ACTON-AGUA DULCE UNIFIED SCHOOL DISTRICT
"Many Paths to Learning, One Standard of Excellence"

Special Meeting of the Board of Trustees
Thursday, April 27, 2017
6:30 p.m.
Agenda
District Office
Acton, CA

1.0 CALL TO ORDER AND ROLL CALL

1.1 Roll Call Time_____ p.m.

Mike Fox	President
Ed Porter	Vice President
Ken Pfalzgraf	Clerk
Mark Distaso	Member
Larry H. Layton	Member

Action **2.0 APPROVE/ADOPT AGENDA FOR REGULAR MEETING**

It is recommended the Board of Trustees adopt as presented, the agenda for the Special Board Meeting of April 27, 2017.

Moved by ____ Seconded by ____ Ayes ___ Nays ___ Absent____

3.0 PLEDGE OF ALLEGIANCE Led by:_____

4.0 PUBLIC COMMENT – Agenda Items Only

Members of the audience may address the Board of Trustees on items listed on the special meeting agenda. Speaking time is limited to three (3) minutes per speaker with a maximum of (20) minutes per topic. Persons wishing to address the Board should complete and submit prior to the meeting a yellow Public Comment card available on the information table.

5.0 BUSINESS AND FINANCIAL

Action *Enclosure* 5.1 **Contract with BrightPath Consulting Service, $39,500.00**

It is recommended the Board approve the contract with BrightPath Consulting Service, in the amount of $39,500.00.

Moved by ____ Seconded by _____ Ayes ____ Nays ____ Absent____

Action *Enclosure* 5.2 **Meadowlark Elementary School Infrastructure E-Rate School Year 20, $181,318.21**

It is recommended the Board approve the contract with Vector USA, for Meadowlark Elementary School, Infrastructure E-Rate School Year 20, in the amount of $181,318.21.

Moved by ____ Seconded by _____ Ayes ____ Nays ____ Absent____

6.0 CALENDAR

May 11, 2017	Regular Board Meeting, 7:30 p.m., District Office
May 25, 2017	Regular Board Meeting, 7:30 p.m., District Office

Action **7.0 ADJOURNMENT**

7.1 The Regular meeting of Board of Trustees adjourned at _____ p.m.

Moved by ____ Seconded by ____ Ayes ____ Nays____ Absent____

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April 21, 2017

Dr. Steve Budhraja
Chief Financial Officer
Acton-Agua Dulce Unified School District (AAUSD)
32248 Crown Valley Road
Acton, CA 93510

Dear Dr. Budhraja,

Subject: Acton-Agua Dulce Unified School District Ongoing Health and Benefits Consulting Contract –

The purpose of this letter is to confirm our recent conversations about the services BrightPath Consulting Services Inc, also known as BCS; dba BrightPath Employee Benefits and Insurance Services will provide for Acton-Agua Dulce Unified School District ("AAUSD"). Thank you for giving BCS the opportunity to work with you. As we discussed, this letter documents our fees/commission for the ongoing consulting services for the medical, dental, vision, life, disability and voluntary benefits program, which are more fully set forth in Exhibit A.

The services and fees included in this letter are set forth below, including any attached Exhibits and may be performed by us.

For completing the assignment outlined in this letter, Acton-Agua Dulce Unified School District (AAUSD) will pay to BCS a fee of $39,500 that will include any associated out-of-pocket expenses. The fee applies without regard to the amount of time that BCS spends on the assignment. This contract will expire on April 30, 2018 with the option to renew by the District for another year.

The fee will be paid by AAUSD to BCS based on the following schedule: first payment of $17,000 due on June 1, 2017, second payment is $12,500 due on November 1, 2017 and final payment of $10,000 due on February 1, 2018 for the first year of services.

BCS's goal is to procure insurance for you with insurance companies possessing the financial strength to perform in today's economic environment. Toward this objective, BCS regularly reviews publicly available information concerning an insurer's financial condition, including, but not limited to:

- Approvals by various regulatory authorities;
- Analyses of insurers by professional rating agencies such as A.M. Best, Standard and Poors,
- Moody's, and/or Fitch; and
- The input of our global affiliates and correspondents.

Most BCS placements are made with insurers that are rated "Excellent" by the professional rating agencies; however, BCS does not guarantee the solvency of any insurer. We encourage you to review the publicly available information made available by the various insurers and rating agencies.

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1042 N Mountain Ave, Suite B102, Upland, California 91786
Robert.Lacayo@brightpathcs.com
Cell (818) 438-6927 – fax (866) 288-1782 – website: brightpathcs.com

The decision to accept or reject an insurer will be made solely by you.

Change in Scope

Please be aware that requested changes to the "Exhibit A" in page 3 provided by BCS could result in an increase in fees and charges. Out-of-scope services will be discussed with AAUSD for prior approval in writing.

The services may be terminated for convenience by either party by providing ninety (90) days prior written notice. If this Agreement is terminated prior to its initial end date Acton-Agua Dulce Unified School District will be responsible for any incurred out-of-pocket expenses, fees and services rendered through the date of termination not to exceed $39,500.

With respect to any work or project, BCS retain all ownership rights to our existing and intellectual property, and any products thereof. AAUSD may internally use BCS's intellectual property for intended purposes during the term of our agreement. Each party agrees to treat the other's information as confidential. AAUSD agrees to only provide data (e.g., names of plan participants or beneficiaries) to BCS that is in compliance with U.S. trade statues, rules and regulates (e.g., OFAC).

BCS professional services does not in any case include legal, investment, or accounting services, and we are not a fiduciary to your plans. The services and work product provided by BCS hereunder are provided solely for your internal use; they are not intended to be used or relied upon by third parties.

Any disputes under this letter will be governed by the internal laws of California.

Please acknowledge your consent to these arrangements for this engagement by signing below. Please contact us with any questions or comments. Again, we look forward to working with you and your team.

Sincerely,

Robert Lacayo
Senior Vice President, Operations & Consulting

Accepted this __ day of _____, 20___ by Acton-Agua Dulce Unified School District.

By: _____

Name: _____ Title: _____

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Services to be Provided (Exhibit A)

Marketing Preparation	
• Two training sessions (either management or committee)	Included
• Strategic plan linking business objectives	Included
• Standard Benchmark cost/design	Included
• Benefit review	Included
• Data collection	Included
• Vendor review	Included
• Face-to-face meetings (as needed)	Included
Marketing	
• Medical	Included
• Dental	Included
• Vision	Included
• Life	Included
• Disability	Included
Results Presentations	
• Detailed marketing/renewal report	Included
• Budget projections	Included
• Network access and provider disruption analysis	Included
• Contribution modeling	Included
• Carrier financial ratings	Included
• Performance/rate guarantees (if applicable)	Included
• COBRA rates development	Included
• Finalist meetings and scorecard analysis	Included
• Best and final negotiations	Included
• Total and itemized costs	Included
Miscellaneous	
• Disclosure of all proposals and compensations	Included
• New carrier benefit summary review	Included
• Market selection approval	Included
• Medical/Rx utilization review	Included

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Services to be Provided (Exhibit A) – continued

Strategy	
• Strategic plan linking business objectives	Included
• Benchmark design/costs	Included
• Health Care Reform updates	Included
• Cost containment tactics	Included
• Executive/Board summary reports	Included
• Strategic planning	Included
• Action plan and service schedule	Included
Financials	
• Develop budget projections	Included
• Monitor/communicate budget variances	Included
• Contribution modeling	Included
• COBRA rate development	Included
• Alternate funding arrangement analysis	Included
• Actuarial impact of design changes	Included
• Financial reporting	Included
• Comprehensive medical/Rx utilization analysis	Included
Renewal	
• Trend data	Included
• Detailed renewal report	Included
• Total and itemized costs	Included
• Provide disruption analysis	Included
• Rate guarantees negotiations	Included
• Renewal negotiations	Included
• Carrier financial ratings	Included
• Vendor site visits	Included
• Disclosure of all renewals	Included

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Services to be Provided (Exhibit A) – continued

Ongoing Service	
• Carrier application preparation assistance	Included
• Enrollment meeting support/coordination	Included
• Contract review	Included
• Review vendor-created employee communications	Included
• Administrative arrangements (billing, banking, reporting, data)	Included
• Executive summary of final decisions	Included
• Schedule vendor service meetings	Included
• Issue resolution (claim, billing, eligibility)	Included
• Work plan for ongoing tasks/projects	Included
• Enrollment guide (printing additional cost) - up to 8 pages	Included
• Attending Benefit Committee meetings	Included
• Preparing agenda for the Benefit Committee meetings	Included
• Employee benefit surveys	Included
Contracts and Health Care Reform Support	
• Compliance review of SPD provisions, contracts, agreement, and documents	Included
• Health Care Reform updates	Included
• Health Care Compliance assistance	Included
Voluntary Benefits	
• Needs assessment	Included
• Employee enrollment assistance	Included
• Marketing and presentation	Included
Wellness	
• Wellness opportunity evaluation	Included
• Wellness and Open Enrollment Fairs including vendor contact and set up	Included

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1. Ownership and Control of Data and Work Product

(a) BCS has created, acquired or otherwise has rights in, and may, in connection with the performance of Services hereunder, employ, provide, modify, create, acquire or otherwise obtain rights in, various concepts, ideas, methods, methodologies, procedures, processes, know-how, and techniques (including, without limitation, function, process, system and data models); templates; software systems, user interfaces and screen designs; general purpose consulting and software tools; websites; benefit administration systems; and data, documentation, and proprietary information and processes ("BCS Information").

(b) All right, title and interest in and to any data, information and other materials furnished to BCS by Client hereunder ("Client Information") are and shall remain Client's sole and exclusive property. Client grants to BCS a license to use such Client Information to provide the Services. Except as provided below, upon full and final payment to BCS hereunder, any BCS work product which the parties expressly agree is created solely and exclusively to be owned by Client (the "Deliverables"), if any, shall become the property of Client. To the extent that any BCS Information is contained in any of the Deliverables, subject to the terms of this Agreement, BCS hereby grants to Client a paid-up, royalty-free, nonexclusive license to use such BCS Information solely for Client's internal use in connection with the Deliverables.

(c) To the extent that BCS utilizes any of its property, including, without limitation, the BCS Information, in connection with the performance of Services, such property shall remain the property of BCS and, except for the limited license expressly granted in the preceding paragraph, the Client shall acquire no right or interest in such property. Client will honor BCS copyrights, patents, and trademarks relating to Services, Deliverables and BCS Information, and will not use BCS's name or other intellectual property without BCS's prior written consent.

(d) Provided that Client promptly notifies BCS of a claim that the BCS Information infringes a presently issued U.S. patent or copyright, BCS will defend such claim at its expense and will indemnify Client for any costs and damages that may be awarded against Client in connection with such claim. BCS will not indemnify Client, however, if the claim of infringement results from (i) use of other than the most recent version of the BCS Information made available to Client by BCS; (ii) Client's alteration of the BCS Information; (iii) use of any BCS Information in combination with other software not provided by BCS; or (iv) improper use of BCS Information.

(e) Nothing contained in this Agreement will prohibit BCS from using any of its general knowledge or knowledge acquired under this Agreement (excluding Client's Confidential Information) to perform similar services for others.

2. Confidentiality

(a) For the purposes of this Agreement, "Confidential Information" includes: (i) the terms of this Agreement (including any Schedules); (ii) Client Information; (iii) BCS Information; (iv) oral and written information designated by a party as confidential prior to the other party obtaining access thereto; and (v) oral and written information which should reasonably be deemed confidential by the recipient whether or not such information is designated as confidential. Each party's respective Confidential Information will remain its sole and exclusive property.

(b) Each party will use reasonable efforts to cause its employees to minimize distribution and duplication and prevent unauthorized disclosure of the Confidential Information of the other party. Each party agrees that only employees who have a need to know the Confidential Information of the other party will receive such Confidential Information. No party will disclose the other party's Confidential Information to a third party without the prior written consent of the other party, which

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consent may be conditioned upon the execution of a confidentiality agreement reasonably acceptable to the owner of the Confidential Information, except that BCS may use Client's Confidential Information in combination with other data, including the disclosure of such information to third parties, provided that no such Client Confidential Information is identifiable by Client or Client employee and that either party may disclose the other party's Confidential Information to its legal counsel and auditors. BCS may also disclose Client's Confidential Information to any subcontractor or, as instructed by Client, to any other third party providing services to Client under this Agreement as reasonably necessary for such subcontractor or third party to perform its services, provided that any such subcontractor is subject to a confidentiality agreement. BCS may retain a copy of all Client Confidential Information for archival purposes.

(c) Confidential Information does not include information if and to the extent such information: (i) is or becomes generally available or known to the public through no fault of the receiving party; (ii) was already known by or available to the receiving party prior to the disclosure by the disclosing party; (iii) is subsequently disclosed to the receiving party by a third party who is not under any obligation of confidentiality to the party who disclosed the information; or (iv) has already been or is hereafter independently acquired or developed by the receiving party without violating any confidentiality agreement with or other obligation to the party who disclosed the information.

(d) The receiving party may disclose Confidential Information of the disclosing party if required to as part of a judicial process, government investigation, legal proceeding, or other similar process, provided that the receiving party has given prior written notice of such requirement to the disclosing party. Reasonable efforts will be made to provide this notice in sufficient time to allow the disclosing party to seek an appropriate confidentiality agreement, protective order, or modification of any disclosure, and the receiving party will reasonably cooperate in such efforts.

3. Representations and Responsibilities

(a) BCS represents that it: (i) shall, at all times during the term of this Agreement, remain in material compliance with all laws and regulations applicable to it as a service provider, including any required licenses, permits, or registrations, necessary for BCS to be able to perform the Services; and (ii) has no outstanding commitment or agreement to which it is a party or legal impediment of any kind known to it which is likely to limit, restrict, or impair the rights granted to Client hereunder. If a potential conflict should arise, BCS will discuss the situation with Client.

(b) Client will submit to BCS all Client Information in Client's control necessary for BCS to perform the Services covered by this Agreement. The Services are not of a legal nature, and BCS will in no event give, or be required to give, any legal opinion or provide legal representation to Client. Client will maintain in compliance with applicable law any and all benefit plan legal documents related to the Services. Client is responsible for the accuracy and completeness of any and all Client Information that is submitted to BCS. Client agrees to notify BCS as soon as possible of any problems or errors in Client Information submitted. Services performed by BCS in correcting such problems or errors are additional services for which additional fees will be payable.

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(c) BCS is not a fiduciary within the meaning of the Employee Retirement Income Security Act (ERISA) or other legislation. BCS has no discretion with respect to the management or administration of Client's employee benefit plans, and/or control or authority over any assets of Client's employee benefit plans, including the investment of those assets. All such discretion and control remain with Client and other fiduciaries to Client's employee benefit plans.

4. Liability/Indemnification

(a) BCS will correct its work product without additional charge if any errors or omissions occur in its work. BCS shall indemnify and hold Client harmless from and against any and all damages, losses and liabilities (collectively, a "Loss" or "Losses") arising from BCS's failure to comply with the applicable terms and conditions of this Agreement (regardless of whether such Loss is based on breach of contract, tort, strict liability, breach of warranty, failure of essential purpose or otherwise):

(i) for Losses arising from (aa) BCS's willful, fraudulent or criminal misconduct, (bb) bodily injury, including death, or damage to personal or real property, (cc) infringement by BCS Information pursuant to Section 1(d) hereof, and (dd) BCS's breach of its confidentiality obligations set forth in Section 2 hereof. Any claim under this Section 4(a) must be asserted before the date that is three (3) years following the act or omission giving rise to the claim.

(b) Subject to BCS's indemnity obligations in Sections 1(d) and 4(a), Client shall indemnify, defend, and hold BCS harmless from and against any and all Losses arising from (i) claims made by third parties, including, without limitation, Client's employees, affiliates, and plans with respect to the Services provided hereunder if such losses arise from Client's negligence or willful or criminal misconduct, or (ii) Client's failure to comply with the applicable terms and conditions of this Agreement, including without limitation, any infringement of BCS Information by Client in violation of Section 1 or any breach by Client of the confidentiality provisions of Section 2.

(c) In no event will either party be liable to the other party for incidental, consequential, special, or punitive damages (including loss of profits, data, business or goodwill, or government fines, penalties, taxes, or filing fees), regardless of whether such liability is based on breach of contract, tort, strict liability, breach of warranty, failure of essential purpose or otherwise, and even if advised of the likelihood of such damages.

(d) Notwithstanding the foregoing, as applicable to the Client and the Services, BCS will not be liable to Client for any amounts for which Client or any of its employee benefits plans would have been responsible to pay irrespective of any act, error or omission by BCS, including interest adjustments. Each of BCS and Client agrees to use reasonable efforts to mitigate its own, as well as the other party's, liability, damages, and other losses suffered in connection with this Agreement.

5. Dispute Resolution

Except where law prohibits, the following procedures shall be used in the event of any dispute or controversy arising out of or relating to this Agreement. All negotiations between the parties conducted pursuant to the dispute resolution process described herein (and any of the parties' submissions in contemplation hereof) shall be kept confidential by the parties and shall be treated by the parties and their respective representatives as compromise and settlement negotiations for purposes of the applicable court rules of evidence.

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(a) The parties shall attempt in good faith to resolve any dispute arising out of or relating to this Agreement promptly by negotiation between executives who have authority to settle the controversy and who are at a higher level of management than the persons with direct responsibility for administration of this Agreement. Either party may give the other party written notice of any dispute not resolved in the ordinary course of business. Within fifteen (15) days after delivery of the notice, the party receiving the notice shall submit to the other a written response.

(b) Within thirty (30) days after delivery of the notice, the designated executives shall meet at a mutually acceptable time and place, and thereafter as often as they reasonably deem necessary, to attempt to resolve the dispute. All reasonable requests for information made by one party to the other shall be honored in a timely fashion.

6. Insurance/Indemnity

(a) Coverage. BCS shall maintain, at all times during the term of this Agreement, the following minimum insurance coverages and limits:

(i) Workers' Compensation and related insurance as prescribed by the law of the state in which the Services are to be performed;

(ii) General Liability in the amount of $500,000 per occurrence and $1,000,000 in the aggregate; and

(iii) Professional Liability/Error & Emission in the amount of $1,000,000 per occurrence and $3,000,000 in aggregate.

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Acton-Agua Dulce Unified School District

Meadowlark Elementary School E-Rate Year 20

March 24, 2017

Prepared for:

Ty Devoe

Prepared by:

Ray Flores

Account Executive

SPIN 143020726

March 24, 2017

Acton- Agua Dulce Unified School District
ATTN: Ty Devoe
32248 Crown Valley Road
Acton, CA 93510

Dear Mr. Devoe,

Vector Resources, Inc. dba VectorUSA ("Vector") is pleased to submit our proposal in response to your RFP for Year 20 E-Rate. Please note that VectorUSA is responding to the **"AADUSD District Network Electronics 470# 170064043"**

We are uniquely qualified to handle this project due to our:

Proven Track Record – Vector is one of California's premiere network integration companies. We design, build and maintain efficient, manageable and flexible networks for some of the state's largest school districts. To date, Vector has been successful in providing all the equipment, labor and services to design, install, test and certify Local Area Networks (LAN's) at over a thousand (1000) public school sites throughout Southern California. Our company attributes its success to being self-sufficient; we are small enough to adapt to changes quickly yet large enough to handle sizeable projects. Our own employees will handle almost every aspect of this IT Upgrade project. Vector will also be responsible for the management and maintenance of any subcontractor relationships and their executed work.

Dependability – Vector has a $125 million project bonding capacity, an excellent corporate credit rating, and a customer reputation for executing all manner of network projects on time and on budget.

Capacity –With over 300 employees spread among 5 offices (3 in California, 1 in Arizona, 1 in Pennsylvania), Vector has the capacity to successfully execute all aspects of the Acton Agua Dulce Unified School District's project on time and under budget.

Cost-effectiveness – Vector is conscious of the limited funding available to school districts. We understand that every penny used is valuable and therefore design and build our networks in the most cost-effective manner possible.

Versatility – Although Vector's resume in the education space is without peer, our Company also executes enterprise-level technology projects for Fortune 500 Companies, global shipping and logistics companies, major research hospitals, and all varieties of small and medium-sized businesses.

Our employees will ensure the success of this project. Vector is a registered service provider with the Schools and Libraries Program, our SPIN is **143020726**. We also have Green Light Status with the FCC.

We look forward to the possibility of assisting Acton-Agua Dulce School District with the advanced technology initiatives that ultimately drive teaching and learning. We appreciate the opportunity to

submit this bid for your consideration, and stand ready to respond to any questions or requests for additional information.

Sincerely,

Ray Flores
Account Executive
T: +1 (310) 436-1197
C: +1 (310) 916-1922
rflores@vectorusa.com

TABLE OF CONTENTS

1. COMPANY INFORMATION

VectorUSA is one of America's premiere technology companies, designing, building and maintaining voice, data and video networks. With 29 years of experience and more than 350 employees, we work closely with our technical partners to provide customized solutions for public and private K12 and higher education schools, ports and terminals, hospitals, large and small commercial enterprises, and state, local, and federal agencies.

VectorUSA has been designing, installing and maintaining E-Rate projects since 2000. We are licensed under the State of California (Lic. 654046 – C7, C10, B) and the State of Arizona (Lic. 268250 – K-11, 268250 – KB-1) with an FCC ID number of 0012223764 and a SPIN of 143020726. VectorUSA is affiliated with a reputable contractor's license bonding company, workman's compensation insurance provider, commercial liability insurance provider and commercial vehicle insurance provider. VectorUSA is familiar with and is committed to complying with all current E-Rate program requirements, regulations, and conditions. Our vast experience and expertise in E-Rate projects, coupled with our deep technological training and certification, unite together seamlessly allowing VectorUSA to provide, install, and fully maintain a complete turn-key solution for our clients.

VectorUSA is proud to be an equal opportunity employer, will comply with the Equal Opportunity Employment Act. Vector will also comply with the Fair Labor Standards Act, and any other applicable State and Federal statutes applicable to the delivery of services under this RFP.

