Switch Faceplate View

COMPREHENSIVE MANAGEMENT AND TROUBLESHOOTING

Role-Based Access, Discovery and Topology

AirWave utilizes a role-based model for administrative access. Multiple combinations of access and management rights can be assigned as needed. AirWave allows IT to protect the environment and provides the ability to tailor administrative access based on assigned scope and responsibilities.

AirWave also discovers and maps devices across the entire environment, including those with distributed locations. The resulting topology map shows upstream relationships between APs, controllers and switches in order to assess the impact on related devices and clients, and to isolate root cause of issues.



Figure 3: Aruba AirWave Topology View

Stage-based Connectivity Health

A reliable connection is the foundation of a successful user experience. AirWave monitors the connectivity of clients, to proactively help identify and resolve issues. Data points include client association, as well as network authentication and DHCP metrics.

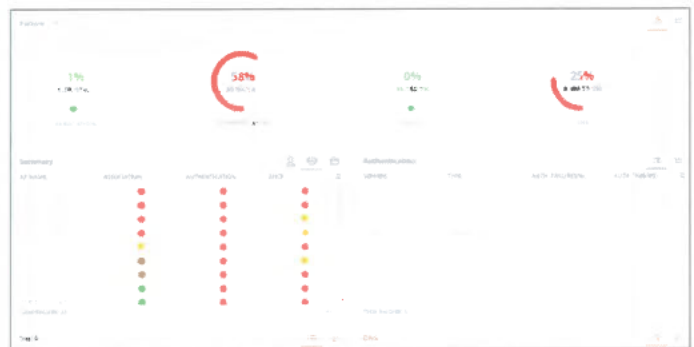


Figure 4: Aruba AirWave Connectivity Health

VisualRF for Wi-Fi Visibility & Management

Real-time views of actual floorplan maps make it easy to see RF coverage issues, location of all access points, and possible interference points. The result is a comprehensive view of how the network is performing, and potential trouble spots.

Selectable overlays show client health, traffic thresholds, UCC performance and channel utilization to quickly diagnose client, building, floor or location specific issues.

VisualRF also provides the ability to capture and playback physical movement of devices and clients within locations to isolate and troubleshoot those challenging intermittent mobility issues.

RAPIDS for Intrusion Detection

AirWave utilizes Aruba's Rogue AP Intrusion Detection Service (RAPIDS), to identify and resolve issues caused by rogue access points, and clients.

Wired and wireless data is correlated to identify relevant threats, while reducing false positives to strengthen network security. RAPIDS includes:

- Summary Data – percentage of device classification and acknowledgments, and device counts by type.
- Lists & Events – concise summaries of devices by type and events by severity, category and scope.
- Rules Engine – easily define and edit wireless, wired, and controller properties to detect rogues, classifications and threat levels.

Firmware Upgrade & Compliance

An advanced image upgrade and compliance module, makes it easy to update firmware by device type or version group, split download images, and schedule updates during off hours to minimize the impact during peak operations.

FLEXIBLE PLATFORM AND DEPLOYMENT OPTIONS

Aruba AirWave is available on either pre-configured hardware appliances or deployed in virtual machines (VMs).

AirWave hardware appliances are designed and tested to meet the demanding requirements of growing distributed networks. The AirWave Pro appliance is optimized to support up to 1,500 managed devices, and the AirWave Enterprise and Central Ready appliances support up to 4,000 managed devices each.

The AirWave Central Ready appliance is designed for investment protection. Providing the enhanced performance, storage, and interface requirements to support either AirWave or the planned Aruba Central on-premises deployment option.

AirWave virtual deployments are supported on VMware and Microsoft Hyper-V host hypervisors.

GOVERNMENT-GRADE CERTIFICATIONS

AirWave is highly secure, and has achieved the Federal Information Processing Standard (FIPS) Publication 140-2 validation, a government level computer security standard for cryptographic modules (Certificate #2577). See detailed security documentation for more information.

HARDWARE APPLIANCES

Category	Pro Appliance	Pro Appliance (Gen10)	Central Ready Appliance
Appliance Specifications			
CPU	8-core 2.6 Ghz HPE DL360 Gen9 E5-2640v3	8 Core Intel Xeon-S 4110 @ 2.10 Ghz - HPE DL360 Gen10	2 20-core Intel Xeon-G 6138 @ 2.0 GHz - HPE DL360 Gen10
Memory	48GB	48GB	256GB
Storage	6 300GB 12G SAS 15K 2.5in SC ENT HDD	6 300GB SAS 15K SFF SC DS HDD	2 TB SSD HDD (4 TB in RAID 10)
Appliance Scalability			
Maximum Managed Devices	1,500	1,500	4,000
Power			
Power	500W FS Plat Hot Plug Power Supply	500W FS Plat Hot Plug Power Supply	500W FS Plat Hot Plug Power Supply
Power Supply	Optional redundant power supply	Optional redundant power supply	Optional redundant power supply
AC Input Voltage	110/220 VAC Auto-Selecting	110/220 VAC Auto-Selecting	110/220 VAC Auto-Selecting
AC Input Frequency	50/60 Hz Auto-Selecting	50/60 Hz Auto-Selecting	50/60 Hz Auto-Selecting
Physical			
Rackmount	1U SFF Easy Install Rail 1U Cable Management Arm	1U SFF Easy Install Rail 1U Cable Management Arm	1U SFF Easy Install Rail 1U Cable Management Arm
Dimensions (H x W x D)	1.7 x 17.1 x 27.5 inches (4.32 x 43.47 x 69.85 cm)	1.7 x 17.1 x 27.5 inches (4.32 x 43.47 x 69.85 cm)	1.7 x 17.1 x 27.8 inches (4.29 x 43.46 x 70.7 cm)
Weight	33.3 lb. (15.31 kg) max	33.3 lb. (15.31 kg) max	35.9 lb. (16.27 kg) max
HP SmartDrives	8 + 2 SFF/4 LFF max, HDD/SSD	8 + 2 SFF/4 LFF max, HDD/SSD	4 LFF SAS/SATA/SSD 8 or 10 SFF SAS/SATA/SSD
Networking	4 x 1GbE embedded + Flexible LOM slot	4 x 1GbE embedded + Flexible LOM slot or HPE FlexFabric 10Gb 4-Port 536FLR-T Adapter	2 x 10GbE and 4 x 1GbE embedded + Flexible-LOM slot
VGA/serial/USB ports	Front VGA opt, rear VGA standard, and serial opt., 5 USB 3.0	Front VGA opt, rear VGA standard, and serial opt., 5 USB 3.0	Front VGA opt, rear VGA standard, and serial opt., 5 USB 3.0, iLO Remote Mgmt, MicroSD Slot
Industry compliance	ASHRAE A3 and A4, lower idle power	ASHRAE A3 and A4, lower idle power	ASHRAE A3 and A4, lower idle power
Warranty			
Hardware	1 year parts	1 year parts	1 year parts
Software	90 days	90 days	90 days

ORDERING INFORMATION

Part Number	Description
JW546AAE	Aruba LIC-AW Aruba Airwave with RAPIDS and VisualRF 1 Device License E-LTU
JW558AAE	Aruba AW-25-FR AirWave 25 Device Failover License E-LTU
JW559AAE	Aruba AW-50-FR AirWave 50 Device Failover License E-LTU
JW560AAE	Aruba AW-100-FR AirWave 100 Device Failover License E-LTU
JW561AAE	Aruba AW-200-FR AirWave 200 Device Failover License E-LTU
JW562AAE	Aruba AW-500-FR AirWave 500 Device Failover License E-LTU
JW563AAE	Aruba AW-1000-FR 1000 AirWave Device Failover License E-LTU
JW564AAE	Aruba AW-2500-FR 2500 AirWave Device Failover License E-LTU
JW565AAE	Aruba AW-EXF1-50 AirWave 50 Device Failover Expansion License E-LTU
JW566AAE	Aruba AW-EXF1-2500 AirWave 2500 Volume Failover Expansion License E-LTU
JW567AAE	Aruba AW-MASTER AirWave Master Console License E-LTU
JX918A	Aruba AirWave DL360 Professional Edition Hardware Appliance
R3W19A	Aruba AirWave Pro Gen 10 Hardware Appliance
R1Q04A	Aruba Central Ready AirWave 8 Appliance
JZ075A	Aruba AW-HW-GLASS AirWave Hardware Appliance for Centralized Monitoring
R1T38A	Aruba DL360 Gen10 500W Spare PSU
JZ076AAE	Aruba AW-VA-GLASS AirWave Virtual Appliance for Centralized Monitoring E-LTU

Package Contents

- Plastic access point covers (20)
- AP-335-CVR-20 Installation Guide

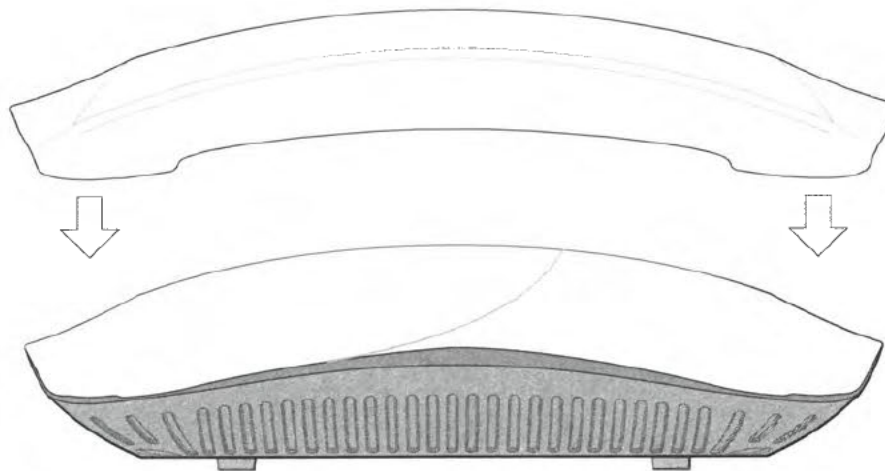
Introduction

The AP-335-CVR-20 cover clips into the exterior of the access point, offering a practical and aesthetic solution for concealment and customization.

Installing the AP-335-CVR-20

1. Align the cover with the access point so that the LED display on the access point is matched with the LED slots on the cover.
2. Fit the bottom corners of the cover around the access point, then press the cover onto the access point until all corners are securely clipped into place.

Figure 1 Attaching cover onto access point



0511887-01

AP-220-MNT-W1 Wall Mount Kit

Installation Guide

The AP-220-MNT-W1 allows you to mount your 220 series access point to a wall.

1. Begin by attaching the wall mount adapter to the wall as shown in [Figure 1](#) or [Figure 2](#).
 - a. Install any necessary wall anchors. Wall anchors are not included in this kit.
 - b. Align the screw holes in the mounting bracket with the previously installed anchors or demarcated screw points.
 - c. Insert the screws to secure the mounting bracket. Screws are not included in this kit.

Figure 1 *Attaching the Adapter to a Wall*

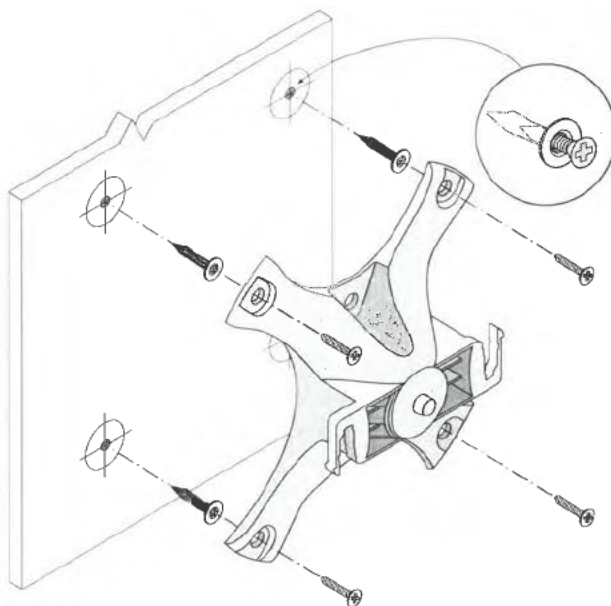
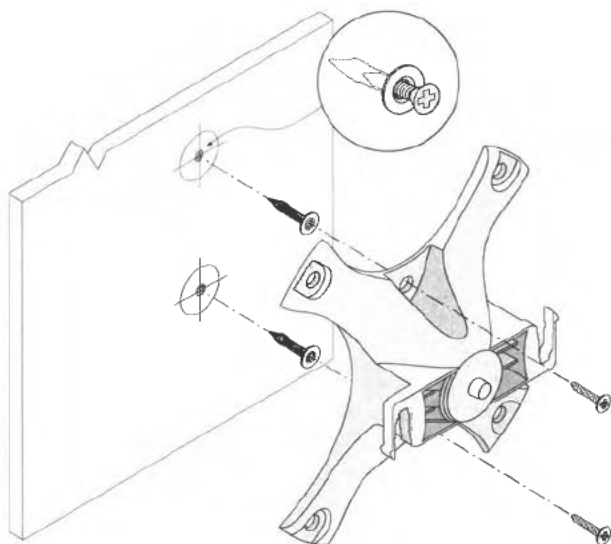


Figure 2 *Attaching the Adapter to a Wall (Alternate)*



2. Attach necessary cables and/or antennas to the AP.
3. Attach the AP to the secured mounting adapter as shown in [Figure 3](#).
 - a. Align the AP with a mounting adapter, placing the AP so that it's mounting tabs are at an angle of approximately 30 degrees to the adapter.
4. Pushing toward the wall, rotate the AP clockwise until it clicks into place (see [Figure 3](#)).

Figure 3 Attaching the AP to the Mounting Bracket

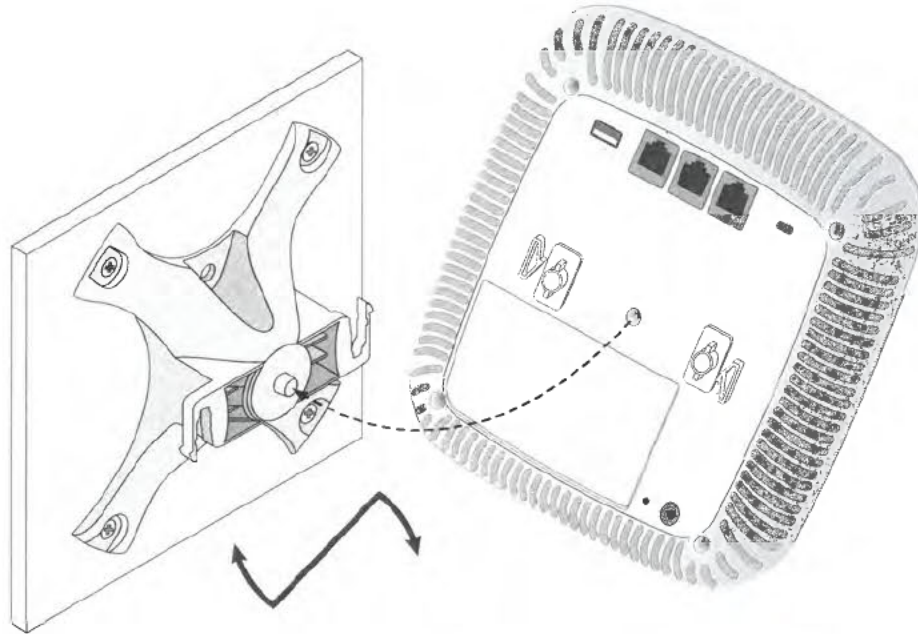
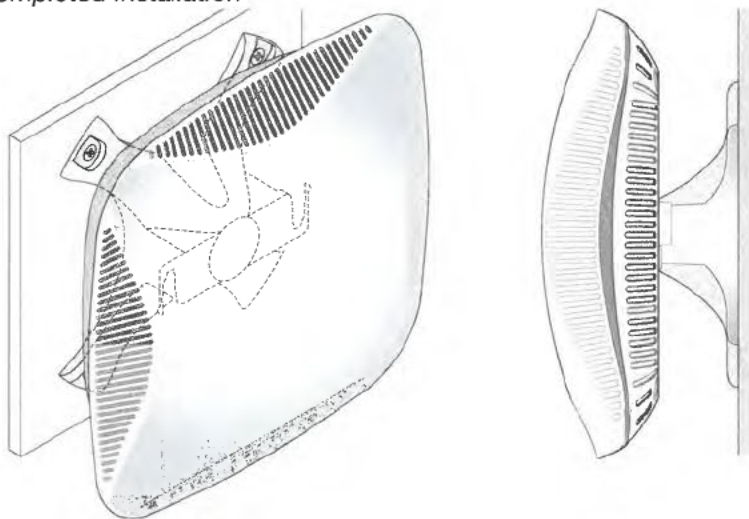


Figure 4 Completed Installation



AP-270-MNT-H1 Horizontal Mounting Kit

Installation Guide

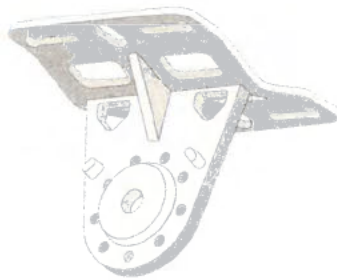


This mounting kit supports multiple access point (AP) models. All installation images show the 275 AP.

Package Content

- Horizontal Mounting Bracket x 1
- Mounting Holder x 1
- M10x30 Screw (with washer) x 1
- M10 Nut x 1
- M6x20 Screws x 3
- 60cm Cable Tie x 1
- 6 inches Hose Clamps x 2
- Mounting Template
- Installation Guide (this document)

Figure 1 *Horizontal Mounting Bracket and Mounting Holder*



Mounting Bracket

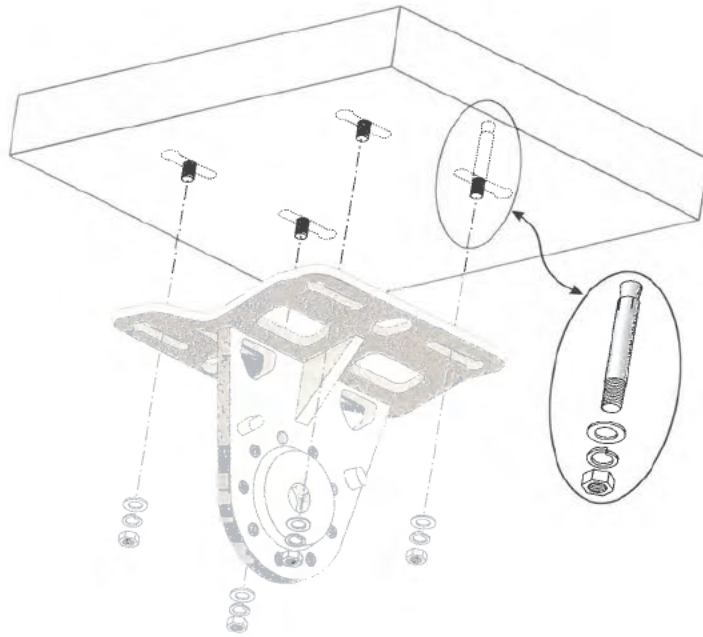


Mounting Holder

Mounting the AP to a Ceiling

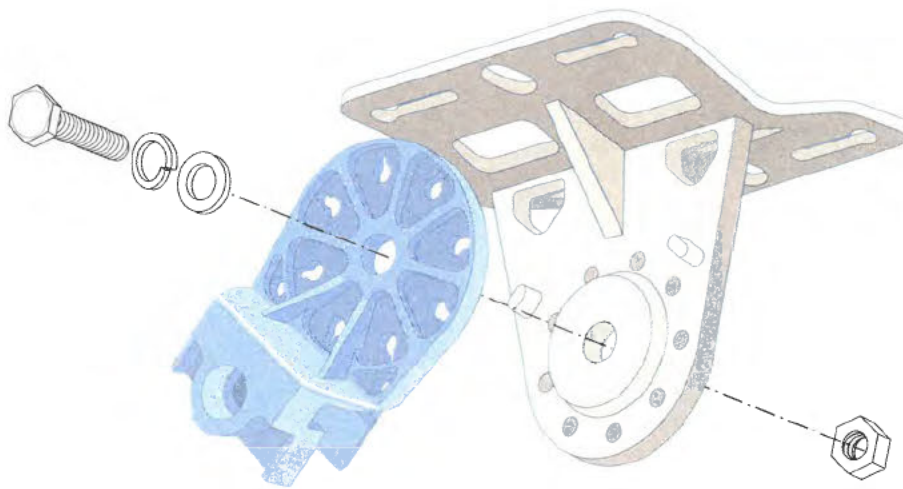
1. Use the mounting template provided in the package to mark the four mounting points on the ceiling.
2. Use a drill to create four holes on the four markings you created in the previous step.
3. Insert an anchor bolt into each drilled hole. Anchor bolts are not included in the package.
4. Place the mounting bracket over the anchor bolts and press the bracket against the ceiling.
5. Place the washers and nut onto the bolt's threaded end and tighten the nut until the mounting bracket is firmly attached to the ceiling as shown in [Figure 2](#).

Figure 2 Attaching the Mounting Bracket to a Ceiling



6. Use the M10x30 screw (with washer) and M10 nut included in the package to attach the mounting holder to the mounting bracket as shown in [Figure 3](#).

Figure 3 Attaching the Mounting Holder to the Mounting Bracket



7. Slide the holder of the AP into the opening of the mounting holder and use two M6x20 screws included in the package to fix the AP to the mounting holder as shown in [Figure 4](#).

Figure 4 Attaching the AP to the Mounting Holder

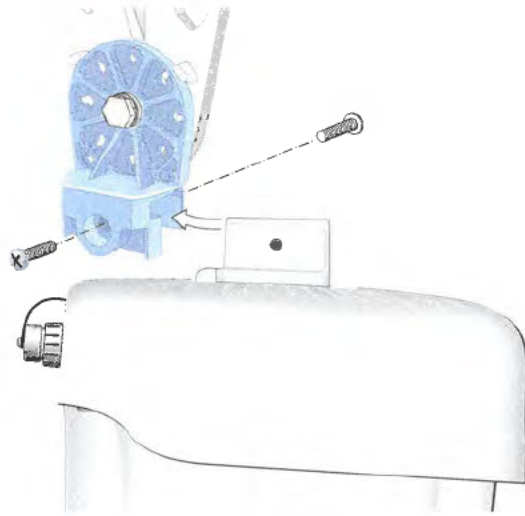


Figure 5 Attaching the AP to the Mounting Holder (Completed)



The inclination of the AP (mounted to the mounting holder) can be adjusted up to ± 45 degrees by inserting the M6x20 screw (included in the package) into the different holes on the mounting holder as show in [Figure 6](#).

Figure 6 *Adjusting the Inclination of the AP*

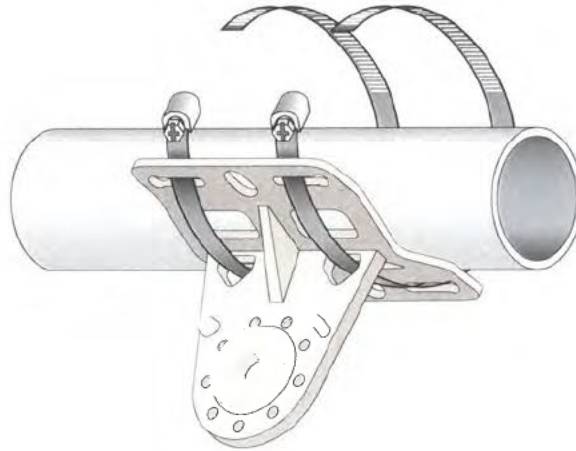


8. Use the cable tie to fasten the cables on the bracket.

Mounting the AP to a Horizontal Pole

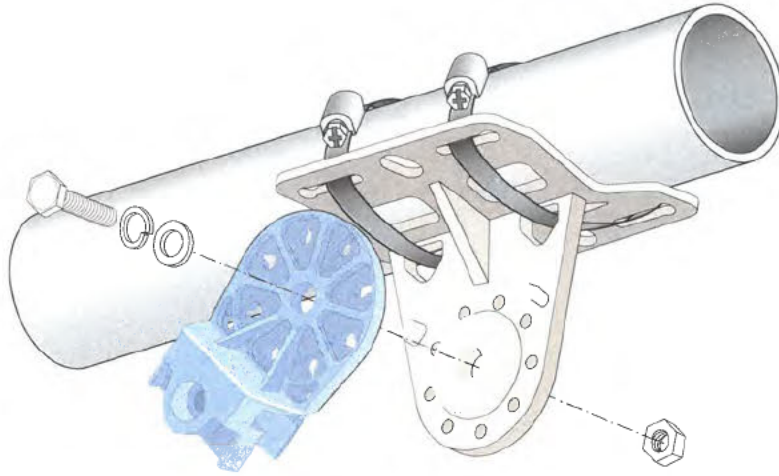
1. Begin by attaching the mounting bracket to the horizontal pole as shown in [Figure 7](#).
 - a. Pass a hose clamp through the two slots on the mounting bracket, attach the mounting bracket to the pole and tighten the clamp using a screw driver to twist its screw head.
 - b. Use another hose clamp through the other two slots on the mounting bracket and tighten the clamp.