VectorUSA has not offered gratuities to any District employee with intention to secure favorable treatment with respect to this RFP. VectorUSA has no interest in any other organization that would conflict with our obligations to deliver services under this RFP.

VectorUSA's certifications and partnerships allow us to serve as a full service solution provider. Our business partners include: Ascom Wireless, APC, Aruba, Avaya, Axis, Cisco Systems, Corning, Extron, HP Networking, OnSSI, Sony, Sumitomo (Air-Blown Fiber), TE Connectivity, Tripp Lite, Vicon, and many others.

We understand the complex demands of today's dynamic technology environment. The breadth of our services and the depth of our expertise give us exceptional abilities to deliver the best network solutions for our customers. As VectorUSA expands our range of services, we continue to deliver smart technology solutions including Unified Communications and Collaboration, Innovative Infrastructure, Intelligent Surveillance, and Managed Solutions, helping businesses operate more securely and efficiently. No other network integration company performs for its customers with the speed, agility and responsiveness of VectorUSA - providing our customers with the power to connect people to information and the world.

2. PROJECT INFORMATION

VectorUSA is pleased to present **Acton-Agua Dulce Unified School District** with a proposal for the Meadowlark Elementary School E-Rate Year 20 project. This proposal includes the:

Specifications for the installation of new structured communication cabling

Specifications for the installation of new wireless mobility equipment

Specifications for the installation of uninterruptible power supplies

Specifications for the installation of new data networking equipment

Specifications for the installation of a new enterprise firewall

This proposal is based on information gathered/provided from E-Rate 470 Application Details, the RFQ, meetings and conversations, and our experience with similar types of projects. The proposal includes the furnishing of all materials, labor, transportation, tools, and incidentals necessary for the complete installation of all work specified within this document.

3. CABLE INFRASTRUCTURE

Horizontal

VectorUSA will install approximately (104) telecommunication outlets, equaling (172) Cat-6 cables for voice and data purposes at various locations throughout the site.

Total Cables - 172 Cat-6 cables Cable Hangers and Supports:
VectorUSA shall install cable hangers, J-hooks, or other supporting assemblies in order to properly secure and support all horizontal cables. Within the ceiling space, supports will be installed every 4-5 ft. or as needed.

No cables will be attached to support wire for ceiling tile grid, support assemblies for electrical conduits or the conduits themselves, or support assemblies for the fire protection.

IDF

For this project, (2) IDF's have been identified. The following applies to the IDF.

This proposal includes the installation of two (2) Wall Mount 24"x 24"x 30" deep cabinets replacing the existing wall mount cabinets.

The cabinets shall be braced to the floor/wall utilizing properly sized anchors and bolts.

All installed equipment shall be grounded to the telecommunications ground bus bar.

The General Contractor shall be responsible for providing a ground bus bar within the IDF.

Horizontal Wire Management
Horizontal wire managers will be provided for each patch panel.

The horizontal wire managers will be double sided (front and rear) and shall be 2 RMU in height.

The horizontal wire managers include snap-on hinged doors/covers.

The horizontal wire management will be black in color.

Plywood Backboard
VectorUSA shall provide (2) ¾ inch A/C fire-rated plywood backboard.

The plywood backboard will be painted with insulating fire-retardant white paint.

Fiber Backbone Installation

This proposal includes the installation of fiber optic backbone cables to each IDF. See the following for details:

(2) 6-Strand 50/125 MM OM4 Fiber Optic Cable

The cables shall be installed separately from the horizontal cables.

The cables shall be riser rated.

Where cables are housed in conduits or conduit sleeves, the backbone cables and horizontal cables will be installed separately.

Cable Hangers and Supports:
VectorUSA shall install cable hangers, J-hooks, cable tray (if applicable) or other supporting assemblies in order to properly secure and support all backbone cables. Within the ceiling space, supports will be installed every 4-5 ft. or as needed.

No cables will be attached to support wire for ceiling tile grid, support assemblies for electrical conduits or the conduits themselves, or support assemblies for the fire protections systems.

Fiber Optic Termination Hardware:

All strands of the fiber optic cable will be terminated with LC style connectors and dressed into rack mounted enclosures. The enclosures will utilize 6 port LC coupler panels.

A 1" riser rated innerduct will be installed to be utilized as the pathway for the fiber optic cable.

Testing and Labeling

Copper Testing:
All cables and termination hardware shall be tested.

All cables shall be tested in accordance with ANSI/TIA/EIA standards, manufacturer specifications and best industry practice.

All twisted pair copper cables links shall be tested for continuity, pair reversals, shorts, opens and performance as indicated for the type of cable installed.

This project includes the testing for Cat-6 cables.

All cables tested for data and voice applications will be recorded and submitted as part of a final documentation package.

Fiber Optic Testing:
All strands will be tested one way with Power Meter. All test results shall be documented and submitted with the final documentation package.

Documentation

Package Includes:
This project includes the delivery and submittal of:

1. Test results for all copper data cable(s)
   a. Summary
   b. Detail

2. Test results for all copper voice cable(s)
   a. Summary
   b. Detail

3. Test results for all fiber optic cables/strands
   a. Power-Meter

4. CAD drawing(s) – AutoCAD drawings depicting all work performed.
   a. Plan View
      i. Space layout with identification labels for all NEW work.

b. Backbone Diagram (TR to TR, Riser, Campus)
   i. Copper

5. Warranty Information
   a. VectorUSA 1-year warranty
   b. Manufacturer warranty - 25 year

Upon completion, one (1) hard copy set shall be delivered to the primary contact within one (1) week of completing the project. Soft copy drawings are available upon request.

Customer Responsibilities
If applicable/available, preliminary soft copy drawings must be provided by the customer in an AutoCAD format. Drawings must be provided three (3) days after approving the contract proposal/quote. Drawings must contain a core, a shell and a space layout of the most recent configuration.

4. DATA NETWORKING

VectorUSA will provide, configure, and install (1) HPE/Aruba 5406 Chassis and (2) Aruba 3810 48 port switches, with associated SFP+ transceivers at Meadowlark Elementary School.

This proposal includes the installation of (1) HPE/Aruba 5406 chassis switch to be installed and configured within the MDF. VectorUSA has configured the chassis to with the following equipment:

(3) 24-port 1gig PoE modules
(1) 20-port 1gig PoE/2-port 10gig SFP+ module
(1) 1100 Watt power supply

VectorUSA will use the 1gig PoE modules to support copper workstation cabling that terminates in the MDF. The 2-port 10gig SFP+ will provide connectivity for the edge switches that will be installed within the IDF's. See below for proposed switch breakdown:

IDF-1 (1) Aruba 3810 48 port switch w/ 4Port SFP+ Module & 680W Power Supply
IDF-2 (1) Aruba 3810 48 port switch w/ 4Port SFP+ Module & 680W Power Supply

VectorUSA will configure the switches with a basic configuration. The basic configuration will consist of assigning an IP address, user name and password for on-line and off-line access, set up of the default gateway, and 3 VLANs with prioritization for voice, wireless and data.

UPS Installation

VectorUSA will install each Tripp Lite UPS within the rack-mounted enclosures / cabinets / telecommunication racks in the appropriate MDF and IDF locations:

Location Model Number

MDF SMART3000RMXL2U with (1) BP48V24-2U Battery
IDF -1 SMART2200RMXL2U
IDF -2 SMART2200RMXL2U

*This proposal assumes that VectorUSA will use the existing 2-post rack within the MDF.

The SMART3000RMXL2UA SmartPro 120V 3kVA Line-Interactive Sine Wave UPS provides battery backup and AC power protection against blackouts, brownouts, power surges and line noise that can damage electronics or destroy data. Ideal for backing up servers and network storage devices, the SMART3000RMXL2UA switches to battery mode in milliseconds to keep your connected equipment running long enough to save files and shut down safely with no data loss.

Featuring eight NEMA 5-15/20R outlets (two independently switchable loadbanks) and a 10- foot power cord with 120V NEMA L5-30P input, the SMART1500RMXL2UA has an internal battery that provides 14 minutes of support at half load and 4.9 minutes at full load. A front- panel LCD screen lets you monitor important data, such as load level, voltage, battery charge and estimated runtimes.

The BP48V24-2U external battery pack extends the runtime of compatible Tripp Lite UPS Systems and its heavy gauge cabling provides a high-current DC connection. The external battery pack provides 31 minutes of support at half load and 11 minutes at full load.

The SMART2200RMXL2U SmartPro 120V 2.2kVA 2200kW Line-Interactive Sine Wave UPS provides battery backup and AC power protection against blackouts, brownouts, power surges and line noise that can damage electronics or destroy data. Ideal for backing up servers and network storage devices, the SMART2200RMXL2U switches to battery mode in milliseconds to keep your connected equipment running long enough to save files and shut down safely with no data loss.

Featuring four NEMA 5-15R outlets and four NEMA 5-20R outlets and a 10-foot power cord with 120V NEMA 5-20P input, the SMART2200RMXL2U has an internal battery that provides 12 minutes of support at half load and 4.5 minutes at full load. A front-panel LCD screen lets you monitor important data, such as load level, voltage, battery charge and estimated runtimes. Adding external battery packs, such as Tripp Lite's BP48V60RT-3U (sold separately), provides extended runtime.

VectorUSA will configure and install 1 SNMP Management Card within each UPS.

Tripp Lite's SNMPWEBCARD allows network users to operate any expansion slot-equipped Tripp Lite SmartPro or SmartOnline UPS as a managed device on the network. The card enables remote monitoring and control of UPS and site electrical conditions using the SNMP network management platform or a web browser and also provides remote viewing of site electrical data, UPS status information and self-test logs.

Testing
VectorUSA will test and ensure functionality of the UPS and the battery capacity under load at its Torrance facility.

Documentation
VectorUSA will provide documentation on the UPS devices as well as the SNMP Management cards including IP addresses for the management of the UPS systems.

5. WIRELESS MOBILITY

VectorUSA will provide, configure, and install (23) Aruba 325 Instant Access Points at various locations within Meadowlark Elementary School.

VectorUSA will install all access points at internal/external locations, defined prior to the installation of the communication cabling. Access points will be installed at ceiling mount locations and patched into the existing network cables.

6. ENTERPRISE FIREWALL

VectorUSA will provide, configure and install up to (1) Fortinet FortiGate FG-2000E Network Security Appliance for the district.

VectorUSA will configure the Network Security Appliance within the existing Acton Agua Dulce Unified School District network equipment infrastructure. This proposal assumes that the Fortinet appliance will reside between the internal Acton Agua Dulce USD LAN and the incoming WAN & ISP environments. The FG-2000E requires 2U of rack space and the appropriate power connection. VectorUSA is responsible for racking and powering/patching the Fortinet appliance at the site. Included with each FG-2000E are (2) 10GE SFP+ SR Transceivers. Cabling and any additional transceivers, if necessary, is the responsibility of the client.

Working with Acton Aqua Dolce USD IT staff, the Engineer will discuss and gather existing router and firewall configurations from the existing network equipment and use such information for the new Fortinet setup. Following the initial discovery and configuration, VectorUSA may enable features, as configuration time permits, such as: policy creation/enforcement, integration with existing RADIUS, AD/LDAP authentication, user profiles, newly implemented routing protocols, IPS, Web Filtering, Application Control, DLP, Antivirus, Antispam. Custom or new firewall policies, custom filtering/QoS profiles, ADOMs, etc. may require additional configuration available through a written change order.

VectorUSA will provide documentation regarding the Fortinet solution, including IP information, admin accounts including username/passwords, configuration settings and warranty & support documents.

Warranty/Maintenance

The Fortinet FortiGate Network Security Appliances come with a standard Fortinet manufacturer's hardware warranty of 1-year. See below for additional warranty and maintenance coverage included with the Fortinet Bundle.

FortiGuard & FortiCare - 1 Year Bundle Services

FortiGuard Security Subscription Services deliver dynamic, automated updates for Fortinet products. The Fortinet Global Security Research Team creates these updates to ensure up-to- date protection against sophisticated threats. Subscriptions include antivirus, intrusion prevention, web filtering, antispam, vulnerability and compliance management, application control, and database security services.

FortiCare Support Services provide global support for all Fortinet products and services. FortiCare support enables your Fortinet products to perform optimally through firmware and general upgrades. The support plans includes with 8x5 Comprehensive Support with Advanced Hardware (Next Business Day) replacement.

Configuration services, if requested at time of installation, will include enabling FortiGuard services. Advanced configuration, as detailed above in the scope of work, of the Security Appliance is not included as part of this proposal.

VectorUSA will remotely connect to each of the Fortigate appliances for initial configuration following physical install onsite.

7. CODES AND STANDARDS

All work performed on this project will be installed in accordance with IEEE 802.11 installation guidelines, the current edition of the NEC, NESC, Bicsi Telecommunications Distribution Methods Manual (TDMM), BICSI Cabling Installation Manual, and the latest issue of the ANSI/TIA/EIA Standards, along with all state/local codes and ordinances.

8. PROJECT TEAM

Installation Procedure
VectorUSA will establish a project team comprised of several individuals with relevant knowledge and experience. An experienced Project Manager/Coordinator will head the project team to ensure the project is on schedule and within budget.

In addition to the core project team, VectorUSA has over 350 employees with a full range of specialties that can be utilized to assist in the project as needed. Among these employee resources are VectorUSA's

quality control officials who will visit the project site throughout the duration of the project to ensure that the highest quality installation practices are being used.

VectorUSA recommends that the client create its own project team prior to the project's implementation. This team will work in conjunction with VectorUSA's team to determine the implementation schedule, establish policies and procedures, and decide how best to handle the distribution of information to client 's staff members, technical issues, training, device management and maintenance, and system maintenance.

9. PROJECT PARAMETERS

Access
VectorUSA has access to all areas required to perform the proposed scope of work in a timely manner.

Change Order
Any work that is added to or deleted from the original scope of this proposal and which alters the original costs or completion date must be agreed upon by both parties in the form of a written change order.

Delays
The client must provide five working days' advance notice of any factor that will delay this project or VectorUSA will issue a work stoppage change order. Additionally, idle time incurred by VectorUSA due to the absence of required escorts, clearance, permits, inability to enter the work place, delays by other trades or other factors beyond VectorUSA's control will be addressed with a written change order.

Work Days/Overtime
This work will be performed during Vector's regular standard business hours of 7:00 a.m. to 5:00 p.m. Pacific Standard Time, Monday through Friday, except holidays. Work outside of regular business hours is available, but requires a written change order.

Schedule
VectorUSA plans to implement this project in a continuous fashion or as outlined within the RFP. If any additional mobilization is required, as a result of a change in the project schedule, not caused by Vector, it will be addressed with a written change order.

Asbestos/Hazardous Materials
VectorUSA assumes that the installation teams will be working in areas that will not contain asbestos or any other hazardous material that would require additional time or alternative installation procedures.

It is the responsibility of the client to give written notification to VectorUSA, prior to the start of a project, of any asbestos contained material (ACMs) in or around the area of the project. In the event that ACMs are present prior to job commencement or if ACMs are encountered during the project, additional cost, damages and/or delays attributed to necessary procedures for working in this environment will be the responsibility of the client.

Adequate Room
The client must provide adequate room for the installation of the proposed termination hardwired at the station and in the communications closets.

Storage Area
The client will provide a secured storage area inside the building for VectorUSA's materials and tools.

Office Furniture
VectorUSA will not be responsible for disassembling or moving desks or other office furniture to gain proper access to perform installation tasks.

Ceiling Tile
VectorUSA exercises care in the removal, storage and reinstallation of existing (used) ceiling tiles; however, VectorUSA accepts no liability for any incidental damages that may result from the handling of ceiling tiles.

Existing Cable
VectorUSA has not confirmed that the existing cable infrastructure is usable (e.g. labeled, correct pin configurations, etc.). The client will be responsible for providing technician(s) (e.g. cable vendor) to troubleshoot any wiring issues that may arise during installation.

VectorUSA will troubleshoot or resolve in-house wire issues if requested by the client in the form of a written change order.

Existing Conduit
The client is responsible for ensuring that the existing conduit/pathway is free and clear from defects. If the conduit/pathway is not free and clear from defects, the client will be responsible for making it free and clear.

VectorUSA can assist with making the existing conduit/pathway free and clear if requested by the client in the form of a written change order.

Coring
If coring is necessary, it will be address with a written change order.

Add & Delete
Any additional work requested will be considered as separate work and addressed with a written change order. This proposal is not to be used as an "Add & Delete" schedule; it only applies to the work specified in the original RFP.

Defective Materials
If there is a delay and/or Vector is unable to perform its scope of work, due to problems with the existing hardware and/or materials provided by the client or other third parties, it will be addressed with a written change order.

Dial Tone/Data Circuits
It is the responsibility of the client to ensure that dial tone and data circuits are installed and operational in the communications room as needed. Time spent troubleshooting and correcting circuit issues will be addressed with a written change order.

Taxes
Taxes will be billed on tax rates and guidelines at time of invoice.

Extraordinary Service. Certain additional charges related to extraordinary levels of support or out of pocket costs incurred by VectorUSA, through no fault of its own, will be reimbursable by Acton-Agua Dulce Unified School District under this agreement.

Examples of costs reimbursable under this section include, but are not limited to; 1) shipping expenses related to unusual site handling expenses (e.g. extra distance, no loading dock, extra stairs, extra demurrage charges), 2) storage or special handling expenses incurred if an installation site is not able to accept delivery as scheduled, 3) expenses incurred by VectorUSA to resolve network compatibility issues caused by Acton-Agua Dulce Unified School District's election to substitute non-VectorUSA provided equipment or services, and 4) expenses incurred by VectorUSA for additional installation time and/or materials caused by a site not being prepared as called for in this proposal.

VectorUSA shall promptly notify Acton-Agua Dulce Unified School District in writing of such charges. Notification will be provided, when feasible, prior to the incurrence of such charges, unless circumstances preclude such prior written notification (by way of example, but not limited to, unusual site handling charges). Provided the incurrence of such charges is not due to VectorUSA's fault or negligence,

VectorUSA shall be entitled to an equitable adjustment in the prices herein, the delivery schedule, or both to reflect such charges and any related delay.

Proprietary Information. The information contained in this document is proprietary to VectorUSA and intended to be used as evaluative and/or bidding information only. No part of this document may be disclosed, reproduced and/or distributed to anyone except the listed recipients within this package without written permission from VectorUSA.

10. DETAILED PRICING

AADUSD UNIFIED SCHOOL DISTRICT RFQ NO: Meadowlark 01 (2017/2018) **DUE DATE: March 24, 2017 3:00 PM PST PRICING FOR SECTION: All**

DISTRICT CONTACT: Ty Devoe, Director of Technology **EMAIL: tdevoe@aadusd.k12.ca.us**

Please provide pricing in the following format by individual section and site.

QTY	UNIT	DESCRIPTION	MODEL	MANUFACTURER	UNIT COST	EXTENDED COST	E-RATE ELIGIBILITY %	TOTAL E-RATE ELIGIBLE COST	TOTAL E-RATE INELIGIBLE COST
29000	ft	Cat6 Riser	219560-6	Amp	$ 0.17	$ 4,930.00	100%	$ 4,930.00	
2000	ft	Cat6 indoor/outdoor	M58772	Mohawk	$ 0.51	$ 1,020.00	100%	$ 1,020.00	
600	ea	Misc. Cable Support		VectorUSA	$ 3.38	$ 2,026.50	100%	$ 2,026.50	
120	linear ft	2400 Surface Raceway		Wiremold	$ 6.12	$ 734.40	100%	$ 734.40	
180	linear ft	4000 Surface Raceway		Wiremold	$ 12.36	$ 2,224.80	100%	$ 2,224.80	
172	ea	Cat6 Insert Blue	1375055-6	Amp	$ 6.80	$ 1,169.60	100%	$ 1,169.60	
68	ea	4 Port Faceplate White	2111024-3	Amp	$ 1.50	$ 102.00	100%	$ 102.00	
36	ea	2 Port Surface Mount Box	1933668-3	Amp	$ 3.54	$ 127.44	100%	$ 127.44	
8	ea	24 Port Cat6 Patch Panel	1375014-2	Amp	$ 158.40	$ 1,267.20	100%	$ 1,267.20	
8	ea	2RMU Wire Management	WMPH2E	Panduit	$ 55.20	$ 441.60	100%	$ 441.60	
172	ea	Testing and Labeling		VectorUSA	$ 0.30	$ 51.60	100%	$ 51.60	
172	ea	CAD Documentation		VectorUSA	$ 0.30	$ 51.60	100%	$ 51.60	
1500	ft	6 Strand OM4 Fiber	DX006DALE9QR	OCC	$ 0.78	$ 1,170.00	100%	$ 1,170.00	
150	ft	1" Riser Innerduct	24108T	Carlon	$ 0.47	$ 70.50	100%	$ 70.50	
125	ea	2" J Hook	CAT32HP	Erico	$ 2.22	$ 277.50	100%	$ 277.50	
1	ea	2U Fiber Enclosure	CCH-02U	Corning	$ 214.28	$ 214.28	100%	$ 214.28	
2	ea	1U Fiber Enclosure	CCH-01U	Corning	$ 180.22	$ 360.44	100%	$ 360.44	
4	ea	6 Port LC Coupler Panel	CCH-CP06-E4	Corning	$ 41.30	$ 165.20	100%	$ 165.20	
24	ea	LC Fiber Connector	95-051-98-Sp-X	Corning	$ 4.00	$ 96.00	100%	$ 96.00	
12	ea	Fiber Testing & Labeling		VectorUSA	$ 0.60	$ 7.20	100%	$ 7.20	
172	ea	3Ft Cat6 Patch Cord	1933118-3	Amp	$ 6.60	$ 1,135.20	100%	$ 1,135.20	
46	ea	10ft Cat6 Patch Cord	1-1933118-0	Amp	$ 8.16	$ 375.36	100%	$ 375.36	
6	ea	2m LC/LC Fiber Patch Cord			$ 28.80	$ 172.80	100%	$ 172.80	
23	ea	IAP-315 Access Point	JW327A	Aruba	$ 725.40	$ 16,684.20	100%	$ 16,684.20	
23	ea	AP Mounting Kit	JW048A	Aruba	$ 37.05	$ 852.15	100%	$ 852.15	
1	ea	3000VA UPS	SMART3000RMXL2U	Tripp-Lite	$ 1,109.21	$ 1,109.21	100%	$ 1,109.21	
1	ea	Battery Pack for 3000VA	BP48V24-2U	Tripp-Lite	$ 506.32	$ 506.32	0%		$ 506.32