Figure 7 *Attaching the Mounting Bracket to a Horizontal Pole*



2. Use the M10x30 screw (with washer) and M10 nut included in the package to attach the mounting holder to the mounting bracket as shown in [Figure 8](#).

Figure 8 Attaching the Mounting Holder to the Mounting Bracket



3. Slide the holder of the AP into the opening of the mounting holder and use two M6x20 screws included in the package to fix the AP to the mounting holder as shown in [Figure 9](#).

Figure 9 Attaching the AP to the Mounting Holder

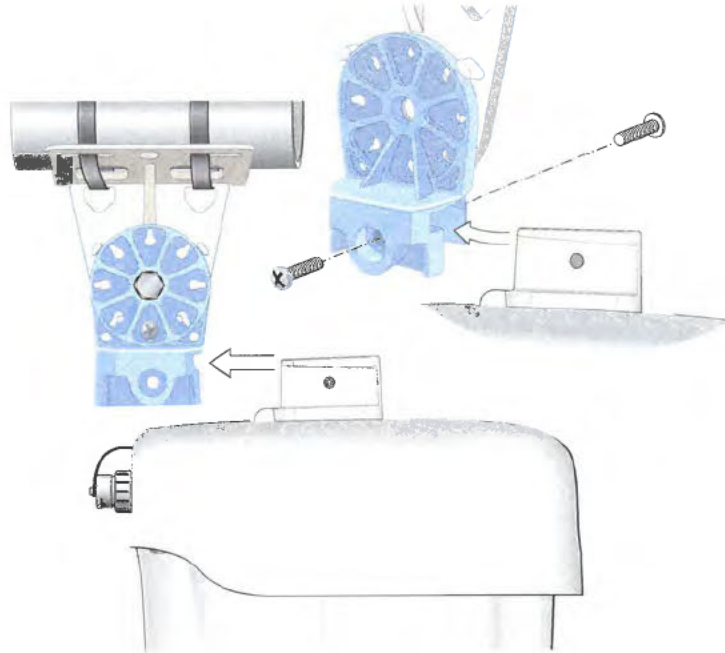


Figure 10 *Attaching the AP to the Mounting Holder (Completed)*



The inclination of the AP (mounted to the mounting holder) can be adjusted up to ± 45 degrees by inserting the M6x20 screw (included in the package) into the different holes on the mounting holder as show in [Figure 6](#).

4. Use the cable tie to fasten the cables on the bracket.

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0511508-01



Request for Proposal

RFP# CMJ-1068

**ATLANTIC UNION BANK CENTER
– HIGH DENSITY WIRELESS NETWORK**

December 2, 2019



REQUEST FOR PROPOSAL
RFP# CMJ-1068

Issue Date: December 2, 2019
Title: ATLANTIC UNION BANK CENTER - AV SYSTEMS PACKAGE
Issuing Agency: Commonwealth of Virginia
James Madison University
Procurement Services MSC 5720
752 Ott Street, Wine Price Building
First Floor, Suite 1023
Harrisonburg, VA 22807

Period of Contract: From Date of Award Through One Year (Renewable)

Sealed Proposals Will Be Received Until 2:00 PM on January 14, 2020 for Furnishing The Services Described Herein.

SEALED PROPOSALS MAY BE MAILED, EXPRESS MAILED, OR HAND DELIVERED DIRECTLY TO THE ISSUING AGENCY SHOWN ABOVE.

All Inquiries For Information And Clarification Should Be Directed To: Colleen Johnson, Buyer Specialist, Procurement Services, johns9cm@jmu.edu; 540-568-3137; (Fax) 540-568-7935 not later than **January 3, 2020**.

NOTE: THE SIGNED PROPOSAL AND ALL ATTACHMENTS SHALL BE RETURNED.

In compliance with this Request for Proposal and to all the conditions imposed herein, the undersigned offers and agrees to furnish the goods/services in accordance with the attached signed proposal or as mutually agreed upon by subsequent negotiation.

Name and Address of Firm:

By: _____
(Signature in Ink)

Name: _____
(Please Print)

Date: _____

Title: _____

Web Address: _____

Phone: _____

Email: _____

Fax #: _____

ACKNOWLEDGE RECEIPT OF ADDENDUM: #1____ #2____ #3____ #4____ #5____ (please initial)

CONTRACTOR/SUBCONTRACTOR LICENSE REQUIREMENT: By my signature on this solicitation, I certify that this firm/individual and subcontractor is properly licensed for providing the goods/services specified. License # _____ Type _____

SMALL, WOMAN OR MINORITY OWNED BUSINESS:

☐ YES; ☐ NO; *IF YES* ⇒ ☐ SMALL; ☐ WOMAN; ☐ MINORITY ***IF MINORITY*** ☐ AA; ☐ HA; ☐ AsA; ☐ NW; ☐ Micro

Note: This public body does not discriminate against faith-based organizations in accordance with the *Code of Virginia*, § 2.2-4343.1 or against an offeror because of race, religion, color, sex, national origin, age, disability, or any other basis prohibited by state law relating to discrimination in employment.

REQUEST FOR PROPOSAL

RFP # CMJ-1068

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	B. SWaM Utilization Plan		
	C. Sample of Standard Contract		
	D. Performance Specifications		
	E. Wi-Fi Exclusion Areas – attached as a separate PDF file		
	F. High-Density Wi-Fi Systems Pricing Form - attached as a separate Excel spreadsheet (<i>All Offerors are required to complete in addition to information requested in Section IV</i>)		
	G. 17963 JMU Convo Composite Set.zip (<i>Click here for download 1.5g</i>)		
	H. Information Technology Services Addendum (<i>All Offerors are required to complete</i>)		
	I. Higher Education Cloud Assessment Tool (HECVAT) Lite - attached as a separate Excel spreadsheet (<i>All Offerors are required to complete</i>)		

I. PURPOSE

The purpose of this Request for Proposal (RFP) is to solicit sealed proposals from qualified sources to enter into a contract to provide a Wi-Fi Systems Package for the Atlantic Bank Union Center for James Madison University (JMU), an agency of the Commonwealth of Virginia. Initial contract shall be for two (2) years with an option to renew for eight (8) additional one-year periods.

II. BACKGROUND

James Madison University (JMU) is a comprehensive public institution in Harrisonburg, Virginia with an enrollment of approximately 22,000 students and 4,000 faculty and staff. Further information about the University may be found at the following website: <http://www.jmu.edu>. The University sponsors an 18-sport intercollegiate athletics program that competes at The Division I level of the National Collegiate Athletic Association. JMU is also affiliated with the Colonial Athletic Association, of which it was a charter member in 1985, and with the Eastern College Athletic Conference.

James Madison University has invested heavily in its athletics facilities, highlighted by Bridgeforth Stadium/Zane Showker Field. In 2020, the Atlantic Union Bank Center will complete construction as the 8,500-seat home of JMU men's and women's basketball while also serving as a destination for numerous campus and community events with capacity potential for 10,000 for certain special event configurations. More details on the Atlantic Union Bank Center can be found at <https://jmusports.com/feature/AtlanticUnionBankCenter>.

III. SMALL, WOMAN-OWNED AND MINORITY PARTICIPATION

It is the policy of the Commonwealth of Virginia to contribute to the establishment, preservation, and strengthening of small businesses and businesses owned by women and minorities, and to encourage their participation in State procurement activities. The Commonwealth encourages contractors to provide for the participation of small businesses and businesses owned by women and minorities through partnerships, joint ventures, subcontracts, and other contractual opportunities. Attachment B contains information on reporting spend data with subcontractors.

IV. STATEMENT OF NEEDS

With the upcoming debut of the Atlantic Union Bank Center, JMU seeks proposals for a High Density Wi-Fi Network System Package. Project highlights can be found at: <https://jmusports.com/feature/AtlanticUnionBankCenter>.

NOTE: Offerors shall provide pricing information for the items listed in Section IV *Statement of Needs* and Attachment D *Performance Specifications* by returning Attachment F *Pricing Form (excel)* and providing additional information on pricing models or narrative as needed in Section X *Pricing Schedule* in the RFP document.

A. GENERAL INFORMATION:

1. The work contemplated in this RFP includes manufacture, supply, delivery, installation, labor, tools, engineering, supervision, licenses, insurance, permits, related services (including design) and testing of all equipment, and materials necessary to install and operate the High Density Wi-Fi Network as described in the RFP Documents, and more

particularly in Attachment D *Performance Specifications*.

2. Offerors responding to this RFP must provide pricing inclusive of cost for the provision and installation of all items necessary to provide finished and fully operational systems as specified in the Options in Attachment D Section 1.1.B. Materials, equipment and related services required for the provision and installation of such a system that are not expressly addressed in this RFP are understood to be the responsibility of the Offeror.
3. Offerors are clearly advised that any drawings, plans, charts or other materials, whether supplied by or on behalf of James Madison University, AJP, or third parties, describing aspects of the site provided as part of this document or otherwise are not to be considered as definitive or as a substitute for any information which would otherwise be obtained by the Offeror during negotiation.
4. Offerors must submit proposals for the complete package including all required equipment, installation and functional connection of all equipment as described in this document and related attachments. A proposal submitted in response to this RFP signifies the Offeror agrees to sell to the University the indicated products, in whole or in part, at the sole discretion of the University.
5. Contractor shall be responsible for day to day premises and facilities cleanup, including temporary storage, removal and disposal of debris, trash and rubbish caused by its employees, or installation material men or workmen. All tools, equipment and materials shall be secured upon completion of the day's work. Surplus materials shall be removed from the work site and stored in their appropriate location.
6. Contractor's personnel shall follow University standards and personal conduct codes while on the University's premises. A copy of those standards and codes will be provided to Contractor on request. Personnel found violating these standards or regulations will be asked to leave the work site and shall not be allowed to return.
7. It is Contractor's responsibility to guarantee that all items of hardware, services rendered or working environments meet or exceed those requirements and guidelines established by the Occupational Safety and Health Act (OSHA).
8. Contractor shall warrant and guarantee to the University, without limitations or qualification, that all equipment, components, materials, workmanship and the system as an entity shall conform to and perform in accordance with local building codes.

B. DELIVERY, STORAGE, AND SECUIRITY

1. The Contractor shall provide pricing for each item to include delivery to the site for all system components and related materials.
2. The Contractor shall coordinate delivery with the University.
3. The Contractor shall unload, uncrate, assemble, and transport each component to its desired location for installation and install the system on-site in accordance with on-site regulations.

4. The Contractor shall be responsible for the cleanup and disposal of all packaging materials and debris.
5. The Contractor shall be responsible for providing any temporary on-site storage for equipment and materials unless adequate on-site storage is available from the University.
6. The University shall not be responsible for security or insurance related to said equipment or materials, even if stored on-site at locations designated or approved by the University.
7. Any temporary storage requirements must be coordinated with the University.

C. DEFINITIONS:

1. "Substantial Completion" – shall be defined as all work under the Contract has been substantially completed in accordance with the terms of the Contract and the system is fully operational and ready for the intended use. Systems shall be installed, all rack equipment installed, all cabling completed, system has been commissioned and tested in accordance with applicable requirements of the Technical Specifications and the Contract. The project is ready for final punch list by the University and/or the University's designated representative.
2. "Final Completion" – shall be defined as all punch list items have been completed and all work under the Contract is ready for final acceptance by the University once five (5) consecutive problem free events have been completed as defined by Section 3.6.B. of the Performance Specifications (Attachment D).

D. RESPONSE REQUIRED BY OFFERORS

1. Describe in detail offeror's approach to provide the RFP parameters as laid out in the Performance Specifications, Attachment D.
 - a. Provide the following: In addition to proposing specifically for what is specified in this RFP, the Offeror is encouraged to furnish alternative solutions that may satisfy or complement the solution proposed in this RFP.
 - b. Provide the following: Offerors are also encouraged to suggest alternative solutions that would reduce the overall cost without hindering the performance of the system from its intended use.
2. Training:
 - a. Describe all training included in project implementation (remote and/or on premises).
 - b. Describe all ongoing training options available (remote and/or on premises) for the duration of the contract.
 - c. Provide any associated training pricing for hourly and daily rates (to include travel costs for on premises training) in X. Pricing Schedule.
3. Describe the procedures for obtaining services for all types of maintenance and applicable "escalation" procedures for providing additional assistance in diagnosing a failure that is not resolved in a timely manner, to include notification procedures and timing as well as

what higher levels of assistance will be made available.

4. Provide a complete list of references for similar installations performed in the past three (3) years with name of facility, photo of installation, contact name, title, address and direct phone number.
5. Provide a formal list of intended design professionals, sub-contractors and suppliers, including primary place of business, and estimated dollar amount. Contractor, subcontractors, and design professionals shall be licensed by appropriate Virginia authorities / board as appropriate and required by law. Proposals should include a statement indicating the licensing status of Contractor, subcontractors, and design professionals required to be licensed in Virginia and identified in your proposal.
6. Provide an Equipment List with line item pricing.
7. Provide product cut sheets and technical data for each item proposed.
8. Specify parts and labor warranty to include cost and length of service.
9. Provide the most recent SOC 2 Report available.

E. TENTATIVE SCHEDULE

1. The University anticipates delivery and installation will begin approximately **March 30, 2020**, subject to change based on overall project schedule, to be coordinated and confirmed by the awarded vendor with the University and General Contractor.
 - a. Describe, in detail, your ability to meet the tentative schedule provided.

V. PROPOSAL PREPARATION AND SUBMISSION

A. GENERAL INSTRUCTIONS

To ensure timely and adequate consideration of your proposal, offerors are to limit all contact, whether verbal or written, pertaining to this RFP to the James Madison University Procurement Office for the duration of this Proposal process. Failure to do so may jeopardize further consideration of Offeror's proposal.

1. RFP Response: In order to be considered for selection, the **Offeror shall submit a complete response to this RFP**; and shall submit to the issuing Purchasing Agency:
 - a. **One (1) original and fifteen (15) copies** of the entire proposal, INCLUDING ALL ATTACHMENTS. Any proprietary information should be clearly marked in accordance with 3.f. below.
 - b. **One (1) electronic copy in WORD format or searchable PDF (*CD or flash drive*)** of the entire proposal, INCLUDING ALL ATTACHMENTS. **Attachments F and I should additionally be returned as Excel files on a CD or flash drive.** Any proprietary information should be clearly marked in accordance with 3.f. below.

- c. Should the proposal contain **proprietary information**, provide **one (1) redacted hard copy** of the proposal and all attachments with **proprietary portions removed or blacked out**. This copy should be clearly marked “*Redacted Copy*” on the front cover. The classification of an entire proposal document, line item prices, and/or total proposal prices as proprietary or trade secrets is not acceptable. JMU shall not be responsible for the Contractor’s failure to exclude proprietary information from this redacted copy.

No other distribution of the proposal shall be made by the Offeror.

- 2. The version of the solicitation issued by JMU Procurement Services, as amended by an addenda, is the mandatory controlling version of the document. Any modification of, or additions to, the solicitation by the Offeror shall not modify the official version of the solicitation issued by JMU Procurement services unless accepted in writing by the University. Such modifications or additions to the solicitation by the Offeror may be cause for rejection of the proposal; however, JMU reserves the right to decide, on a case-by-case basis in its sole discretion, whether to reject such a proposal. If the modification or additions are not identified until after the award of the contract, the controlling version of the solicitation document shall still be the official state form issued by Procurement Services.
- 3. Proposal Preparation
 - a. Proposals shall be signed by an authorized representative of the Offeror. All information requested should be submitted. Failure to submit all information requested may result in the purchasing agency requiring prompt submissions of missing information and/or giving a lowered evaluation of the proposal. Proposals which are substantially incomplete or lack key information may be rejected by the purchasing agency. Mandatory requirements are those required by law or regulation or are such that they cannot be waived and are not subject to negotiation.
 - b. Proposals shall be prepared simply and economically, providing a straightforward, concise description of capabilities to satisfy the requirements of the RFP. Emphasis should be placed on completeness and clarity of content.
 - c. Proposals should be organized in the order in which the requirements are presented in the RFP. All pages of the proposal should be numbered. Each paragraph in the proposal should reference the paragraph number of the corresponding section of the RFP. It is also helpful to cite the paragraph number, sub letter, and repeat the text of the requirement as it appears in the RFP. If a response covers more than one page, the paragraph number and sub letter should be repeated at the top of the next page. The proposal should contain a table of contents which cross references the RFP requirements. Information which the offeror desires to present that does not fall within any of the requirements of the RFP should be inserted at the appropriate place or be attached at the end of the proposal and designated as additional material. Proposals that are not organized in this manner risk elimination from consideration if the evaluators are unable to find where the RFP requirements are specifically addressed.
 - d. As used in this RFP, the terms “must”, “shall”, “should” and “may” identify the criticality of requirements. “Must” and “shall” identify requirements whose absence will have a major negative impact on the suitability of the proposed solution. Items labeled as “should” or “may” are highly desirable, although their absence will not have a large impact and would be useful, but are not necessary. Depending on the overall

response to the RFP, some individual “must” and “shall” items may not be fully satisfied, but it is the intent to satisfy most, if not all, “must” and “shall” requirements. The inability of an offeror to satisfy a “must” or “shall” requirement does not automatically remove that offeror from consideration; however, it may seriously affect the overall rating of the offeror’s proposal.

- e. Each copy of the proposal should be bound or contained in a single volume where practical. All documentation submitted with the proposal should be contained in that single volume.
 - f. Ownership of all data, materials and documentation originated and prepared for the State pursuant to the RFP shall belong exclusively to the State and be subject to public inspection in accordance with the Virginia Freedom of Information Act. Trade secrets or proprietary information submitted by the offeror shall not be subject to public disclosure under the Virginia Freedom of Information Act; however, the offeror must invoke the protection of Section 2.2-4342F of the Code of Virginia, in writing, either before or at the time the data is submitted. The written notice must specifically identify the data or materials to be protected and state the reasons why protection is necessary. The proprietary or trade secret materials submitted must be identified by some distinct method such as highlighting or underlining and must indicate only the specific words, figures, or paragraphs that constitute trade secret or proprietary information. The classification of an entire proposal document, line item prices and/or total proposal prices as proprietary or trade secrets is not acceptable and will result in rejection and return of the proposal.
4. Oral Presentation: Offerors who submit a proposal in response to this RFP may be required to give an oral presentation of their proposal to James Madison University. This provides an opportunity for the Offeror to clarify or elaborate on the proposal. This is a fact-finding and explanation session only and does not include negotiation. James Madison University will schedule the time and location of these presentations. Oral presentations are an option of the University and may or may not be conducted. Therefore, proposals should be complete.

The University may request select offerors to provide a demonstration of the proposed solution on one of the following possible dates: February 4 or 5, 2020. Selected offerors will be given as much advanced notice as possible; however, all offerors should maintain flexibility in scheduling during these days.

B. SPECIFIC PROPOSAL INSTRUCTIONS

Proposals should be as thorough and detailed as possible so that James Madison University may properly evaluate your capabilities to provide the required services. Offerors are required to submit the following items as a complete proposal:

- 1. Return RFP cover sheet and all addenda acknowledgements, if any, signed and filled out as required.
- 2. Plan and methodology for providing the goods/services as described in Section IV. Statement of Needs of this Request for Proposal.

3. A written narrative statement to include, but not be limited to, the expertise, qualifications, and experience of the firm and resumes of specific personnel to be assigned to perform the work.
4. Offeror Data Sheet, included as *Attachment A* to this RFP.
5. Small Business Subcontracting Plan, included as *Attachment B* to this RFP. Offeror shall provide a Small Business Subcontracting plan which summarizes the planned utilization of Department of Small Business and Supplier Diversity (SBSD)-certified small businesses which include businesses owned by women and minorities, when they have received Department of Small Business and Supplier Diversity (SBSD) small business certification, under the contract to be awarded as a result of this solicitation. This is a requirement for all prime contracts in excess of \$100,000 unless no subcontracting opportunities exist.
6. Identify the amount of sales your company had during the last twelve months with each VASCUPP Member Institution. A list of VASCUPP Members can be found at: www.VASCUPP.org.
7. Proposed Cost. See Section X. Pricing Schedule of this Request for Proposal.

VI. EVALUATION AND AWARD CRITERIA

A. EVALUATION CRITERIA

Proposals shall be evaluated by James Madison University using the following criteria:

1. Quality of products/services offered and suitability for intended purposes
2. Qualifications and experience of Offeror in providing the goods/services
3. Specific plans or methodology to be used to perform the services
4. Participation of Small, Women-Owned, & Minority (SWaM) Businesses
5. Cost

Allocation of points for evaluation criteria will be published to the eVA solicitation posting prior to the closing date and time.

- B. AWARD TO MULTIPLE OFFERORS:** Selection shall be made of two or more offerors deemed to be fully qualified and best suited among those submitting proposals on the basis of the evaluation factors included in the Request for Proposals, including price, if so stated in the Request for Proposals. Negotiations shall be conducted with the offerors so selected. Price shall be considered, but need not be the sole determining factor. After negotiations have been conducted with each offeror so selected, the agency shall select the offeror which, in its opinion, has made the best proposal, and shall award the contract to that offeror. The Commonwealth reserves the right to make multiple awards as a result of this solicitation. The Commonwealth may cancel this Request for Proposals or reject proposals at any time prior to an award, and is not required to furnish a statement of the reasons why a particular proposal was not deemed to be the most advantageous. Should the Commonwealth determine

in writing and in its sole discretion that only one offeror is fully qualified, or that one offeror is clearly more highly qualified than the others under consideration, a contract may be negotiated and awarded to that offeror. The award document will be a contract incorporating by reference all the requirements, terms and conditions of the solicitation and the contractor's proposal as negotiated.

VII. GENERAL TERMS AND CONDITIONS

- A. PURCHASING MANUAL: This solicitation is subject to the provisions of the Commonwealth of Virginia's Purchasing Manual for Institutions of Higher Education and Their Vendors and any revisions thereto, which are hereby incorporated into this contract in their entirety. A copy of the manual is available for review at the purchasing office. In addition, the manual may be accessed electronically at <http://www.jmu.edu/procurement> or a copy can be obtained by calling Procurement Services at (540) 568-3145.
- B. APPLICABLE LAWS AND COURTS: This solicitation and any resulting contract shall be governed in all respects by the laws of the Commonwealth of Virginia and any litigation with respect thereto shall be brought in the courts of the Commonwealth. The Contractor shall comply with applicable federal, state and local laws and regulations.
- C. ANTI-DISCRIMINATION: By submitting their proposals, offerors certify to the Commonwealth that they will conform to the provisions of the Federal Civil Rights Act of 1964, as amended, as well as the Virginia Fair Employment Contracting Act of 1975, as amended, where applicable, the Virginians With Disabilities Act, the Americans With Disabilities Act and §10 of the Rules Governing Procurement, Chapter 2, Exhibit J, Attachment 1 (available for review at <http://www.jmu.edu/procurement>). If the award is made to a faith-based organization, the organization shall not discriminate against any recipient of goods, services, or disbursements made pursuant to the contract on the basis of the recipient's religion, religious belief, refusal to participate in a religious practice, or on the basis of race, age, color, gender or national origin and shall be subject to the same rules as other organizations that contract with public bodies to account for the use of the funds provided; however, if the faith-based organization segregates public funds into separate accounts, only the accounts and programs funded with public funds shall be subject to audit by the public body. (*§6 of the Rules Governing Procurement*).