2	ea	2200VA UPS	SMART2200RMXL2U	Tripp-Lite	$ 973.22	$ 1,946.44	100%	$ 1,946.44	
2	ea	2 Post RM Install Kit	2POSTRMKITWM	Tripp-Lite	$ 70.19	$ 140.38	100%	$ 140.38	
3	ea	Card for UPS Management	SNMPWEBCARD	Tripp-Lite	$ 208.24	$ 624.72	100%	$ 624.72	
100	linear ft	Conduit Pathway		VectorUSA	$ 15.32	$ 1,532.45	100%	$ 1,532.45	
1	ea	5406 Chassis	J9821A	Aruba	$ 1,632.07	$ 1,632.07	100%	$ 1,632.07	
1	ea	1100W Power Supply	J9829A	Aruba	$ 829.20	$ 829.20	100%	$ 829.20	
1	ea	4 Post Rackmount Kit	J9852A	Aruba	$ 269.21	$ 269.21	100%	$ 269.21	
3	ea	24Port PoE+ Module	J9534A	Aruba	$ 2,428.21	$ 7,284.63	100%	$ 7,284.63	
1	ea	24port PoE+/2port SFP+ Blade	J9536A	Aruba	$ 2,123.71	$ 2,123.71	100%	$ 2,123.71	
2	ea	48port PoE+ switch/4Port SFP+ Module/680W Power supply Bundle	JL428A	Aruba	$ 4,220.90	$ 8,441.80	100%	$ 8,441.80	
4	ea	10G SFP+ Tranceiver	J9150A	Aruba	$ 481.55	$ 1,926.20	100%	$ 1,926.20	
1	ea	Fortigate-2000E + Forticare + Fortiguard 1 Year 8x5	FG-2000E-BDL-USG	Fortinet	$ 43,942.51	$ 43,942.51	73%	$ 31,963.78	$ 11,978.73
1	ea	QuadraRack Server Frame	15053-703	CPI	$ 723.10	$ 723.10	100%	$ 723.10	
2	ea	Vertical Wire management	WMPV45E	Panduit	$ 201.60	$ 403.20	100%	$ 403.20	
2	ea	Wall Mounted Cabinet	12419-724	CPI	$ 607.64	$ 1,215.28	100%	$ 1,215.28	
3	ea	Misc. Cabinet Mounting Materials		VectorUSA	$ 86.13	$ 258.40	100%	$ 258.40	
20	ft	12" Cable Runway	10250-712	CPI	$ 9.00	$ 180.00	100%	$ 180.00	
2	ea	Rack/Runway Mounting Plate	10595-712	CPI	$ 31.92	$ 63.84	100%	$ 63.84	
2	ea	Wall Angle Support	11421-712	CPI	$ 23.22	$ 46.44	100%	$ 46.44	
3	ea	Cabinet/Rack Grounding		VectorUSA	$ 34.03	$ 102.10	100%	$ 102.10	
1	ea	Freight/Shipping		VectorUSA	$ 97.50	$ 97.50	100%	$ 97.50	
Describe Standard Manufacturer Warranty Description and any associated costs:									

					SUB-TOTAL		$ 98,641.23	$ 12,485.05
					SALES TAX		$ 10,001.37	
					SHIP/ HANDLING		$ 97.50	
					Installation/Configuration		$ 51,733.27	
					Professional Services		$ 8,360.00	
					TOTAL COST		$ 181,318.42	

DELIVERY TIME: 14 Business days **PAYMENT TERMS:** Progress bill, due Net 30 **DATE:** 3/24/2017 **E-RATE SPIN #:** 143020726

COMPANY NAME: Vector Resources, Inc. dba VectorUSA **REPRESENTATIVE NAME:** Ray Flores

ADDRESS: 3530 Voyager Street, Torrance, CA 90503 **PHONE NO.:** (310) 436-1197

EMAIL: rflores@vectorusa.com

11. SIGNATURE PAGE

7) **PROCUREMENT OF ADDITIONAL GOODS AND/OR SERVICES/COTERMINOUS EXPIRATION**

During the term of any Agreement resulting from this RFQ, the District may elect to procure additional or like goods and/or services offered by the Respondent. Such services shall be negotiated and obtained via an official amendment to this Agreement and approval by the District's Governing Board. All terms, conditions, warranties, obligations, maintenance and support of said goods or services shall have a coterminous expiration date with the original date of this Agreement. The District shall not enter into a separate Agreement for said goods or services. Respondents must state in their proposal that they acknowledge, accept and are in agreement with coterminous expiration conditions.

I, the undersigned, as an authorized agent of Vector Resources, Inc. dba VectorUSA (Service Provider Name), hereby certify that I have read the E-rate Supplemental Terms and Conditions, am fully compliant and intend to cooperate with the E-rate process as outlined above. Signature: _____ Title: Executive Vice President Phone Number: (310) 436-1002 Email: rmessinger@vectorusa.com Service Provider Name: VectorUSA

Right to Reject Any and All Quotes

The Applicant reserves the right to reject any or all quotation submittals and to waive any informalities or regularities. The Service Provider's quotation submission is recognition of this right.

In addition, the Applicant reserves the right to fund, (proceed with project or purchase) or not to fund, regardless of E-Rate approval.

Trade Names and Alternatives

For convenience in designation on the plans or in the specifications, certain articles or materials to be incorporated in the work may be designated under a trade name or in the name of a manufacturer. Whenever in specifications any materials, process, or article is indicated or specified by grade, patent, or proprietary name or by name of manufacturer, such specification shall be deemed to be used for the purpose of facilitating description of material, process or article desired and shall be deemed to be followed by the words "or equal," and service provider may, unless otherwise stated, offer any material, process or article which shall be substantially equal or better in every respect to that so indicated or specified. If material, process or article offered by service provider is not, in opinion of the District, substantially equal or better in every respect to that specified, then service provider shall furnish material, process or article specified. Burden of proof as to equality of any material, process or article shall rest with service provider. Without such documentation, the District cannot accept the argument on functionality equivalent or better based on cost alone. Products must be compatible with existing systems. Service Provider shall submit request together with substantiating data for substitution of any "or equal" item within the sealed bid packet at the closing of bids. Provision authorizing submission of "or equal" justification data shall not in any way authorize an extension of time for performance of this contract.

Please note. All "or equal" components must not void and must be supported by corresponding manufacture warranty.
District retains the right to be sole judge as to whether equivalency has been proven and whether alternatives will be accepted.

12. REFERENCES

Education Projects

VectorUSA is pleased to provide extensive references demonstrating our experience designing, installing, and maintaining LAN systems for many large school districts located throughout Southern California. The list below also includes references for several multi-year, District-wide, E-rate basic maintenance contracts.

1. Project Owner: Los Angeles Unified School District
   Contact Person: Dr. James Alther
   Phone Number: (213) 241-1800
   Email Address: jalther@lausd.net
   Address: 333 South Beaudry Avenue, Los Angeles CA 90017

Name of Project: LAUSD Y15-Y19 Basic Maintenance

Initial contract value: $2,000,000 to $2,500,000 annually
Final contract value: contract is in progress
Liquidated damages: None
Original completion date: June 30, 2017
Date completed: in progress
Period of Performance: July 1, 2015 - June 30, 2017

Project Overview
VectorUSA provides comprehensive maintenance services for Local Area Network (LAN), Wireless Local Area Network (WLAN) and Voice over IP (Services) at over 800 LAUSD schools throughout the greater Los Angeles area. Services include structured cabling and network/wireless/voice systems troubleshooting, diagnosis and remediation, and hardware/software repair or replacement software to restore networking services to schools within designated Service Level Agreement (SLA) times.

2. Project Owner: San Diego Unified School District
   Contact Person: Mike Watts
   Phone Number: (858) 637-6296
   Email Address: mwatts@sandi.net
   Address: 4860 Ruffner Street, San Diego CA 92111
   Designer: VectorUSA, (310) 436-1000

Name of Project: E-Rate Year 15

Initial contract value: $45,015,022.06
Liquidated damages: None
Original completion date: September 30, 2017
Date completed: Still in Progress
Period of Performance: August 26, 2013 – September 30, 2017

Project Overview
Vector has or will design, install and configure LANs at 69 schools throughout the District. This includes design and installation of communications pathways, cabinets, and copper and fiber cabling infrastructure in compliance with current District specifications. Vector has or will design, install and configure complete WLAN systems at the 69 campuses in compliance with current District specifications. Vector will also provide, install and configure all routers and switches located in each campus' MDF, IDF, BDF, and CDF. Vector will also implement IP addressing schemes for VLANs at each campus. Additionally the current VoIP system will be expanded at over 15 of the sites; Vector developed a standard implementation for remote site survivability and PSTN access configuration at each site. Vector will provide the SDUSD Information Technology Department hard and soft copies of comprehensive as-built CAD drawings. Vector will also submit fiber optic cable, CAT6 copper cable and wireless LAN performance test results and network diagrams in hard-copy and on CD.

3. Project Owner: San Diego Unified School District
Contact Person: Mike Watts
Phone Number: (858) 637-6296
Email Address: mwatts@sandi.net
Address: 4860 Ruffner Street, San Diego CA 92111
Designer: VectorUSA, (310) 436-1000

Name of Project: SDUSD 2009 Prop S Technology Upgrade

Initial contract value: $35,900,000.00
Final Contract Value: $36,451,986.89
Liquidated damages: None
Original completion date: June 30, 2012, extended to September 30, 2015
Date completed: June 30, 2014
Period of Performance: April 1, 2009 – June 30, 2012, extended to September 30, 2015

Project Overview
Vector has or will design, install and configure LANs at 62 schools throughout the District. This includes design and installation of communications pathways, cabinets, and copper and fiber cabling infrastructure in compliance with current District specifications. Vector has or will design, install and configure complete WLAN systems at 62 campuses in compliance with current District specifications. Vector also provided, installed and configured all routers and switches located in each campus' MDF, IDF, LDF, and CLDF. Vector also implemented IP addressing schemes for VLANs at each campus. The current VoIP project will expand IP telephony at 53 sites; Vector developed a standard implementation for remote site survivability and PSTN access configuration at each site. Vector will provide the SDUSD Information Technology Department hard and soft copies of comprehensive as-built CAD drawings. Vector will also submit fiber optic cable, CAT6 copper cable and wireless LAN performance test results and network diagrams in hard-copy and on CD.

4. Project Owner: Anaheim City Schools
Contact Person: Jim Giordano
Phone Number: (714) 517-7532 x4173
Email Address: jgiordano@acsd.k12.ca.us
Address: 1001 South East Street, Anaheim CA 92805
Designer: Collaboration of Anaheim City Schools and Mark Allen, VectorUSA

Name of Project: ACSD Y14 – All Schools
Initial contract value: $2,410,470
Final contract value: $2,120,490.74
Liquidated damages: None
Original completion date: June 30, 2012; extended to Sept 30, 2016
Date completed: February 3, 2016
Period of Performance: June 1, 2011 – Sept 30, 2012; extended to Sept 30, 2016

Project Overview
Vector is in the process of designing, installing and configuring WLAN systems at 26 campuses in compliance with current District specifications. Other projects associated with this contract include miscellaneous cabling, high speed electronics, PRI upgrades, Firewall upgrades and e-mail storage.

5. Project Owner: Jurupa Unified School District Y18
Contact Person: April Devlin
Phone Number: (951) 360-4102
Email Address: april_devlin@jusd.k12.ca.us
Address: 4850 Pedley Road, Riverside, CA 92509
Designer: VectorUSA, (310) 436-1000

Name of Project: E-Rate Year 18 Design and Engineering

Initial contract value: $5,220,395.17
Final contract value: $8,071,357.44
Liquidated damages: None
Original completion date: September 30, 2016
Date completed: September 30, 2016
Period of Performance: June 1, 2015 – September 30, 2016

Project Overview
Vector is providing network infrastructure upgrades at 18 district schools. The project includes all necessary labor, tools, materials, and equipment per the specifications included in the bid packet.

6. Project Owner: Escondido Unified School District Y18
Contact Person: Mike Malone
Phone Number: (760) 432-2145
Email Address: mmalone@eusd.org
Address: 2310 Aldergrove Avenue, Escondido CA 92029

Name of Project: E-Rate Year 18 Technology Infrastructure Upgrade

Initial contract value: $7,431,226.11
Final contract value: contract is in progress
Liquidated damages: None
Original completion date: June 1, 2017
Date completed: in progress
Period of Performance: April 1, 2015 – June 1, 2017

Project Overview
Vector is replacing aging network electronics (switch/wireless components and related equipment). Our solution includes the design, engineering, equipment procurement, configuration and installation, testing, and basic training necessary at 15 E-rate-eligible sites. The WLAN solution will provide an easy to use and flexible interface which will allow District IT personnel to maintain and configure a complete network. In addition, the solution will establish a secure and reliable network within each campus and between schools for collaboration and the exchange of information.

7. Project Owner: Rialto Unified School District Y18
Contact Person: Beth Ann Scantlebury
Phone Number: (909) 820-7700 x2601
Email Address: bscantle@rialto.k12.ca.us
Address: 260 S. Willow Avenue, Rialto CA 92376
Designer: VectorUSA, (310) 436-1000

Name of Project: E-Rate Year 18

Initial contract value: $5,988,254.31
Final contract value: contract is in progress
Liquidated damages: None
Original completion date: June 30, 2016
Date completed: in progress
Period of Performance: June 2, 2015 – September 30, 2016

Project Overview
Vector is upgrading existing computer networks at 25 school sites and the district office; sites will be replaced with 10GB based backbone, capable of supporting future backbone transmission rates.

8. Project Owner: Victor Valley Community College
Contact Person: Tim Isbell
Phone Number: (760) 245-4271 x2488
Email Address: Tim.Isbell@vvc.edu
Address: 18422 Bear Valley Road, Victorville CA 92395
Designer: VectorUSA, (310) 436-1000

Name of Project: Audio Visual Ramp-Up Project

Initial contract value: $2,963,603.65
Final contract value: $2,938,998.99
Liquidated damages: None
Original completion date: March 1, 2016
Date completed: August, 2016
Period of Performance: February 17, 2015 – March 1, 2016

Project Overview
VectorUSA provided electronic equipment, custom software and installation services for approximately 31 Immersive Conference Classrooms (ICC), one Portable Field Unit (PFU), one Mobile Unit (MU), one System Bridge (SB), and one System Management Console (SMC) for the California Career Pathways Trust Immersive Conference Classroom project. This project encompasses classrooms that are located throughout San Bernardino, Kern and Los Angeles Counties to include Community Colleges, K-12 and Charter school Districts.

Equipment being installed include the following: Touch Panel Control Systems, Screens, LCD Projectors, DVD and document camera Units, Microphone and Sound Reinforcements, Classroom Area Microphones, Surround Sound Systems, and Stage Console/Podiums. Personnel training is also included in this project. Following the installation, there is a 3 year service contract with the possibility of one year renewals. This contract covers 24 hour response time for any system malfunctions, one on-site preventative maintenance call per month and labor for warranty repairs.

9. Project Owner: Los Angeles Unified School District
Contact Person: Dr. James Alther, Director of LAUSD E-Rate Projects
Contact Number: (213) 241-1800; jalther@lausd.net
Address: 333 South Beaudry Avenue, Los Angeles CA 90017
Designer: VectorUSA, (310) 436-1000

Name of Project: LAUSD RFP 1082 LAN Modernization

Package 3: 14 schools
Initial contract value: $10,740,449.51
Final contract value: $10,740,446.77
Liquidated damages: None
Original completion date: June 30, 2014
Date completed: December 30, 2014
Period of Performance: July 1, 2012 – June 30, 2014, extended to September, 2015

Project Overview
Vector designed, installed and configured Local Area Networks (LAN) at many schools throughout the District. This included design and installation of communications pathways, cabinets, copper and fiber cabling infrastructure in compliance with current District specifications. Vector designed, installed and configured of complete Wireless LAN (WLAN) systems at each campus in compliance with current

District specifications. LAN duties included installation and configuration of routers and switches located in each campus' Main Distribution Frame (MDF), Intermediate Distribution Frames (IDF), Local Distribution Frames (LDF), and Classroom Local Distribution Frames (CLDF). Vector implemented IP addressing schemes for Virtual Local Area Networks (VLANs) at each campus. Vector provided to the LAUSD Information Technology Department hard and soft copies of comprehensive as-built CAD drawings of each campus' newly installed network utilizing EIA/TIA symbols and naming conventions. Vector also submitted fiber optic cable, CAT5E copper cable and wireless LAN performance test results and network diagrams in hard-copy and on CD, and developed and conducted LAN Systems Operation and Maintenance training classes for LAUSD employees as required. Vector was also responsible for LAN maintenance throughout the build period at each school site.

10. Project Owner: Los Angeles Unified School District
Contact Person: Dr. James Alther, Director of LAUSD E-Rate Projects
Contact Number: (213) 241-1800; jalther@lausd.net
Address: 333 South Beaudry Avenue, Los Angeles CA 90017
Designer: VectorUSA, (310) 436-1000

Name of Project: LAUSD 2012 LAN Modernization

Contract Package 1 1200203 - 27 schools
Initial contract value: $17,035,297.28
Final contract value: $15,659,325.43
Liquidated damages: None
Original completion date: Sept 30, 2013; extended to 2015
Date completed: October 8, 2015
Period of Performance: July 1, 2012 – Sept 30, 2013; extended to September, 2015

Contract Package 2 1200204 - 29 schools
Initial contract value: $13,843,798.57
Final contract value: $13,469,742.27
Liquidated damages: None
Original completion date: Sept 30, 2013; extended to June 30, 2014
Date completed: August 3, 2015
Period of Performance: July 1, 2012 – Sept 30, 2013; extended 2015

Contract Package 3 1200205 - 23 schools
Initial contract value: $15,887,700.56
Final contract value: $15,308,892.12
Liquidated damages: None
Original completion date: Sept 30, 2013; extended to June 30, 2014
Date completed: August 13, 2015
Period of Performance: July 1, 2012 – Sept 30, 2013; extended to 2015

Contract Package 4 1200206 - 25 schools
Initial contract value: $18,532,892.59
Final contract value: $17,147,231.44
Liquidated damages: None
Original completion date: Sept 30, 2013; extended to June 30, 2014
Date completed: October 14, 2015
Period of Performance: July 1, 2012 – Sept 30, 2013; extended to 2015

Project Overview
Vector designed, installed and configured Local Area Networks (LAN) at many schools throughout the District. This included design and installation of communications pathways, cabinets, copper and fiber cabling infrastructure in compliance with current District specifications. Vector designed, installed and configured complete Wireless LAN (WLAN) systems at each campus in compliance with current District specifications. LAN duties included installation and configuration of routers and switches located in each campus' Main Distribution Frame (MDF), Intermediate Distribution Frames (IDF), Local Distribution Frames (LDF), and Classroom Local Distribution Frames (CLDF). Vector implemented IP addressing schemes for Virtual Local Area Networks (VLANs) at each campus. Vector provided to the LAUSD Information Technology Department hard and soft copies of comprehensive as-built CAD drawings of each campus' newly installed network utilizing EIA/TIA symbols and naming conventions.

11. Project Owner: Los Angeles Unified School District
Contact Person: Dr. James Alther, Director of LAUSD E-Rate Projects
Contact Number: (213) 241-1800; jalther@lausd.net
Address: 333 South Beaudry Avenue, Los Angeles CA 90017
Designer: VectorUSA, (310) 436-1000

Name of Project: LAUSD 2011 LAN Modernization
Package 1: 31 schools; Package 2: 26 schools

Contract Package 1 (90%) 1200008
Initial contract value: $21,049,610.29
Final contract value: $21,049,232.32
Liquidated damages: None
Original completion date: Sept 30, 2012, extended to Sept 30, 2014
Date completed: December 30, 2013
Period of Performance: Sept 26, 2011 – April 15, 2014

Contract Package 2 (87%) 1200009
Initial contract value: $18,880,893.94
Final contract value: $ 18,727,820.68
Liquidated damages: None
Original completion date: Sept 30, 2012
Date completed: Sept 23, 2014
Period of Performance: December 21, 2011 – Sept 30, 2012, extended to Sept 30, 2014

Project Overview
Vector designed, installed and configured Local Area Networks (LAN) at many schools throughout the District. This includes design and installation of communications pathways, cabinets, copper and fiber cabling infrastructure in compliance with current District specifications. Vector designed, installed and configured the complete Wireless LAN (WLAN) systems at each campus in compliance with current District specifications. LAN duties include installation and configuration of routers and switches located in each campus' Main Distribution Frame (MDF), Intermediate Distribution Frames (IDF), Local Distribution Frames (LDF), and Classroom Local Distribution Frames (CLDF). Vector is implementing IP addressing schemes for Virtual Local Area Networks (VLANs) at each campus. Vector provides to the LAUSD Information Technology Department hard and soft copies of comprehensive as-built CAD drawings of each campus' newly installed network utilizing EIA/TIA symbols and naming conventions. Vector also submits fiber optic cable, CAT5E copper cable and wireless LAN performance test results and network diagrams in hard-copy and on CD, and develops and conducts LAN Systems Operation and Maintenance training classes for LAUSD employees as required. Vector is also responsible for LAN maintenance throughout the build period at each school site.

12. Project Owner: Los Angeles Unified School District
Contact Person: Dr. James Alther, Director of LAUSD E-Rate Projects
Contact Number: (213) 241-1800; jalther@lausd.net
Address: 333 South Beaudry Avenue, Los Angeles CA 90017
Designer: VectorUSA, (310) 436-1000

Name of Project: LAUSD 2008 LAN Modernization; Package 2: 62 Schools

Contract Package #2 (86%) 0850111
Initial contract value: $19,279,846.43
Final contract value: $19,064,513.84
Liquidated damages: None
Original completion date: Sept 30, 2009, extended to Sept 30, 2010
Date completed: Sept 30, 2010
Period of Performance: July 1, 2008 – Sept 30, 2010

Project Overview
Vector designed, installed and configured Local Area Networks at many schools throughout the District. This includes design and installation of communications pathways, cabinets, and copper and fiber cabling infrastructure in compliance with current District specifications. Vector also has designed, installed and configured of complete Wireless LAN (WLAN) systems at each campus in compliance with current District specifications. Local Area Network duties included installation and configuration of Routers and switches located in each campus' Main Distribution Frame (MDF), Intermediate Distribution Frames (IDF), Local Distribution Frames (LDF), and Classroom Local Distribution Frames (CLDF). Vector implemented IP addressing schemes for Virtual Local Area Networks (VLANs) at each campus. Vector provided to the LAUSD Information Technology Department hard- and soft-copies of comprehensive as-built CAD drawings of each campus' newly installed network utilizing EIA/TIA symbols and naming conventions. Vector also submitted fiber optic cable, CAT5E copper cable and wireless LAN performance test results and network diagrams in hard-copy and on CD, and developed and conducted

LAN Systems Operation and Maintenance training classes for LAUSD employees as required. Vector was also responsible for LAN maintenance throughout the build period at each school site.

13. Project Owner: Los Angeles Unified School District
Contact Person: Dr. James Alther, Director of LAUSD E-Rate Projects
Contact Number: (213) 241-1800; jalther@lausd.net
Address: 333 South Beaudry Avenue, Los Angeles CA 90017
Designer: VectorUSA, (310) 436-1000

Name of Project: LAUSD 2007 LAN Modernization; Package 4: 35 Schools

Contract Package #4 (86%) 0800007
Initial contract value: $42,309,167.45
Final contract value: $29,978,128.34
Liquidated damages: None
Original completion date: June 30, 2009, extended to Sept 30, 2010
Date completed: Sept 30, 2010
Period of Performance: October 1, 2007 – Sept 30, 2010

Project Overview
Vector designed, installed and configured Local Area Networks at many schools throughout the District. This includes design and installation of communications pathways, cabinets, and copper and fiber cabling infrastructure in compliance with current District specifications. Vector also has designed, installed and configured of complete Wireless LAN (WLAN) systems at each campus in compliance with current District specifications. Local Area Network duties included installation and configuration of Routers and switches located in each campus' Main Distribution Frame (MDF), Intermediate Distribution Frames (IDF), Local Distribution Frames (LDF), and Classroom Local Distribution Frames (CLDF). Vector implemented IP addressing schemes for Virtual Local Area Networks (VLANs) at each campus. Vector provided to the LAUSD Information Technology Department hard- and soft-copies of comprehensive as-built CAD drawings of each campus' newly installed network utilizing EIA/TIA symbols and naming conventions. Vector also submitted fiber optic cable, CAT5E copper cable and wireless LAN performance test results and network diagrams in hard-copy and on CD, and developed and conducted LAN Systems Operation and Maintenance training classes for LAUSD employees as required. Vector was also responsible for LAN maintenance throughout the build period at each school site.

14. Project Owner: Green Dot Public Schools
Contact Person: Kevin Keelen
Contact Number: (323) 565-16901 kevin.keelen@greendot.org
Address: 1149 South Hill Street, Suite #600, Los Angeles CA 90015
Designer: Mark Allen, VectorUSA, 310-436-1008 mallen@vectorusa.com

Name of Project: GDPS Y14 Cabling

Initial contract value: $5,734,705.27
Final contract value: $2,841,116.67
Liquidated damages: None
Original completion date: September 30, 2014
Date completed: September 30, 2015
Period of Performance: July 1, 2011 – Sept 30, 2014; extended to September 30, 2015

Project Overview
Vector designed and built communications pathways, cabinets, and copper and fiber cabling infrastructure in compliance with District specifications for sixteen school sites.

15. Project Owner: South Bay Union School District
Contact Person: Janet Wraight, IMS Director
Contact Number: (619) 628-1671; jwraight@sbusd.k12.ca.us
Address: 601 Elm Street, Imperial Beach CA 91932
Designer: VectorUSA, (310) 436-1000

Name of Project: SBUSD 2009 VoIP System; Agreement P-89-027-JP

Initial contract value: $1,184,000.00
Final contract value: $1,184,000.00
Liquidated damages: None
Original completion date: Sept 30, 2009, extended to June 30, 2010
Date completed: June 30, 2010
Period of Performance: April 1, 2009 – June 30, 2010

Project Overview
Vector designed, installed and implemented a district-wide Voice over Internet Protocol (VoIP) private branch exchange (PBX) system replacing the current telephony infrastructure at 14 locations within the South Bay Union School District. Vector also provided user training and ongoing maintenance for the system.

16. Project Owner: Jurupa Unified School District
Contact Person: April Devlin, Director, Centralized Support Services
Contact Number: (951) 360-4102; april_devlin@jusd.k12.ca.us
Address: 4850 Pedley Road, Riverside, CA 92509
Designer: Michael Roark, ITS, (760) 369-8418, mroark@4its.org

Name of Project: E-Rate Year 11 Network Infrastructure Upgrade for 2 High Schools and 3 Middle Schools

Initial contract value: $5,898,806.44
Final contract value: $5,752,621.39
Liquidated damages: None

Original completion date: extended to Sept 30, 2011
Date completed: May 5, 2011
Period of Performance: January 25 2010 – May 5, 2011

Project Overview
VectorUSA was awarded this contract encompassing five schools throughout the District. The project entailed the complete rebuild of each school's data infrastructure system to include single-mode fiber optic back bone, 4,400 CAT6 cable drops; as well as the installation of all new racks and cabinets, and Outside Plant (OSP) backbone feeder. In addition to the cable infrastructure Vector Resources, Inc also installed a complete Aruba wireless network including 200 access points; and Cisco 10 Gigabyte Ethernet electronics utilizing Power over Ethernet (PoE) switching fabric.

17. Project Owner: Ontario-Montclair School District
Contact Person: John Lewis
Contact Number: (909) 917-1849; Jon.Lewis@omsd.k12.ca.us
Address: 950 West D Street, Ontario CA 91762
Designer: Michael Roark, ITS, (760) 369-8418, mroark@4its.org

Name of Project: E-Rate Year 12 at Various Sites
Agreement #M-089-23, Project# AD 59

Initial contract value: $1,856,145.95
Final contract value: $1,804,064.71
Liquidated damages: None
Original completion date: extended to Sept 30, 2011
Date completed: Sept 30, 2010
Period of Performance: February 1, 2010 – Sept 30, 2010

Project Overview
VectorUSA was awarded this contract to upgrade telecommunications network at 5 sites. This upgrade included the installation of AMP manufactured Category 6 horizontal cabling and channel components throughout; as well as the removal of existing and installation of new fiber optic backbone. Vector was also responsible for providing, configuring and installing active network electronics for the LAN Network at all locations.

18. Project Owner: Anaheim City Schools
Contact Person: Jim Giordano
Contact Number: (714) 517-7532 x4173; jgiordano@acsd.k12.ca.us
Address: 1001 South East Street, Anaheim CA 92805
Designer: Collaboration of Anaheim City Schools and
Mark Allen, VectorUSA, 310-436-1008 mallen@vectorusa.com

Name of Project: ACSD Y11 – All Schools

Initial contract value: $1,575,984.17
Final contract value: $1,527,120.17
Liquidated damages: None
Original completion date: June 30, 2010; extended to Sept 30, 2014
Date completed: Sept 30, 2014
Period of Performance: June 1, 2009 – Sept 30, 2014

Project Overview
Vector is in the process of designing, installing and configuring Wireless LAN (WLAN) systems at 21 campuses in compliance with current District specifications. Other projects associated with this contract include miscellaneous cabling, high speed electronics, PRI upgrades, Firewall upgrades and e-mail storage.

19. Project Owner: San Bernardino City School District
Contact Person: Dilip Patel
Phone Number: (909) 386-2550
Email Address: dilip.patel@sbcusd.com
Address: 793 North E Street, San Bernardino CA 92410
Designer: Maintenance only

Name of Project: SBCUSD Maintenance Contract (E-Rate 14 – 16)
District Wide Data Voice & Data Product Maintenance
Initial contract value: $2,000,000.00
Final contract value: $572,787.60
Liquidated damages: None
Original completion date: June 30, 2014
Date completed: June 30, 2014
Period of Performance: July 1, 2011 – June 30, 2014

Project Overview
VectorUSA was awarded a three year contract to maintain all LAN and WAN data equipment district wide. This encompasses 63 schools and 19 district facilities.

13. TERMS AND CONDITIONS OF CONTRACT

TERMS AND CONDITIONS

All work is to be completed in a workmanlike manner according to standard practices. All material is to be as specified. Any alterations or deviation from above specifications involving extra costs will be executed only upon written orders, and will become an extra charge over the estimate. All agreements contingent upon strikes, accidents or delays beyond our control will be settled in a formal agreement. Owner is responsible to carry fire, tornado and other necessary insurance. Our workers are fully covered by Workman's Compensation Insurance.

PAYMENT REQUIREMENTS

Monthly progress invoices will be generated based on percentage of completion and due Net 30. Balance will be invoiced upon substantial completion and due Net 30.

Acton Agua Dulce Unified School District

32248 Crown Valley Road

Acton, CA 93510

Job Total $181,318.42

Vector Resources, Inc. dba VectorUSA Authorized Signature _____ Date _____

ACCEPTANCE OF PROPOSAL

The prices, specifications and conditions are satisfactory and are hereby accepted. You are authorized to do the work as specified. Payment will be made as outlined above.

Authorized Signature _____ Date _____

Print Name _____

14. SUPPLEMENTAL INFORMATION

Proof of Spin

Service Provider Information by SPIN Search Results

Page 1 of 1

SLD Home | Site Map | Search Site | Contact SLD

Service Provider Area

Service Provider Information by SPIN

Service Provider Annual Certification Status

1. Service Provider Name	2. SPIN	3. Funding Year	4. Status
Vector Resources, Inc.	143020726	07/01/2016 - 06/30/2017	Certified on 07/06/2016

Percentages of FRNs Processed for SPIN 143020726

Total: 0.0%

486 Notification Letters Sent for SPIN 143020726

No letters have been sent for your SPIN

BEAR (Billed Entity Application Reimbursement) Letters Sent for SPIN 143020726

No letters have been sent for your SPIN

Menu | New Search

Questions about the SLD Programs? Call our Client Service Bureau at (888) 203-8100

Green Light Status

Contractor's License

STATE OF CALIFORNIA

Contractors State License Board

Pursuant to Chapter 9 of Division 3 of the Business and Professions Code and the Rules and Regulations of the Contractors State License Board, the Registrar of Contractors does hereby issue this license to

VECTOR RESOURCES INC

CONTRACTORS STATE LICENSE BOARD ACTIVE LICENSE

654046 — CORP

VECTOR RESOURCES INC. DBA VECTOR/USA

C-7 C10 B D56/D68

08/30/2018

License Number 654046

to engage in the business or act in the capacity of a contractor in the following classification(s):

C-7 - LOW VOLTAGE SYSTEMS
C10 - ELECTRICAL
B - GENERAL BUILDING CONTRACTOR
D56 - TRENCHING (ONLY)

Witness my hand and seal this day

December 7, 2012

Issued September 11, 1992

James Miller
Board Chair

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Registrar of Contractors

Manufacturer Specification Sheets

DATA SHEET

ARUBA 3810 SWITCH SERIES

PRODUCT OVERVIEW

The Aruba 3810 Switch Series is an industry-leading mobile campus access solution for enterprises, SMBs, and branch office networks. With HPE Smart Rate multi-gigabit ports for high-speed IEEE 802.11ac devices, the Aruba 3810 will prepare your network for tomorrow. Right-size deployment and back haul capacity with modular 10GbE and 40GbE uplinks.

Full PoE+ provisioning available on 48-ports. Dual, redundant, hot-swappable power supplies and innovative backplane stacking technology delivers resiliency and scalability in a convenient 1U form factor. Advanced Layer 2 and 3 feature set with OSPF, IPv6, IPv4 BGP, Tunneled node, robust QoS, and policy-based routing are included with no software licensing.

With support for OpenFlow, the Aruba 3810 is ready to take advantage of SDN applications such as HPE Network Visualizer, HPE Network Optimizer, and HPE Network Protector applications. Easy to deploy and manage with advanced security and network management tools like Aruba ClearPass Policy Manager and Aruba AirWave. With support from Aruba Central, you can quickly set up remote branch sites with little or no IT support.

KEY FEATURES

- Advanced Layer 3 switch series with backplane stacking, low latency and resiliency
- Security and network management tools with ClearPass Policy Manager, AirWave and Central support
- Modular line rate 10GbE and 40GbE ports for wireless aggregation
- HPE Smart Rate for high-speed multi-gigabit capacity and PoE+ power
- Optimized for innovative SDN applications with OpenFlow support

FEATURES AND BENEFITS

Software-defined networking

- OpenFlow is a key technology that enables SDN by allowing separation of the data (packet forwarding) and control (routing decision) paths

Unified wired and wireless

- Aruba ClearPass Policy Manager provides profiling, authentication, and policy management across multi-vendor wired and wireless networks
- HTTP redirect function supports HPE Intelligent Management Center (IMC) bring your own device (BYOD) solution
- Switch auto-configuration automatically configures switch for different settings such as VLAN, CoS, PoE max power, and PoE priority when Aruba AP is detected
- User Role a set of switch-based policies in areas such as security, authentication, and QoS. A User Role can be assigned to a group of users or devices, using switch configuration or ClearPass
- Per-port Tunneled Node provide secured tunnel to transport network traffic on a per-port basis to Aruba Controller. Authentication and network policies will be applied and enforced at the Controller
- NEW Static IP Visibility allows ClearPass to do accounting for clients with static IP address

Quality of Service (QoS)

- Advanced classifier-based QoS classifies traffic using multiple match criteria based on Layer 2, 3, and 4 information; applies QoS policies such as setting priority level and rate limit to selected traffic on a per-port or per-VLAN basis
- Layer 4 prioritization enables prioritization based on TCP/UDP port numbers
- Class of Service (CoS) sets the IEEE 802.1p priority tag based on IP address, IP Type of Service (ToS), Layer 3 protocol, TCP/UDP port number, source port, and DiffServ
- Bandwidth shaping
  - Port-based rate limiting provides per-port ingress-/egress-enforced increased bandwidth

- Classifier-based rate limiting uses an access control list (ACL) to enforce increased bandwidth for ingress traffic on each port
- Reduced bandwidth provides per-port, per-queue egress-based reduced bandwidth

- Remote intelligent mirroring mirrors selected ingress/egress traffic based on an ACL, port, MAC address, or VLAN to a local or remote HPE 8200 zl, 6600, 6200 yl, 5400 zl, 5400R, or 3500 Switch anywhere on the network
- Remote monitoring (RMON), Extended RMON (XRMON), and sFlow[3] v5 provide advanced monitoring and reporting capabilities for statistics, history, alarms, and events
- Traffic prioritization allows real-time traffic classification into eight priority levels that are mapped to eight queues

Management

- NEW Aruba Central support Cloud based management platform offers simple, secure, and cost effective way to manage switches
- Friendly port names allows assignment of descriptive names to ports
- IEEE 802.1AB Link Layer Discovery Protocol (LLDP) advertises and receives management information from adjacent devices on a network, facilitating easy mapping by network management applications
- Command authorization leverages RADIUS to link a custom list of CLI commands to an individual network administrator's login; an audit trail documents activity
- Multiple configuration files stores easily to the flash image
- Dual flash images provides independent primary and secondary operating system files for backup while upgrading
- Out-of-band Ethernet management port enables management over a separate physical management network; and keeps management traffic segmented from network data traffic
- Comware CLI
  - Comware-compatible CLI bridges the experience of Hewlett Packard Enterprise (HPE) Comware CLI users who are using the ArubaOS-Switch CLI
  - Display and fundamental Comware CLI commands are natively embedded in the switch CLI; display output is formatted as on Comware-based switches; fundamental commands provide Comware-familiar initial switch setup
  - Configuration Comware CLI commands when Comware commands are entered, CLI help is elicited to formulate the correct ArubaOS-Switch software CLI command
- Zero-Touch Provisioning (ZTP) simplified installation of the switch infrastructure using Aruba Activate-based or DHCP-based process with AirWave Network Management
- Unidirectional Link Detection (UDLD) supports HPE UDLD and DLDP protocols to monitor a cable between two switches and shut down the ports on both ends if a broken link is detected, preventing network problems such as loops
- NEW IP SLA for Voice Monitor quality of voice traffic with UDP Jitter and UDP Jitter for VoIP tests

Connectivity

- Jumbo frames on Gigabit Ethernet and 10-Gigabit Ethernet ports, jumbo frames allow high-performance remote backup and disaster-recovery services
- IEEE 802.3at PoE+ provides up to 30 W per port to IEEE 802.3at-complaint PoE/PoE+-powered devices such as video IP phones, IEEE 802.11n wireless access points, and advanced pan/zoom/tilt security cameras
- Pre-standard PoE support detects and provides power to pre-standard PoE devices (refer to the list of supported devices in the product FAQs, which can be accessed at www.hpe.com/networking)
- Choice of uplinks
  - SFP+ uplink models provide fiber-optic (up to 70 km) or direct-attach-cable (DAC) connectivity
  - 10GBASE-T uplink models offer 10GbE speeds, using standard RJ-45 connectors and standard twisted-pair cabling up to 100 m
- Auto-MDIX provides automatic adjustments for straight-through or crossover cables on all RJ-45 ports
- IPv6
  - IPv6 host enables switch management in an IPv6 network
  - Dual stack (IPv4 and IPv6) transitions IPv4 to IPv6, supporting connectivity for both protocols
  - MLD snooping forwards IPv6 multicast traffic to the appropriate interface
  - IPv6 ACL/QoS supports ACL and QoS for IPv6 traffic
  - IPv6 routing supports static, RIPng, OSPFv3 routing protocols
  - 6in4 tunneling supports encapsulation of IPv6 traffic in IPv4 packets
  - Security provides RA guard, DHCPv6 protection, dynamic IPv6 lockdown, and ND snooping

Performance

- Selectable queue configurations allows for increased performance by selecting the number of queues and associated memory buffering that best meet the requirements of the network applications
- Energy-efficient design
  - 80 PLUS Silver Certified Power Supply increases power efficiency and savings
  - Energy-efficient Ethernet (EEE) support reduces power consumption in accordance with IEEE 802.3az
- Meshed stacking technology
  - High-performance stacking provides up to 336 Gbps of stacking throughput; each 4-port stacking module can support up to 42 Gbps in each direction per stacking port
  - Ring, chain, and mesh topologies support up to a 10-member ring or chain and 5-member fully meshed stacks; meshed topologies offer increased resiliency vs. a standard ring
  - Virtualized switching provides simplified management as the switches appear as a single chassis when stacked
- Aruba Provision ASIC architecture is designed with the latest ProVision ASIC, providing very low latency, increased packet buffering, and adaptive power consumption

Resiliency and high availability

- Virtual Router Redundancy Protocol (VRRP) allows groups of two routers to back each other up dynamically to create highly available routed environments in IPv4 and IPv6 networks
- Nonstop switching and routing improves network availability to better support critical applications, such as unified communication and mobility; traffic will continue to be forwarded during failovers, when the backup member of the stack becomes the commander
- IEEE 802.3ad Link Aggregation Protocol (LACP) and Hewlett Packard Enterprise port trunking support up to 144 trunks, each with up to 8 links (ports) per trunk
- IEEE 802.1s Multiple Spanning Tree provides high link availability in multiple VLAN environments by allowing multiple spanning trees; provides legacy support for IEEE 802.1d and IEEE 802.1w
- Dual hot-swappable power supplies
  - Increased resiliency provides secondary power supply to enable complete switch power redundancy in case of power line or supply failure
  - Increased PoE+ power provides the secondary power supply to increase the total available PoE+ power
- Distributed trunking enables loop-free and redundant network topology without using Spanning Tree Protocol; allows a server or switch to connect to two switches using one logical trunk for redundancy and load sharing
- SmartLink provides easy-to-configure link redundancy of active and standby links

Layer 2 switching

- IEEE 802.1ad QinQ increases the scalability of an Ethernet network by providing a hierarchical structure; connects multiple LANs on a high-speed campus or metro network
- VLAN support and tagging supports the IEEE 802.1Q standard and 4096 VLANs simultaneously
- IEEE 802.1v protocol VLANs isolate select non-IPv4 protocols automatically into their own VLANs
- MAC-based VLAN provides granular control and security; uses RADIUS to map a MAC address/user to specific VLANs
- Rapid Per-VLAN Spanning Tree (RPVST+) allows each VLAN to build a separate spanning tree to improve link bandwidth usage; is compatible with PVST+
- HPE switch meshing dynamically load balances across multiple active redundant links to increase available aggregate bandwidth; allows concurrent Layer 3 routing
- GVRP and MVRP allows automatic learning and dynamic assignment of VLANs

Layer 3 services

- Loopback interface address defines an address in Routing Information Protocol (RIP) and Open Shortest Path First (OSPF), improving diagnostic capability
- Route maps provide more control during route redistribution; allow filtering and altering of route metrics
- User datagram protocol (UDP) helper function allows UDP broadcasts to be directed across router interfaces to specific IP unicast or subnet broadcast addresses; and helps prevent server spoofing for UDP services such as DHCP
- DHCP server centralizes and reduces the cost of IPv4 address management
- Bidirectional Forwarding Detection (BFD) enables link connectivity monitoring and reduces network convergence time for OSPFv2, and VRRP

Layer 3 routing

- Static IP routing provides manually configured routing for both IPv4 and IPv6 networks
- OSPF provides OSPFv2 for IPv4 routing and OSPFv3 for IPv6 routing
- Policy-based routing makes routing decisions based on policies set by the network administrator

- Border Gateway Protocol (BGP) provides IPv4 Border Gateway Protocol routing, which is scalable, robust, and flexible
- Routing Information Protocol (RIP) provides RIPv1, RIPv2, and RIPng