In every contract over \$10,000 the provisions in 1. and 2. below apply:

- 1. During the performance of this contract, the contractor agrees as follows:
 - a. The contractor will not discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, age, disability, or any other basis prohibited by state law relating to discrimination in employment, except where there is a bona fide occupational qualification reasonably necessary to the normal operation of the contractor. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.
 - b. The contractor, in all solicitations or advertisements for employees placed by or on behalf of the contractor, will state that such contractor is an equal opportunity employer.

- c. Notices, advertisements, and solicitations placed in accordance with federal law, rule, or regulation shall be deemed sufficient for the purpose of meeting these requirements.
- 2. The contractor will include the provisions of 1. Above in every subcontract or purchase order over \$10,000, so that the provisions will be binding upon each subcontractor or vendor.
- D. ETHICS IN PUBLIC CONTRACTING: By submitting their proposals, offerors certify that their proposals are made without collusion or fraud and that they have not offered or received any kickbacks or inducements from any other offeror, supplier, manufacturer or subcontractor in connection with their proposal, and that they have not conferred on any public employee having official responsibility for this procurement transaction any payment, loan, subscription, advance, deposit of money, services or anything of more than nominal value, present or promised, unless consideration of substantially equal or greater value was exchanged.
- E. IMMIGRATION REFORM AND CONTROL ACT OF 1986: By entering into a written contract with the Commonwealth of Virginia, the Contractor certifies that the Contractor does not, and shall not during the performance of the contract for goods and services in the Commonwealth, knowingly employ an unauthorized alien as defined in the federal Immigration Reform and Control Act of 1986.
- F. DEBARMENT STATUS: By submitting their proposals, offerors certify that they are not currently debarred by the Commonwealth of Virginia from submitting proposals on contracts for the type of goods and/or services covered by this solicitation, nor are they an agent of any person or entity that is currently so debarred.
- G. ANTITRUST: By entering into a contract, the contractor conveys, sells, assigns, and transfers to the Commonwealth of Virginia all rights, title and interest in and to all causes of action it may now have or hereafter acquire under the antitrust laws of the United States and the Commonwealth of Virginia, relating to the particular goods or services purchased or acquired by the Commonwealth of Virginia under said contract.
- H. MANDATORY USE OF STATE FORM AND TERMS AND CONDITIONS RFPs: Failure to submit a proposal on the official state form provided for that purpose may be a cause for rejection of the proposal. Modification of or additions to the General Terms and Conditions of the solicitation may be cause for rejection of the proposal; however, the Commonwealth reserves the right to decide, on a case by case basis, in its sole discretion, whether to reject such a proposal.
- I. CLARIFICATION OF TERMS: If any prospective offeror has questions about the specifications or other solicitation documents, the prospective offeror should contact the buyer whose name appears on the face of the solicitation no later than **January 3, 2020**. Any revisions to the solicitation will be made only by addendum issued by the buyer.
- J. PAYMENT:
 - 1. To Prime Contractor:
 - a. Invoices for items ordered, delivered and accepted shall be submitted by the contractor directly to the payment address shown on the purchase order/contract. All invoices shall show the state contract number and/or purchase order number; social security number (for individual contractors) or

the federal employer identification number (for proprietorships, partnerships, and corporations).

- b. Any payment terms requiring payment in less than 30 days will be regarded as requiring payment 30 days after invoice or delivery, whichever occurs last. This shall not affect offers of discounts for payment in less than 30 days, however.
- c. All goods or services provided under this contract or purchase order, that are to be paid for with public funds, shall be billed by the contractor at the contract price, regardless of which public agency is being billed.
- d. The following shall be deemed to be the date of payment: the date of postmark in all cases where payment is made by mail, or the date of offset when offset proceedings have been instituted as authorized under the Virginia Debt Collection Act.
- e. Unreasonable Charges. Under certain emergency procurements and for most time and material purchases, final job costs cannot be accurately determined at the time orders are placed. In such cases, contractors should be put on notice that final payment in full is contingent on a determination of reasonableness with respect to all invoiced charges. Charges which appear to be unreasonable will be researched and challenged, and that portion of the invoice held in abeyance until a settlement can be reached. Upon determining that invoiced charges are not reasonable, the Commonwealth shall promptly notify the contractor, in writing, as to those charges which it considers unreasonable and the basis for the determination. A contractor may not institute legal action unless a settlement cannot be reached within thirty (30) days of notification. The provisions of this section do not relieve an agency of its prompt payment obligations with respect to those charges which are not in dispute (*Rules Governing Procurement, Chapter 2, Exhibit J, Attachment 1 § 53; available for review at <http://www.jmu.edu/procurement>*).

2. To Subcontractors:

- a. A contractor awarded a contract under this solicitation is hereby obligated:
 - (1) To pay the subcontractor(s) within seven (7) days of the contractor's receipt of payment from the Commonwealth for the proportionate share of the payment received for work performed by the subcontractor(s) under the contract; or
 - (2) To notify the agency and the subcontractors, in writing, of the contractor's intention to withhold payment and the reason.
- b. The contractor is obligated to pay the subcontractor(s) interest at the rate of one percent per month (unless otherwise provided under the terms of the contract) on all amounts owed by the contractor that remain unpaid seven (7) days following receipt of payment from the Commonwealth, except for amounts withheld as stated in (2) above. The date of mailing of any payment by U. S. Mail is deemed to be payment to the addressee. These provisions apply to each sub-tier contractor performing under the primary contract. A contractor's obligation to pay an interest charge to a subcontractor may not be construed to be an obligation of the Commonwealth.

3. Each prime contractor who wins an award in which provision of a SWAM procurement plan is a condition to the award, shall deliver to the contracting agency or institution, on or before request for final payment, evidence and certification of compliance (subject only to insubstantial shortfalls and to shortfalls arising from subcontractor default) with the SWAM procurement plan. Final payment under the contract in question may be withheld until such certification is delivered and, if necessary, confirmed by the agency or institution, or other appropriate penalties may be assessed in lieu of withholding such payment.
 4. The Commonwealth of Virginia encourages contractors and subcontractors to accept electronic and credit card payments.
- K. PRECEDENCE OF TERMS: Paragraphs A through J of these General Terms and Conditions and the Commonwealth of Virginia Purchasing Manual for Institutions of Higher Education and their Vendors, shall apply in all instances. In the event there is a conflict between any of the other General Terms and Conditions and any Special Terms and Conditions in this solicitation, the Special Terms and Conditions shall apply.
- L. QUALIFICATIONS OF OFFERORS: The Commonwealth may make such reasonable investigations as deemed proper and necessary to determine the ability of the offeror to perform the services/furnish the goods and the offeror shall furnish to the Commonwealth all such information and data for this purpose as may be requested. The Commonwealth reserves the right to inspect offeror's physical facilities prior to award to satisfy questions regarding the offeror's capabilities. The Commonwealth further reserves the right to reject any proposal if the evidence submitted by, or investigations of, such offeror fails to satisfy the Commonwealth that such offeror is properly qualified to carry out the obligations of the contract and to provide the services and/or furnish the goods contemplated therein.
- M. TESTING AND INSPECTION: The Commonwealth reserves the right to conduct any test/inspection it may deem advisable to assure goods and services conform to the specifications.
- N. ASSIGNMENT OF CONTRACT: A contract shall not be assignable by the contractor in whole or in part without the written consent of the Commonwealth.
- O. CHANGES TO THE CONTRACT: Changes can be made to the contract in any of the following ways:
1. The parties may agree in writing to modify the scope of the contract. An increase or decrease in the price of the contract resulting from such modification shall be agreed to by the parties as a part of their written agreement to modify the scope of the contract.
 2. The Purchasing Agency may order changes within the general scope of the contract at any time by written notice to the contractor. Changes within the scope of the contract include, but are not limited to, things such as services to be performed, the method of packing or shipment, and the place of delivery or installation. The contractor shall comply with the notice upon receipt. The contractor shall be compensated for any additional costs incurred as the result of such order and shall give the Purchasing Agency a credit for any savings. Said compensation shall be determined by one of the following methods:
 - a. By mutual agreement between the parties in writing; or

- b. By agreeing upon a unit price or using a unit price set forth in the contract, if the work to be done can be expressed in units, and the contractor accounts for the number of units of work performed, subject to the Purchasing Agency's right to audit the contractor's records and/or to determine the correct number of units independently; or
 - c. By ordering the contractor to proceed with the work and keep a record of all costs incurred and savings realized. A markup for overhead and profit may be allowed if provided by the contract. The same markup shall be used for determining a decrease in price as the result of savings realized. The contractor shall present the Purchasing Agency with all vouchers and records of expenses incurred and savings realized. The Purchasing Agency shall have the right to audit the records of the contractor as it deems necessary to determine costs or savings. Any claim for an adjustment in price under this provision must be asserted by written notice to the Purchasing Agency within thirty (30) days from the date of receipt of the written order from the Purchasing Agency. If the parties fail to agree on an amount of adjustment, the question of an increase or decrease in the contract price or time for performance shall be resolved in accordance with the procedures for resolving disputes provided by the Disputes Clause of this contract or, if there is none, in accordance with the disputes provisions of the Commonwealth of Virginia Purchasing Manual for Institutions of Higher Education and their Vendors. Neither the existence of a claim nor a dispute resolution process, litigation or any other provision of this contract shall excuse the contractor from promptly complying with the changes ordered by the Purchasing Agency or with the performance of the contract generally.
- P. DEFAULT: In case of failure to deliver goods or services in accordance with the contract terms and conditions, the Commonwealth, after due oral or written notice, may procure them from other sources and hold the contractor responsible for any resulting additional purchase and administrative costs. This remedy shall be in addition to any other remedies which the Commonwealth may have.
- Q. INSURANCE: By signing and submitting a proposal under this solicitation, the offeror certifies that if awarded the contract, it will have the following insurance coverage at the time the contract is awarded. For construction contracts, if any subcontractors are involved, the subcontractor will have workers' compensation insurance in accordance with § 25 of the Rules Governing Procurement – Chapter 2, Exhibit J, Attachment 1, and 65.2-800 et. Seq. of the Code of Virginia (available for review at <http://www.jmu.edu/procurement>) The offeror further certifies that the contractor and any subcontractors will maintain these insurance coverage during the entire term of the contract and that all insurance coverage will be provided by insurance companies authorized to sell insurance in Virginia by the Virginia State Corporation Commission.

MINIMUM INSURANCE COVERAGES AND LIMITS REQUIRED FOR MOST CONTRACTS:

1. Workers' Compensation: Statutory requirements and benefits. Coverage is compulsory for employers of three or more employees, to include the employer. Contractors who fail to notify the Commonwealth of increases in the number of employees that change their workers' compensation requirement under the Code of Virginia during the course of the contract shall be in noncompliance with the contract.
2. Employer's Liability: \$100,000
3. Commercial General Liability: \$1,000,000 per occurrence and \$2,000,000 in the aggregate. Commercial General Liability is to include bodily injury and property damage,

personal injury and advertising injury, products and completed operations coverage. The Commonwealth of Virginia must be named as an additional insured and so endorsed on the policy.

4. Automobile Liability: \$1,000,000 combined single limit. *(Required only if a motor vehicle not owned by the Commonwealth is to be used in the contract. Contractor must assure that the required coverage is maintained by the Contractor (or third party owner of such motor vehicle.)*

- R. ANNOUNCEMENT OF AWARD: Upon the award or the announcement of the decision to award a contract over \$100,000, as a result of this solicitation, the purchasing agency will publicly post such notice on the DGS/DPS eVA web site (www.eva.virginia.gov) for a minimum of 10 days.
- S. DRUG-FREE WORKPLACE: During the performance of this contract, the contractor agrees to (i) provide a drug-free workplace for the contractor's employees; (ii) post in conspicuous places, available to employees and applicants for employment, a statement notifying employees that the unlawful manufacture, sale, distribution, dispensation, possession, or use of a controlled substance or marijuana is prohibited in the contractor's workplace and specifying the actions that will be taken against employees for violations of such prohibition; (iii) state in all solicitations or advertisements for employees placed by or on behalf of the contractor that the contractor maintains a drug-free workplace; and (iv) include the provisions of the foregoing clauses in every subcontract or purchase order of over \$10,000, so that the provisions will be binding upon each subcontractor or vendor.

For the purposes of this section, "drug-free workplace" means a site for the performance of work done in connection with a specific contract awarded to a contractor, the employees of whom are prohibited from engaging in the unlawful manufacture, sale, distribution, dispensation, possession or use of any controlled substance or marijuana during the performance of the contract.

- T. NONDISCRIMINATION OF CONTRACTORS: An offeror, or contractor shall not be discriminated against in the solicitation or award of this contract because of race, religion, color, sex, national origin, age, disability, faith-based organizational status, any other basis prohibited by state law relating to discrimination in employment or because the offeror employs ex-offenders unless the state agency, department or institution has made a written determination that employing ex-offenders on the specific contract is not in its best interest. If the award of this contract is made to a faith-based organization and an individual, who applies for or receives goods, services, or disbursements provided pursuant to this contract objects to the religious character of the faith-based organization from which the individual receives or would receive the goods, services, or disbursements, the public body shall offer the individual, within a reasonable period of time after the date of his objection, access to equivalent goods, services, or disbursements from an alternative provider.
- U. eVA BUSINESS TO GOVERNMENT VENDOR REGISTRATION, CONTRACTS, AND ORDERS: The eVA Internet electronic procurement solution, website portal www.eVA.virginia.gov, streamlines and automates government purchasing activities in the Commonwealth. The eVA portal is the gateway for vendors to conduct business with state agencies and public bodies. All vendors desiring to provide goods and/or services to the Commonwealth shall participate in the eVA Internet eprocurement solution by completing the free eVA Vendor Registration. All offerors must register in eVA and pay the Vendor Transaction Fees specified below; failure to register will result in the proposal being rejected.

Vendor transaction fees are determined by the date the original purchase order is issued and the current fees are as follows:

Vendor transaction fees are determined by the date the original purchase order is issued and the current fees are as follows:

1. For orders issued July 1, 2014 and after, the Vendor Transaction Fee is:
 - a. Department of Small Business and Supplier Diversity (SBSD) certified Small Businesses: 1% capped at \$500 per order.
 - b. Businesses that are not Department of Small Business and Supplier Diversity (SBSD) certified Small Businesses: 1% capped at \$1,500 per order.
 2. For orders issued prior to July 1, 2014 the vendor transaction fees can be found at www.eVA.virginia.gov.
 3. The specified vendor transaction fee will be invoiced by the Commonwealth of Virginia Department of General Services approximately 60 days after the corresponding purchase order is issued and payable 30 days after the invoice date. Any adjustments (increases/decreases) will be handled through purchase order changes.
- V. AVAILABILITY OF FUNDS: It is understood and agreed between the parties herein that the Commonwealth of Virginia shall be bound hereunder only to the extent of the funds available or which may hereafter become available for the purpose of this agreement.
- W. PRICING CURRENCY: Unless stated otherwise in the solicitation, offerors shall state offered prices in U.S. dollars.
- X. E-VERIFY REQUIREMENT OF ANY CONTRACTOR: Any employer with more than an average of 50 employees for the previous 12 months entering into a contract in excess of \$50,000 with James Madison University to perform work or provide services pursuant to such contract shall register and participate in the E-Verify program to verify information and work authorization of its newly hired employees performing work pursuant to any awarded contract.
- Y. TAXES: Sales to the Commonwealth of Virginia are normally exempt from State sales tax. State sales and use tax certificates of exemption, Form ST-12, will be issued upon request. Deliveries against this contract shall usually be free of Federal excise and transportation taxes. The Commonwealth's excise tax exemption registration number is 54-73-0076K.
- Z. TRANSPORTATION AND PACKAGING: By submitting their proposals, all Offerors certify and warrant that the price offered for FOB destination includes only the actual freight rate costs at the lowest and best rate and is based upon the actual weight of the goods to be shipped. Except as otherwise specified herein, standard commercial packaging, packing and shipping containers shall be used. All shipping containers shall be legibly marked or labeled on the outside with purchase order number, commodity description, and quantity.

VIII. SPECIAL TERMS AND CONDITIONS

- A. ADVERTISING: In the event a contract is awarded for supplies, equipment, or services resulting from this bid/proposal, no indication of such sales or services to James Madison University will be used in product literature or advertising. The contractor shall not state in

any of its advertising or product literature that James Madison University has purchased or uses any of its products or services, and the contractor shall not include James Madison University in any client list in advertising and promotional materials.

- B. AUDIT: The Contractor hereby agrees to retain all books, records, systems, and other documents relative to this contract for five (5) years after final payment, or until audited by the Commonwealth of Virginia, whichever is sooner. The Commonwealth of Virginia, its authorized agents, and/or State auditors shall have full access to and the right to examine any of said materials during said period.
- C. CANCELLATION OF CONTRACT: James Madison University reserves the right to cancel and terminate any resulting contract, in part or in whole, without penalty, upon 60 days written notice to the contractor. In the event the initial contract period is for more than 12 months, the resulting contract may be terminated by either party, without penalty, after the initial 12 months of the contract period upon 60 days written notice to the other party. Any contract cancellation notice shall not relieve the contractor of the obligation to deliver and/or perform on all outstanding orders issued prior to the effective date of cancellation.
- D. IDENTIFICATION OF PROPOSAL ENVELOPE: The signed proposal should be returned in a separate envelope or package, sealed and identified as follows:

From: _____	
Name of Offeror	Due Date Time
Street or Box No.	RFP #
City, State, Zip Code	RFP Title
Name of Purchasing Officer: _____	

The envelope should be addressed as directed on the title page of the solicitation.

The Offeror takes the risk that if the envelope is not marked as described above, it may be inadvertently opened and the information compromised, which may cause the proposal to be disqualified. Proposals may be hand-delivered to the designated location in the office issuing the solicitation. No other correspondence or other proposals should be placed in the envelope.

- E. LATE PROPOSALS: To be considered for selection, proposals must be received by the issuing office by the designated date and hour. The official time used in the receipt of proposals is that time on the automatic time stamp machine in the issuing office. Proposals received in the issuing office after the date and hour designated are automatically non responsive and will not be considered. The University is not responsible for delays in the delivery of mail by the U.S. Postal Service, private couriers, or the intra university mail system. It is the sole responsibility of the Offeror to ensure that its proposal reaches the issuing office by the designated date and hour.
- F. UNDERSTANDING OF REQUIREMENTS: It is the responsibility of each offeror to inquire about and clarify any requirements of this solicitation that is not understood. The University will not be bound by oral explanations as to the meaning of specifications or language contained in this solicitation. Therefore, all inquiries deemed to be substantive in nature must be in writing and submitted to the responsible buyer in the Procurement Services Office. **Offerors are asked to include reference to RFP section, page, and item number in their questions when relevant.** Offerors must ensure that written inquiries reach the buyer by **January 3,**

2020. A copy of all queries and the respective response will be provided in the form of an addendum to all offerors who have indicated an interest in responding to this solicitation. Your signature on your Offer certifies that you fully understand all facets of this solicitation. These questions may be sent to the Buyer as referenced on the signature sheet.

- G. RENEWAL OF CONTRACT: This contract may be renewed by the Commonwealth for a period of eight (8) successive one year periods under the terms and conditions of the original contract except as stated in 1. and 2. below. Price increases may be negotiated only at the time of renewal. Written notice of the Commonwealth's intention to renew shall be given approximately 90 days prior to the expiration date of each contract period.
1. If the Commonwealth elects to exercise the option to renew the contract for an additional one-year period, the contract price(s) for the additional one year shall not exceed the contract price(s) of the original contract increased/decreased by no more than the percentage increase/decrease of the other services category of the CPI-W section of the Consumer Price Index of the United States Bureau of Labor Statistics for the latest twelve months for which statistics are available.
 2. If during any subsequent renewal periods, the Commonwealth elects to exercise the option to renew the contract, the contract price(s) for the subsequent renewal period shall not exceed the contract price(s) of the previous renewal period increased/decreased by more than the percentage increase/decrease of the other services category of the CPI-W section of the Consumer Price Index of the United States Bureau of Labor Statistics for the latest twelve months for which statistics are available.
- H. SUBMISSION OF INVOICES: All invoices shall be submitted within sixty days of contract term expiration for the initial contract period as well as for each subsequent contract renewal period. Any invoices submitted after the sixty day period will not be processed for payment.
- I. OPERATING VEHICLES ON JAMES MADISON UNIVERSITY CAMPUS: Operating vehicles on sidewalks, plazas, and areas heavily used by pedestrians is prohibited. In the unlikely event a driver should find it necessary to drive on James Madison University sidewalks, plazas, and areas heavily used by pedestrians, the driver must yield to pedestrians. For a complete list of parking regulations, please go to www.jmu.edu/parking; or to acquire a service representative parking permit, contact Parking Services at 540.568.3300. The safety of our students, faculty and staff is of paramount importance to us. Accordingly, violators may be charged.
- J. COOPERATIVE PURCHASING / USE OF AGREEMENT BY THIRD PARTIES: It is the intent of this solicitation and resulting contract(s) to allow for cooperative procurement. Accordingly, any public body, (to include government/state agencies, political subdivisions, etc.), cooperative purchasing organizations, public or private health or educational institutions or any University related foundation and affiliated corporations may access any resulting contract if authorized by the Contractor.

Participation in this cooperative procurement is strictly voluntary. If authorized by the Contractor(s), the resultant contract(s) will be extended to the entities indicated above to purchase goods and services in accordance with contract terms. As a separate contractual relationship, the participating entity will place its own orders directly with the Contractor(s) and shall fully and independently administer its use of the contract(s) to include contractual disputes, invoicing and payments without direct administration from the University. No modification of this contract or execution of a separate agreement is required to participate; however, the participating entity and the Contractor may modify the terms and conditions of

this contract to accommodate specific governing laws, regulations, policies, and business goals required by the participating entity. Any such modification will apply solely between the participating entity and the Contractor.

The Contractor will notify the University in writing of any such entities accessing this contract. The Contractor will provide semi-annual usage reports for all entities accessing the contract. The University shall not be held liable for any costs or damages incurred by any other participating entity as a result of any authorization by the Contractor to extend the contract. It is understood and agreed that the University is not responsible for the acts or omissions of any entity and will not be considered in default of the contract no matter the circumstances.

Use of this contract(s) does not preclude any participating entity from using other contracts or competitive processes as needed.