Security

- Source-port filtering allows only specified ports to communicate with each other
- RADIUS/TACACS+ eases switch management security administration by using a password authentication server
- Secure shell encrypts all transmitted data for secure remote CLI access over IP networks
- Secure Sockets Layer (SSL) encrypts all HTTP traffic, allowing secure access to the browser-based management GUI in the switch
- Port security allows access only to specified MAC addresses, which can be learned or specified by the administrator
- MAC address lockout prevents particular configured MAC addresses from connecting to the network
- Detection of malicious attacks monitors 10 types of network traffic and sends a warning when an anomaly that potentially can be caused by malicious attacks is detected
- Secure FTP allows secure file transfer to and from the switch; protects against unwanted file downloads or unauthorized copying of a switch configuration file
- Switch management logon security helps secure switch CLI logon by optionally requiring either RADIUS or TACACS+ authentication
- Secure management access delivers secure encryption of all access methods (CLI, GUI, or MIB) through SSHv2, SSL, and/or SNMPv3
- ICMP throttling defeats ICMP denial-of-service attacks by enabling any switch port to automatically throttle ICMP traffic automatically
- Identity-driven ACL enables implementation of a highly granular and flexible access security policy and VLAN assignment specific to each authenticated network user
- STP BPDU port protection blocks Bridge Protocol Data Units (BPDUs) on ports that do not require BPDUs, preventing forged BPDU attacks
- Dynamic IP lockdown works with DHCP protection to block traffic from unauthorized hosts, preventing IP source address spoofing
- DHCP protection blocks DHCP packets from unauthorized DHCP servers, preventing denial-of-service attacks
- Dynamic ARP protection blocks ARP broadcasts from unauthorized hosts, preventing eavesdropping or theft of network data
- STP root guard protects the root bridge from malicious attacks or configuration mistakes
- Management Interface Wizard helps secure management interfaces such as SNMP, telnet, SSH, SSL, Web, and USB at the desired level
- Security banner displays a customized security policy when users log in to the switch
- Switch CPU protection provides automatic protection against malicious network traffic trying to shut down the switch
- ACLs provide filtering based on the IP field, source/destination IP address/subnet and source/destination TCP/UDP port number on a per-VLAN or per-port basis
- Multiple authentication methods
  - IEEE 802.1X authenticates multiple IEEE 802.1X users per port; prevents a user from "piggybacking" on another user's authentication
  - Web-based authentication authenticates from Web browser for clients that do not support 802.1X supplicant
  - MAC-based authentication authenticates client with the RADIUS server based on client's MAC address
  - Concurrent authentication modes enables a switch port to accept up to 32 sessions of 802.1X, Web, and MAC authentication
- Private VLAN provides network security by restricting peer-to-peer communication to prevent a variety of malicious attacks; typically a switch port can only communicate with other ports in the same community and/or an uplink port, regardless of VLAN ID or destination MAC address

Convergence

- IP multicast snooping (data-driven IGMP) prevents flooding of IP multicast traffic
- LLDP-MED (Media Endpoint Discovery) defines a standard extension of LLDP that stores values for parameters such as QoS and VLAN to configure network devices such as IP phones automatically
- PoE allocations supports multiple methods (automatic, IEEE 802.3af class, LLDP-MED, or user-specified) to allocate PoE power for more efficient energy savings
- IP multicast routing includes PIM sparse and dense modes to route IP multicast traffic

- Auto VLAN configuration for voice
  - RADIUS VLAN uses a standard RADIUS attribute and LLDP-MED to configure a VLAN automatically for IP phones
  - CDPv2 uses CDPv2 to configure legacy IP phones
- Local MAC Authentication assigns attributes such as VLAN and QoS using locally configured profile that can be a list of MAC prefixes

Warranty and support

- Limited Lifetime Warranty
  See www.hpe.com/networking/warrantysummary for warranty and support information included with your product purchase.
- Software releases to find software for your product, refer to www.hpe.com/networking/support; for details on the software releases available with your product purchase, refer to www.hpe.com/networking/warrantysummary

SPECIFICATIONS

	Aruba 3810M 24G 1-slot Switch (JL071A)	Aruba 3810M 48G 1-slot Switch (JL072A)	Aruba 3810M 24G PoE+ 1-slot Switch (JL073A)
Included accessories			
	1 Aruba 3810 Switch Fan Tray (JL088A)	1 Aruba 3810 Switch Fan Tray (JL088A)	1 Aruba 3810 Switch Fan Tray (JL088A)
I/O ports and slots			
	24 RJ-45 autosensing 10/100/1000 ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3ab Type 1000BASE-T); Duplex: 10BASE-T/100BASE-TX: half or full; 1000BASE-T: full only; Ports 1 – 24 support MACSec	48 RJ-45 autosensing 10/100/1000 ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3ab Type 1000BASE-T); Duplex: 10BASE-T/100BASE-TX: half or full; 1000BASE-T: full only; Ports 1 – 48 support MACSec	24 RJ-45 autosensing 10/100/1000 PoE+ ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3ab Type 1000BASE-T, IEEE 802.3at PoE+); Duplex: 10BASE-T/100BASE-TX: half or full; 1000BASE-T: full only; Ports 1 – 24 support MACSec
	1 open module slot	1 open module slot	1 open module slot
	Supports a maximum of 4 SFP+ ports or 1 40GbE ports, with optional module	Supports a maximum of 4 SFP+ ports or 2 40GbE ports, with optional module	Supports a maximum of 4 SFP+ ports or 1 40GbE ports, with optional module
Additional ports and slots			
	1 stacking module slot	1 stacking module slot	1 stacking module slot
	1 RJ-45 serial console port	1 RJ-45 serial console port	1 RJ-45 serial console port
	1 RJ-45 out-of-band management port	1 RJ-45 out-of-band management port	1 RJ-45 out-of-band management port
	1 dual-personality (RJ-45 or USB micro-B)	1 dual-personality (RJ-45 or USB micro-B)	1 dual-personality (RJ-45 or USB micro-B)
Power supplies			
	2 power supply slots	2 power supply slots	2 power supply slots
	1 minimum power supply required (ordered separately)	1 minimum power supply required (ordered separately)	1 minimum power supply required (ordered separately)
Fan tray			
	Includes:	Includes:	Includes:
	1 x JL088A	1 x JL088A	1 x JL088A
	1 fan tray slot	1 fan tray slot	1 fan tray slot
	Switch ships with 1 JL088A fan tray installed. Spares ordered separately.	Switch ships with 1 JL088A fan tray installed. Spares ordered separately.	Switch ships with 1 JL088A fan tray installed. Spares ordered separately.

SPECIFICATIONS

	Aruba 3810M 24G 1-slot Switch (JL071A)	Aruba 3810M 48G 1-slot Switch (JL072A)	Aruba 3810M 24G PoE+ 1-slot Switch (JL073A)
Physical characteristics			
Dimensions	17.42(w) x 16.98(d) x 1.73(h) in (44.25 x 43.13 x 4.39 cm) (1U height)	17.42(w) x 16.98(d) x 1.73(h) in (44.25 x 43.13 x 4.39 cm) (1U height)	17.42(w) x 16.98(d) x 1.73(h) in (44.25 x 43.13 x 4.39 cm) (1U height)
Weight	12.76 lb (5.79 kg)	13.20 lb (5.99 kg)	13.02 lb (5.91 kg)
Memory and processor			
	P2020 Dual Core @ 1.2 GHz, 4 GB DDR3 SDRAM, 1 GB SD Card	P2020 Dual Core @ 1.2 GHz, 4 GB DDR3 SDRAM, 1 GB SD Card	P2020 Dual Core @ 1.2 GHz, 4 GB DDR3 SDRAM, 1 GB SD Card
	Dual ARM® Coretex A9 @ 1 GHz, 2 GB DDR3 SDRAM; Packet buffer size: 13.5 MB Internal	Dual ARM® Coretex A9 @ 1 GHz, 2 GB DDR3 SDRAM; Packet buffer size: 13.5 MB Internal	Dual ARM® Coretex A9 @ 1 GHz, 2 GB DDR3 SDRAM; Packet buffer size: 13.5 MB Internal
Mounting and enclosure			
	Mounts in an EIA-standard 19 in. telco rack or equipment cabinet (hardware included); Horizontal surface mounting only	Mounts in an EIA-standard 19 in. telco rack or equipment cabinet (hardware included); Horizontal surface mounting only	Mounts in an EIA-standard 19 in. telco rack or equipment cabinet (hardware included); Horizontal surface mounting only
Performance			
	IPv6 Ready Certified	IPv6 Ready Certified	IPv6 Ready Certified
1000 Mb Latency	< 2.8 µs (FIFO 64-byte packets)	< 2.8 µs (FIFO 64-byte packets)	< 2.8 µs (FIFO 64-byte packets)
10 Gbps Latency	< 1 8 µs (FIFO 64-byte packets)	< 1.8 µs (FIFO 64-byte packets)	< 1.8 µs (FIFO 64-byte packets)
40 Gbps Latency	< 1.5 µs (FIFO 64-byte packets)	< 1.5 µs (FIFO 64-byte packets)	< 1.5 µs (FIFO 64-byte packets)
Throughput	up to 95.2 Mpps (64-byte packets)	up to 190.5 Mpps (64-byte packets)	up to 95.2 Mpps (64-byte packets)
Routing/Switching capacity	160 Gbps	320 Gbps	160 Gbps
Switch fabric speed	169 Gbps	338 Gbps	169 Gbps
Routing table size	10000 entries (IPv4), 5000 entries (IPv6)	10000 entries (IPv4), 5000 entries (IPv6)	10000 entries (IPv4), 5000 entries (IPv6)
MAC address table size	64000 entries	64000 entries	64000 entries
Environment			
Operating temperature	32°F to 113°F (0°C to 45°C)	32°F to 113°F (0°C to 45°C)	32°F to 113°F (0°C to 45°C)
Operating relative humidity	15% to 95% @ 104°F (40°C), noncondensing	15% to 95% @ 104°F (40°C), noncondensing	15% to 95% @ 104°F (40°C), noncondensing
Nonoperating/Storage temperature	-40°F to 158°F (-40°C to 70°C)	-40°F to 158°F (-40°C to 70°C)	-40°F to 158°F (-40°C to 70°C)
Nonoperating/Storage relative humidity	15% to 90% @ 149°F (65°C), noncondensing	15% to 90% @ 149°F (65°C), noncondensing	15% to 90% @ 149°F (65°C), noncondensing
Altitude	up to 10,000 ft (3 km)	up to 10,000 ft (3 km)	up to 10,000 ft (3 km)
Acoustic	Power: 39 dB, Pressure: 22.8 dB	Power: 38 dB, Pressure: 21.8 dB	Power: 48 dB, Pressure: 30.7 dB

SPECIFICATIONS

	Aruba 3810M 24G 1-slot Switch (JL071A)	Aruba 3810M 48G 1-slot Switch (JL072A)	Aruba 3810M 24G PoE+ 1-slot Switch (JL073A)
Safety			
	EN 60950/IEC 60950; UL 60950; UL 60950-1; CAN/CSA 22.2 No. 60950; EN 60825; CSA 22.2 60950-1; EN62479:2010; EN 60950-1:2006 +A11:2009 +A1: 2010 +A12:2011+A2:2013; EN 62368-1, Ed. 2; IEC 60950-1:2005 Ed.2; Am 1:2009+A2:2013; IEC 60825:2007; EN60850-1:2007 / IEC 60825-1: 2007 Class1 Class 1 Laser Products /Laser Klasse 1; UL 62368-1 Ed.2	EN 60950/IEC 60950; UL 60950; UL 60950-1; CAN/CSA 22.2 No. 60950; EN 60825; CSA 22.2 60950-1; EN62479:2010; EN 60950-1:2006 +A11:2009 +A1: 2010 +A12:2011+A2:2013; EN 62368-1, Ed. 2; IEC 60950-1:2005 Ed.2; Am 1:2009+A2:2013; IEC 60825:2007; EN60850-1:2007 / IEC 60825-1: 2007 Class1 Class 1 Laser Products / Laser Klasse 1; UL 62368-1 Ed.2	EN 60950/IEC 60950; UL 60950; UL 60950-1; CAN/CSA 22.2 No. 60950; EN 60825; CSA 22.2 60950-1; EN62479:2010; EN 60950-1:2006 +A11:2009 +A1:2010 +A12:2011+A2:2013; EN 62368-1, Ed. 2; IEC 60950-1:2005 Ed.2; Am 1:2009+A2:2013; IEC 60825:2007; EN60850-1:2007 / IEC 60825-1: 2007 Class1 Class 1 Laser Products / Laser Klasse 1; UL 62368-1 Ed.2
Emissions			
	FCC Class A; VCCI Class A; EN 55022/CISPR 22 Class A; EN 60950-1:2006 +A11:2009 +A1:2010 +A12:2011+A2:2013	FCC Class A; VCCI Class A; EN 55022/CISPR 22 Class A; EN 60950-1:2006 +A11:2009 +A1:2010 +A12:2011+A2:2013	FCC Class A; VCCI Class A, EN 55022/CISPR 22 Class A; EN 60950-1:2006 +A11:2009 +A1:2010 +A12:2011+A2:2013
Immunity			
Generic EN	EN55022: 2010	EN55022: 2010	EN55022: 2010
ESD	EN55024: 2010	EN55024: 2010	EN55024: 2010
Radiated	IEC 61000-4-2	IEC 61000-4-2	IEC 61000-4-2
EFT/Burst	IEC 61000-4-3; 3 V/m	IEC 61000-4-3; 3 V/m	IEC 61000-4-3; 3 V/m
Surge	IEC 61000-4-4; 1.0 kV (power line), 0.5 kV (signal line) IEC 61000-4-5; 1 kV/2 kV AC	IEC 61000-4-4; 1.0 kV (power line), 0.5 kV (signal line) IEC 61000-4-5; 1 kV/2 kV AC	IEC 61000-4-4; 1.0 kV (power line), 0.5 kV (signal line) IEC 61000-4-5; 1 kV/2 kV AC
Conducted	IEC 61000-4-6; 3 V	IEC 61000-4-6; 3 V	IEC 61000-4-6; 3 V
Power frequency magnetic field	IEC 61000-4-8; 1 A/m, 50 or 60 Hz	IEC 61000-4-8; 1 A/m, 50 or 60 Hz	IEC 61000-4-8; 1 A/m, 50 or 60 Hz
Voltage dips and interruptions	IEC 61000-4-11; >95% reductions, 0.5 period; 30% reduction, 25 periods	IEC 61000-4-11; >95% reductions, 0.5 period; 30% reduction, 25 periods	IEC 61000-4-11; >95% reductions, 0.5 period; 30% reduction, 25 periods
Harmonics	EN61000-3-2:2006 +A1:2009 +A2:2009 Class A	EN61000-3-2:2006 +A1:2009 +A2:2009 Class A	EN61000-3-2:2006 +A1:2009 +A2:2009 Class A
Flicker	EN61000-3-3:2008	EN61000-3-3:2008	EN61000-3-3:2008
Management			
	Aruba AirWave Network Management; IMC – Intelligent Management Center; Command-line interface; Web browser; Configuration menu; Out-of-band management (RJ-45 Ethernet); In-line and out-of-band; Out-of-band management (serial RS-232c or micro usb)	Aruba AirWave Network Management; IMC – Intelligent Management Center; Command-line interface; Web browser; Configuration menu; Out-of-band management (RJ-45 Ethernet); In-line and out-of-band; Out-of-band management (serial RS-232c or micro usb)	Aruba AirWave Network Management; IMC – Intelligent Management Center; Command-line interface; Web browser; Configuration menu; Out-of-band management (RJ-45 Ethernet); In-line and out-of-band; Out-of-band management (serial RS-232c or micro usb)
Services			
	Refer to the Hewlett Packard Enterprise website at www.hpe.com/networking/services for details on the service-level descriptions and product numbers. For details about services and response times in your area, please contact your local Hewlett Packard Enterprise sales office.	Refer to the Hewlett Packard Enterprise website at www.hpe.com/networking/services for details on the service-level descriptions and product numbers. For details about services and response times in your area, please contact your local Hewlett Packard Enterprise sales office.	Refer to the Hewlett Packard Enterprise website at www.hpe.com/networking/services for details on the service-level descriptions and product numbers. For details about services and response times in your area, please contact your local Hewlett Packard Enterprise sales office.

SPECIFICATIONS

	Aruba 3810M 48G PoE+ 1-slot Switch (JL074A)	Aruba 3810M 16SFP+ 2-slot Switch (JL075A)	Aruba 3810M 40G 8 HPE Smart Rate PoE+ 1-slot Switch (JL076A)
Included accessories			
	1 Aruba 3810 Switch Fan Tray (JL088A)	1 Aruba 3810 Switch Fan Tray (JL088A)	1 Aruba 3810 Switch Fan Tray (JL088A)
I/O ports and slots			
	48 RJ-45 autosensing 10/100/1000 PoE+ ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3ab Type 1000BASE-T, IEEE 802.3at PoE+); Duplex: 10BASE-T/100BASE-TX: half or full; 1000BASE-T: full only; Ports 1 – 48 support MACSec 1 open module slot Supports a maximum of 4 SFP+ ports or 2 40GbE ports, with optional module	16 SFP+ fixed 1000/10000 SFP+ ports; Duplex: 100BASE-TX: half or full; 1000BASE-T: full only; Ports 1 – 16 support MACSec 2 open module slots Supports a maximum of 8 SFP+ ports or 2 40GbE ports, with optional module	40 RJ-45 autosensing 10/100/1000 PoE+ ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3ab Type 1000BASE-T, IEEE 802.3at PoE+); Duplex: 10BASE-T/100BASE-TX: half or full; 1000BASE-T: full only; Ports 1 – 40 support MACSec 8 RJ-45 HPE Smart Rate Multi-Gigabit ports; Ports 1 – 8 support MACSec 1 open module slot Supports a maximum of 4 SFP+ ports or 2 40GbE ports, with optional module
Additional ports and slots			
	1 stacking module slot 1 RJ-45 serial console port 1 RJ-45 out-of-band management port 1 dual-personality (RJ-45 or USB micro-B)	1 stacking module slot 1 RJ-45 serial console port 1 RJ-45 out-of-band management port 1 dual-personality (RJ-45 or USB micro-B)	1 stacking module slot 1 RJ-45 serial console port 1 RJ-45 out-of-band management port 1 dual-personality (RJ-45 or USB micro-B)
Power supplies			
	2 power supply slots 1 minimum power supply required (ordered separately)	2 power supply slots 1 minimum power supply required (ordered separately)	2 power supply slots 1 minimum power supply required (ordered separately)
Fan tray			
	Includes: 1 x JL088A 1 fan tray slot Switch ships with 1 JL088A fan tray installed. Spares ordered separately	Includes: 1 x JL088A 1 fan tray slot Switch ships with 1 JL088A fan tray installed. Spares ordered separately.	Includes: 1 x JL088A 1 fan tray slot Switch ships with 1 JL088A fan tray installed. Spares ordered separately
Physical characteristics			
Dimensions	17.42(w) x 16.98(d) x 1.73(h) in (44.25 x 43.13 x 4.39 cm) (1U height)	17.42(w) x 16.98(d) x 1.73(h) in (44.25 x 43.13 x 4.39 cm) (1U height)	17.42(w) x 16.98(d) x 1.73(h) in (44.25 x 43.13 x 4.39 cm) (1U height)
Weight	13.62 lb (6.18 kg)	13.28 lb (6.02 kg)	13.61 lb (6.17 kg)
Memory and processor			
	P2020 Dual Core @ 1.2 GHz, 4 GB DDR3 SDRAM, 1 GB SD Card Dual ARM Coretex A9 @ 1 GHz, 2 GB DDR3 SDRAM; Packet buffer size: 13.5 MB Internal	P2020 Dual Core @ 1.2 GHz, 4 GB DDR3 SDRAM, 1 GB SD Card Dual ARM Coretex A9 @ 1 GHz, 2 GB DDR3 SDRAM; Packet buffer size: 13.5 MB Internal	P2020 Dual Core @ 1.2 GHz, 4 GB DDR3 SDRAM, 1 GB SD Card Dual ARM Coretex A9 @ 1 GHz, 2 GB DDR3 SDRAM; Packet buffer size: 13.5 MB Internal

SPECIFICATIONS

	Aruba 3810M 48G PoE+ 1-slot Switch (JL074A)	Aruba 3810M 16SFP+ 2-slot Switch (JL075A)	Aruba 3810M 40G 8 HPE Smart Rate PoE+ 1-slot Switch (JL076A)
Mounting and enclosure			
	Mounts in an EIA-standard 19 in. telco rack or equipment cabinet (hardware included); Horizontal surface mounting only	Mounts in an EIA-standard 19 in. telco rack or equipment cabinet (hardware included); Horizontal surface mounting only	Mounts in an EIA-standard 19 in. telco rack or equipment cabinet (hardware included); Horizontal surface mounting only
Performance			
	IPv6 Ready Certified	IPv6 Ready Certified	IPv6 Ready Certified
1000 Mb Latency	< 2.8 µs (FIFO 64-byte packets)	< 2.8 µs (FIFO 64-byte packets)	< 2.8 µs (FIFO 64-byte packets)
10 Gbps Latency	< 1.8 µs (FIFO 64-byte packets)	< 1.8 µs (FIFO 64-byte packets)	< 1.8 µs (FIFO 64-byte packets)
40 Gbps Latency	< 1.5 µs (FIFO 64-byte packets)	< 1.5 µs (FIFO 64-byte packets)	< 1.5 µs (FIFO 64-byte packets)
Throughput	up to 190.5 Mpps (64-byte packets)	up to 285.7 Mpps (64-byte packets)	up to 273.8 Mpps (64-byte packets)
Routing/Switching capacity	320 Gbps	480 Gbps	480 Gbps
Switch fabric speed	338 Gbps	508 Gbps	508 Gbps
Routing table size	10000 entries (IPv4), 5000 entries (IPv6)	10000 entries (IPv4), 5000 entries (IPv6)	10000 entries (IPv4), 5000 entries (IPv6)
MAC address table size	64000 entries	64000 entries	64000 entries
Environment			
Operating temperature	32°F to 113°F (0°C to 45°C)	32°F to 113°F (0°C to 45°C)	32°F to 113°F (0°C to 45°C)
Operating relative humidity	15% to 95% @ 104°F (40°C), noncondensing	15% to 95% @ 104°F (40°C), noncondensing	15% to 95% @ 104°F (40°C), noncondensing
Nonoperating/Storage temperature	-40°F to 158°F (-40°C to 70°C)	-40°F to 158°F (-40°C to 70°C)	-40°F to 158°F (-40°C to 70°C)
Nonoperating/Storage relative humidity	15% to 90% @ 149°F (65°C), noncondensing	15% to 90% @ 149°F (65°C), noncondensing	15% to 90% @ 149°F (65°C), noncondensing
Altitude	up to 10,000 ft (3 km)	up to 10,000 ft (3 km)	up to 10,000 ft (3 km)
Acoustic	Power: 42 dB, Pressure: 26 dB	Power: 39 dB, Pressure: 22.3 dB	Power: 45 dB, Pressure: 27.9 dB
Safety			
	EN 60950/IEC 60950; UL 60950; UL 60950 1; CAN/CSA 22.2 No. 60950; EN 60825; CSA 22.2 60950-1; EN62479:2010; EN 60950-1:2006 +A11:2009 +A1:2010 +A12:2011+A2:2013; EN 62368-1, Ed. 2; IEC 60950-1:2005 Ed.2; Am 1:2009+A2:2013; IEC 60825:2007; EN60850-1:2007 / IEC 60825-1: 2007 Class1 Class 1 Laser Products / Laser Klasse 1; UL 62368-1 Ed.2	EN 60950/IEC 60950; UL 60950; UL 60950-1; CAN/CSA 22.2 No. 60950; EN 60825; CSA 22.2 60950-1; EN62479:2010; EN 60950-1:2006 +A11:2009 +A1:2010 +A12:2011+A2:2013; EN 62368-1, Ed. 2; IEC 60950-1:2005 Ed.2; Am 1:2009+A2:2013; IEC 60825:2007; EN60850-1:2007 / IEC 60825-1: 2007 Class1 Class 1 Laser Products / Laser Klasse 1; UL 62368-1 Ed.2	EN 60950/IEC 60950; UL 60950; UL 60950-1; CAN/CSA 22 2 No. 60950; EN 60825; CSA 22.2 60950-1; EN62479:2010; EN 60950-1:2006 +A11:2009 +A1:2010 +A12:2011+A2:2013; EN 62368-1, Ed. 2; IEC 60950-1:2005 Ed.2; Am 1:2009+A2:2013; IEC 60825:2007; EN60850-1:2007 / IEC 60825-1: 2007 Class1 Class 1 Laser Products / Laser Klasse 1; UL 62368-1 Ed.2

SPECIFICATIONS

	Aruba 3810M 48G PoE+ 1-slot Switch (JL074A)	Aruba 3810M 16SFP+ 2-slot Switch (JL075A)	Aruba 3810M 40G 8 HPE Smart Rate PoE+ 1-slot Switch (JL076A)
Emissions			
	FCC Class A; VCCI Class A; EN 55022/CISPR 22 Class A; EN 60950-1:2006 +A11:2009 +A1:2010 +A12:2011+A2:2013	FCC Class A; VCCI Class A; EN 55022/CISPR 22 Class A; EN 60950-1:2006 +A11:2009 +A1:2010 +A12:2011+A2:2013	FCC Class A; VCCI Class A; EN 55022/CISPR 22 Class A; EN 60950-1:2006 +A11:2009 +A1:2010 +A12:2011+A2:2013
Immunity			
Generic	EN55022: 2010	EN55022: 2010	EN55022: 2010
EN	EN55024: 2010	EN55024: 2010	EN55024: 2010
ESD	IEC 61000-4-2	IEC 61000-4-2	IEC 61000-4-2
Radiated	IEC 61000-4-3; 3 V/m	IEC 61000-4-3; 3 V/m	IEC 61000-4-3; 3 V/m
EFT/Burst	IEC 61000-4-4; 1.0 kV (power line), 0.5 kV (signal line)	IEC 61000-4-4; 1.0 kV (power line), 0.5 kV (signal line)	IEC 61000-4-4; 1.0 kV (power line), 0.5 kV (signal line)
Surge	IEC 61000-4-5; 1 kV/2 kV AC	IEC 61000-4-5; 1 kV/2 kV AC	IEC 61000-4-5; 1 kV/2 kV AC
Conducted	IEC 61000-4-6; 3 V	IEC 61000-4-6; 3 V	IEC 61000-4-6; 3 V
Power frequency magnetic field	IEC 61000-4-8; 1 A/m, 50 or 60 Hz	IEC 61000-4-8; 1 A/m, 50 or 60 Hz	IEC 61000-4-8; 1 A/m, 50 or 60 Hz
Voltage dips and interruptions	IEC 61000-4-11; >95% reductions, 0.5 period; 30% reduction, 25 periods	IEC 61000-4-11; >95% reductions, 0.5 period; 30% reduction, 25 periods	IEC 61000-4-11; >95% reductions, 0.5 period; 30% reduction, 25 periods
Harmonics	EN61000-3-2:2006 +A1:2009 +A2:2009 Class A	EN61000-3-2:2006 +A1:2009 +A2:2009 Class A	EN61000-3-2:2006 +A1:2009 +A2:2009 Class A
Flicker	EN61000-3-3:2008	EN61000-3-3:2008	EN61000-3-3:2008
Management			
	Aruba AirWave Network Management; IMC – Intelligent Management Center; Command-line interface; Web browser; Configuration menu; Out-of-band management (RJ-45 Ethernet); In-line and out-of-band; Out-of-band management (serial RS-232c or micro usb)	Aruba AirWave Network Management; IMC – Intelligent Management Center; Command-line interface; Web browser; Configuration menu; Out-of-band management (RJ-45 Ethernet); In-line and out-of-band; Out-of-band management (serial RS-232c or micro usb)	Aruba AirWave Network Management; IMC – Intelligent Management Center; Command-line interface; Web browser; Configuration menu; Out-of-band management (RJ-45 Ethernet); In-line and out-of-band; Out-of-band management (serial RS-232c or micro usb)
Services			
	Refer to the Hewlett Packard Enterprise website at www.hpe.com/networking/services for details on the service-level descriptions and product numbers. For details about services and response times in your area, please contact your local Hewlett Packard Enterprise sales office.	Refer to the Hewlett Packard Enterprise website at www.hpe.com/networking/services for details on the service-level descriptions and product numbers. For details about services and response times in your area, please contact your local Hewlett Packard Enterprise sales office.	Refer to the Hewlett Packard Enterprise website at www.hpe.com/networking/services for details on the service-level descriptions and product numbers. For details about services and response times in your area, please contact your local Hewlett Packard Enterprise sales office.

SPECIFICATIONS

	Aruba 3810M 48G PoE+ 4SFP+ 680W Switch (JL428A)	Aruba 3810M 48G PoE+ 4SFP+ 1050W Switch (JL429A)	Aruba 3810M 24SFP+ 250W Switch (JL430A)
Included accessories			
	1 Aruba 3810 Switch Fan Tray (JL088A)	1 Aruba 3810 Switch Fan Tray (JL088A)	1 Aruba 3810 Switch Fan Tray (JL088A)
	1 Aruba 3810M 4SFP+ Module (JL083A)	1 Aruba 3810M 4SFP+ Module (JL083A)	2 Aruba 3810M 4SFP+ Module (JL083A)
	1 Aruba Aruba X372 54VDC 680W 100-240VAC Power Supply (JL086A)	1 Aruba X372 54VDC 1050W 110-240VAC Power Supply (JL087A)	1 Aruba X371 12VDC 250W 100-240VAC Power Supply (JL085A)
I/O ports and slots			
	48 RJ-45 autosensing 10/100/1000 PoE+ ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3ab Type 1000BASE-T, IEEE 802.3at PoE+); Duplex: 10BASE-T/100BASE-TX: half or full; 1000BASE-T: full only; Ports 1-48 support MACSec	48 RJ-45 autosensing 10/100/1000 PoE+ ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3ab Type 1000BASE-T, IEEE 802.3at PoE+); Duplex: 10BASE-T/100BASE-TX: half or full; 1000BASE-T: full only; Ports 1-48 support MACSec	24 SFP+ fixed 1000/10000 SFP+ ports; Duplex: 100BASE-TX: half or full; 1000BASE-T: full only; Ports 1-24 support MACSec
	Supports a maximum of 4 SFP+ ports or 2 40 GbE ports, with optional module	Supports a maximum of 4 SFP+ ports or 2 40 GbE ports, with optional module	Supports a maximum of 24 SFP+ ports or 2 40 GbE ports, with optional module(s)
Additional ports and slots			
	1 stacking module slot	1 stacking module slot	1 stacking module slot
	1 RJ-45 serial console port	1 RJ-45 serial console port	1 RJ-45 serial console port
	1 RJ-45 out-of-band management port	1 RJ-45 out-of-band management port	1 RJ-45 out-of-band management port
	1 dual-personality (RJ-45 or USB micro-B)	1 dual-personality (RJ-45 or USB micro-B)	1 dual-personality (RJ-45 or USB micro-B)
Power supplies			
	2 power supply slots	2 power supply slots	2 power supply slots
	1 power supply included	1 power supply included	1 power supply included
	1 minimum power supply required (ordered separately)	1 minimum power supply required (ordered separately)	1 minimum power supply required (ordered separately)
Fan tray			
	Includes:	Includes:	Includes:
	1 x JL088A	1 x JL088A	1 x JL088A
	1 fan tray slot	1 fan tray slot	1 fan tray slot
	Switch ships with 1 JL088A fan tray installed. Spares ordered separately..	Switch ships with 1 JL088A fan tray installed. Spares ordered separately..	Switch ships with 1 JL088A fan tray installed. Spares ordered separately.
Physical characteristics			
Dimensions	17.42(w) x 16.98(d) x 1.73(h) in (44.25 x 43.13 x 4.39 cm) (1U height)	17.42(w) x 16.98(d) x 1.73(h) in (44.25 x 43.13 x 4.39 cm) (1U height)	17.42(w) x 16.98(d) x 1.73(h) in. (44.25 x 43.13 x 4.39 cm) (1U height)
Weight	15.82 lb (7.18 kg)	15.94 lb (7.23 kg)	15.56 lb (7.06 kg)
Memory and processor			
	P2020 Dual Core @ 1.2 GHz, 4 GB DDR3 SDRAM, 1 GB SD Card	P2020 Dual Core @ 1.2 GHz, 4 GB DDR3 SDRAM, 1 GB SD Card	P2020 Dual Core @ 1.2 GHz, 4 GB DDR3 SDRAM, 1 GB SD Card
	Dual ARM Coretex A9 @ 1 GHz, 2 GB DDR3 SDRAM; Packet buffer size: 13.5 MB Internal	Dual ARM Coretex A9 @ 1 GHz, 2 GB DDR3 SDRAM; Packet buffer size: 13.5 MB Internal	Dual ARM Coretex A9 @ 1 GHz, 2 GB DDR3 SDRAM; Packet buffer size: 13.5 MB Internal

SPECIFICATIONS

	Aruba 3810M 48G PoE+ 4SFP+ 680W Switch (JL428A)	Aruba 3810M 48G PoE+ 4SFP+ 1050W Switch (JL429A)	Aruba 3810M 24SFP+ 250W Switch (JL430A)
Mounting and enclosure			
	Mounts in an EIA-standard 19 in. telco rack or equipment cabinet (hardware included); Horizontal surface mounting only	Mounts in an EIA-standard 19 in. telco rack or equipment cabinet (hardware included); Horizontal surface mounting only	Mounts in an EIA-standard 19 in. telco rack or equipment cabinet (hardware included); Horizontal surface mounting only
Performance			
	IPv6 Ready Certified	IPv6 Ready Certified	IPv6 Ready Certified
1000 Mb Latency	< 2.8 µs (FIFO 64-byte packets)	< 2.8 µs (FIFO 64-byte packets)	< 2.8 µs (FIFO 64-byte packets)
10 Gbps Latency	< 1.8 µs (FIFO 64-byte packets)	< 1.8 µs (FIFO 64-byte packets)	< 1.8 µs (FIFO 64-byte packets)
40 Gbps Latency	< 1.5 µs (FIFO 64-byte packets)	< 1.5 µs (FIFO 64-byte packets)	< 1.5 µs (FIFO 64-byte packets)
Throughput	up to 190.5 Mpps (64-byte packets)	up to 190.5 Mpps (64-byte packets)	up to 285.7 Mpps (64-byte packets)
Routing/Switching capacity	320 Gbps	320 Gbps	480 Gbps
Switch fabric speed	338 Gbps	338 Gbps	508 Gbps
Routing table size	10000 entries (IPv4), 5000 entries (IPv6)	10000 entries (IPv4), 5000 entries (IPv6)	10000 entries (IPv4), 5000 entries (IPv6)
MAC address table size	64000 entries	64000 entries	64000 entries
Environment			
Operating temperature	32°F to 113°F (0°C to 45°C)	32°F to 113°F (0°C to 45°C)	32°F to 113°F (0°C to 45°C)
Operating relative humidity	15% to 95% @ 104°F (40°C), noncondensing	15% to 95% @ 104°F (40°C), noncondensing	15% to 95% @ 104°F (40°C), noncondensing
Nonoperating/Storage temperature	-40°F to 158°F (-40°C to 70°C)	-40°F to 158°F (-40°C to 70°C)	-40°F to 158°F (-40°C to 70°C)
Nonoperating/Storage relative humidity	15% to 90% @ 149°F (65°C), noncondensing	15% to 90% @ 149°F (65°C), noncondensing	15% to 90% @ 149°F (65°C), noncondensing
Altitude	up to 10,000 ft (3 km)	up to 10,000 ft (3 km)	up to 10,000 ft (3 km)
Acoustic	Power: 47 dB, Pressure: 29.4 dB	Power: 47 dB, Pressure: 29.4 dB	Power: 39 dB, Pressure: 22.3 dB
Safety			
	EN 60950/IEC 60950; UL 60950; UL 60950-1; CAN/CSA 22.2 No. 60950; EN 60825; CSA 22.2 60950-1; EN62479:2010; EN 60950-1:2006 +A11:2009 +A1:2010 +A12:2011+A2:2013; EN 62368-1, Ed. 2; IEC 60950-1:2005 Ed.2; Am 1:2009+A2:2013; IEC 60825:2007; EN60850-1:2007 / IEC 60825-1: 2007 Class1 Class 1 Laser Products / Laser Klasse 1; UL 62368-1 Ed.2	EN 60950/IEC 60950; UL 60950; UL 60950-1; CAN/CSA 22.2 No. 60950; EN 60825; CSA 22.2 60950-1; EN62479:2010; EN 60950-1:2006 +A11:2009 +A1:2010 +A12:2011+A2:2013; EN 62368-1, Ed. 2; IEC 60950-1:2005 Ed.2; Am 1:2009+A2:2013; IEC 60825:2007; EN60850-1:2007 / IEC 60825-1: 2007 Class1 Class 1 Laser Products / Laser Klasse 1; UL 62368-1 Ed.2	EN 60950/IEC 60950; UL 60950; UL 60950-1; CAN/CSA 22 2 No. 60950; EN 60825; CSA 22.2 60950-1; EN62479:2010; EN 60950-1:2006 +A11:2009 +A1:2010 +A12:2011+A2:2013; EN 62368-1, Ed. 2; IEC 60950-1:2005 Ed.2; Am 1:2009+A2:2013; IEC 60825:2007; EN60850-1:2007 / IEC 60825-1: 2007 Class1 Class 1 Laser Products / Laser Klasse 1; UL 62368-1 Ed.2

SPECIFICATIONS

	Aruba 3810M 48G PoE+ 4SFP+ 680W Switch (JL428A)	Aruba 3810M 48G PoE+ 4SFP+ 1050W Switch (JL429A)	Aruba 3810M 24SFP+ 250W Switch (JL430A)
Emissions			
	FCC Class A; VCCI Class A; EN 55022/CISPR 22 Class A; EN 60950-1:2006 +A11:2009 +A1:2010 +A12:2011+A2:2013	FCC Class A; VCCI Class A; EN 55022/CISPR 22 Class A; EN 60950-1:2006 +A11:2009 +A1:2010 +A12:2011+A2:2013	FCC Class A; VCCI Class A; EN 55022/CISPR 22 Class A; EN 60950-1:2006 +A11:2009 +A1:2010 +A12:2011+A2:2013
Immunity			
Generic	EN55022: 2010	EN55022: 2010	EN55022: 2010
EN	EN55024: 2010	EN55024: 2010	EN55024: 2010
ESD	IEC 61000-4-2	IEC 61000-4-2	IEC 61000-4-2
Radiated	IEC 61000-4-3; 3 V/m	IEC 61000-4-3; 3 V/m	IEC 61000-4-3; 3 V/m
EFT/Burst	IEC 61000-4-4; 1.0 kV (power line), 0.5 kV (signal line)	IEC 61000-4-4; 1.0 kV (power line), 0.5 kV (signal line)	IEC 61000-4-4; 1.0 kV (power line), 0.5 kV (signal line)
Surge	IEC 61000-4-5; 1 kV/2 kV AC	IEC 61000-4-5; 1 kV/2 kV AC	IEC 61000-4-5; 1 kV/2 kV AC
Conducted	IEC 61000-4-6; 3 V	IEC 61000-4-6; 3 V	IEC 61000-4-6; 3 V
Power frequency magnetic field	IEC 61000-4-8; 1 A/m, 50 or 60 Hz	IEC 61000-4-8; 1 A/m, 50 or 60 Hz	IEC 61000-4-8; 1 A/m, 50 or 60 Hz
Voltage dips and interruptions	IEC 61000-4-11; >95% reductions, 0.5 period; 30% reduction, 25 periods	IEC 61000-4-11; >95% reductions, 0.5 period; 30% reduction, 25 periods	IEC 61000-4-11; >95% reductions, 0.5 period; 30% reduction, 25 periods
Harmonics	EN61000-3-2:2006 +A1:2009 +A2:2009 Class A	EN61000-3-2:2006 +A1:2009 +A2:2009 Class A	EN61000-3-2:2006 +A1:2009 +A2:2009 Class A
Flicker	EN61000-3-3:2008	EN61000-3-3:2008	EN61000-3-3:2008
Management			
	Aruba AirWave Network Management; IMC – Intelligent Management Center; Aruba Central; Command-line interface; Web browser; Configuration menu; Out-of-band management (RJ-45 Ethernet); In-line and out-of-band; Out-of-band management (serial RS-232c or micro usb)	Aruba AirWave Network Management; IMC – Intelligent Management Center; Aruba Central; Command-line interface; Web browser; Configuration menu; Out-of-band management (RJ-45 Ethernet); In-line and out-of-band; Out-of-band management (serial RS-232c or micro usb)	Aruba AirWave Network Management; IMC – Intelligent Management Center; Aruba Central; Command-line interface; Web browser; Configuration menu; Out-of-band management (RJ-45 Ethernet); In-line and out-of-band; Out-of-band management (serial RS-232c or micro usb)
Services			
	Refer to the Hewlett Packard Enterprise website at www.hpe.com/networking/services for details on the service-level descriptions and product numbers. For details about services and response times in your area, please contact your local Hewlett Packard Enterprise sales office.	Refer to the Hewlett Packard Enterprise website at www.hpe.com/networking/services for details on the service-level descriptions and product numbers. For details about services and response times in your area, please contact your local Hewlett Packard Enterprise sales office.	Refer to the Hewlett Packard Enterprise website at www.hpe.com/networking/services for details on the service-level descriptions and product numbers. For details about services and response times in your area, please contact your local Hewlett Packard Enterprise sales office.