K. SMALL BUSINESS SUBCONTRACTING AND EVIDENCE OF COMPLIANCE:

1. It is the goal of the Commonwealth that 42% of its purchases are made from small businesses. This includes discretionary spending in prime contracts and subcontracts. All potential offerors are required to submit a Small Business Subcontracting Plan. Unless the offeror is registered as a Department of Small Business and Supplier Diversity (SBSD)-certified small business and where it is practicable for any portion of the awarded contract to be subcontracted to other suppliers, the contractor is encouraged to offer such subcontracting opportunities to SBSD-certified small businesses. This shall not exclude SBSD-certified women-owned and minority-owned businesses when they have received SBSD small business certification. No offeror or subcontractor shall be considered a Small Business, a Women-Owned Business or a Minority-Owned Business unless certified as such by the Department of Small Business and Supplier Diversity (SBSD) by the due date for receipt of proposals. If small business subcontractors are used, the prime contractor agrees to report the use of small business subcontractors by providing the purchasing office at a minimum the following information: name of small business with the SBSD certification number or FEIN, phone number, total dollar amount subcontracted, category type (small, women-owned, or minority-owned), and type of product/service provided. **This information shall be submitted to: JMU Office of Procurement Services, Attn: SWAM Subcontracting Compliance, MSC 5720, Harrisonburg, VA 22807.**
2. Each prime contractor who wins an award in which provision of a small business subcontracting plan is a condition of the award, shall deliver to the contracting agency or institution with every request for payment, evidence of compliance (subject only to insubstantial shortfalls and to shortfalls arising from subcontractor default) with the small business subcontracting plan. **This information shall be submitted to: JMU Office of Procurement Services, SWAM Subcontracting Compliance, MSC 5720, Harrisonburg, VA 22807.** When such business has been subcontracted to these firms and upon completion of the contract, the contractor agrees to furnish the purchasing office at a minimum the following information: name of firm with the Department of Small Business and Supplier Diversity (SBSD) certification number or FEIN number, phone number, total dollar amount subcontracted, category type (small, women-owned, or minority-owned), and type of product or service provided. Payment(s) may be withheld until compliance with the plan is received and confirmed by the agency or institution. The agency or institution reserves the right to pursue other appropriate remedies to include, but not be limited to, termination for default.
3. Each prime contractor who wins an award valued over \$200,000 shall deliver to the contracting agency or institution with every request for payment, information on use of

subcontractors that are not Department of Small Business and Supplier Diversity (SBSD)-certified small businesses. When such business has been subcontracted to these firms and upon completion of the contract, the contractor agrees to furnish the purchasing office at a minimum the following information: name of firm, phone number, FEIN number, total dollar amount subcontracted, and type of product or service provided. **This information shall be submitted to: JMU Office of Procurement Services, Attn: SWAM Subcontracting Compliance, MSC 5720, Harrisonburg, VA 22807.**

- L. AUTHORIZATION TO CONDUCT BUSINESS IN THE COMMONWEALTH: A contractor organized as a stock or nonstock corporation, limited liability company, business trust, or limited partnership or registered as a registered limited liability partnership shall be authorized to transact business in the Commonwealth as a domestic or foreign business entity if so required by Title 13.1 or Title 50 of the Code of Virginia or as otherwise required by law. Any business entity described above that enters into a contract with a public body shall not allow its existence to lapse or its certificate of authority or registration to transact business in the Commonwealth, if so required under Title 13.1 or Title 50, to be revoked or cancelled at any time during the term of the contract. A public body may void any contract with a business entity if the business entity fails to remain in compliance with the provisions of this section.
- M. PUBLIC POSTING OF COOPERATIVE CONTRACTS: James Madison University maintains a web-based contracts database with a public gateway access. Any resulting cooperative contract/s to this solicitation will be posted to the publicly accessible website. Contents identified as proprietary information will not be made public.
- N. CRIMINAL BACKGROUND CHECKS OF PERSONNEL ASSIGNED BY CONTRACTOR TO PERFORM WORK ON JMU PROPERTY: The Contractor shall obtain criminal background checks on all of their contracted employees who will be assigned to perform services on James Madison University property. The results of the background checks will be directed solely to the Contractor. The Contractor bears responsibility for confirming to the University contract administrator that the background checks have been completed prior to work being performed by their employees or subcontractors. The Contractor shall only assign to work on the University campus those individuals whom it deems qualified and permissible based on the results of completed background checks. Notwithstanding any other provision herein, and to ensure the safety of students, faculty, staff and facilities, James Madison University reserves the right to approve or disapprove any contract employee that will work on JMU property. Disapproval by the University will solely apply to JMU property and should have no bearing on the Contractor's employment of an individual outside of James Madison University.
- O. INDEMNIFICATION: Contractor agrees to indemnify, defend and hold harmless the Commonwealth of Virginia, its officers, agents, and employees from any claims, damages and actions of any kind or nature, whether at law or in equity, arising from or caused by the use of any materials, goods, or equipment of any kind or nature furnished by the contractor/any services of any kind or nature furnished by the contractor, provided that such liability is not attributable to the sole negligence of the using agency or to failure of the using agency to use the materials, goods, or equipment in the manner already and permanently described by the contractor on the materials, goods or equipment delivered.
- P. ADDITIONAL GOODS AND SERVICES: The University may acquire other goods or services that the supplier provides than those specifically solicited. The University reserves the right, subject to mutual agreement, for the Contractor to provide additional goods and/or services under the same pricing, terms, and conditions and to make modifications or enhancements to the existing goods and services. Such additional goods and services may

include other products, components, accessories, subsystems, or related services that are newly introduced during the term of this Agreement. Such additional goods and services will be provided to the University at favored nations pricing, terms, and conditions.

- Q. ELECTRICAL EQUIPMENT STANDARDS: All equipment/material shall conform to the latest issue of all applicable standards as established by National Electrical Manufacturer's Association (NEMA), American National Standards Institute (ANSI), and Occupational Safety & Health Administration (OSHA). All equipment and material, for which there are OSHA standards, shall bear an appropriate label of approval for use intended from a Nationally Recognized Testing Laboratory (NRTL).
- R. EXTRA CHARGES NOT ALLOWED: The pricing shall be for complete installation ready for the Commonwealth's use, and shall include all applicable freight and installation charges; extra charges will not be allowed.
- S. CONFIDENTIALITY (Commonwealth): The Commonwealth agrees that neither it nor its employees, representatives, or agents shall knowingly divulge any proprietary information with respect to the operation of the software, the technology embodied therein, or any other trade secret or proprietary information related thereto, except as specifically authorized by the contractor in writing or as required by the Freedom of Information Act or similar law. It shall be the contractor's responsibility to fully comply with § 11-52 D of the *Code of Virginia*. All trade secrets or proprietary information must be identified in writing or other tangible form and conspicuously labeled as "proprietary" either prior to or at the time of submission to the Commonwealth.
- T. LATEST SOFTWARE VERSION: Any software product(s) provided under the contract shall be the latest version available to the general public as of the due date of this solicitation.
- U. PRODUCT SUBSTITUTION: During the term of any contract resulting from this solicitation, the vendor is not authorized to substitute any item for that product and/or software identified in the solicitation without the prior written consent of the contracting officer whose name appears on the front of this solicitation, or their designee.
- V. QUALIFIED REPAIR PERSONNEL: All warranty or maintenance services to be performed on the items specified in this solicitation as well as any associated hardware or software shall be performed by qualified technicians properly authorized by the manufacturer to perform such services. The Commonwealth reserves the right to require proof of certification prior to award and at any time during the term of the contract.
- W. RELOCATION OF EQUIPMENT: Should it become necessary to move equipment covered by the contract to another location, the Commonwealth reserves the right to do so at its own expense. If contractor supervision is required, the Commonwealth will provide prior written notice of the move at least thirty days in advance, in which case the contractor shall provide the required services and be reasonably compensated by the Commonwealth. Both the compensation to be paid and any adjustment to the maintenance terms resulting from the move shall be as mutually agreed between the parties. Regular maintenance charges shall be suspended on the day the equipment is dismantled and resume once the equipment is again certified ready for operational use.
- X. RENEWAL OF MAINTENANCE: Maintenance of the hardware or software specified in the resultant contract may be renewed by the mutual written agreement of both parties for additional one-year periods, under the terms and conditions of the original contract except as noted herein. Price changes may be negotiated at time of renewal; however, in no case shall

the maintenance costs for a succeeding one-year period exceed the prior year's contract price(s), increased or decreased by more than the percentage increase or decrease in the other services category of the CPI-W section of the US Bureau of Labor Statistics Consumer Price Index, for the latest twelve months for which statistics are available.

- Y. REPAIR PARTS: In the event that the performance of maintenance services under the contract results in a need to replace defective parts, such items may only be replaced by new parts. In no instance shall the contractor be permitted to replace defective items with refurbished, remanufactured, or surplus items without prior written authorization of the Commonwealth.
- Z. SERVICE PERIOD (EXTENDED): Due to the criticality of the applications for which the equipment and/or software is purchased, the contractor shall provide 24 hours a day, 7 days a week, maintenance support, including state holidays. On-site response time shall be within 12-24 hours following initial notification. All necessary repairs or corrections shall be completed within 72 hours of the initial notification.
- AA. SERVICE PERIOD (ROUTINE): Contractor shall provide 24-hour toll free phone support with a 24 hour return call response time. On-site maintenance services shall carry a 12-24 hour response time following initial notification and be available during the normal working hours of 8 A.M. to 5 P.M. Monday through Friday, excluding state holidays. All necessary repairs or corrections shall be completed within 72 hours of the initial notification.
- BB. SERVICE REPORTS: Upon completion of any maintenance call, the contractor shall provide the agency with a signed service report that includes, at a minimum: a general statement as to the problem, action taken, any materials or parts furnished or used, and the number of hours required to complete the repairs.
- CC. SOFTWARE UPGRADES: The Commonwealth shall be entitled to any and all upgraded versions of the software covered in the contract that becomes available from the contractor. The maximum charge for upgrade shall not exceed the total difference between the cost of the Commonwealth's current version and the price the contractor sells or licenses the upgraded software under similar circumstances.
- DD. SOURCE CODE: In the event the contractor ceases to maintain experienced staff and the resources needed to provide required software maintenance, the Commonwealth shall be entitled to have, use, and duplicate for its own use, a copy of the source code and associated documentation for the software products covered by the contract. Until such time as a complete copy of such material is provided, the Commonwealth shall have exclusive right to possess all physical embodiments of such contractor owned materials. The rights of the Commonwealth in this respect shall survive for a period of twenty years after the expiration or termination of the contract. All lease and royalty fees necessary to support this right are included in the initial license fee as contained in the pricing schedule.
- EE. TERM OF SOFTWARE LICENSE: Unless otherwise stated in the solicitation, the software license(s) identified in the pricing schedule shall be purchased on a perpetual basis and shall continue in perpetuity. However the Commonwealth reserves the right to terminate the license at any time, although the mere expiration or termination of this contract shall not be construed as an intent to terminate the license. All acquired license(s) shall be for use at any computing facilities, on any equipment, by any number of users, and for any purposes for which it is procured. The Commonwealth further reserves the right to transfer all rights under the license to another state agency to which some or all of its functions are transferred.

- FF. THIRD PARTY ACQUISITION OF SOFTWARE: The contractor shall notify the procuring agency in writing should the intellectual property, associated business, or all of its assets be acquired by a third party. The contractor further agrees that the contract's terms and conditions, including any and all license rights and related services, shall not be affected by the acquisition. Prior to completion of the acquisition, the contractor shall obtain, for the Commonwealth's benefit and deliver thereto, the assignee's agreement to fully honor the terms of the contract.
- GG. TITLE TO SOFTWARE: By submitting a bid or proposal, the bidder or offeror represents and warrants that it is the sole owner of the software or, if not the owner, that it has received all legally required authorizations from the owner to license the software, has the full power to grant the rights required by this solicitation, and that neither the software nor its use in accordance with the contract will violate or infringe upon any patent, copyright, trade secret, or any other property rights of another person or organization.
- HH. WARRANTY AGAINST SHUTDOWN DEVICES: The contractor warrants that the equipment and software provided under the contract shall not contain any lock, counter, CPU reference, virus, worm, or other device capable of halting operations or erasing or altering data or programs. Contractor further warrants that neither it, nor its agents, employees, or subcontractors shall insert any shutdown device following delivery of the equipment and software.
- II. WARRANTY (COMMERCIAL): The contractor agrees that the goods or services furnished under any award resulting from this solicitation shall be covered by the most favorable commercial warranties the contractor gives any customer for such goods or services and that the rights and remedies provided therein are in addition to and do not limit those available to the Commonwealth by any other clause of this solicitation. A copy of this warranty should be furnished with the proposal.
- JJ. NONVISUAL ACCESS TO TECHNOLOGY: All information technology which, pursuant to this Agreement, is purchased or upgraded by or for the use of any State agency or institution or political subdivision of the Commonwealth (the "Technology") shall comply with the following nonvisual access standards from the date of purchase or upgrade until the expiration of this Agreement:
- (i) effective, interactive control and use of the Technology shall be readily achievable by nonvisual means;
 - (ii) the Technology equipped for nonvisual access shall be compatible with information technology used by other individuals with whom any blind or visually impaired user of the Technology interacts;
 - (iii) nonvisual access technology shall be integrated into any networks used to share communications among employees, program participants or the public; and
 - (iv) the technology for nonvisual access shall have the capability of providing equivalent access by nonvisual means to telecommunications or other interconnected network services used by persons who are not blind or visually impaired.

Compliance with the foregoing nonvisual access standards shall not be required if the head of the using agency, institution or political subdivision determines that (i) the Technology is not available with nonvisual access because the essential elements of the Technology are visual

and (ii) nonvisual equivalence is not available.

Installation of hardware, software or peripheral devices used for nonvisual access is not required when the Technology is being used exclusively by individuals who are not blind or visually impaired, but applications programs and underlying operating systems (including the format of the data) used for the manipulation and presentation of information shall permit the installation and effective use of nonvisual access software and peripheral devices.

If requested, the Contractor must provide a detailed explanation of how compliance with the foregoing nonvisual access standards is achieved and a validation of concept demonstration.

The requirements of this Paragraph shall be construed to achieve full compliance with the Information Technology Access Act, 2.2-3500 through 2.2-3504 of the *Code of Virginia*.

All information technology which, pursuant to this Agreement, is purchased or upgraded by or for the use of any Commonwealth agency or institution or political subdivision of the Commonwealth (the "Technology") shall comply with Section 508 of the Rehabilitation Act (29 U.S.C. 794d), as amended. If requested, the Contractor must provide a detailed explanation of how compliance with Section 508 of the Rehabilitation Act is achieved and a validation of concept demonstration. (<http://www.section508.gov/>). The requirements of this Paragraph along with the Non-Visual Access to Technology Clause shall be construed to achieve full compliance with the Information Technology Access Act, §§2.2-3500 through 2.2-3504 of the *Code of Virginia*.

KK. AS BUILT DRAWINGS: The contractor shall provide the Commonwealth a clean set of reproducible "as built" drawings and wiring diagrams, marked to record all changes made during installation or construction. The contractor shall also provide the Commonwealth with maintenance manuals, parts lists and a copy of all warranties for all equipment. All "as built" drawings and wiring diagrams, maintenance manuals, parts lists and warranties shall be delivered to the Commonwealth upon completion of the work and prior to final payment.

LL. CONTRACTOR REGISTRATION: If a contract for construction, removal, repair or improvement of a building or other real property is for \$120,000 or more, or if the total value of all such contracts undertaken by bidder/offeror within any 12-month period is \$750,000 or more, the bidder/offeror is required under Title 54.1-1100, *Code of Virginia* (1950), as amended, to be licensed by the State Board of Contractors a "CLASS A CONTRACTOR." If such a contract is for \$10,000 or more but less than \$120,000, or if the total value of all such contracts undertaken by bidder/offeror within any 12-month period is \$150,000 or more, but less than \$750,000 or more, the bidder/offeror is required to be licensed as a "CLASS B CONTRACTOR." If such a contract is over \$1,000 but less than \$10,000, or if the contractor does less than \$150,000 in business in a 12-month period, the bidder/offeror is required to be licensed as a "CLASS C CONTRACTOR." The board shall require a master tradesmen license as a condition of licensure for electrical, plumbing and heating, ventilation and air conditioning contractors. The bidder/offeror shall place on the outside of the envelope containing the bid/proposal and shall place in the bid/proposal over his signature whichever of the following notations is appropriate, inserting his contractor license number:

Licensed Class A

Virginia Contractor No. _____ Specialty _____

Licensed Class B

Virginia Contractor No. _____ Specialty _____

Licensed Class C

Virginia Contractor No. _____

Specialty _____

If the bidder/offeror shall fail to provide this information on his bid/proposal or on the envelope containing the bid/proposal and shall fail to promptly provide said contractor license number to the Commonwealth in writing when requested to do so before or after the opening of bids/proposals, he shall be deemed to be in violation of § 54.1-1115 of the *Code of Virginia* (1950), as amended, and his bid/proposal will not be considered.

If a bidder/offeror shall fail to obtain the required license prior to submission of his bid/proposal, the bid/proposal shall not be considered.

- MM. DELIVERY AND STORAGE: It shall be the responsibility of the contractor to make all arrangements for delivery, unloading, receiving and storing materials in the building during installation. The owner will not assume any responsibility for receiving these shipments. Contractor shall check with the owner and make necessary arrangements for security and storage space in the building during installation.
- NN. FINAL INSPECTION: At the conclusion of the work, the contractor shall demonstrate to the authorized owner's representative that the work is fully operational and in compliance with contract specifications and codes. Any deficiencies shall be promptly and permanently corrected by the contractor at the contractor's sole expense prior to final acceptance of the work.
- OO. MAINTENANCE MANUALS: The contractor shall provide with each piece of equipment an operations and maintenance manual with wiring diagrams, parts list, and a copy of all warranties.
- GGG. WORK SITE DAMAGES: Any damage to existing utilities, equipment or finished surfaces resulting from the performance of this contract shall be repaired to the Commonwealth's satisfaction at the contractor's expense.
- HHH. INSTALLATION: All items must be assembled and set in place, ready for use. All crating and other debris must be removed from the premises.
- III. CONTRACTOR'S TITLE TO MATERIALS: No materials or supplies for the work shall be purchased by the contractor or by any subcontractor subject to any chattel mortgage or under a conditional sales or other agreement by which an interest is retained by the seller. The contractor warrants that he has clear title to all materials and supplies for which he invoices for payment.
- JJJ. PRIME CONTRACTOR RESPONSIBILITIES: The contractor shall be responsible for completely supervising and directing the work under this contract and all subcontractors that he may utilize, using his best skill and attention. Subcontractors who perform work under this contract shall be responsible to the prime contractor. The contractor agrees that he is as fully responsible for the acts and omissions of his subcontractors and of persons employed by them as he is for the acts and omissions of his own employees.
- KKK. SUBCONTRACTS: No portion of the work shall be subcontracted without prior written consent of the purchasing agency. In the event that the contractor desires to subcontract some

part of the work specified herein, the contractor shall furnish the purchasing agency the names, qualifications and experience of their proposed subcontractors. The contractor shall, however, remain fully liable and responsible for the work to be done by its subcontractor(s) and shall assure compliance with all requirements of the contract.

LLL. KEYS: If the Contractor is given keys for this project, it is the Contractor's responsibility to return the keys when the contract is terminated, as well as for the safekeeping of the keys during the contract period. The Contractor shall not loan or duplicate the keys. In the event the Contractor loses the keys, they will be charged for the replacement of the keys and any locks which are rekeyed or replaced.

MMM. STANDARDS OF CONDUCT: The work site will be occupied by students and University Personnel during the times work is performed. Contractor and Contractor's personnel shall exercise a particularly high level of discipline, safety and cooperation at all times while on the job site. The Contractor shall be responsible for controlling employee conduct, for assuring that its employees are not boisterous or rude, and assuring that they are not engaging in any destructive or criminal activity.

IX. METHOD OF PAYMENT

The contractor will be paid on the basis of invoices submitted in accordance with the solicitation and any negotiations. James Madison University recognizes the importance of expediting the payment process for our vendors and suppliers. We are asking our vendors and suppliers to enroll in the Wells Fargo Bank single use Commercial Card Number process or electronic deposit (ACH) to your bank account so that future payments are made electronically. Contractors signed up for the Wells Fargo Bank single use Commercial Card Number process will receive the benefit of being paid in Net 15 days. Additional information is available online at:

<http://www.jmu.edu/financeoffice/accounting-operations-disbursements/cash-investments/vendor-payment-methods.shtml>

X. PRICING SCHEDULE

The offeror shall provide pricing for all products and services included in proposal indicating one-time and on-going costs. **Provide pricing for items included in Section IV Statement of Needs.**

Provide a completed copy of the attached **High-Density Wi-Fi Systems Pricing Form (Attachment F, attached to posting as a separate Excel spreadsheet)** both in print and accompanying your electronic submission (See Section V. Proposal Preparation and Submission).

Specify any associated charge card processing fees, if applicable, to be billed to the university. Vendors shall provide their VISA registration number when indicating charge card processing fees. Any vendor requiring information on VISA registration may refer to

<https://usa.visa.com/support/small-business/regulations-fees.html> and for questions <https://usa.visa.com/dam/VCOM/global/support-legal/documents/merchant-surcharging-qa-for-web.pdf>.

XI. ATTACHMENTS

Attachment A: Offeror Data Sheet

Attachment B: Small, Women, and Minority-owned Business (SWaM) Utilization Plan

Attachment C: Standard Contract Sample

Attachment D: Performance Specifications

Attachment E: Wi-Fi Exclusion Areas – attached as a separate PDF file

Attachment F: High-Density Wi-Fi Systems Pricing Form - attached as a separate Excel spreadsheet (***All Offerors are required to complete***)

Attachment G: 17963 JMU Convo Composite Set.zip ([***Click here for download 1.5g***](#))

Attachment H: Information Technology Services Addendum (***All Offerors are required to complete***)

Attachment I: Higher Education Cloud Assessment Tool (HECVAT) Lite - attached as a separate Excel spreadsheet (***All Offerors are required to complete***)

ATTACHMENT A

OFFEROR DATA SHEET

TO BE COMPLETED BY OFFEROR

1. QUALIFICATIONS OF OFFEROR: Offerors must have the capability and capacity in all respects to fully satisfy the contractual requirements.
2. YEARS IN BUSINESS: Indicate the length of time you have been in business providing these types of goods and services.

Years _____ Months _____

3. REFERENCES: Indicate below a listing of at least five (5) organizations, either commercial or governmental/educational, that your agency is servicing. Include the name and address of the person the purchasing agency has your permission to contact.

CLIENT	LENGTH OF SERVICE	ADDRESS	CONTACT PERSON/PHONE #
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4. List full names and addresses of Offeror and any branch offices which may be responsible for administering the contract.

5. RELATIONSHIP WITH THE COMMONWEALTH OF VIRGINIA: Is any member of the firm an employee of the Commonwealth of Virginia who has a personal interest in this contract pursuant to the [CODE OF VIRGINIA](#), SECTION 2.2-3100 – 3131?

[] YES [] NO

IF YES, EXPLAIN: _____

ATTACHMENT B

Small, Women and Minority-owned Businesses (SWaM) Utilization Plan

Offeror Name: _____ **Preparer Name:** _____

Date: _____

Is your firm a **Small Business Enterprise** certified by the Department of Small Business and Supplier Diversity (SBSD)? Yes _____ No _____

If yes, certification number: _____ Certification date: _____

Is your firm a **Woman-owned Business Enterprise** certified by the Department of Small Business and Supplier Diversity (SBSD)? Yes _____ No _____

If yes, certification number: _____ Certification date: _____

Is your firm a **Minority-Owned Business Enterprise** certified by the Department of Small Business and Supplier Diversity (SBSD)? Yes _____ No _____

If yes, certification number: _____ Certification date: _____

Is your firm a **Micro Business** certified by the Department of Small Business and Supplier Diversity (SBSD)? Yes _____ No _____

If yes, certification number: _____ Certification date: _____

Instructions: *Populate the table below to show your firm's plans for utilization of small, women-owned and minority-owned business enterprises in the performance of the contract. Describe plans to utilize SWAMs businesses as part of joint ventures, partnerships, subcontractors, suppliers, etc.*

Small Business: "Small business " means a business, independently owned or operated by one or more persons who are citizens of the United States or non-citizens who are in full compliance with United States immigration law, which, together with affiliates, has 250 or fewer employees, or average annual gross receipts of \$10 million or less averaged over the previous three years.

Woman-Owned Business Enterprise: A business concern which is at least 51 percent owned by one or more women who are U.S. citizens or legal resident aliens, or in the case of a corporation, partnership or limited liability company or other entity, at least 51 percent of the equity ownership interest in which is owned by one or more women, and whose management and daily business operations are controlled by one or more of such individuals. **For purposes of the SWAM Program, all certified women-owned businesses are also a small business enterprise.**

Minority-Owned Business Enterprise: A business concern which is at least 51 percent owned by one or more minorities or in the case of a corporation, partnership or limited liability company or other entity, at least 51 percent of the equity ownership interest in which is owned by one or more minorities and whose management and daily business operations are controlled by one or more of such individuals. **For purposes of the SWAM Program, all certified minority-owned businesses are also a small business enterprise.**

Micro Business is a certified Small Business under the SWaM Program and has no more than twenty-five (25) employees **AND** no more than \$3 million in average annual revenue over the three-year period prior to their certification.

All small, women, and minority owned businesses must be certified by the Commonwealth of Virginia Department of Small Business and Supplier Diversity (SBSD) to be counted in the SWAM program. Certification applications are available through SBSD at 800-223-0671 in Virginia, 804-786-6585 outside Virginia, or online at <http://www.sbsd.virginia.gov/> (Customer Service).

RETURN OF THIS PAGE IS REQUIRED

ATTACHMENT B (CNT'D)
Small, Women and Minority-owned Businesses (SWaM) Utilization Plan

Procurement Name and Number: _____

Date Form Completed: _____

Listing of Sub-Contractors, to include, Small, Woman Owned and Minority Owned Businesses
for this Proposal and Subsequent Contract

Offeror / Proposer: _____

Firm

Address

Contact Person/No.

Sub-Contractor's Name and Address	Contact Person & Phone Number	SBSD Certification Number	Services or Materials Provided	Total Subcontractor Contract Amount (to include change orders)	Total Dollars Paid Subcontractor to date (to be submitted with request for payment from JMU)

(Form shall be submitted with proposal and if awarded, again with submission of each request for payment)

RETURN OF THIS PAGE IS REQUIRED

ATTACHMENT C



**COMMONWEALTH OF VIRGINIA
STANDARD CONTRACT**

Contract No. _____

This contract entered into this _____ day of _____, 20____, by _____ hereinafter called the "Contractor" and Commonwealth of Virginia, James Madison University called the "Purchasing Agency".

WITNESSETH that the Contractor and the Purchasing Agency, in consideration of the mutual covenants, promises and agreements herein contained, agree as follows:

SCOPE OF CONTRACT: The Contractor shall provide the services to the Purchasing Agency as set forth in the Contract Documents.

PERIOD OF PERFORMANCE From _____ through _____

The contract documents shall consist of:

- (1) This signed form;
- (2) The following portions of the Request for Proposals dated _____:
- (a) The Statement of Needs,
 - (b) The General Terms and Conditions,
 - (c) The Special Terms and Conditions together with any negotiated modifications of those Special Conditions;
 - (d) List each addendum that may be issued
 - (e) Performance Specifications
- (3) The Contractor's Proposal dated _____ and the following negotiated modification to the Proposal, all of which documents are incorporated herein.
- (a) Negotiations summary dated _____.

IN WITNESS WHEREOF, the parties have caused this Contract to be duly executed intending to be bound thereby.

CONTRACTOR:

PURCHASING AGENCY:

By: _____
(Signature)

By: _____
(Signature)

(Printed Name)

(Printed Name)

Title: _____

Title: _____

ATTACHMENT D

PERFORMANCE SPECIFICATIONS

JAMES MADISON UNIVERSITY - ATLANTIC UNION BANK CENTER

PERFORMANCE SPECIFICATIONS – HIGH DENSITY WIRELESS NETWORK

Proposals need to also include Offeror response to the items included in the RFP Statement of Needs (Section IV) in addition to the addenda.

PART 1 GENERAL

1.1 INTRODUCTION

- A. James Madison University – Atlantic Union Bank Center (hereinafter referred to as “the University”) intends to acquire a high density wireless networking system(s). The University herewith requests proposals for the design, engineering, installation, commissioning, testing, and acceptance of the systems described in the attached specifications and to include forthcoming drawings from the Offerors. Offerors may propose the complete package (Option 1) or any one of the Options as broken out in 1.1.B. below. Prices quoted shall be all-inclusive and represent complete installation at the site shown on the forthcoming drawings and in the attached specifications. The Contractor shall be responsible for all parts, labor, and all other associated apparatus necessary to completely install, test, and turn-over for acceptance to the University turnkey, fully operational systems. These systems (Indicated as Base Cost on Pricing Form) include, but are not limited to, the following:
1. State of The Art High Density Wireless Network
 2. Wi-Fi User Onboarding Service
 3. Wi-Fi Analytics
- B. The University requests itemized pricing for the following Options (**offerors shall provide pricing using the Attachment F Pricing Form [excel] and in the RFP Section X Pricing Schedule**):
1. Option 1 All Inclusive (Solution, Managed Services, and ISP): Complete all-inclusive turnkey system and system operation including detailed methodology and ISP pricing per RFP and attachments included.
 2. Option 2 Managed Services (Managed Services and ISP only - assumes separate solution purchase by owner): Turnkey Operation and Management of the proposed wireless system including ISP to begin upon final system acceptance. The pricing shall include contractor provided internet service connectivity appropriate to the performance as specified in this specification. The submittal should include a detailed methodology plan clearly stating all service level agreements for managing, operating, and maintaining the system.
 3. Option 3 Event Support/Event Rate (Event Support Only - assumes separate solution purchase with ISP and operation by owner): The University requests pricing for remote event support at a per event rate, assuming an estimated 120 events annually to begin upon final system completion. The submittal should include a detailed methodology plan clearly stating all service level agreements for providing remote event support.

1.2 GENERAL DESCRIPTION OF CONTRACTOR REQUIREMENTS

- A. The Contractor shall be responsible for providing all system(s) equipment as proposed by such Contractor.
- B. The Contractor shall be responsible for the provision and installation of all secondary structural steel (i.e., conduit supports and mounting structures) and mounting brackets/hardware required to accommodate the new system(s). This includes all labor, materials, equipment, tools, transportation, and project management required to complete a fully operational system(s) on the project.
- C. Contractor shall be responsible for assembly, secondary modifications (if necessary) and mounting of all system(s) components onto new or existing structures.

- D. The University will provide Primary Power at defined demarcation points as shown on the project electrical drawings. Contractor shall be responsible for all power and electrical distribution from demarcation point (Secondary Power) to new system(s). Contractor shall provide all Secondary Power connections/terminations required to power new system(s).
- E. The University will provide conduits or raceways as shown on the project electrical drawings for low voltage. All additional conduit and raceways required to complete a path to each solution component shall be furnished and installed by Contractor. Contractor shall be responsible to furnish, install, and terminate all required cabling needed to make new system(s) complete and fully operational.
- F. Contractor is responsible for supplying a complete and fully operational system(s) as intended by the RFP documents and any subsequent addendums. Prior to entering into a contract for the project, Contractor (then as an Offeror) is responsible for notifying the University of any equipment omissions in the RFP documents that may prevent the completion of a fully operational system(s). If Contractor (then Offeror) fails to notify of any equipment omissions, Contractor shall assume responsibility for providing the required equipment at no additional cost to the University.
- G. Contractor shall field verify all work site conditions prior to submitting shop drawings.
- H. Contractor shall grant the University an irrevocable license to use all proprietary software provided with this RFP for the life of the system(s).
- I. All equipment (except University Furnished (OFE)) and materials shall be new (latest version at time of proposal) and shall conform to applicable UL, EIA, TIA, or ANSI provisions. Re-manufactured or "B" stock equipment shall not be accepted without prior written consent from the University. Evidence of unauthorized re-manufactured or "B" stock equipment on the project site shall be deemed evidence of the Contractor's Failure to Perform the Work. Contractor shall take care during installation to prevent scratches, dents, chips or disfiguration.
- J. All network equipment power circuits must have an emergency back-up system as deemed necessary per the local or state fire code; whichever is more restrictive.

1.3 OFFEROR QUALIFICATIONS

- A. The University seeks to contract with an Offeror for the full performance of the work as described in this RFP and has the option to obtain a long-term service contract and support for all equipment supplied by the selected Offeror. In an effort to ensure the chosen Offeror has the long-term interests of the University in mind, the following shall be required in order to submit a proposal for this project. Failure to submit acceptable responses to all of these requirements shall eliminate an Offeror from consideration. The University, in its sole discretion, shall reserve the right to waive any or all of the requirements listed below.
- B. Offeror shall provide a list of a minimum of three (3) facilities (facility, contact name, title, address and current phone number) where the Offeror has provided equipment and services of equivalent size and scope within the last five (5) years.
- C. Offeror shall provide a minimum of one (1) facility (facility, contact name, title, address and current phone number) where the Offeror has provided equipment and services of equivalent size and scope that is at least five (5) years old.
- D. Offeror shall have a direct service employee or certified contractor capable of providing maintenance response on site within three (3) hours of a call for service.

- E. Offeror shall have a minimum of five (5) years in the communications, networking, and structured cabling business.
- F. Offeror's primary line of business shall be communications and structured cabling.
- G. Offeror will have a minimum of ten (10) full-time installers.

1.4 SUBMITTAL REQUIREMENTS

- A. Contractor shall be required to provide submittals and shop drawings (print and electronic) to the University within twenty (20) calendar days of date shown on award notice, acknowledged with a binding letter of intent. Contractor shall be responsible to ensure that the dimensions and specifications of each component and all systems fit within the building allowances. Contractor shall advise the University of any discrepancy that may affect installation. If Contractor fails to notify the University of any discrepancies, Contractor shall assume responsibility for providing the required equipment or correcting such discrepancies at no additional cost to the University. The following required submittals will be defined by guidelines established by the University and shall include but not be limited to:
 - 1. One set of electronic shop drawings in PDF format, and predictive analysis studies product data and samples together in one package within twenty (20) calendar days of date shown on award notice to Contract and prior to ordering equipment.
 - 2. Catalog data sheets, neatly bound with title page, space for submittal stamps, and tabbed dividers between Sections. Provide a complete list of proposed equipment with reference to its corresponding specification paragraph number or equipment title in specification paragraph order. Denote all approved substitutions.
 - 3. Point-to-point wiring diagrams and typed wire lists identifying every connection. Include electronic devices such as switches, transformers and terminal blocks. Indicate locations of all components. Identify cables by types, colors and wire numbers. Complete, detailed wiring diagrams for the systems, based on the contract documents but including cable types, identification and color codes, and detailed wiring of connections, both at equipment and between equipment racks and wiring conduit, connector types, expansion loops and cable lengths. Drawings shall comply with ANSI and International Electro Technical Commission recommendations and standards as appropriate. Provide drawing set cover sheet clearly dimensioning all cable preparation details for each cable type and connector utilized in the system.
 - 4. Structural engineered drawings (if required) for all secondary steel framing required for this scope of work. Structural drawings submitted shall include attachments to primary steel structure. Structural engineered drawings shall also include method of attachment for all components required for this scope of work. A licensed/registered engineer in the state where this project is located shall stamp all structural drawings.
 - 5. Conduit riser diagrams showing required conduits and junction boxes along with types of quantities of cables to be contained in each conduit. Show details of weatherproofing, lightning protection and grounding, strain relief and cable support, fire stop protection, and wall penetrations through all rated partitions.
 - 6. Rack elevations indicating the proposed arrangement of mounted equipment including power junction box location and locations of conduit penetrations. Rack elevations shall include front and rear views. BTU loads for each piece of equipment shall also be included on the rack elevation drawing.
 - 7. Detail drawings of all custom fabricated items and approved equipment modifications. Include complete parts lists, schematic diagrams, and all dimensions required for proper assembly.

8. Proposed color selections and finishes for all exposed surfaces and custom fabricated items. Submit actual color/finish samples, wall plates, and custom labels.
9. A list of all lower tier subcontractors and suppliers. List shall include lower tier subcontractor's qualifications indicating performance of similar work on past projects of this type and scope.
10. A project schedule in Gantt chart format outlining equipment delivery dates and installation start and finish dates. Project schedule shall be broken down into sufficient detail (work task and duration) to permit the University to monitor installation progress on a daily basis.
11. Copies of all required business and contractor licenses.
12. Proof of compliance with all insurance requirements.
13. Approval of submitted items indicates only the acceptance of the manufacturer and quality. Specific requirements, arrangements, and quantities shall comply with the intent of the Contract Documents as interpreted by the University unless specifically approved in writing.
14. Submittals that are incomplete, deviate significantly from the requirements of the Contract Documents, or contain numerous errors will be returned without review for rework and re-submittal, and may result in back charges to the Contractor.

1.5 CONTRACT CLOSEOUT SUBMITTAL

- A. When the installation is substantially complete including the Testing Reports in Part 3 of this Section, Contractor shall submit two (2) complete initial hard copy sets of contract closeout submittals to the University for review. After review and approval of initial set, the University shall return one (1) initial hard copy to Contractor with comments for updating. Contractor shall provide four (4) final sets of closeout submittals and one (1) electronic copy in PDF format, or format related to discipline. Closeout submittals shall include, but not be limited to:
 1. Project Record Drawings (As-Built Drawings) including final secondary steel structural drawings, electrical drawings, systems block diagrams, rack elevation drawings and wiring schedule.
 2. As built configuration files.
 3. An Operation & Maintenance Manual.
 4. A list of all equipment provided and its location within the facility. List shall include manufacturer name, model identifier, serial number, and any other pertinent information needed to obtain service, maintenance, and/or replacement.
 5. A list of all subcontractors who performed work for Contractor during installation. List shall include company name, physical company address, phone number, and contact person(s).
 6. Copies of all software, settings and programs used in the control and operation of this system.
 7. Copies of all equipment registration documentation.
 8. Test reports for all new copper and fiber optic cable installed under this scope of work. Test reports shall indicate end to end signal loss does not exceed applicable industry standards.

1.6 OPERATION & MAINTENANCE MANUAL

- A. Upon substantial completion but prior to onsite training with the University, Contractor shall provide two (2) print final Operation & Maintenance Manuals (O&M Manuals) and one electronic PDF copy. O&M Manuals shall have tab dividers and shall be logically organized to provide easy access to information without the need to research through entire manual. All documents provided in the O&M Manual shall be written in English and shall provide sufficient detail as to be understood by an individual with basic knowledge of the provided systems. Contents of the O&M Manual shall include, but not be limited to:

1. Table of Contents.
2. Description / overview of system(s) including key features and operational procedures.
3. Full start up procedure for all systems equipment and any additional networking components written under the assumption that all equipment was in full powered off mode.
4. Full shutdown procedure for all systems equipment written under the assumption that the facility is in an extended power failure situation.
5. Owner's Manuals for all third party and/or "off the shelf" type equipment provided by Contractor; e.g., KVM's, fiber modems, network switches/routers, and UPS battery backups.
6. Small scale plans showing locations and circuit numbers for all system outlets and receptacles.
7. Single-line block diagrams showing all major components of the systems.
8. All third-party equipment and/or "off the shelf" equipment warranties and a notarized system warranty.

1.7 EQUIPMENT GENERAL SPECIFICATIONS

- A. All equipment and materials, except University furnished, shall be new and the latest version at the time of proposal submission and shall conform to applicable UL, ULC, CSA or ANSI provisions. Re-manufactured or "B" stock equipment shall not be accepted by the University. Evidence of unauthorized re-manufactured or "B" stock equipment on the project site shall be deemed evidence of the Contractor's failure to perform the work. Contractor shall take care during installation to prevent scratches, dents, chips or disfiguration of equipment and materials supplied. All damaged equipment and/or materials shall be repaired or replaced at the University's discretion. Contractor shall perform either option selected by the University at no additional cost to the University.
- B. All cabling [power and data] is to be labeled at each end of the cable with a description in English OR with a reference to a wire designation on a wiring diagram. Cabling numbers will be provided by James Madison Office of IT. These diagrams must be part of the Project documentation submitted to the University at time of acceptance.
- C. Each device shall meet all of its published manufacturer's specifications. Verify performance as required.
- D. Install all rack mounted equipment with Middle Atlantic Products HP Series truss head screws or approved equal.
- E. Some rack-mounted equipment may require shaft locks, security covers, or removal of knobs; provide and install during Acceptance Testing.
- F. Networking enclosures exposed to the outdoors, shall be of a NEMA 4X rating or better and provide adequate environmental control to ensure long-term equipment operation.
- G. Provide self-adhesive labels at the front of all rack-mounted signal processing equipment. Mount labels on the equipment chassis and attach in a neat and permanent manner. Embossed label shall not be accepted. Label equipment with schematic enumeration reference, and with descriptive information regarding its function or area it is serving. Similarly, provide engraved labels at the rear only of equipment mounted in furniture consoles.
- H. Mounting Hardware exposed to the weather shall be aluminum, brass epoxy painted galvanized steel or stainless steel. Apply corrosion inhibitor to all threaded fittings.

- I. Catwalk Equipment Racks shall be Middle Atlantic Products model MRK-4436, or approved equal, with accessories as noted below. Quantity of racks shall be as required to house all equipment supplied under this scope of work. Any unused rack mounting spaces shall have ventilated (~64%) blank panels to fully enclose the rack assembly. Multiple racks shall be anchored together using appropriate ganging hardware. Standard solid rear door shall be replaced with Middle Atlantic Products model MW-VRD-44 vented rear door.
 - 1. Provide two (2) side panels per individual stand-alone rack or series of racks ganged together. The intent is to have an enclosed rack system. A single stand-alone rack shall have two (2) side panels and a series of three (3) racks ganged together shall also have two (2) side panels. Side panels shall be Middle Atlantic Products model SPN-44-36 or approved equal.
 - 2. Provide Middle Atlantic Products model MW-4QFT-FC integrated fan top, or approved equal, for each rack. Fan shall be thermostatically controlled to ensure in-rack temperatures of less than 68 degrees Fahrenheit.
 - 3. Provide two (2) Middle Atlantic Products model LT-GN-PL gooseneck work lights, or equivalent, for each rack required for this scope of work.
 - 4. Provide Middle Atlantic Products model PDT-2X1020T, or approved equal, in rack vertical power strip. Power strip shall have enough receptacles to accommodate all equipment housed in the associated rack with a minimum of two spare receptacles per rack.
 - 5. Wall mount enclosures may be used at catwalk level. University to retain all approvals of enclosures.
- J. Any rear mounted rack equipment shall be placed so the equipment does not block access to the back of front mounted equipment.
- K. Contractor shall exercise care when wiring racks to avoid damaging cables and equipment. Contractor shall install grommets around cut-outs and knock-outs where conduit or chase nipples are not installed.
- L. Equipment Racks shall have a ground buss installed in each rack. Ground buss shall be insulated from the rack. Attach equipment rack to ground buss at one point using #4 insulated copper wire. Ground any equipment chassis without a three-conductor power cord directly to the buss bar using #12 insulated copper wire. Tie each power receptacle ground contact to the buss bar using #12 insulated copper wire. Interconnect signal cables shall be routed from junction boxes through metallic flexible conduit(s) (2.5 cm to 5 cm diameter) as appropriate. Flexible conduit shall be insulated from racks by approved insulating bushings.
- M. Power wiring and signal/data wiring shall be installed on opposite sides of rack. Contractor may determine which side is used for power and which side for signal. Method shall be kept the same for entire installation, if multiple racks are required. Contractor shall exercise care when wiring racks to avoid damaging cables and equipment.
- N. Equipment installed in exterior locations shall be IP67 rated and operating temperature range 0 degrees F to 90 degrees F and survivable from -20 degrees F to 110 degrees F.
- O. All equipment mounted above seating areas and venue floor is required to be secondarily fastened to structure using aircraft cable and appropriate fasteners. Cable sizing and fasteners to be capable of supporting a minimum of two (2) times the weight of the affixed device.
- P. Non-Catwalk MDF and IDF Equipment Racks will be provided by Owner and will be seven foot, two post, 19 inch Chatsworth 55053-503 racks.

1.8 QUALITY ASSURANCE

- A. All requirements of the latest published editions of the following standards shall apply, unless otherwise noted. In the event of conflict between cited or referenced standards, the more stringent shall govern.
 - 1. National Electric Code (CE Code)
 - 2. National Electrical Manufacturers Association (NEMA)
 - 3. Occupational Safety and Health Administration (OSHA)
 - 4. Underwriters Laboratories (UL)
 - 5. Electronic Industries Association (E.I.A.)
 - 6. Telecommunications Industries Association (T.I.A.)
- B. Review all architectural, civil, structural, mechanical, electrical, and other project documents relative to this work.
- C. Verify all dimensions and site conditions prior to starting work.
- D. Coordinate the specified work with all other trades.
- E. Maintain a competent supervisor and supporting technical personnel, acceptable to the University during the entire installation. Change of supervisor during the project shall not be permitted without prior written approval from the University.
- F. Provide all items not indicated on the drawings or mentioned in the specifications that are necessary, required or appropriate for this work to realize a complete and fully operational system that performs in stable and safe manner.
- G. Review project documentation and continuously make known any conflicts discovered and provide all items necessary to complete this work to the satisfaction of the University without additional expense. In all cases where a device or item or equipment is referred to in singular number or without quantity, each such reference shall apply to as many such devices or items as are required to complete the work.
- H. Provide additional support or positioning members as required for the proper installation and operation of equipment, materials and devices provided as part of this work as approved by the University, without additional cost to the University.
- I. Regularly examine all construction, and the work of others, which may affect Contractors work to ensure proper conditions exist at site for the equipment and devices before their manufacture, fabrication or installation.
- J. Contractor shall be responsible for the proper fitting of the systems, equipment, materials, and devices provided as part of this work.
- K. Promptly notify the University in writing of any difficulties that may prevent proper coordination or timely completion of this work. Failure to do so shall constitute acceptance of construction as suitable in all ways to receive this work, except for defects that may develop in the work of others after its execution.
- L. After installation, submit photographs showing cable entries and terminations within equipment racks, enclosures and pedestals at the job site.

1.9 APPLICABLE STANDARDS

- A. The following standards are applicable to this document and must be adhered to for any installation work performed.
 - 1. TIA/EIA 568-B: Commercial Building Telecommunications Cabling Standard.
 - 2. TIA/EIA TSB-67: Transmission Performance Specifications for UTP Cabling.
 - 3. TIA/EIA 568-A-1: Propagation Delay and Delay Skew for 100 Ohm 4-pair Cable.
 - 4. TIA/EIA 568-B.2.1: Category 6 Final Draft.
 - 5. TIA/EIA-569-A: Commercial Building Standard for Pathways and Spaces.
 - 6. TIA/EIA-606: Administration Standard for Commercial Buildings.
 - 7. TIA/EIA-607: Commercial Building Grounding/Bonding Requirements.
 - 8. ANSI/NFPA-70: National Electrical Code.
 - 9. ANSI/IEEE C-2: National Electrical Safety Code.
 - 10. Pertinent Local Codes and Standards

1.10 HIGHLIGHT REQUIREMENTS

- A. All UTP cables installed:
 - 1. Shall not exceed 1cm untwist at termination.
 - 2. Shall not exceed 2cm jacket removal at termination.
 - 3. Shall maintain 2.5cm minimum bend radius always.
 - 4. Shall not be stepped-on, kinked, or otherwise disfigured during installation.
 - 5. Shall be installed, wherever possible, 60cm from sources of EMI such as fluorescent lamps, electrical cables and conduits; when this is impossible, maintain as much separation as possible with a minimum of 15cm.
 - 6. Shall not be laid directly onto suspended ceiling grid.
 - 7. Cabling is to be dressed via Velcro ties, nylon cable ties are to be used only at the approval of OIT if and when required.
 - 8. All 4-pair of each UTP cable shall be terminated onto a single jack or patch panel port; splitting pairs (i.e., 2 pair for voice, 2 pair for data) shall not be allowed.
 - 9. All cable runs in ceiling areas shall be supported with 25.4 cm bend radius compliant supports every 1.5 meters; cable ties to ceiling grid wire shall not be used as a ceiling support facility.
 - 10. All conduit sleeves and slots shall have fire stop with appropriate fire-rated materials as designated by building design.
 - 11. Contractor shall be cognizant of any areas requiring low smoke, zero halogen cabling and institute appropriate products where required.

END OF PART 1 GENERAL

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS AND PRODUCTS

- A. Network core equipment (routers, switches, etc.) shall consist of Cisco manufactured products. Wireless equipment to include all access points shall consist of Aruba manufactured products.
- B. All connectivity, patch cords, wire management, surface raceway, and identification products used in this installation must meet the standards as specified in section 1.9 of this specification and be compatible with the equipment listed in 2.1.C.1-6.
- C. Following is a listing of required part numbers for use in the installation of structured copper cabling.