STANDARDS AND PROTOCOLS (APPLIES TO ALL PRODUCTS IN SERIES)

BGP

- RFC 1997 BGP Communities Attribute
- RFC 2918 Route Refresh Capability
- RFC 4271 A Border Gateway Protocol 4 (BGP-4)
- RFC 4456 BGP Route Reflection: An Alternative to Full Mesh Internal BGP (IBGP)
- RFC 4724 Graceful Restart Mechanism for BGP
- RFC 5492 Capabilities Advertisement with BGP-4

Denial of service protection

- CPU DoS Protection

Device management

- RFC 1591 DNS (client)
- RFC 2576 (Coexistence between SNMP V1, V2, V3)
- RFC 2579 (SMIv2 Text Conventions)
- RFC 2580 (SMIv2 Conformance)
- RFC 3416 (SNMP Protocol Operations v2)
- RFC 3417 (SNMP Transport Mappings)
- HTML and telnet management

General protocols

- IEEE 802.1ad Q-in-Q
- IEEE 802.1AX-2008 Link Aggregation
- IEEE 802.1D MAC Bridges
- IEEE 802.1p Priority
- IEEE 802.1Q VLANs
- IEEE 802.1s Multiple Spanning Trees
- IEEE 802.1v VLAN classification by Protocol and Port
- IEEE 802.1w Rapid Reconfiguration of Spanning Tree
- IEEE 802.3ad Link Aggregation Control Protocol (LACP)
- IEEE 802.3af Power over Ethernet
- IEEE 802.3x Flow Control
- RFC 768 UDP
- RFC 783 TFTP Protocol (revision 2)
- RFC 792 ICMP
- RFC 793 TCP
- RFC 826 ARP
- RFC 854 TELNET
- RFC 868 Time Protocol
- RFC 951 BOOTP
- RFC 1058 RIPv1
- RFC 1350 TFTP Protocol (revision 2)
- RFC 1519 CIDR
- RFC 1542 BOOTP Extensions
- RFC 1918 Address Allocation for Private Internet
- RFC 2030 Simple Network Time Protocol (SNTP) v4
- RFC 2131 DHCP
- RFC 2453 RIPv2
- RFC 2548 (MS-RAS-Vendor only)
- RFC 3046 DHCP Relay Agent Information Option
- RFC 3575 IANA Considerations for RADIUS
- RFC 3576 Ext to RADIUS (CoA only)
- RFC 3768 VRRP
- RFC 4675 RADIUS VLAN & Priority
- RFC 5798 VRRP (exclude Accept Mode and sub-sec timer)
- RFC 5880 Bidirectional Forwarding Detection
- RFC 5905 Network Time Protocol Version 4: Protocol and Algorithms Specification
- UDLD (Uni-directional Link Detection)

IP multicast

- RFC 3376 IGMPv3
- RFC 3973 PIM Dense Mode
- RFC 4601 PIM

IPv6

- RFC 1981 IPv6 Path MTU Discovery
- RFC 2080 RIPng for IPv6
- RFC 2081 RIPng Protocol Applicability Statement
- RFC 2082 RIP-2 MD5
- RFC 2375 IPv6 Multicast Address Assignments
- RFC 2460 IPv6 Specification
- RFC 2464 Transmission of IPv6 over Ethernet Networks
- RFC 2710 Multicast Listener Discovery (MLD) for IPv6
- RFC 2925 Definitions of Managed Objects for Remote Ping, Traceroute, and Lookup Operations (Ping only)
- RFC 3019 MLDv1 MIB
- RFC 3315 DHCPv6 (client only)
- RFC 3484 Default Address Selection for IPv6
- RFC 3587 IPv6 Global Unicast Address Format
- RFC 3596 DNS Extension for IPv6
- RFC 3810 MLDv2 (host joins only)
- RFC 4022 MIB for TCP
- RFC 4087 IP Tunnel MIB
- RFC 4113 MIB for UDP
- RFC 4213 Basic Transition Mechanisms for IPv6 Hosts and Routers
- RFC 4251 SSHv6 Architecture
- RFC 4252 SSHv6 Authentication
- RFC 4253 SSHv6 Transport Layer
- RFC 4254 SSHv6 Connection
- RFC 4291 IP Version 6 Addressing Architecture
- RFC 4293 MIB for IP

- RFC 4294 IPv6 Node Requirements
- RFC 4419 Key Exchange for SSH
- RFC 4443 ICMPv6
- RFC 4541 IGMP & MLD Snooping Switch
- RFC 4861 IPv6 Neighbor Discovery
- RFC 4862 IPv6 Stateless Address Auto-configuration
- RFC 5095 Deprecation of Type 0 Routing Headers in IPv6
- RFC 5340 OSPFv3 for IPv6
- RFC 5453 Reserved IPv6 Interface Identifiers
- RFC 5519 Multicast Group Membership Discovery MIB (MLDv2 only)
- RFC 5722 Handling of Overlapping IPv6 Fragments
- RFC 6620 FCFS SAVI
- draft-ietf-savi-mix

MIBs

- IEEE 802.1ap (MSTP and STP MIB's only)
- IEEE 8021-Bridge-MIB (2008)
- IEEE 8021-Q-Bridge-MIB (2008)
- RFC 1155 Structure & ID of Mgmt Info for TCP/IP Internets
- RFC 1213 MIB II
- RFC 1493 Bridge MIB
- RFC 1724 RIPv2 MIB
- RFC 1850 OSPFv2 MIB
- RFC 2021 RMONv2 MIB
- RFC 2096 IP Forwarding Table MIB
- RFC 2578 Structure of Management Information Version 2 (SMIv2)
- RFC 2613 SMON MIB
- RFC 2618 RADIUS Client MIB
- RFC 2620 RADIUS Accounting MIB
- RFC 2665 Ethernet-Like-MIB
- RFC 2668 802.3 MAU MIB
- RFC 2674 802.1p and IEEE 802.1Q Bridge MIB
- RFC 2737 Entity MIB (Version 2)
- RFC 2787 VRRP MIB
- RFC 2863 The Interfaces Group MIB
- RFC 2925 Ping MIB
- RFC 2932 IP (Multicast Routing MIB)
- RFC 2933 IGMP MIB
- RFC 3411 SNMP Management Frameworks
- RFC 3412 Message Processing and Dispatching for the Simple Network Management Protocol (SNMP)
- RFC 3413 Simple Network Management Protocol (SNMP) Applications
- RFC 3414 User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)
- RFC 3415 View-based Access Control Model (VACM) for the Simple Network Management Protocol (SNMP)
- RFC 3418 Management Information Base (MIB) for the Simple Network Management Protocol (SNMP)
- RFC 4836 Managed Objects for 802.3 Medium Attachment Units (MAU)
- RFC 7331 BFD MIB

Network management

- IEEE 802.1AB Link Layer Discovery Protocol (LLDP)
- RFC 2819 Four groups of RMON: 1 (statistics), 2 (history), 3 (alarm) and 9 (events)
- RFC 3176 sFlow
- RFC 5424 Syslog Protocol
- ANSI/TIA-1057 LLDP Media Endpoint Discovery (LLDP-MED)
- SNMPv1/v2c/v3
- XRMON

OSPF

- RFC 2328 OSPFv2
- RFC 3101 OSPF NSSA
- RFC 3623 Graceful OSPF Restart (Unplanned Outages only)
- RFC 5340 OSPFv3 for IPv6

QoS/CoS

- RFC 2474 DiffServ Precedence, including 8 queues/port
- RFC 2475 DiffServ Architecture
- RFC 2597 DiffServ Assured Forwarding (AF)
- RFC 2598 DiffServ Expedited Forwarding (EF)

Security

- IEEE 802.1X Port Based Network Access Control
- RFC 1321 The MD5 Message-Digest Algorithm
- RFC 2818 HTTP Over TLS RFC 1492 TACACS+
- RFC 2865 RADIUS (client only)
- RFC 2866 RADIUS Accounting
- RFC 3579 RADIUS Support For Extensible Authentication Protocol (EAP)
- Secure Sockets Layer (SSL)
- SSHv2 Secure Shell

ARUBA 3810 SWITCH SERIES ACCESSORIES

Modules

- Aruba 3810M 4-port Stacking Module (JL084A)
- Aruba 3810M 4SFP+ Module (JL083A)
- Aruba 3810M 1QSFP+ 40GbE Module (JL078A)
- Aruba 3810M 2QSFP+ 40GbE Module (JL079A)

Transceivers

- HPE X111 100M SFP LC FX Transceiver (J9054C)
- HPE X121 1G SFP LC SX Transceiver (J4858C)
- HPE X121 1G SFP LC LX Transceiver (J4859C)
- HPE X121 1G SFP LC LH Transceiver (J4860C)
- HPE X121 1G SFP RJ45 T Transceiver (J8177C)
- HPE X122 1G SFP LC BX-D Transceiver (J9142B)
- HPE X122 1G SFP LC BX-U Transceiver (J9143B)
- HPE X132 10G SFP+ LC SR Transceiver (J9150A)
- HPE X132 10G SFP+ LC LR Transceiver (J9151A)
- HPE X132 10G SFP+ LC LRM Transceiver (J9152A)
- HPE X132 10G SFP+ LC ER Transceiver (J9153A)
- HPE X142 40G QSFP+ MPO SR4 Transceiver (JH231A)
- HPE X142 40G QSFP+ MPO CSR4 300M Transceiver (JH233A)
- HPE X142 40G QSFP+ LC LR4 SM Transceiver (JH232A)
- HPE X242 10G SFP+ to SFP+ 1m Direct Attach Copper Cable (J9281B)
- HPE X242 10G SFP+ to SFP+ 3m Direct Attach Copper Cable (J9283B)
- HPE X242 10G SFP+ to SFP+ 7m Direct Attach Copper Cable (J9285B)
- HPE X244 10G XFP to SFP+ 1m Direct Attach Copper Cable (J9300A)
- HPE X244 10G XFP to SFP+ 3m Direct Attach Copper Cable (J9301A)
- HPE X244 10G XFP to SFP+ 3m Direct Attach Copper Cable (J9302A)
- HPE X242 40G QSFP+ to QSFP+ 1m Direct Attach Copper Cable (JH234A)
- HPE X242 40G QSFP+ to QSFP+ 3m DAC Cable (JH235A)
- HPE X242 40G QSFP+ to QSFP+ 5m DAC Cable (JH236A)

Cables

- HPE 3800 0.5m Stacking Cable (J9578A)
- HPE 3800 1m Stacking Cable (J9665A)
- HPE 3800 3m Stacking Cable (J9579A)
- HPE Premier Flex LC/LC Multi-mode OM4 2 fiber 1m Cable (QK732A)
- HPE Premier Flex LC/LC Multi-mode OM4 2 fiber 2m Cable (QK733A)
- HPE Premier Flex LC/LC Multi-mode OM4 2 fiber 5m Cable (QK734A)
- HPE Premier Flex LC/LC Multi-mode OM4 2 fiber 15m Cable (QK735A)
- HPE Premier Flex LC/LC Multi-mode OM4 2 fiber 30m Cable (QK736A)
- HPE Premier Flex LC/LC Multi-mode OM4 2 fiber 50m Cable (QK737A)

Power Supply

- Aruba X371 12VDC 250W 100-240VAC Power Supply (JL085A)
- Aruba X372 54VDC 680W 100-240VAC Power Supply (JL086A)
- Aruba X372 54VDC 1050W 110-240VAC Power Supply (JL087A)

Fan Tray

- Aruba 3810 Switch Fan Tray (JL088A)

Mounting Kit

- HPE X410 1U Universal 4-post Rack Mounting Kit (J9583A)

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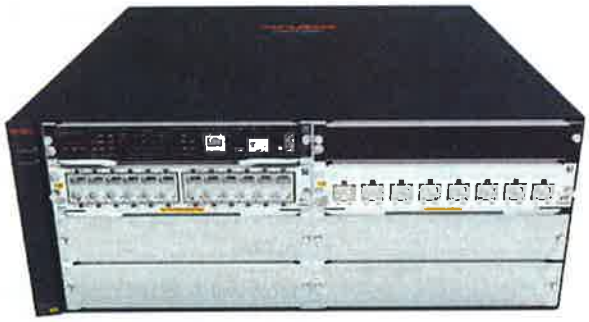
Hewlett Packard Enterprise

Aruba 5400R zl2 Switch Series



Key features

- High performance advanced Layer 3 modular switch with VSF stacking, low latency and resiliency.
- HPE Smart Rate for high-speed multi-gigabit bandwidth and PoE+ power.
- Scalable line rate 40GbE for wireless traffic aggregation.
- Optimized for innovative SDN applications with OpenFlow support.
- Security and network management tools with ClearPass Policy Manager and AirWave support.

Product overview

The Aruba 5400R zl2 Switch Series is an industry-leading mobile campus access solution with HPE Smart Rate multi-gigabit ports for high-speed 802.11ac devices. It delivers enterprise-class resiliency with innovative flexibility and scalability for customers creating digital workplaces that are optimized for mobile users with an integrated wired and wireless approach. This series brings scalable aggregation with Virtual Switching Framework (VSF) stacking technology, hitless failover, and Fast Software Upgrade for 5400R VSF stacks. The advanced Layer 2 and 3 feature set includes OSPF, IPv6, IPv4 BGP, Tunneled Node, robust QoS and policy-based routing with no software licensing required.

Based on a powerful ProVision ASIC, the Aruba 5400R zl2 Switch Series has a high-speed, high-capacity architecture with 2 Tbps crossbar switching fabric with low 2.1 µ latency, unprecedented programmability, and supports innovative SDN applications. This series offers flexible connectivity options with 6- or 12-slot compact chassis, line rate 40GbE, up to 96 line rate 10GbE ports and up to 288 ports of PoE+. The 5400R is SDN optimized with OpenFlow support and is easy to deploy and manage with advanced security and network management tools like Aruba ClearPass Policy Manager and Aruba AirWave.

Features and benefits

Software-defined networking

- OpenFlow

  Supports OpenFlow 1.0 and 1.3 specifications to enable SDN by allowing separation of the data (packet forwarding) and control (routing decision) paths

- Fully flexible OpenFlow

  Creates custom OpenFlow pipelines (processing stages) on-demand to support new SDN applications (requires v3 modules)

Unified Wired and Wireless

- ClearPass Policy Manager

  Supports unified wired and wireless policies using Aruba ClearPass Policy Manager

- HTTP redirect function

  Supports HPE Intelligent Management Center (IMC) bring your own device (BYOD) solution

- Switch auto-configuration

  Automatically configures switch for different settings such as VLAN, CoS, PoE max power, and PoE priority when Aruba AP is detected

- User Role

  A set of switch-based policies in areas such as security, authentication, and QoS. A User Role can be assigned to a group of users or devices, using switch configuration or ClearPass

- Per-port Tunneled Node

  Provide secured tunnel to transport network traffic on a per-port basis to Aruba Controller. Authentication and network policies will be applied and enforced at the Controller

- **New** Static IP Visibility

  Allows ClearPass to do accounting for clients with static IP address

Quality of Service (QoS)

- Advanced classifier-based QoS

  Classifies traffic using multiple match criteria based on Layer 2, 3, and 4 information; applies QoS policies such as setting priority level and rate limit to selected traffic on a per-port or per VLAN basis

- Traffic prioritization

  Allows real-time traffic classification into eight priority levels mapped to eight queues

- Bandwidth shaping
  - Port-based rate limiting

    provides per-port ingress-/egress-enforced increased bandwidth
  - Classifier-based rate limiting

    uses an access control list (ACL) to enforce increased bandwidth for ingress traffic on each port
  - Reduced bandwidth

    provides per-port, per-queue egress-based reduced bandwidth
- Class of Service (CoS)

  Sets the IEEE 802.1p priority tag based on IP address, IP Type of Service (ToS), Layer 3 protocol, TCP/UDP port number, source port, and DiffServ

Management

- Zero-Touch Provisioning (ZTP)

  Simplifies installation of the switch infrastructure using Aruba Activate-based or DHCP-based process with AirWave Network Management
- **New** IP SLA for Voice

  Monitor quality of voice traffic with UDP Jitter and UDP Jitter for VoIP (requires v3 modules)
- Remote intelligent mirroring

  Mirrors selected ingress/egress traffic based on ACL, port, MAC address, or VLAN to a local or remote HPE 8200 zl, 6600, 6200 yl, 5400 zl, 5400R, 3500, or 3800 Switch located anywhere on the network
- RMON, XRMON, and sFlow® v5

  Provide advanced monitoring and reporting capabilities for statistics, history, alarms, and events
- IEEE 802.1AB Link Layer Discovery Protocol (LLDP)

  Advertises and receives management information from adjacent devices on a network, facilitating easy mapping by network management applications
- Uni-Directional Link Detection (UDLD)

  Support Hewlett Packard Enterprise (HPE) UDLD and DLDP protocols to monitor a cable between two switches and shut down the ports on both ends if the cable is broken
- Management simplicity

  Provides common software features and CLI implementation across all HPE ProVision-based switches (including the zl and yl switches)
- Command authorization

  Leverages RADIUS to link a custom list of CLI commands to an individual network administrator's login; an audit trail documents activity

- Friendly port names

  Allows assignment of descriptive names to ports

- Dual flash images

  Provides independent primary and secondary operating system files for backup while upgrading

- Multiple configuration files

  Stores easily to the flash image

- Comware CLI

  - Comware-compatible CLI

    bridges the experience of HPE Comware CLI users who are using the HPE ProVision software CLI

  - Display and fundamental Comware CLI commands

    are embedded in the switch CLI as native commands; display output is formatted as on Comware-based switches, and fundamental commands provide a Comware-familiar initial switch setup

  - Configuration Comware CLI commands

    when Comware commands are entered, CLI help is elicited to formulate the correct ProVision software CLI command

Connectivity

- IEEE 802.3az Energy Efficient Ethernet

  Lowers power consumption in periods of low link usage (supported on v2 zl 10/100/1000 and 10/100 modules)

- IEEE 802.3af Power over Ethernet (PoE)

  Provides up to 15.4 W per port to IEEE 802.3af-compliant PoE-powered devices such as IP phones, wireless access points, and security cameras

- IEEE 802.3at Power over Ethernet Plus

  Provides up to 30 W per port, for up to 288 ports simultaneously, for PoE- and PoE+-powered devices, such as video IP phones, IEEE 802.11n wireless access points, and advanced pan/zoom/tilt security cameras

- Prestandard PoE support

  Detects and provides power to prestandard PoE devices

- High-density port connectivity

  Provides up to 12 interface module slots and up to 288 wire-speed 10/100/1000 PoE-enabled ports or 96 10GbE ports per system

- Jumbo frames

  On Gigabit Ethernet and 10-Gigabit Ethernet ports, jumbo frames allow high-performance remote backup and disaster-recovery services

- Auto-MDIX

  Provides automatic adjustments for straight-through or crossover cables on all 10/100 and 10/100/1000 ports

- IPv6

  - IPv6 host

    enables switches to be managed in an IPv6 network

  - Dual stack (IPv4 and IPv6)

    transitions from IPv4 to IPv6, supporting connectivity for both protocols

  - MLD snooping

    forwards IPv6 multicast traffic to the appropriate interface

  - IPv6 ACL/QoS

    supports ACL and QoS for IPv6 network traffic

  - IPv6 routing

    supports static, RIPng, and OSPFv3 routing protocols

  - 6in4 tunneling

    supports encapsulation of IPv6 traffic in IPv4 packets

  - Security

    provides RA guard, DHCPv6 protection, dynamic IPv6 lockdown, and ND snooping

Performance

- High-speed, high-capacity architecture

  2 Tbps crossbar switching fabric provides intra-module and inter-module switching with 785.7 million pps throughput on the purpose-built ProVision ASICs

- Selectable queue configurations

  Allows for increased performance by selecting the number of queues and associated memory buffering that best meet the requirements of the network applications

Resiliency and high availability

- Virtual Switching Framework (VSF)

  Creates one virtual resilient switch from two switches; servers or switches can be attached using standard LACP for automatic load balancing and high availability; simplify network operation by reduce the need for complex protocols like Spanning Tree Protocol (STP), Equal-Cost Multipath (ECMP), and VRRP (requires v3 modules)

- **New** Fast Software Upgrade

  Reduces downtime of the VSF stack during an upgrade by sequentially upgrading the members in the stack shrinking the downtime to a few seconds (requires v3 modules)

- Virtual Router Redundancy Protocol (VRRP)

  Allows groups of two routers to dynamically back each other up to create highly available routed environments for IPv4 and IPv6 networks

- Nonstop switching

  Improves network availability to better support critical applications such as unified communication and mobility; interface and fabric modules continue switching traffic during failover from active to standby management module

- Nonstop routing

  Enhances Layer 3 high availability; OSPFv2/v3 and VRRP will continue to operate and route network traffic during failover from an active to a standby management module

- Redundant management and power

  Provide enhanced system availability and continuity of operations

- IEEE 802.1s Multiple Spanning Tree Protocol

  Provides high link availability in multiple VLAN environments by allowing multiple spanning trees; encompasses IEEE 802.1D Spanning Tree Protocol and IEEE 802.1w Rapid Spanning Tree Protocol

- IEEE 802.3ad Link Aggregation Control Protocol (LACP) and HPE port trunking

  Support up to 144 trunks, each with up to eight links (ports) per trunk

- Distributed trunking

  Enables loop-free and redundant network topology without using Spanning Tree Protocol; allows a server or switch to connect to two switches using one logical trunk for redundancy and load sharing

- Optional redundant power supply

  Provides uninterrupted power and allows hot-swapping of the redundant power supplies when installed

- Hot-swappable modules

  Allows dissimilar modules, and power supplies in a redundant power supply configuration to be added or swapped without interrupting the network

- Sparing simplicity

  HPE zl-common accessories (interface modules and power supplies)

- Uplink Failure Detection

  Provides active-standby network path redundancy for servers that are configured for active-standby NIC teaming

- Smart Link

  Provides easy-to-configure link redundancy of active and standby links

Layer 2 switching

- VLAN support and tagging

  Supports the IEEE 802.1Q standard and 4,094 VLANs simultaneously

- IEEE 802.1v protocol VLANs

  Isolate select non-IPv4 protocols automatically into their own VLANs

- VxLAN

  Encapsulation (tunneling) protocol for overlay network that enables a more scalable virtual network deployment (requires v3 modules)

- GVRP and MVRP

  Allows automatic learning and dynamic assignment of VLANs

- IEEE 802.1ad Q-in-Q

  Increases the scalability of an Ethernet network by providing a hierarchical structure; connects multiple LANs on a high-speed campus or metro network

- MAC-based VLAN

  Provides granular control and security; uses RADIUS to map a MAC address/user to specific VLANs (requires v2 or higher modules)

- Rapid Per-VLAN Spanning Tree (RPVST+)

  Allows each VLAN to build a separate spanning tree to improve link bandwidth usage; is compatible with PVST+

- HPE switch meshing

  Dynamically load balances across multiple active redundant links to increase available aggregate bandwidth; allows concurrent Layer 3 routing with v2 or higher modules

Layer 3 services

- Bidirectional Forwarding Detection (BFD)

  Enables link connectivity monitoring and reduces network convergence time for OSPFv2 and VRRP (requires v3 modules)

- User Datagram Protocol (UDP) helper function

  Allows UDP broadcasts to be directed across router interfaces to specific IP unicast or subnet broadcast addresses and prevents server spoofing for UDP services such as DHCP

- Loopback interface address

  Defines an address in Routing Information Protocol (RIP) and Open Standard Path First (OSPF), improving diagnostic capability

- Route maps

  Provide more control during route redistribution; allow filtering and altering of route metrics

- DHCP server

  Centralizes and reduces the cost of IPv4 address management

Layer 3 routing

- Static IP routing

  Provides manually configured routing for both IPv4 and IPv6 networks

- Routing Information Protocol (RIP)

  Provides RIPv1, RIPv2, and RIPng routing

- OSPF

  Provides OSPFv2 for IPv4 routing and OSPFv3 for IPv6 routing

- Policy-based routing

  Uses a classifier to select traffic that can be forwarded based on policy set by the network administrator (requires v2 or higher modules)

- Border Gateway Protocol (BGP)

  Provides IPv4 Border Gateway Protocol routing, which is scalable, robust, and flexible

Security

- Access control lists (ACLs)

  Provide filtering based on the IP field, source/destination IP address/subnet, and source/destination TCP/UDP port number on a per-VLAN or per-port basis

- Multiple user authentication methods

  – IEEE 802.1X users per port

    provides authentication of multiple IEEE 802.1X users per port

  – Web-based authentication

    authenticates from a web browser for clients that do not support IEEE 802.1X supplicant