1.	6H-272-DB	Superior Essex	Cat6A Cabling (Plenum)
2.	OR-40300548	Ortronics	Cat6A Face plates (2 Port) Trac Jack
3.	OR-TJ610-68	Ortronics	Cat6A Jacks (Single)
4.	OR-40300546	Ortronics	Cat6A Face plates (4-Port) Trac Jack
5.	OR-PHDHJU24	Ortronics	24 Port Flat Modular Patch Panel (Unloaded)HD
6.	OR-HDJ6A-45	Ortronics	Hgh Density Patchpanel Jacks (Green) Modular
- D. Single Mode and Multimode Fiber Optic Feeder and Riser: University Provided

2.2 CABLING PERFORMANCE SPECIFICATIONS

- A. The UTP cabling system proposed for this project shall meet the following minimum system (cable and hardware combined) industry standard compliance requirements as evidenced by 3rd party verified lab test results (i.e., ETL labs) submitted with proposal. Systems performing below these levels shall not be accepted.
 - 1. NEC/(UL) Specification: CMP/CMR Respectively
 - 2. NEC Articles: 800
 - 3. CEC/C(UL) Specification: CMP/CMR Respectively
 - 4. EU Directive 2011/65/EU (ROHS II)
 - 5. ISO/IEC 11801 Ed 2.1 (2008) Class E: CMR Only
 - 6. EU CE Mark
 - 7. EU Directive 2000/53/EC (ELV)
 - 8. EU Directive 2002/95/EC (RoHS)
 - 9. EU RoHS Compliance
 - 10. EU Directive 2002/96/EC (WEEE)
 - 11. EU Directive 2003/11/EC (BFR)
 - 12. CA Prop 65 (CJ for Wire & Cable)
 - 13. MII Order #39 (China RoHS)
 - 14. Telecommunications Standards: Category 6 - TIA 568.C.2
- B. All fiber optic cable proposed for this installation shall meet or exceed the following industry compliance standards.
 - 1. TIA/EIA-568-C.3

2. ISO/IEC 11801, 2nd Edition
 3. Telcordia GR-409-CORE
 4. RoHS II 2011/65/EU
 5. REACH EC1907-2006
 6. NEC/CEC OFNR/OFN FT.4 (RISER - PVC)
 7. NEC/CEC OFNR/OFN FT.4 (LSZH - FRPE)
 8. NEC/CEC OFNP/OFN FT.6 (PLENUM - PVC or PVDF)
 9. ICEA S-83-596
- C. Fiber optic cable maintenance loops shall be a minimum of three (3) meters at the wiring closet.

2.3 HORIZONTAL CABLE SUBSYSTEMS

- A. Where connectors must be installed into surface mounted raceway, the Contractor shall provide the appropriate faceplate as well as any necessary adapters to facilitate the installation of the connectors specified in this section directly into the raceway. Surface mounted boxes shall not be accepted as mounting devices on surface raceways.
- B. At the wiring closet, each UTP cable shall be terminated onto an approved connector and loaded into an approved modular patch panel or equivalents. All patch panels shall be modular, front-access, high density patch panels. No fixed-port 110-style panels shall be accepted. Contractor shall provide required patch panels ports plus 20 percent for future growth. Patch panel ports provided as excess for future growth need not be populated with connectors. However, all excess ports not populated shall have installed a single blank insert.
- C. A two-rack-space horizontal wire management panel shall be installed for every 48-port patch panel. D-ring wire management systems shall not be accepted.

2.4 BONDING AND GROUNDING

- A. All cabling, racks, and patch panels shall be bonded and grounded in accordance with TIA 942. Specific highlight requirements are listed below:
 1. Telecommunications Grounding Bus bars (TGB) shall be provided by the University
 2. Telecommunications Main Grounding Bus bars (TMGB) shall be provided by the University.
 3. Racks shall be put together with paint piercing grounding washer kits, Panduit part number RGW-12-1 or equivalent.
 4. 2.13 m rack grounding strip kits shall be installed on the rear of each rack installed, one per rack, Panduit part number RGS134-10-1 or equivalent.
 5. Each patch panel shall be installed to the rack utilizing at least one (1) bonding screw.
- B. Maintenance loops for any Category 6A cabling installed shall not be made inside single-gang wall boxes but shall be installed above the stubbed conduit at each outlet location. All maintenance loops at the outlet and at the wiring closet shall be installed in a staggered-loop pattern.
- C. All Category 6 cables shall be tested the final draft of the TIA/EIA Category 6A standard with a Fluke, DTX 1800 or higher, tester and meet or exceed the performance criteria. Test reports evidencing these performance levels shall be provided for each cable link. Test results shall be provided in hard copy and electronic format to the University upon completion of the project.

- D. All fiber optic cables shall be tested the final draft of the TIA/EIA applicable standard with a Fluke, CertiFiber Pro or equivalent, tester and meet or exceed the performance criteria. Test reports evidencing these performance levels shall be provided for each cable link. Test results shall be provided in hard copy and electronic format to the University upon completion of the project.
- E. All cables, outlets, and patch panel ports shall be labeled in accordance with JMU Telecom Specifications using a mechanical hand-held labeler or Panduit PanMark software. No hand-written labels shall be accepted. The University shall provide the numbering sequence upon start of project.

2.5 NETWORKING COMPONENTS AND SERVICES

- A. Reference accompanying pricing proposal sheets (Attachment F) for Excel submittal format.
- B. Pricing proposals must be submitted in this format. No other formats will be considered. Offerors may return a PDF copy of the Excel sheet as confirmation but must provide the Excel file in the USB or CD copy of the submission that accompanies the hard copies.

END OF PART 2 PRODUCTS

PART 3 EXECUTION

3.1 SYSTEMS NARRATIVE DESCRIPTION

A. High Density Wireless Network

1. The high density wireless network shall provide throughput of 11 Mbps per user and coverage for identified areas of the facility, with anticipated 8,300 associated, authenticated, and active fan-based users distributed throughout the facility and surrounding area. These users will access the internet, video streaming, video uploading, social media, custom applications, ticketing application, concessions, merchandise, and view statistics. The 8,300 users of the fan facing wireless solution are not intended to be inclusive of business operations or back of house ("BOH") operations. Contractors are to be cognizant of any operational/enterprise function system loads, understanding that the fan facing deployment performance shall not be impacted by the operational/enterprise functions.
 - a. Accompanying PDF Wi-Fi Exclusion Areas (Attachment E) indicating areas excluded from coverage has been provided. It is the intent for the University to provide wireless coverage in these areas. All other areas are assumed to be provided by the Contractors high-density solution.
 - b. Contractor has been provided facility construction drawings as part of this RFP package for system design. It is expected that these documents in conjunction with the exclusion areas referenced above will provide sufficient detail to provide a functional high-density Wi-Fi design for the venue.
2. User onboarding will occur in a relatively short period of time, during ingress to the arena, the Contractor shall be cognizant and provide solutions to handle the onboarding efficiently. Allowing 8,300 users to authenticate to the high density wireless network within a 30-minute activation window. Anticipated user onboarding time is less than 3 seconds, once splash page activation is completed.
3. The Contractor shall provide a captive portal gateway for user access, to be used at the University's discretion.
4. Contractor is required to provide example of user onboarding experience.
5. The wireless system shall support 5 GHz, bands n, ac, ax draft.
6. Wireless system hardware deployment (access point, repeaters, etc.) is to be of minimal visual impact, providing both an aesthetically pleasing (University's Discretion) and robust deployment. Drawings of currently provided infrastructure and locations are forthcoming to aide in systems design.
7. Seamless roaming- Users able to move through the identified areas, inclusive of, but not limited to, elevator cabs, ramps, and stairwells, without dropping any TCP/UDP connections.
8. System shall support Various Authentication options to be implemented based on the user experience(s), defined by the University, these includes but are not limited to Ad's for access (both still and video), Social media login (Facebook, Twitter, Google+) Apps for access, pay for access, and roaming authentication through radius integration.
9. Tier offerings to be supported based on data rates and data volume.
10. Captive Portal User Experience shall be customizable based on location, and authentication method.
11. System shall support integration with industry standard programmatic Ad serving platforms to be defined by the University. Solution to include VAST 3.0 player.
12. System shall support next generation hot spot technologies including, but not limited to, Hot Spot 2.0 EAP-SIM.

13. System shall support Wi-Fi presence-based technology.
14. System shall provide API's and web services to access back office syslogs and databases, including, but not limited to, DHCP logs, DNS logs, Web Server logs and Proxy server logs. System shall automatically provide raw user data to the University within 12 hours after an event.
15. System to include management portal with extensive reporting and filtering including, but not limited to:
 - a. Unique users
 - b. Session times
 - c. Revenue
 - d. Google analytics
 - e. Presence
 - f. Domains visited
 - g. Trouble tickets
 - h. Help desk logs
 - i. Device service history
 - j. User bandwidth
 - k. Device type
 - l. User identity
 - m. Heat maps
16. System shall support indoor mapping.
17. Systems Security:
 - a. Rogue AP detection and mitigation - Rogue AP Mitigation must be performed in all cases in conjunction with JMU Information Technology.
 - b. MITM detection and mitigation
 - c. Captive portal security and the mechanisms in place to prevent credential hijacking

3.2 EXPECTED SYSTEM PERFORMANCE

A. High Density Wireless Network

1. System proposal is to be all inclusive and turnkey including, but not limited to, all switching, routing, servers, intrusion protection, infrastructure, and networked managed uninterruptable power.
2. It is expected that the Contractor shall base component selection and system design on total occupancy of 8,300 spectators and their multiple associated devices in all public areas including surrounding areas (plazas), elevators, and parking. Additionally, it shall include all back-office operations such as private corporate network that would service arena operations, media (i.e. large groups of media personnel with multiple devices in the event level of the arena), food and beverage, retail, etc.
3. The Contractor is responsible for determination, and verification of the number and type of access points to be deployed. Locations are expected to be a mixture of cable tray, exterior, and finished ceiling, and clear span installations based upon coverage needs.

4. Contractor is required to provide any mounting and or custom enclosures as part of their proposed solution.
5. Contractor is required to determine quantities of SSIDs broadcasted and non-broadcasted, based upon their proposed solution and forthcoming needs of the University. James Madison University in any form, to include JMU, shall not be used in SSID naming conventions. Contractor is required to coordinate with JMU Information Technology for all SSID naming conventions.
6. Contractor is required to determine quantities of VLANs based upon their proposed solution and forthcoming needs of the University.
7. No support for legacy 802.11 standards are required. Contractor shall focus on standards n, ac, ax as the basis for their proposed solution.
8. Contractor shall be cognizant and present means by which to minimize rogue traffic and bandwidth conservation such as, but not restricted to, HTTP caching proxy, blocking external streaming sources, and QoS traffic shaping. Rogue AP Mitigation must be performed in all cases in conjunction with JMU Information Technology.
9. Category based content filtering.
10. The following estimations related to event day usage are for reference only, based on historical data from similar installations and shall not be the basis of the Contractor's proposal. The Contractor is responsible for turnkey system performance and is required to independently determine the actual system load for their proposed system, based upon the University's stated performance requirements. Coverage area is bowl seating, suite areas, business operations, BOH operations, concourses, premium areas, truck dock, media, elevator cabs, POS, parking, exterior plazas, portable show spaces, etc. System shall be engineered to cover all areas of the facility. Scope is inclusive of point of sale solution. Contractor shall be responsible for ensuring that any wireless point of sale solution authenticates and operates and roams seamlessly throughout the facility.
 - a. Anticipated provided throughput per user 11 Mbps
 - b. Estimated number of average concurrent connections 5,800
 - c. Total spectators in anticipated coverage area 8,300

3.3 HIGH DENSITY WIRELESS NETWORK CORE

- A. System proposal is to be all inclusive and turnkey including, but not limited to, all switching, routing, servers, intrusion protection, infrastructure, and network managed uninterruptable power.
- B. System topology is to be redundant with fault detection and notification, as well as, implement redundant hardware power supplies to provide for minimal possibility of system outage.
- C. The Contractor shall provide adequate high density wireless network backbone to maintain the level of throughput required for all services, inclusive of event day wireless.
- D. The Contractor shall assume station cabling is to be of Category 6A UTP or better, providing a minimum of a Gigabit physical copper backbone to all edge devices.
- E. Ancillary networked services supported by high density wireless network, but not restricted to:
 1. VoIP
 2. AoIP
 3. Life Services (Security, Fire, and Mechanical)
 4. Video Conferencing
 5. Point of Sale

6. Broadcast
7. Audiovisual
8. Ticketing

3.4 SOFTWARE ENVIRONMENT

- A. Software Environment: The following applications and features, including, but not limited to, represent current desired capabilities of the University.
 1. Management
 - a. RF Performance
 - b. Client RF health
 - c. SNR
 - d. Speed statistics
 2. Firewall
 - a. App performance
 - b. Usage by device
 - c. Destinations, WLAN
 - d. Users or roles
 3. RF Capacity
 - a. Network-wide AP threshold and usage statistics
 4. Anomaly Detection
 - a. Current client count and network usage statistics compared to 40 week rolling average
 5. Watched Clients
 - a. SNR, speed and health statistics for VIPs/problem prone clients
 6. Client On Boarding
 - a. Captive Portal
 - b. Policy Manager
 - c. Real-time visibility and analysis
 - d. Identity Stores
 - e. Enterprise Data
 7. PCI Compliance for POS
 - a. Network Policies
 - b. Device Policies
 8. Visitor Engagement
 - a. Mobility Context
 - b. Location Services
 - c. Impact the Customer experience
 9. Mobile Engagement Technologies
 - a. Services

- b. Network
 - c. Applications
- 10. Virtual Beacons: University preference; Mist Virtual Beacons Application
 - a. Comprehensive Tools

3.5 SSID MANAGEMENT

- A. Smart SSID Management is to be implemented, minimizing the number of SSIDs for management. The University anticipates solution management to provide (1) one broadcasted and accessible fan facing SSID, in conjunction with non-broadcast enterprise SSIDs. Other SSIDs will be specified to support business and event functions. These details will be forthcoming once the Contractor has been awarded.

3.6 WARRANTIES, MAINTENANCE AND LICENSES

- A. The Contractor is required to provide the University with a total cost of ownership broken out by annual cost. An inclusive itemized package encompassing all warranties, licenses, and maintenance contracts on all hardware and software as part of the proposal from the day of system acceptance and sign-off.
- B. Warranty period shall commence on the day of system acceptance and final sign-off. Sign-off will not be awarded until the conclusion of (5) five successful, issue free, consecutive events.

3.7 DATA SYSTEMS

- A. Grounding and Shielding.
- B. Mount and enclose all electrical and electronic equipment in metal enclosures, pedestals or equipment racks.
- C. Use EMT type conduit for all wiring outside of equipment racks except plenum rated wiring above a lay-in ceiling, and outdoor conduits and raceways, where separate insulated ground wiring shall be supplied.
- D. Use flexible conduits and PVC fittings to provide insulated connections of the building's electrical raceways to equipment racks. Mount all equipment racks at the job site in a manner which provides electrical solution from the building structure and electrical raceways.
- E. Wiring Practices.
 - 1. Where specific instructions are not given, perform all wiring in strict adherence to standard systems engineering practices in accordance with the references listed.
 - 2. Group all wiring into the following classifications by power level or signal type:
 - a. Copper Data
 - b. Fiber Data
 - c. AC Power Circuits
- F. Separate wiring of differing classifications by at least fifteen (15) cm, wherever possible. Wherever lines of differing classification must come closer together than fifteen (15) cm, cross them perpendicular to each other.

- G. Neatly harness wires together within racks by power level classification using horizontal and vertical wiring supports as required. Rigidly support all wires with fixed connection points. Leave service loops of sufficient lengths to allow rack hinges or slides to fully extend to facilitate access to rear panel connectors from the front of each rack. Do not use self-adhesive ty-wrap pads for support of cables unless fastened with screws.
- H. All infrastructure conductors installed under this contract for low voltage shall adhere to the following color code:
 - 1. Copper Station Cabling –Yellow.
 - 2. Copper Patch Cords and Network Interconnects – Shall be stranded, pre-molded, and strain relieved, and black in color
- I. Exercise care in wiring to avoid damaging the cables and equipment. Use grommets around cut-outs and knock-outs where conduit or chase nipples are not installed.
- J. Make network connections using approved mechanical connectors. All connectors shall be insulated from mounting plates or panels. Label each connection point with a unique number.
- K. Any required fiber splicing shall utilize the fusion splice method. The maximum allowable loss per fusion splice shall be .05 dB.
- L. Pull mandrel one size smaller than the conduit, through entire length of all underground conduits.
- M. Cable pulling lubrication shall be utilized when pulling cable in conduits.
- N. A dynamometer shall be used to measure pulling tension during long or difficult runs. The dynamometer is to be placed between the cable puller and the pull line to monitor pulling tension. The manufacturer's pulling tension maximum range shall not be exceeded.
- O. Pulling grips suitable for use with fiber cables shall be applied to the ends of the cable. Consult cable manufacturer to determine appropriate pulling grip and method of attachment. Breakaway or fuse links shall be used at the pulling grip. Insure that the correct fuse pin is installed in the fuse link.
- P. The bend radius for all cables shall conform to manufacturer's specifications.

3.8 LABELING

- A. Label products in a logical, legible, and permanent manner corresponding to the Drawings. Wording, format, style, color and arrangement of text shall be subject to the University's approval. Submit samples and labeling schedule for approval. Labeling will be verified at final system commissioning.
- B. Label all wall plates, as well as, connector mounting plates in all boxes using a mechanical hand-held labeler with black letters on a white background.
- C. Label all permanently installed wires on both ends with approved permanent clip-on type or sleeve type markers.
- D. Label access panels and backboards with designations corresponding to the drawings. Where devices are concealed above access ceilings, provide permanent Lamicaid labels, on the ceiling « tees », corresponding to the drawings in finishes and sizes approved by the University.

3.9 ELECTRICAL AND DATA WIRING

- A. The electrical design and installation of all branch circuits by the Contractor shall comply with NEC, State and local codes, as well as University regulations and guidelines.

- B. The Contractor shall provide separate single-line diagrams for each type of signal.
- C. Electrical design and engineering must be reviewed and approved by the University prior to any electrical work by the Contractor.
- D. The Contractor shall be responsible for power distribution from the demarcation points noted on the included electrical drawings. Any additional electrical components required for a complete and fully operational system but not shown on the electrical drawings shall be the responsibility of the Contractor.
- E. Any additional raceway (conduit, cable tray, J hooks) required to provide a complete system for both power and signal/data shall be furnished and installed by Contractor. Any additional raceway required shall have routing of raceway approved by the University prior to installation.
- F. The Contractor shall be responsible for termination and final connection of power to all elements. All secondary electrical panels must be clearly marked with names of the branch circuits controlled by each breaker to aid in troubleshooting or isolating problems. All electrical services, disconnects, and breaker panels are to be labeled with what they control and where they are fed from.
- G. Contractor shall not use wire nuts or electrical tape for any power or signal connection or any part of the work. All connections shall use a proper terminal block and spade terminal, or terminal block and direct connection as required. Covers shall be provided over all high-power terminal blocks to prevent electrical shock.
- H. Any equipment not certified as required shall require on site certification by a listed testing agency. All cost associated with obtaining on site certification shall be the responsibility of the Contractor. Written proof of certification or equivalent shall be required prior to any work being performed on site.
- I. Contractor to provide all required fiber transmitters and receivers. Contractor shall be responsible to terminate and perform final connection of all cables.

3.10AESTHETIC CONSIDERATIONS

- A. At the time of the release of this RFP the University is still developing certain finishes and aesthetic design elements for consideration. Contractor shall assume premium finishes on all elements not yet defined.
- B. Post contract award, the Contractor must provide a comprehensive outline of intended finish details of all system equipment that is to be located in public viewing areas for University approval. Failure to submit these details shall make Contractor responsible for all finishes as required by the University at no additional cost to the University.
- C. The Contractor shall not visibly display its trademarks or insignia on any of the Equipment or structural elements within public view, unless explicitly negotiated with the University.

3.11FINAL ADJUSTMENT AND COMMISSIONING

- A. Schedule a time for the University and Contractor to perform the Final Adjustment and Commissioning. Notify the University at least seven (7) days in advance.
- B. Furnish engineers who are familiar with the system to assist the Contractor during the Final Adjustment and Commissioning.
- C. Record final settings on all equipment and submit with contract closeout documents.

3.12 TRAINING

- A. The Contractor, at its own expense, shall provide designated University representatives Owner and maintenance training.
- B. Training shall be performed at the site by a qualified technician and shall occur either during installation of the equipment or immediately thereafter.
- C. The training shall cover the operation, routine maintenance and troubleshooting of systems equipment, and shall be sufficient in duration and detail to provide proficiency in the same to the designated University representatives.

3.13 TESTING AND ACCEPTANCE

- A. Contractor must demonstrate the full capabilities of the provided systems and prove performance meets contractual specifications.
- B. Confirmation shall be required of, but not limited to, the following functions: operation of each system component, including back-up systems, control functionality and integration with existing systems.
- C. Contractor must provide all necessary testing equipment for acceptance.
- D. Upon notice from the Contractor of substantial completion and at a time to be mutually agreed upon, the Contractor shall arrange for the testing of all operations of the systems comprised in scope of work at the time of substantial completion.
- E. The following items must be completed and signed off by an appropriate University official before the University will deem the system "Accepted":
 - 1. (5) five completed events with no equipment or system failures. The on-site presence of a contractor representative capable of mitigating failures is required.
 - 2. The University will not be responsible for any added costs as a result of an unsuccessful acceptance test.
 - 3. Acceptance of the system includes, but is not limited to, the completed installation of all physical components as well as system functionality. Tests of the system shall not occur until after the system has been installed, and all work completed. Testing parameters shall include, but not limited to:
 - a. Contractor to provide metrics from monitoring consoles to substantiate performance:
 - 1) Number of connections
 - 2) Connection device type
 - 3) Authentication time
 - 4) Bandwidth per user
 - 5) Total bandwidth
 - 6) Dropped connections
 - 7) Issues and resolution
 - b. Contractor shall demonstrate with an appropriate University representative present: In-game:
 - 1) Seamless roaming
 - 2) Bandwidth to device per section/area

- F. Document all acceptance testing, calibration and correction procedures described herein. Include the following information:
1. Performance date of the given procedure.
 2. Condition of performance of procedure.
 3. Type of procedure, and description.
 4. Parameters measured and their values, including values measured prior to calibration or correction, as applicable.
 5. The names of personnel conducting the procedure.
 6. The equipment used to conduct the procedure.
- G. Upon completion of initial tests and adjustments, submit written report of tests to the University along with all documents, diagrams, and recorded drawings required herein.
- H. Final Procedures
1. Perform all "punch-list" work to correct inadequate performance or unacceptable conditions, as determined by the University, at no additional expense to the University.
 2. Furnish all portable equipment to the University along with complete inventory documentation. All portable equipment shall be presented in the original manufacturers packing, complete with all included instructions, miscellaneous manuals, and additional documents.
 3. Provide new acceptance testing in the same format as initial test reports.
 4. Check, inspect, and if necessary, adjust all systems, equipment, devices and components specified, at the University's convenience, approximately thirty (30) days after the University's acceptance at no additional cost to the University.
 5. Upon completion of the Work, the University may elect to verify test data as part of acceptance procedure. Provide personnel and equipment, at the convenience of the University, to reasonably demonstrate system performance and to assist with such tests without additional cost to the University.
 6. Perform wireless propagation survey of final system close out and provide results to the University.

END OF PART 3 EXECUTION

ATTACHMENT H

James Madison University Information Technology Services Addendum

CONTRACTOR NAME: _____

PRODUCT/SOLUTION: _____

Definitions:

- Agreement: The “Agreement” includes the contract, this addendum and any additional addenda and attachments to the contract, including the Contractor’s Form.
 - University: “University” or “the University” means James Madison University, its trustees, officers and employees.
 - University Data: “University Data” is defined as any data that the Contractor creates, obtains, accesses, transmits, maintains, uses, processes, stores or disposes of in performance of the Agreement. It includes all Personally Identifiable Information and other information that is not intentionally made generally available by the University on public websites.
 - Personally Identifiable Information: “Personally Identifiable Information” (PII) includes but is not limited to: Any information that directly relates to an individual and is reasonably likely to enable identification of that individual or information that is defined as PII and subject to protection by James Madison University under federal or Commonwealth of Virginia law.
 - Security Breach: “Security Breach” means a security-relevant event in which the security of a system or procedure involving University Data is breached, and in which University Data is exposed to unauthorized disclosure, access, alteration, or use.
 - Service(s): “Service” or “Services” means any goods or services acquired by the University from the Contractor.
1. **Rights and License in and to University Data**: The parties agree that as between them, all rights including all intellectual property rights in and to University Data shall remain the exclusive property of the University, and Contractor has a limited, nonexclusive license to use the data as provided in the Agreement solely for the purpose of performing its obligations hereunder. The Agreement does not give a party any rights, implied or otherwise, to the other’s data, content, or intellectual property.
 2. **Disclosure**: All goods, products, materials, documents, reports, writings, video images, photographs, or papers of any nature including software or computer images prepared or provided to the Contractor (or its subcontractors) for the University will not be disclosed to any other person or entity without the written permission of the University.
 3. **Data Privacy**:
 - a. Contractor will use University Data only for the purpose of fulfilling its duties under the Agreement and will not share such data with or disclose it to any third party without the prior written consent of the University, except as required by law.
 - b. University Data will not be stored outside the United States without prior written consent from the University.
 - c. Contractor will provide access to University Data only to its employees and subcontractors who need to access the data to fulfill obligations under the

Agreement. The Contractor will ensure that the Contractor's employees, and subcontractors when applicable, who perform work under the Agreement have received appropriate instruction as to how to comply with the data protection provisions of the Agreement and have agreed to confidentiality obligations at least as restrictive as those contained in this Addendum.

- i. If the Contractor will have access to the records protected by the Family Educational Rights and Privacy Act (FERPA), Contractor acknowledges that for the purposes of the Agreement it will be designated as a "school official" with "legitimate educational interests" in such records, as those terms have been defined under FERPA and its implementing regulations, and Contractor agrees to abide by the limitations and requirements imposed on school officials. Contractor will use such records only for the purpose of fulfilling its duties under the Agreement for University's and its End Users' benefit, and will not share such data with or disclose it to any third party except as required by law or authorized in writing by the University. Contractor acknowledges that its access to such records is limited to only those directly related to and necessary for the completion of Contractor's duties under the Agreement.
- d. The Contractor shall be responsible and liable for the acts and omissions of its subcontractors, including but not limited to third-party cloud hosting providers, and shall assure compliance with the requirements of the Agreement.

4. Data Security:

- a. Contractor will store and process University Data in accordance with commercial best practices, including appropriate administrative, physical, and technical safeguards, to secure such data from unauthorized access, disclosure, alteration, and use. Such measures will be no less protective than those used to secure Contractor's own data of a similar type, and in no event less than reasonable in view of the type and nature of the data involved.
- b. Contractor will store and process University Data in a secure site and will provide a SOC 2 or other security report deemed sufficient by the University from a third party reviewer along with annual updated security reports. If the Contractor is using a third-party cloud hosting company such as AWS, Rackspace, etc., the Contractor will obtain the security audit report from its hosting company and give the results to the University. The University should not have to request the report directly from the hosting company.
- c. Contractor will use industry-standards and up-to-date security tools, technologies and practices such as network firewalls, anti-virus, vulnerability scans, system logging, intrusion detection, 24x7 system monitoring, and third-party penetration testing in providing services under the Agreement.
- d. Without limiting the foregoing, Contractor warrants that all electronic University Data will be encrypted in transmission (including via web interface) and stored at AES 256 or stronger.

5. Data Authenticity, Integrity and Availability:

- a. Contractor will take reasonable measures, including audit trails, to protect University Data against deterioration or degradation of data quality and authenticity. Contractor shall be responsible for ensuring that University Data, per the Virginia Public Records Act, is "preserved, maintained, and accessible throughout their lifecycle, including

converting and migrating electronic records as often as necessary so that information is not lost due to hardware, software, or media obsolescence or deterioration.”

- b. Contractor will ensure backups are successfully completed at the agreed interval and that restoration capability is maintained for restoration to a point-in-time and/or to the most current backup available.
- c. Contractor will maintain an uptime of 99.99% or greater as agreed to for the contracted services via the use of appropriate redundancy, continuity of operations and disaster recovery planning and implementations, excluding regularly scheduled maintenance time.

6. Employee Background Checks and Qualifications:

- a. Contractor shall ensure that its employees have undergone appropriate background screening and possess all needed qualifications to comply with the terms of the Agreement including but not limited to all terms relating to data and intellectual property protection.
- b. If the Contractor must under this agreement create, obtain, transmit, use, maintain, process, or dispose of the subset of University Data known as Personally Identifiable Information or financial or business data, the Contractor shall perform the following background checks on all employees who have potential to access such data in accordance with the Fair Credit Reporting Act: Social Security Number trace; seven (7) year felony and misdemeanor criminal records check of federal, state, or local records (as applicable) for job related crimes; Office of Foreign Assets Control List (OFAC) check; Bureau of Industry and Security List (BIS) check; and Office of Defense Trade Controls Debarred Persons List (DDTC).

7. Security Breach:

- a. Response: Immediately (within one day) upon becoming aware of a Security Breach, or of circumstances that could have resulted in unauthorized access to or disclosure or use of University Data, Contractor will notify the University, fully investigate the incident, and cooperate fully with the University’s investigation of and response to the incident. Except as otherwise required by law, Contractor will not provide notice of the incident directly to individuals whose Personally Identifiable Information was involved, regulatory agencies, or other entities, without prior written permission from the University.
- b. Liability:
 - i. If Contractor must under this agreement create, obtain, transmit, use, maintain, process, or dispose of the subset of University Data known as Personally Identifiable Information, the following provisions apply. In addition to any other remedies available to the University under law or equity, Contractor will reimburse the University in full for all costs incurred by the University in investigation and remediation of any Security Breach caused by Contractor, including but not limited to providing notification to individuals whose Personally Identifiable Information was compromised and to regulatory agencies or other entities as required by law or contract; providing one year’s credit monitoring to the affected individuals if the Personally Identifiable Information exposed during the breach could be used to commit financial identity theft; and the payment of legal fees, audit costs, fines, and other fees imposed by regulatory agencies or contracting partners as a result of the Security Breach.

- ii. If Contractor will NOT under this agreement create, obtain, transmit, use, maintain, process, or dispose of the subset of University Data known as Personally Identifiable Information, the following provisions apply. In addition to any other remedies available to the University under law or equity, Contractor will reimburse the University in full for all costs reasonably incurred by the University in investigation and remediation of any Security Breach caused by Contractor.

8. Requests for Data, Response to Legal Orders or Demands for Data:

- a. Except as otherwise expressly prohibited by law, Contractor will:
 - i. immediately notify the University of any subpoenas, warrants, or other legal orders, demands or requests received by Contractor seeking University Data;
 - ii. consult with the University regarding its response;
 - iii. cooperate with the University's requests in connection with efforts by the University to intervene and quash or modify the legal order, demand or request; and
 - iv. Upon the University's request, provide the University with a copy of its response.
- b. Contractor will make itself and any employees, contractors, or agents assisting in the performance of its obligations under the Agreement, available to the University at no cost to the University based upon claimed violation of any laws relating to security and/or privacy of the data that arises out of the Agreement. This shall include any data preservation or eDiscovery required by the University.
- c. The University may request and obtain access to University Data and related logs at any time for any reason and at no extra cost.

9. Data Transfer Upon Termination or Expiration:

- a. Contractor's obligations to protect University Data shall survive termination of the Agreement until all University Data has been returned or securely destroyed, meaning taking actions that render data written on media unrecoverable by both ordinary and extraordinary means.
- b. Upon termination or expiration of the Agreement, Contractor will ensure that all University Data are securely transferred, returned or destroyed as directed by the University in its sole discretion within 60 days of termination of the Agreement. Transfer/migration to the University or a third party designated by the University shall occur without significant interruption in service. Contractor shall ensure that such transfer/migration uses facilities, methods, and data formats that are accessible and compatible with the relevant systems of the University or its transferee, and to the extent technologically feasible, that the University will have reasonable access to University Data during the transition.
- c. In the event that the University requests destruction of its data, Contractor agrees to securely destroy all data in its possession and in the possession of any subcontractors or agents to which Contractor might have transferred University data. Contractor agrees to provide documentation of data destruction to the University.
- d. Contractor will notify the University of impending cessation of its business and any contingency plans. This includes immediate transfer of any previously escrowed assets and data and providing the University access to Contractor's facilities to remove and destroy University-owned assets and data. Contractor shall implement its exit plan and take all necessary actions to ensure a smooth transition of service with minimal disruption to the University. The Contractor will also provide, as

applicable, a full inventory and configuration of servers, routers, other hardware, and software involved in service delivery along with supporting documentation, indicating which if any of these are owned by or dedicated to the University. Contractor will work closely with its successor to ensure a successful transition to the new service, with minimal downtime and effect on the University, all such work to be coordinated and performed in advance of the formal, final transition date.

10. Audits:

- a. The University reserves the right in its sole discretion to perform audits of the Contractor to ensure compliance with the terms of the Agreement. Contractor shall reasonably cooperate in the performance of such audits. This provision applies to all agreements under which Contractor must create, obtain, transmit, use, maintain, process, or dispose of University Data.
- b. If Contractor must under the Agreement create, obtain, transmit, use, maintain, process, or dispose of the subset of University Data known as Personally Identifiable Information or financial or business data, Contractor will at its expense conduct or have conducted at least annually a(n):
 - i. American Institute of CPAs Service Organization Controls 2 (SOC 2) audit, or other independent security audit with audit objectives deemed sufficient by the University, which attests to Contractor's security policies, procedures, and controls. Contractor shall also submit such documentation for any third-party cloud hosting provider(s) they may use (e.g. AWS, Rackspace, Azure, etc.) and for all subservice providers or business partners relevant to the Agreement. Contractor shall also provide James Madison University with a designated point of contact for the SOC reports and risks related to the contract. This person shall address issues raised in the SOC reports of the Contractor and its relevant providers and partners, and respond to any follow up questions posed by the University in relation to technology systems, infrastructure, or information security concerns related to the contract.
 - ii. vulnerability scan of Contractor's electronic systems and facilities that are used in any way to deliver electronic services under the Agreement; and
 - iii. formal penetration test performed by qualified personnel of Contractor's electronic systems and facilities that are used in any way to deliver electronic services under the Agreement.
- c. Additionally, Contractor will provide the University upon request the results of the above audits, scans and tests, and will promptly modify its security measures as needed based on those results in order to meet its obligations under the Agreement. The University may require, at University expense, the Contractor to perform additional audits and tests, the results of which will be provided promptly to the University.

11. Compliance:

- a. Contractor will comply with all applicable laws and industry standards in performing services under the Agreement. Any Contractor personnel visiting the University's facilities will comply with all applicable University policies regarding access to, use of, and conduct within such facilities. The University will provide copies of such policies to Contractor upon request.
- b. To the extent applicable to the design and intended use of the service, Contractor warrants that the service it will provide to the University is fully compliant with and will enable the University to be compliant with relevant requirements of all laws,

regulation, and guidance applicable to the University and/or Contractor, including but not limited to: the Family Educational Rights and Privacy Act (FERPA), Health Insurance Portability and Accountability Act (HIPAA), Health Information Technology for Economic and Clinical Health Act (HITECH), Gramm-Leach-Bliley Financial Modernization Act (GLB), Payment Card Industry Data Security Standards (PCI-DSS), Americans with Disabilities Act (ADA), Federal Export Administration Regulations, and Defense Federal Acquisitions Regulations.

12. **No End User Agreements:** Any agreements or understandings, whether electronic, click through, verbal or in writing, between Contractor and University employees or other end users under the Agreement that conflict with the terms of the Agreement, including but not limited to this Addendum, shall not be valid or binding on the University or any such end users.

IN WITNESS WHEREOF, the parties have caused this addendum to be duly executed, intending thereby to be legally bound. In the event of conflict or inconsistency between terms of the Agreement and this Addendum, the terms of this Addendum shall prevail.

JAMES MADISON UNIVERSITY

CONTRACTOR

SIGNATURE: _____

SIGNATURE: _____

PRINTED
NAME: _____

PRINTED NAME: _____

TITLE: _____

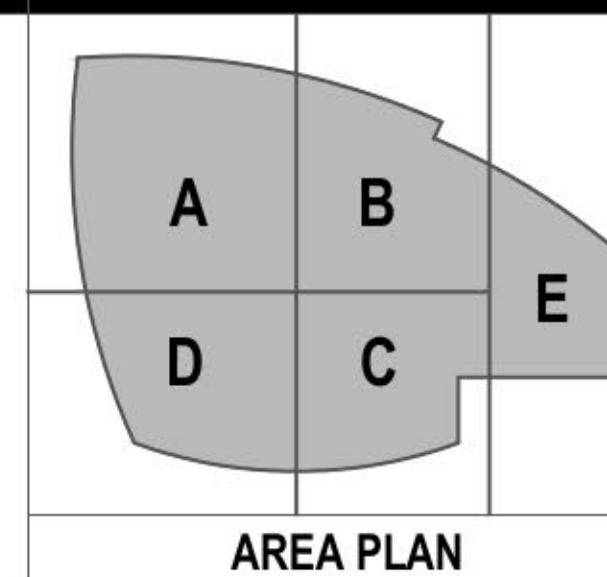
TITLE: _____

DATE: _____

DATE: _____

Attachment E: Wi-Fi Exclusion Areas

RFP #CMJ-1068 Atlantic Union Bank Center – High Density Wireless Network



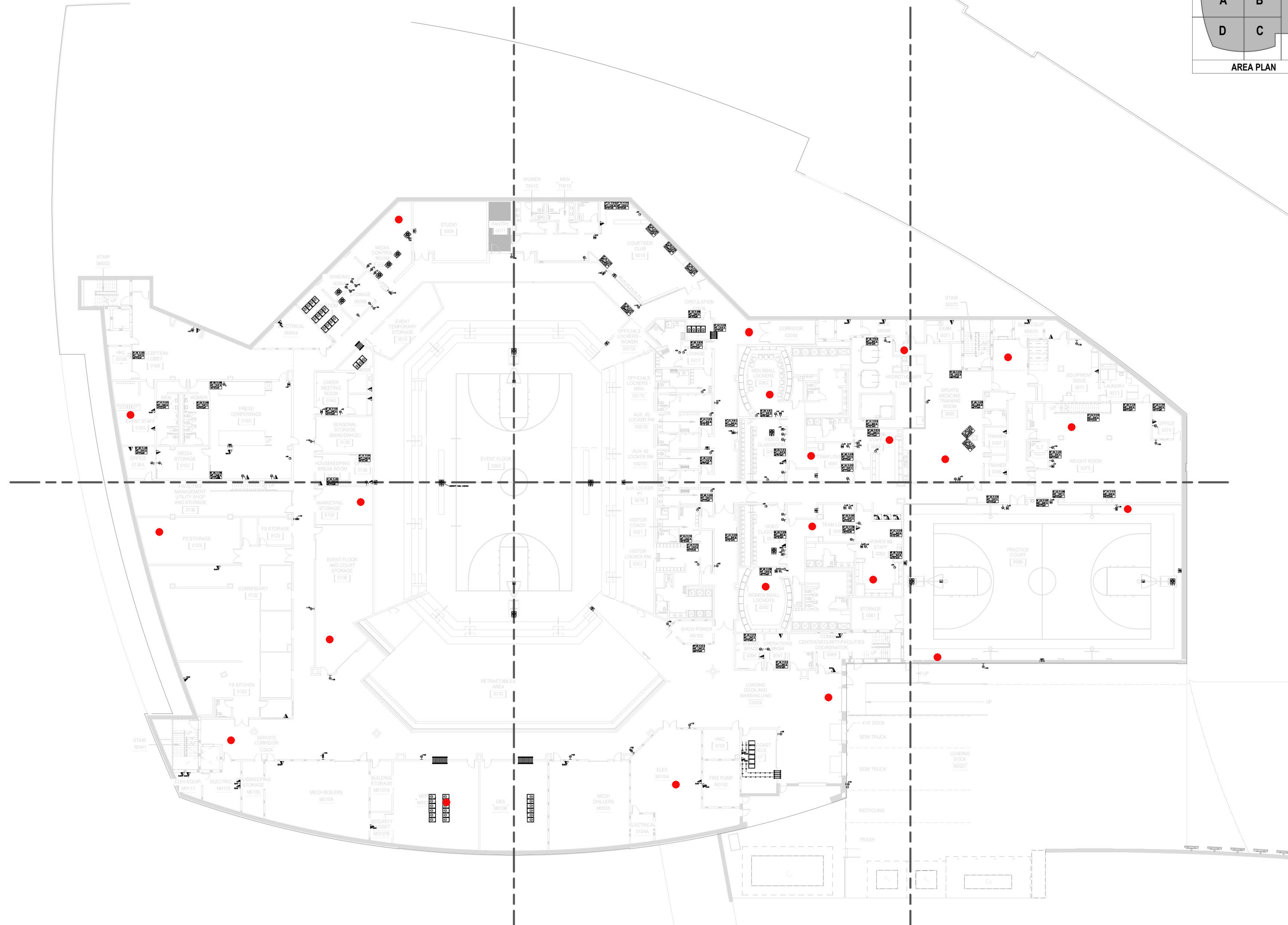
AREA PLAN

NEW CONVOCATION CENTER

STATE PROJECT CODES: 216-17963-000
JAMES MADISON UNIVERSITY
HARRISONBURG, VA 22807

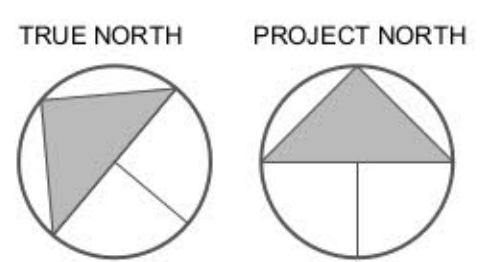
PROJECT NO.	DATE
570458	JULY 18, 2018
REVISIONS	
DATE	DESCRIPTION

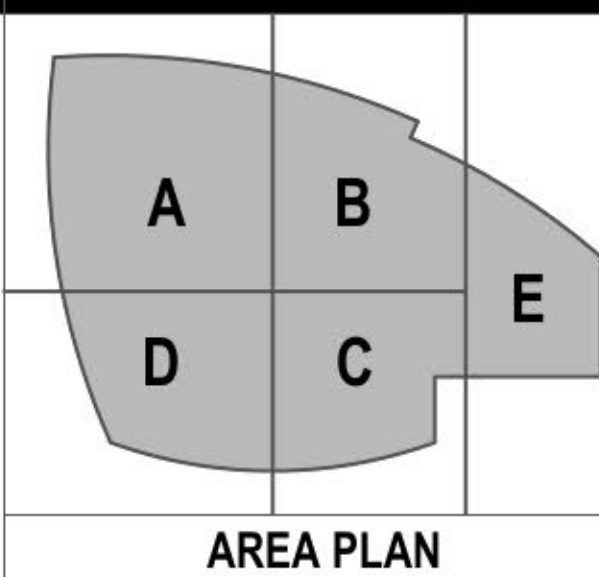
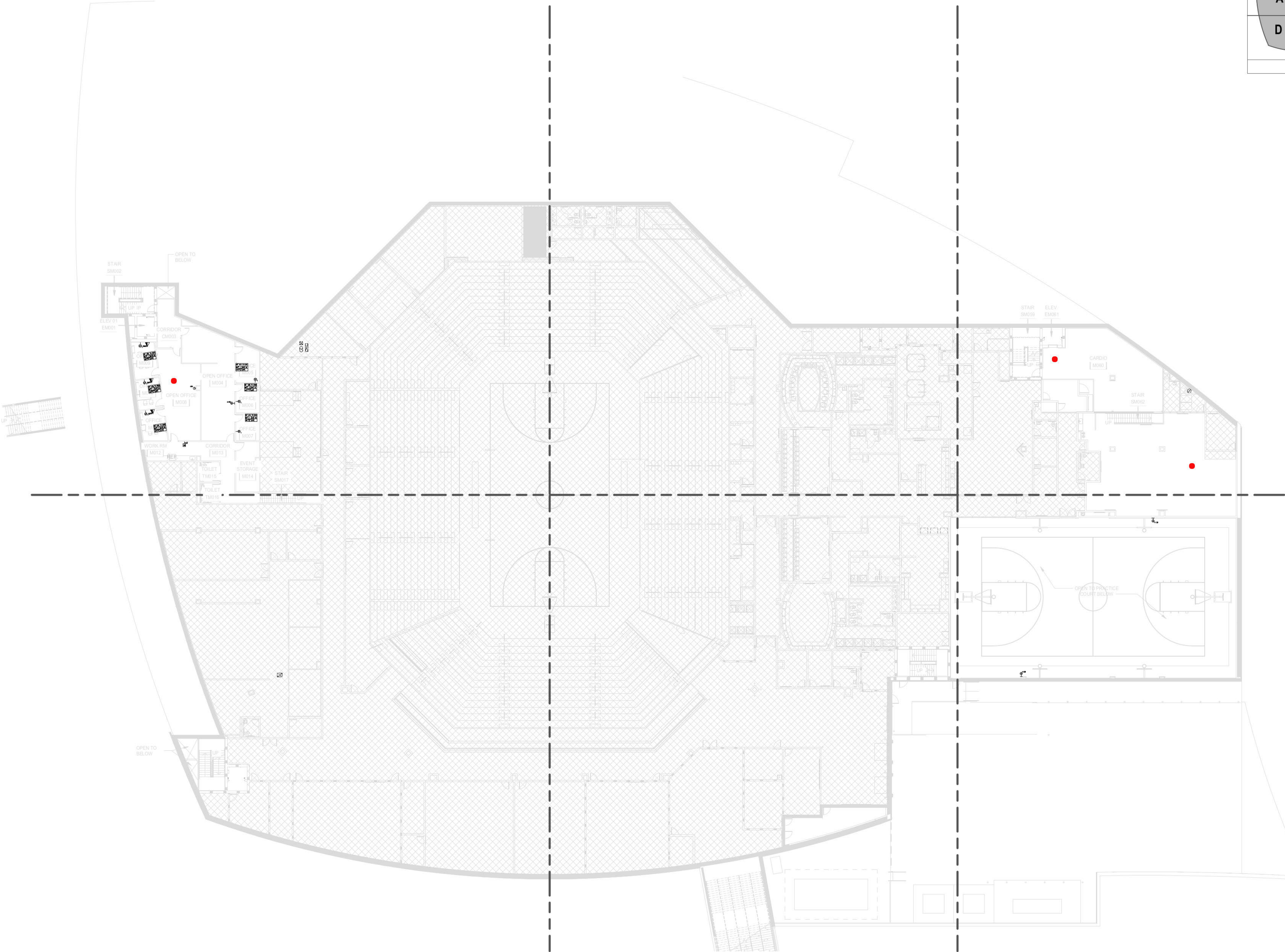
EVENT LEVEL
REFERENCE PLAN
TECHNOLOGY MEP



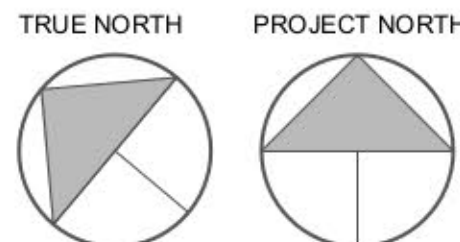
1 EVENT LEVEL - OVERALL

Scale: 1/16" = 1'





AREA PLAN



Scale: 1/16" = 1'

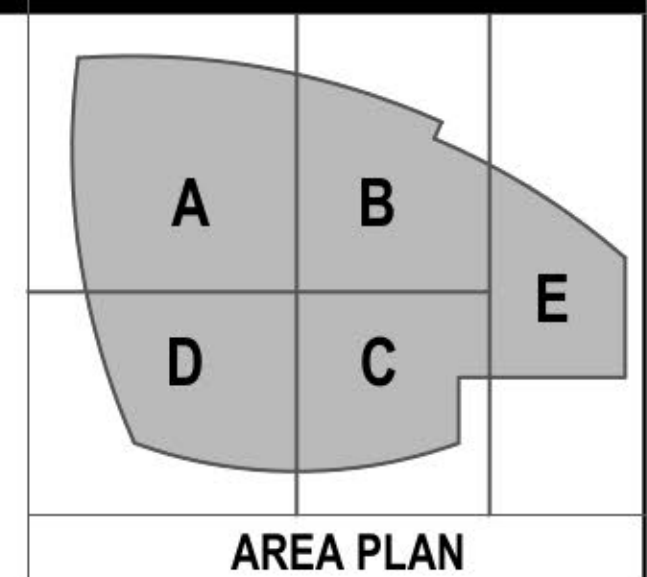
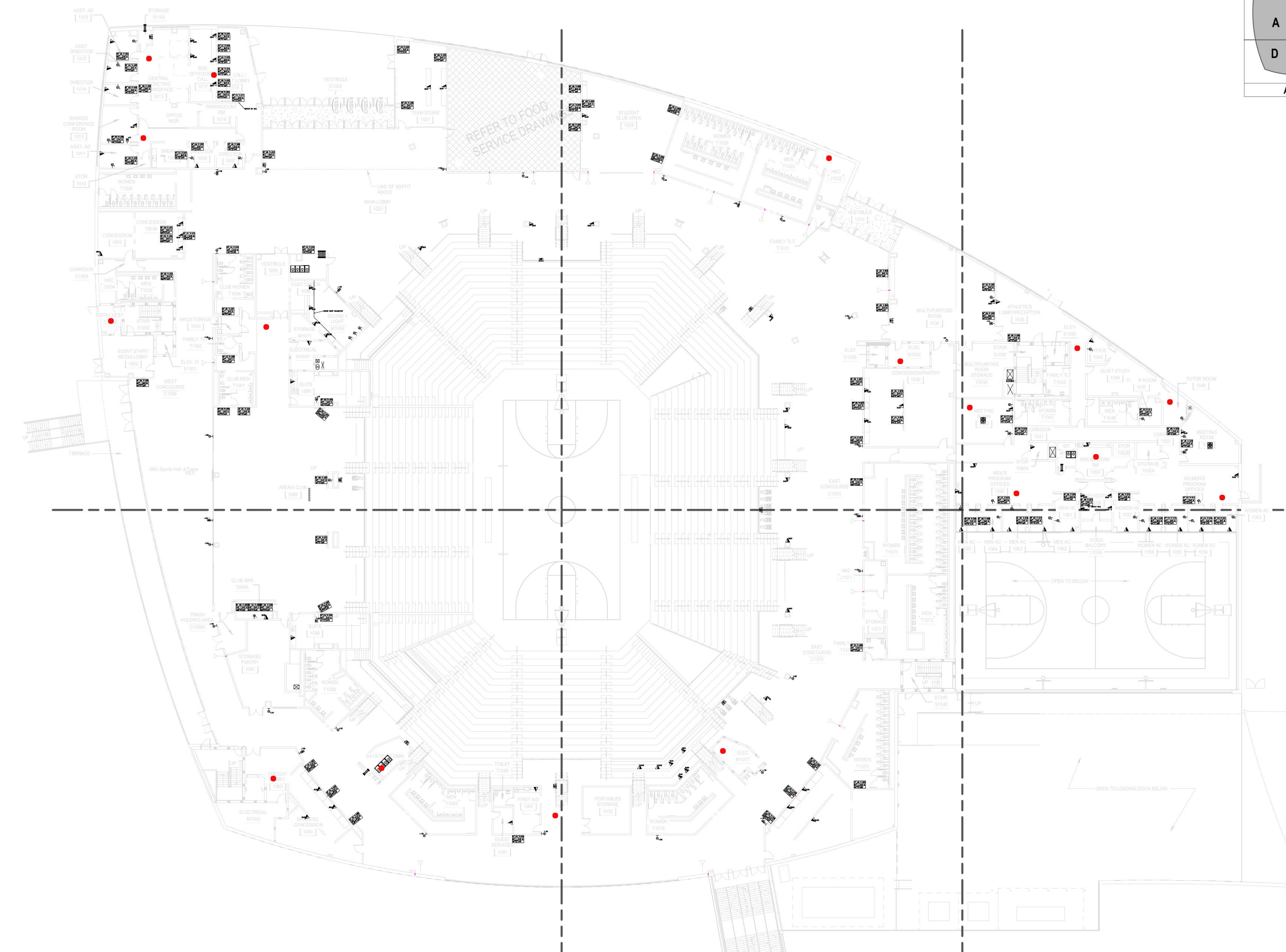
NEW CONVOCATION CENTER

STATE PROJECT CODES: 216-17963-000
JAMES MADISON UNIVERSITY
HARRISONBURG, VA 22807

PROJECT NO.	DATE
570458	JULY 18, 2018
REVISIONS	
DATE	DESCRIPTION

MEZZANINE LEVEL
REFERENCE PLAN
TECHNOLOGY MEP

T2.1.5



MOSELEYARCHITECTS
780 LYNHAVEN PARKWAY, SUITE 200
VIRGINIA BEACH, VIRGINIA 23452
PHONE (703) 388-2800 FAX (703) 368-2233
MOSELEYARCHITECTS.COM

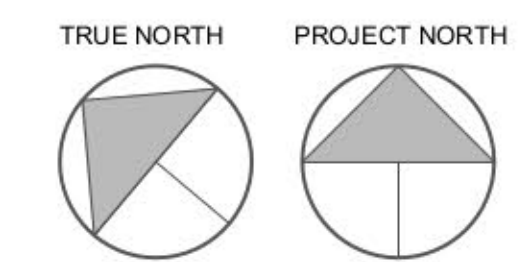
POPULOUS

NEW CONVOCATION CENTER

STATE PROJECT CODES: 216-17963-000
JAMES MADISON UNIVERSITY
HARRISONBURG, VA 22807

PROJECT NO.	DATE
570458	JULY 18, 2018
REVISIONS	
DATE	DESCRIPTION

CONCOURSE LEVEL
REFERENCE PLAN
TECHNOLOGY MEP



REF#	MFG	MODEL	DESCRIPTION	QTY.	UNIT	EXTENDED
SERVER						
1						\$ -
2						\$ -
3						\$ -
4						\$ -
5						\$ -
6						\$ -
SERVER						\$ -
APPLICATIONS						
7						\$ -
8						\$ -
9						\$ -
10						\$ -
11						\$ -
12						\$ -
APPLICATIONS						\$ -
CORE AND EDGE SWITCHING						
13						\$ -
14						\$ -
15						\$ -
16						\$ -
17						\$ -
18						\$ -
CORE AND EDGE SWITCHING						\$ -
MOBILITY CONTROLLER						
19						\$ -
20						\$ -
21						\$ -
22						\$ -
23						\$ -
24						\$ -
MOBILITY CONTROLLER						\$ -
ACCESS POINTS AND ANTENNAS						
25						\$ -
26						\$ -
27						\$ -
28						\$ -
29						\$ -
30						\$ -
ACCESS POINTS AND ANTENNAS						\$ -
DHCP / DNS SERVICES APPLIANCE						
31						\$ -
32						\$ -
33						\$ -
34						\$ -
35						\$ -
36						\$ -
DHCP / DNS SERVICES APPLIANCE						\$ -
ENCLOSURES AND UPS						
37						\$ -
38						\$ -
39						\$ -
40						\$ -
41						\$ -
42						\$ -

ENCLOSURES AND UPS						\$	-
STRUCTURED CABLE							
43	SUPERIOR ESSEX	6H272D	Cat6A Cabling (Plenum)			\$	-
44	ORTRONICS	OR-40300548	Cat6A Face plates (2 Port) Trac Jack			\$	-
45	ORTRONICS	OR-TJ610-68	Cat6A Jacks (Single)			\$	-
46	ORTRONICS	OR-40300546	Cat6A Face plates (4-Port) Trac Jack			\$	-
47	ORTRONICS	OR-PHDHJU24	24 Port Flat Modular Patch Panel (Unloaded)HD			\$	-
48	ORTRONICS	OR-HDJ6A-45	High Density Patch panel Jacks (Green) Modular			\$	-
49	ORTRONICS	TBD	Patch Cords			\$	-
STRUCTURED CABLE						\$	-
INSTALLATION, MATERIALS AND LABOR							
50	Integrator	Materials	Materials			\$	-
51	Integrator	Installation Labor	Installation Labor			\$	-
52	Integrator	Structured Cable Labor	Per Drop Rate			\$	-
53	Integrator	Project Management	Project Management			\$	-
54	Integrator	Engineering	Engineering			\$	-
55	Integrator	Configuration	Configuration			\$	-
56	Integrator	Tuning & Optimization	Tuning & Optimization			\$	-
57	Integrator	Travel and Expenses	Travel and Expenses			\$	-
INSTALLATION, MATERIALS AND LABOR						\$	-
SUMMARY - BASE NETWORK COST							
BASE NETWORK COST TOTAL						\$	-
OPTION 1 : ALL INCLUSIVE (SOLUTION, MANAGED SERVICES, AND ISP)							
Managed Services (SLA to be proposed with pricing). Include total cost of solution and ISP circuits.				Months	Monthly cost	Annual Cost	
			Initial Term 2-Year	24		\$	-
			Year 3	12		\$	-
			Year 4	12		\$	-
			Year 5	12		\$	-
			Year 6	12		\$	-
			Year 7	12		\$	-
			Year 8	12		\$	-
			Year 9	12		\$	-
SUBTOTAL						\$	-
OPTION 1 : ALL INCLUSIVE (SOLUTION, MANAGED SERVICES, AND ISP)						\$	-
OPTION 2 : MANAGED SERVICES (MANAGED SERVICES AND ISP ONLY)							
Managed Services (SLA to be proposed with pricing) and ISP circuits.				Months	Monthly Cost	Annual Cost	
			Initial Term 2-Year	24		\$	-
			Year 3	12		\$	-
			Year 4	12		\$	-
			Year 5	12		\$	-
			Year 6	12		\$	-
			Year 7	12		\$	-
			Year 8	12		\$	-
			Year 9	12		\$	-
OPTION 2 : MANAGED SERVICES (MANAGED SERVICES AND ISP ONLY)						\$	-
OPTION 3: EVENT SUPPORT / EVENT RATE (EVENT SUPPORT ONLY - ASSUMES SEPARATE SOLUTION PURCHASE WITH ISP AND OPERATION BY OWNER)							
Remote Monitoring and Event Support (Assumes 120 events annually)				1		\$	-
Subtotal						\$	-
OPTION 3: EVENT SUPPORT / EVENT RATE (EVENT SUPPORT ONLY - ASSUMES SEPARATE SOLUTION PURCHASE WITH ISP AND OPERATION BY OWNER)						\$	-

Attachment G: Composite Set

17963 JMU Convo Composite Set.zip was provided as a separate download file, to all potential respondents to RFP #CMJ-1068 via link in the RFP document while solicitation was open on the eVA system.

Attachment I: HECVAT

Educause Higher Education Cloud Vendor Assessment Tool (HECVAT) Lite version 2.03 was provided, as a separate Excel file, to all potential respondents to RFP #CMJ-1068 via upload to eVA solicitation and by email to directly solicited vendors.



December 17, 2019

ADDENDUM NO.: One

TO ALL OFFERORS:

REFERENCE: Request for Proposal No: **RFP# CMJ-1068**
Dated: December 2, 2019
Commodity: Atlantic Union Bank Center – High Density Wireless Network
RFP Closing On: **January 14, 2020 at 2:00pm**

Please note the clarifications and/or changes made on this proposal program:

1. Question: If the University has preferred/local cabling contractors.

Answer: While the University does not have preferred local cabling contractors VA certified SWAM members would be ideal (<https://www.sbsd.virginia.gov/directory/>).

2. Question: Is the University willing to consider equipment from other manufacturers? Regarding Attachment D, Part 2, 2.1.

2.1. Acceptable Manufacturers and Products:

A. Network core equipment (routers, switches, etc.) shall consist of Cisco manufactured products. Wireless equipment to include all access points shall consist of Aruba manufactured products.

Answer: The scope of the specification for Manufacturers and Products has not changed.

3. In Attachment D, Part 3.1.A.6. It is indicated that: “Drawings of currently provided infrastructure and locations are forthcoming to aid in systems design”.

Answer: Part 3.1.A.6 of Attachment D is hereby replaced with the following:

Wireless system hardware deployment (access point, repeaters, etc.) is to be of minimal visual impact, providing both an aesthetically pleasing (University’s Discretion) and robust deployment. ~~Drawings of currently provided infrastructure and locations are forthcoming to aid in systems design.~~ Drawings of

MSC 5720
752 Ott Street, Room 1042
Wine Price Building
Harrisonburg, VA 22807
Office of 540.568.3145 Phone
PROCUREMENT SERVICES 540.568.7936 Fax

infrastructure and locations have been provided as a zip file download; see link to Attachments G 17963 *JMU Convo Composite Set.zip* on page 3 of the RFP document to aide in systems design.

Signify receipt of this addendum by initialing "*Addendum #1* _____" on the signature page of your proposal.

Sincerely,



Colleen Johnson
Buyer Specialist
Phone: (540-568-3137)



January 7, 2019 ²⁰²⁰
cm5

ADDENDUM NO.: Two

TO ALL OFFERORS:

REFERENCE: Request for Proposal No: **RFP# CMJ-1068**
Dated: December 2, 2019
Commodity: Atlantic Union Bank Center – High Density Wireless Network
RFP Closing On: **January 14, 2020 at 2:00pm**

Please note the clarifications and/or changes made on this proposal:

1. **Question: Can you please kindly advise of the address for where the circuit will terminate? Or, if not yet established the closest approximate address, along with actual LONG/LAT coordinates?**

Answer: 645 University Blvd, Harrisonburg, VA 22801

2. **Question: What's the circuit bandwidth you'll require?**

Answer: Offeror should propose and justify adequate bandwidth per RFP specifications for their proposed solution.

3. **Question: Would a site visit of the center be available?**

Answer: A site visit will not be possible before RFP close.

4. **Question: Is JMU willing to allow vendors to propose a Ruckus/CommScope homogeneous solution?**

Answer: The scope of the specification for Manufacturers and Products has not changed.

5. **Question: Would JMU entertain proposals to consist of Ruckus Access Points, Switches and Controller?**

Answer: The scope of the specification for Manufacturers and Products has not changed.

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- 6. Question: Will the University accept a powered fiber solution in the event that a WAP exceeds 100M?**

Answer: Yes, however pathways have been designed in such a way that that should not be necessary.

- 7. Question: Are J-Hooks an acceptable pathway or does the University require all CAT6A runs for WAP's be in conduit back to tray?**

Answer: Owner will provide conduit pathways from the WAP location to the cable tray.

- 8. Question: Is a legend for Attachment E available to confirm what the Red Dot and Red Outline areas identify? Do those areas have existing Wi-Fi as part of the construction package?**

Answer: The areas outlined in red are exclusion areas outside the scope of the RFP. Yes, the red dots represent WAP locations for JMU back of house network.

- 9. Question: From the requested references, are there specific details that the photo of installation should reflect?**

Answer: We are looking for a representation of past work performed. Sample photos of equipment as installed, rack installations with terminations, cabling, etc.

- 10. Question: Does the University have a preference for an underseat/picocell WLAN solution versus an overhead WLAN solution?**

Answer: Our preference is for an overhead solution but are open to alternate solutions.

- 11. Question: Is there a requirement to provide external WiFi coverage outside the Arena for onboarding patrons?**

Answer: It is desirable for WiFi coverage to be available external to the building immediately adjacent to the main entrance to the facility.

- 12. Question: Can the University provide a list of low voltage / network wiring contractors that have recently worked on the campus? Of this list of low voltage network wiring contractors that have recently worked on campus, which are VA certified SWAM members? Which low voltage network wiring contractor is working for the GC (general contractor) doing the current arena construction?**

Answer: While the University does not have preferred local cabling contractors VA certified SWAM members would be ideal (<https://www.sbsd.virginia.gov/directory/>).

- 13. Question: Can the University provide a list of electrical contractors that have recently worked on the campus? Of this list of electrical contractors that have recently worked on campus, which are VA certified SWAM members? Which electrical contractor is working for the GC (general contractor) doing the current arena construction?**

Answer: While the University does not have preferred local electrical contractors VA certified SWAM members would be ideal (<https://www.sbsd.virginia.gov/directory/>).

- 14. Question: Can APs be placed in the arena "centerhung" scoreboard? Will the centerhung be stowed / retracted when the arena is being used for convocation or as a theater? What is the height above the floor of the centerhung when deployed versus when it is stowed?**

Answer: There is not an issue with placing APs on the underbelly of the center hung. However, it is not preferred. Any placements will have to be coordinated with LED vendor. Nested height and game height will vary slightly based on manufacturer of center hung.

- 15. Question: What is the height above the floor of the catwalk? Are there any structural limitations to the catwalk from a load perspective that would prohibit or limit its use for installation of access points? Does the catwalk have a pervasive cable tray system that can be utilized for routing Ethernet cables?**

Answer: Installing APs on the catwalk is preferred and a cable tray is provided. There is a cable tray and there is no structural concern.

- 16. Question: Can the University provide RCP (Reflected Ceiling Plan) drawings for the arena? Specifically, we're looking for ceiling types and elevations.**

Answer: A full construction set was provided as part of the distribution. RCPs should be included within.

- 17. Question: Would it be possible for the selected contractor to leverage higher education discounts available to the University when procuring network equipment from Cisco?**

Answer: Offeror should submit pricing based on offerors discount.

- 18. Question: Given the research and preparation required to do a thorough and complete response, will the University consider an extension on the response deadline for an additional week or two?**

Answer: Not possible at this time.

- 19. Question: In Attachment D, Performance Specifications, Part 3 Execution, subsection 3.2 Expected System Performance, item #7 states: *No support for legacy 802.11 standards are required. Contractor shall focus on standards n, ac, ax as the basis for their proposed solution.***

We understand the desire to "future-proof" your network as much as practical but we believe that requiring the 802.11ax protocol, which is currently unratified, is an exercise in using "bleeding edge" technology. We call it "bleeding edge" specifically due to the revamping of the protocol that scraps backward compatibility giving it an "all or nothing" nature to its implementation and we do not foresee a preponderance of client devices using the ax standard for 5 years (2025). We estimate this will increase this portion of the project's cost 2-3x. Again, it's not currently supported by any client devices nor is it fully ratified standard. AC wave2 with backwards compatibility to N is reasonable and still future proofs the system.

Please confirm you require an 802.11ax transmitting system in your responses.

Answer: We do not require 802.11ax.

- 20. Question: In reference to page 32, part A, "All network equipment power circuits must have an emergency back-up system as deemed necessary per the local or state fire code; whichever is more restrictive."**

Does the local/regional legal code and or JMU require UPS?

Answer: Electrical circuits are owner provided with generator back up. Offeror should provide enough UPS capacity to accommodate for generator switch over in the event of a power failure.

- 21. Question: In reference to page 39, section 1.1 Acceptable Manufacturers and Products, part A, “All network equipment power circuits must have an emergency back-up system as deemed necessary per the local or state fire code; whichever is more restrictive.**

Does network core equipment include Firewalls, Gateways and Policy Servers?

Answer: Yes. See answer to previous question number 20.

- 22. Question: In reference to page 43, section 1, “The Contractor is responsible for determination, and verification of the number and type of access points to be deployed. Locations are expected to be a mixture of cable tray, exterior, and finished ceiling, and clear span installations based upon coverage needs.” Is under seat and/or handrail AP Mounting locations acceptable?**

Answer: See answer to previous question number 10.

- 23. Question: In reference to page 44, section 1, “Contractor is required to determine quantities of SSIDs broadcasted and non-broadcasted, based upon their proposed solution and forthcoming needs of the University. James Madison University in any form, to include JMU, shall not be used in SSID naming conventions. Contractor is required to coordinate with JMU Information Technology for all SSID naming conventions.” And section 2, “Contractor is required to determine quantities of VLANs based upon their proposed solution and forthcoming needs of the University.”**

Will University provide SSID/VLAN guidance or specification? Specifically, will specific VLANs be assigned to services such as vending etc? Will security requirements such as isolation be indicated? What SSID requirements and authentication plus coverage be applied to each application or service?

Answer: The University has no preconceived quantity of required SSIDs or VLANs and will work with the winning vendor to determine SSID, VLAN, and security requirements.

- 24. Question: In reference to page 46, section 1, “Virtual Beacons: University preference; Mist Virtual Beaconing Application. What application/service will be required of Beacons? Wayfinding, Location Based Services, Advertising etc?**

Answer: This is a future capability. None of these references should be excluded from potential capabilities.

- 25. Question: Can a more specific coverage details be provided of the outdoor plazas and parking areas?**

Answer: WiFi coverage of the parking areas are not included in the scope of this RFP. See answer to previous question number 11.

- 26. Question: Since the Wi-Fi exclusion areas are adjacent to required coverage will any guidance be given as to co-channel interference, maximum signal levels in exclusion areas, etc.**

Answer: Yes. JMU will coordinate with the awarded contractor.

- 27. Question: Will there be a DAS system?**

Answer: There are no immediate plans for a cellular DAS. There will be a Public Safety DAS installed outside the scope of this RFP.

- 28. Question: Will there be any wireless audio or video systems operating in the coverage areas?**

Answer: Yes. A separate solicitation was issued and is pending award.

29. Question: Does the 11 Mbps per user refer to Downstream, Upstream or Bi-Directional throughput?

Answer: Bi-Directional.

30. Question: Between 802.1x and HS 2.0 SSID's does the university have and estimate of the number of radius server interconnects?

Answer: No

31. Question: Does the university have any minimum RSSI/SNR requirements other than achieving the minimum data rates?

Answer: No

Signify receipt of this addendum by initialing "Addendum #2 _____" on the signature page of your proposal.

Sincerely,

A handwritten signature in black ink, appearing to read 'Colleen Johnson', with a long horizontal flourish extending to the right.

Colleen Johnson
Buyer Specialist
Phone: (540-568-3137)



January 9, 2019 *2020*
ont

ADDENDUM NO.: Three

TO ALL OFFERORS:

REFERENCE: Request for Proposal No: **RFP# CMJ-1068**
Dated: December 2, 2019
Commodity: Atlantic Union Bank Center – High Density Wireless Network
RFP Closing On: **January 14, 2020 at 2:00pm**

Please note the clarifications and/or changes made on this proposal:

In clarification to an answer provided on Addendum Two:

1. **Original Question: Can you please kindly advise of the address for where the circuit will terminate? Or, if not yet established the closest approximate address, along with actual LONG/LAT coordinates?**

Answer: 645 University Blvd, Harrisonburg, VA 22801

Additional Response: The internet carriers do not have a presence in the Atlantic Union Bank Center building at 645 University Blvd. The winning vendor will have to deliver the circuit to 801 Carrier Dr. Harrisonburg, VA 22807. JMU Telecom will extend the circuit to the arena site. Currently only Verizon and Lumos have a presence at 801 Carrier Drive.

Signify receipt of this addendum by initialing "Addendum #3_____" on the signature page of your proposal.

Sincerely,

Colleen Johnson
Buyer Specialist
Phone: (540-568-3137)

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752 Ott Street, Room 1042
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Harrisonburg, VA 22807
Office of 540.568.3145 Phone
PROCUREMENT SERVICES 540.568.7936 Fax



January 14, 2020

ADDENDUM NO.: Four

TO ALL OFFERORS:

REFERENCE: Request for Proposal No: **RFP# CMJ-1068**
Dated: December 2, 2019
Commodity: Atlantic Union Bank Center – High Density Wireless Network
RFP Closing On: ~~January 14, 2020 at 2:00pm~~
January 16, 2020 at 2:00pm

Please note the clarifications or change(s) made on this proposal:

The closing date and time has been extended to January 16, 2020 at 2:00 p.m. Eastern.

Signify receipt of this addendum by initialing "*Addendum #4* _____" on the signature page of your proposal.

Sincerely,

A handwritten signature in black ink, appearing to read "Colleen Johnson".

Colleen Johnson
Buyer Specialist
Phone: (540-568-3137)

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752 Ott Street, Room 1042
Wine Price Building
Harrisonburg, VA 22807
Office of 540.568.3145 Phone
PROCUREMENT SERVICES 540.568.7936 Fax