  – MAC-based authentication

    client is authenticated with the RADIUS server based on the client's MAC address

  – Concurrent IEEE 802.1X, web, and MAC authentication schemes per port

    switch port accepts up to 32 sessions of IEEE 802.1X, web, and MAC authentications

- Private VLAN

  Provides network security by restricting peer-to-peer communication to prevent a variety of malicious attacks; typically a switch port can only communicate with other ports in the same community and/or an uplink port, regardless of VLAN ID or destination MAC address

- DHCP protection

  Blocks DHCP packets from unauthorized DHCP servers, preventing denial-of-service attacks

- Secure management access

  Delivers secure encryption of all access methods (CLI, GUI, or MIB) through SSHv2, SSL, and/or SNMPv3

- Switch CPU protection

  Provides automatic protection against malicious network traffic trying to shut down the switch

- ICMP throttling

  Defeats ICMP denial-of-service attacks by enabling any switch port to automatically throttle ICMP traffic

- Identity-driven ACL

  Enables implementation of a highly granular and flexible access security policy and VLAN assignment specific to each authenticated network user

- STP BPDU port protection

  Blocks Bridge Protocol Data Units (BPDUs) on ports that do not require BPDUs, preventing forged BPDU attacks

- Dynamic IP lockdown

  Works with DHCP protection to block traffic from unauthorized hosts, preventing IP source address spoofing

- Dynamic ARP protection

  Blocks ARP broadcasts from unauthorized hosts, preventing eavesdropping or theft of network data

- STP root guard

  Protects the root bridge from malicious attacks or configuration mistakes

- Detection of malicious attacks

  Monitors 10 types of network traffic and sends a warning when an anomaly that potentially can be caused by malicious attacks is detected

- Port security

  Allows access only to specified MAC addresses, which can be learned or specified by the administrator

- MAC address lockout

  Prevents particular configured MAC addresses from connecting to the network

- Source-port filtering

  Allows only specified ports to communicate with each other

- RADIUS/TACACS+

  Eases switch management security administration by using a password authentication server

- Secure Shell

  Encrypts all transmitted data for secure remote CLI access over IP networks

- Secure Sockets Layer (SSL)

  Encrypts all HTTP traffic, allowing secure access to the browser-based management GUI in the switch

- Secure FTP

  Allows secure file transfer to and from the switch; protects against unwanted file downloads or unauthorized copying of a switch configuration file

- Management Interface Wizard

  Helps secure management interfaces such as SNMP, telnet, SSH, SSL, web, and USB at the desired level

- Switch management logon security

  Helps secure switch CLI logon by optionally requiring either RADIUS or TACACS+ authentication

- Security banner

  Displays a customized security policy when users log in to the switch

- IEEE 802.1AE MACsec

  Provides security on a link between two switch ports (1 Gbps or 10 Gbps) using standard encryption and authentication (requires v3 modules)

Convergence

- IP multicast routing

  Includes PIM Sparse and Dense modes to route IP multicast traffic

- IP multicast snooping (data-driven IGMP)

  Prevents flooding of IP multicast traffic

- LLDP-MED (Media Endpoint Discovery)

  Defines a standard extension of LLDP that stores values for parameters such as QoS and VLAN to automatically configure network devices such as IP phones

- PoE allocations

  Supports multiple methods (automatic, IEEE 802.3af class, LLDP-MED, or user-specified) to allocate PoE power for more efficient energy savings

- Auto VLAN configuration for voice

  – RADIUS VLAN

    uses a standard RADIUS attribute and LLDP-MED to automatically configure a VLAN for IP phones

  – CDPv2

    uses CDPv2 to configure legacy IP phones

- Local MAC Authentication

  Assigns attributes such as VLAN and QoS using locally configured profile that can be a list of MAC prefixes

Warranty and support

- Limited Lifetime Warranty

  See **hpe.com/networking/warrantysummary** for warranty and support information included with your product purchase.

- Software releases

  To find software for your product, refer to **hpe.com/networking/support**; for details on the software releases available with your product purchase, refer to **hpe.com/networking/warrantysummary**.

HPE 5400R zl2 Switch Series

Specifications

	HPE 5406R zl2 Switch (J9821A)	HPE 5412R zl2 Switch (J9822A)	HPE 5406R-44G-PoE+/2SFP+ (No PSU) v2 zl2 Switch (J9823A)
Included accessories	1 HPE 5400R zl2 Management Module (J9827A) 1 HPE 5406R zl2 Switch Fan Tray (J9831A)	1 HPE 5400R zl2 Management Module (J9827A) 1 HPE 5412R zl2 Switch Fan Tray (J9832A)	1 HPE 5400R zl2 Management Module (J9827A) 1 HPE 5406R zl2 Switch Fan Tray (J9831A) 1 HPE 24-port Gig-T PoE+ v2 zl Module (J9534A) 1 HPE 20-port Gig-T PoE+/2-port 10GbE SFP+ v2 zl Module (J9536A)
I/O ports and slots	6 open module slots Supports a maximum of 144 autosensing 10/100/1000 ports or 144 SFP ports or 48 SFP+ ports or 48 HPE Smart Rate Multi-Gigabit or 12 40GbE ports, or a combination	12 open module slots Supports a maximum of 288 autosensing 10/100/1000 ports or 288 SFP ports or 96 SFP+ ports or 96 HPE Smart Rate Multi-Gigabit or 24 40GbE ports, or a combination	44 RJ-45 autosensing 10/100/1000 PoE+ ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3ab Type 1000BASE-T, IEEE 802.3at PoE+); Media Type: Auto-MDIX; Duplex: 10BASE-T/ 100BASE-TX: half or full; 1000BASE-T: full only 2 open 10GbE SFP+ transceiver slots 4 open module slots Supports a maximum of 144 autosensing 10/100/1000 ports or 144 SFP ports or 48 SFP+ ports or 48 HPE Smart Rate Multi-Gigabit or 12 40GbE ports, or a combination
Power supplies	2 power supply slots 1 minimum power supply required (ordered separately)	4 power supply slots 2 minimum power supplies required (ordered separately)	2 power supply slots 1 minimum power supply required (ordered separately)
Fan tray	Includes: 1 x J9831A 1 fan tray slot	Includes: 1 x J9832A 1 fan tray slot	Includes: 1 x J9831A 1 fan tray slot
Physical characteristics			
Dimensions	17.5(w) x 17.75(d) x 6.9(h) in. (44.45 x 45.09 x 17.53 cm) (4U height)	17.5(w) x 17.75(d) x 12.1(h) in. (44.45 x 45.09 x 30.73 cm) (7U height)	17.5(w) x 17.75(d) x 6.9(h) in. (44.45 x 45.09 x 17.53 cm) (4U height)
Weight	24.5 lb (11.11 kg)	38.1 lb (17.28 kg)	28.11 lb (12.75 kg)
Memory and processor			
v3 Gigabit Module	Dual ARM® Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal
v2 Gigabit Module	ARM 11 @ 450 MHz; Packet buffer size: 18 MB internal	ARM 11 @ 450 MHz; Packet buffer size: 18 MB internal	ARM 11 @ 450 MHz; Packet buffer size: 18 MB internal
v3 10G Module	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal
v2 10G Module	ARM 11 @ 550 MHz; Packet buffer size: 18 MB internal	ARM 11 @ 550 MHz; Packet buffer size: 18 MB internal	ARM 11 @ 550 MHz; Packet buffer size: 18 MB internal
v3 40G Module	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal
Management Module	Freescale P2020 dual core @ 1.2 GHz, 16 MB flash, 1 GB SD Card, 4 GB DDR3 SODIMM	Freescale P2020 dual core @ 1.2 GHz, 16 MB flash, 1 GB SD Card, 4 GB DDR3 SODIMM	Freescale P2020 dual core @ 1.2 GHz, 16 MB flash, 1 GB SD Card, 4 GB DDR3 SODIMM

	HPE 5406R zl2 Switch (J9821A)	HPE 5412R zl2 Switch (J9822A)	HPE 5406R-44G-PoE+/2SFP+ (No PSU) v2 zl2 Switch (J9823A)
Mounting and enclosure	Mounts in an EIA standard 19-inch telco rack or equipment cabinet (hardware included); Horizontal surface mounting only	Mounts in an EIA standard 19-inch telco rack or equipment cabinet (hardware included); Horizontal surface mounting only	Mounts in an EIA standard 19-inch telco rack or equipment cabinet (hardware included); Horizontal surface mounting only
Performance	IPv6 Ready Certified	IPv6 Ready Certified	IPv6 Ready Certified
1000 Mb Latency	< 2.8 µs (FIFO 64-byte packets)	< 2.8 µs (FIFO 64-byte packets)	< 2.8 µs (FIFO 64-byte packets)
10 Gbps Latency	< 1.8 µs (FIFO 64-byte packets)	< 1.8 µs (FIFO 64-byte packets)	< 1.8 µs (FIFO 64-byte packets)
40 Gbps Latency	< 1.5 µs (FIFO 64-byte packets)	< 1.5 µs (FIFO 64-byte packets)	< 1.5 µs (FIFO 64-byte packets)
Throughput	Up to 571.4 Mpps	Up to 1142.8 Mpps	Up to 571.4 Mpps
Routing/Switching capacity	960 Gbps	1920 Gbps	960 Gbps
Switch fabric speed	1015 Gbps	2030 Gbps	1015 Gbps
Routing table size	10000 entries (IPv4), 5000 entries (IPv6)	10000 entries (IPv4), 5000 entries (IPv6)	10000 entries (IPv4), 5000 entries (IPv6)
MAC address table size	64000 entries	64000 entries	64000 entries
Environment			
Operating temperature	32°F to 113°F (0°C to 45°C); 0°C to 40°C with J8177C transceiver installed, 0°C to 35°C with FIPS Opacity Shield installed	32°F to 113°F (0°C to 45°C); 0°C to 40°C with J8177C transceiver installed, 0°C to 35°C with FIPS Opacity Shield installed	32°F to 113°F (0°C to 45°C); 0°C to 40°C with J8177C transceiver installed, 0°C to 35°C with FIPS Opacity Shield installed
Operating relative humidity	15% to 95% @ 113°F (45°C), noncondensing	15% to 95% @ 113°F (45°C), noncondensing	15% to 95% @ 113°F (45°C), noncondensing
Nonoperating/Storage temperature	-40°F to 158°F (-40°C to 70°C)	-40°F to 158°F (-40°C to 70°C)	-40°F to 158°F (-40°C to 70°C)
Nonoperating/Storage relative humidity	15% to 95% @ 149°F (65°C), noncondensing	15% to 95% @ 149°F (65°C), noncondensing	15% to 95% @ 149°F (65°C), noncondensing
Altitude	Up to 10,000 ft (3 km)	Up to 10,000 ft (3 km)	Up to 10,000 ft (3 km)
Acoustic	Power: 44 dB, Pressure: 31.7 dB ISO 7779, ISO 9296	Power: 49 dB, Pressure: 35.7 dB ISO 7779, ISO 9296	Power: 44 dB, Pressure: 31.7 dB ISO 7779, ISO 9296
Electrical characteristics			
Frequency	50/60 Hz	50/60 Hz	50/60 Hz
80plus.org Certification	Gold	Gold	Gold
Description	Does not come with power supply. Two power supply slots are available; three different power supplies are available. See power supply products for additional specifications.	Does not come with power supply. Four power supply slots are available; three different power supplies are available. See power supply products for additional specifications.	Does not come with power supply. Two open power supply slots are available; three different power supplies are available. See power supply products for additional specifications.
Maximum heat dissipation	2450 BTU/hr (2584 kJ/hr), (max. non-PoE); 3700 BTU/hr (3903 kJ/hr), (max. using PoE)	4900 BTU/hr (5169 kJ/hr), (max. non-PoE); 7400 BTU/hr (7,807 kJ/hr), (max. using PoE)	2450 BTU/hr (2584.75 kJ/hr), (max. non-PoE); 3700 BTU/hr (3903 kJ/hr), (max. using PoE)
Voltage	100–127/200–240 VAC, rated (Power supply dependent)	100–127/200–240 VAC, rated (Power supply dependent)	110–127/200–240 VAC, rated (Power supply dependent)
Notes	Heat dissipation does not include heat dissipated by the PoE-powered devices themselves. When more than four power cords are installed in a 5412R zl2 switch chassis, additional installation requirements are needed. Refer to the HPE 5400R zl2 Switches Quick Setup Guide and Safety/ Regulatory Information manual for details.	Heat dissipation does not include heat dissipated by the PoE-powered devices themselves. When more than four power cords are installed in a 5412R zl2 switch chassis, additional installation requirements are needed. Refer to the HPE 5400R zl2 Switches Quick Setup Guide and Safety/ Regulatory Information manual for details.	Heat dissipation does not include heat dissipated by the PoE-powered devices themselves. When more than four power cords are installed in a 5412R zl2 switch chassis, additional installation requirements are needed. Refer to the HPE 5400R zl2 Switches Quick Setup Guide and Safety/ Regulatory Information manual for details.

	HPE 5406R zl2 Switch (J9821A)	HPE 5412R zl2 Switch (J9822A)	HPE 5406R-44G-PoE+/2SFP+ (No PSU) v2 zl2 Switch (J9823A)
Safety	CSA 22.2 No. 60950; UL 60950; IEC 60950; EN 60950	CSA 22.2 No. 60950; UL 60950; IEC 60950; EN 60950	CSA 22.2 No. 60950; UL 60950; IEC 60950; EN 60950
Emissions	FCC part 15 Class A; EN 55022/CISPR 22 Class A	FCC part 15 Class A; EN 55022/CISPR 22 Class A	FCC part 15 Class A; EN 55022/CISPR 22 Class A
Immunity			
EN	EN 55024, CISPR 24	EN 55024, CISPR 24	EN 55024, CISPR 24
ESD	IEC 61000-4-2; 4 kV CD, 8 kV AD; HPE ENV. 765.002	IEC 61000-4-2; 4 kV CD, 8 kV AD; HPE ENV. 765.002	IEC 61000-4-2; 4 kV CD, 8 kV AD; HPE ENV. 765.002
Radiated	IEC 61000-4-3; 3 V/m	IEC 61000-4-3; 3 V/m	IEC 61000-4-3; 3 V/m
EFT/Burst	IEC 61000-4-4; 1.0 kV (power line), 0.5 kV (signal line) IEC 61000-4-5; 1 kV/2 kV AC, 1 kV signal, 0.5 kV DC	IEC 61000-4-4; 1.0 kV (power line), 0.5 kV (signal line) IEC 61000-4-5; 1 kV/2 kV AC, 1 kV signal, 0.5 kV DC	IEC 61000-4-4; 1.0 kV (power line), 0.5 kV (signal line) IEC 61000-4-5; 1 kV/2 kV AC, 1 kV signal, 0.5 kV DC
Surge	IEC 61000-4-6; 3 Vrms	IEC 61000-4-6; 3 Vrms	IEC 61000-4-6; 3 Vrms
Conducted	IEC 61000-4-8; 1 A/m, 50 or 60 Hz	IEC 61000-4-8; 1 A/m, 50 or 60 Hz	IEC 61000-4-8; 1 A/m, 50 or 60 Hz
Power frequency magnetic field	IEC 61000-4-11; >95% reduction, 0.5 period; 30% reduction, 25 periods	IEC 61000-4-11; >95% reduction, 0.5 period; 30% reduction, 25 periods	IEC 61000-4-11; >95% reduction, 0.5 period; 30% reduction, 25 periods
Harmonics	EN 61000-3-2, IEC 61000-3-2	EN 61000-3-2, IEC 61000-3-2	EN 61000-3-2, IEC 61000-3-2
Flicker	EN 61000-3-3, IEC 61000-3-3	EN 61000-3-3, IEC 61000-3-3	EN 61000-3-3, IEC 61000-3-3
Management	IMC—Intelligent Management Center; Command-line interface, web browser; Configuration menu; Out-of-band management (RJ-45 Ethernet); SNMP Manager; Out-of-band management (serial RS-232C or micro USB) AirWave Network Management	IMC—Intelligent Management Center; Command-line interface; web browser; Configuration menu; Out-of-band management (RJ-45 Ethernet); SNMP Manager; Out-of-band management (serial RS-232C or micro USB) AirWave Network Management	IMC—Intelligent Management Center; Command-line interface; web browser; Configuration menu; Out-of-band management (RJ-45 Ethernet); SNMP Manager; Out-of-band management (serial RS-232C or micro USB) AirWave Network Management
Notes	Supported 1G SFP transceivers are revision "B" or later (product number ends with the letter "B" or later; for example, J9142B, J8177C)	Supported 1G SFP transceivers are revision "B" or later (product number ends with the letter "B" or later; for example, J9142B, J8177C)	Supported 1G SFP transceivers are revision "B" or later (product number ends with the letter "B" or later; for example, J9142B, J8177C)
Services	Refer to the Hewlett Packard Enterprise website at **hpe.com/networking/services** for details on the service-level descriptions and product numbers. For details about services, and response times in your area, please contact your local Hewlett Packard Enterprise sales office.	Refer to the Hewlett Packard Enterprise website at **hpe.com/networking/services** for details on the service-level descriptions and product numbers. For details about services, and response times in your area, please contact your local Hewlett Packard Enterprise sales office.	Refer to the Hewlett Packard Enterprise website at **hpe.com/networking/services** for details on the service-level descriptions and product numbers. For details about services, and response times in your area, please contact your local Hewlett Packard Enterprise sales office.

HPE 5400R zl2 Switch Series

Specifications (continued)

	HPE 5412R-92G-PoE+/2SFP+ (No PSU) v2 zl2 Switch (J9825A)	HPE 5406R-44G-PoE+/4SFP (No PSU) v2 zl2 Switch (J9824A)	HPE 5412R-92G-PoE+/4SFP (No PSU) v2 zl2 Switch (J9826A)
Included accessories	1 HPE 5400R zl2 Management Module (J9827A) 1 HPE 5412R zl2 Switch Fan Tray (J9832A) 3 HPE 24-port Gig-T PoE+ v2 zl Module (J9534A) 1 HPE 20-port Gig-T PoE+/2-port 10GbE SFP+ v2 zl Module (J9536A)	1 HPE 5400R zl2 Management Module (J9827A) 1 HPE 5406R zl2 Switch Fan Tray (J9831A) 1 HPE 24-port Gig-T PoE+ v2 zl Module (J9534A) 1 HPE 20-port Gig-T PoE+/4-port SFP v2 zl Module (J9535A)	1 HPE 5400R zl2 Management Module (J9827A) 1 HPE 5412R zl2 Switch Fan Tray (J9832A) 3 HPE 24-port Gig-T PoE+ v2 zl Module (J9534A) 1 HPE 20-port Gig-T PoE+/4-port SFP v2 zl Module (J9535A)
I/O ports and slots	92 RJ-45 autosensing 10/100/1000 PoE+ ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3ab Type 1000BASE-T, IEEE 802.3at PoE+); Media Type: Auto-MDIX; Duplex: 10BASE-T/100BASE-TX: half or full; 1000BASE-T: full only 2 open 10GbE SFP+ transceiver slots 8 open module slots Supports a maximum of 288 autosensing 10/100/1000 ports or 288 SFP ports or 96 SFP+ ports or 96 HPE Smart Rate Multi-Gigabit or 24 40GbE ports, or a combination	44 RJ-45 autosensing 10/100/1000 ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3ab Type 1000BASE-T); Media Type: Auto-MDIX; Duplex: 10BASE-T/100BASE-TX: half or full; 1000BASE-T: full only 4 open mini-GBIC (SFP) slots 4 open module slots Supports a maximum of 144 autosensing 10/100/1000 ports or 144 SFP ports or 48 SFP+ ports or 48 HPE Smart Rate Multi-Gigabit or 12 40GbE ports, or a combination	92 RJ-45 autosensing 10/100/1000 PoE+ ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3ab Type 1000BASE-T, IEEE 802.3at PoE+); Media Type: Auto-MDIX; Duplex: 10BASE-T/100BASE-TX: half or full; 1000BASE-T: full only 4 open mini-GBIC (SFP) slots 8 open module slots Supports a maximum of 288 autosensing 10/100/1000 ports or 288 SFP ports or 96 SFP+ ports or 96 HPE Smart Rate Multi-Gigabit or 24 40GbE ports, or a combination
Power supplies	4 power supply slots 2 minimum power supplies required (ordered separately)	2 power supply slots 1 minimum power supply required (ordered separately)	4 power supply slots 2 minimum power supplies required (ordered separately)
Fan tray	Includes: 1 x J9832A 1 fan tray slot	Includes: 1 x J9831A 1 fan tray slot	Includes: 1 x J9832A 1 fan tray slot
Physical characteristics			
Dimensions	17.5(w) x 17.75(d) x 12.1(h) in. (44.45 x 45.09 x 30.73 cm) (7U height)	17.5(w) x 17.75(d) x 6.9(h) in. (44.45 x 45.09 x 17.53 cm) (4U height)	17.5(w) x 17.75(d) x 12.1(h) in. (44.45 x 45.09 x 30.73 cm) (7U height)
Weight	45.19 lb (20.5 kg)	26.19 lb (11.88 kg)	45.4 lb (20.59 kg)
Memory and processor			
v3 Gigabit Module	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal
v2 Gigabit Module	ARM 11 @ 450 MHz; Packet buffer size: 18 MB internal	ARM 11 @ 450 MHz; Packet buffer size: 18 MB internal	ARM 11 @ 450 MHz; Packet buffer size: 18 MB internal
v3 10G Module	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal
v2 10G Module	ARM 11 @ 550 MHz; Packet buffer size: 18 MB internal	ARM 11 @ 550 MHz; Packet buffer size: 18 MB internal	ARM 11 @ 550 MHz; Packet buffer size: 18 MB internal
v3 40G Module	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal
Management Module	Freescale P2020 dual core @ 1.2 MHz, 16 MB flash, 1 GB SD Card, 4 GB DDR3 SODIMM	Freescale P2020 dual core @ 1.2 GHz, 16 MB flash, 1 GB SD Card, 4 GB DDR3 SODIMM	Freescale P2020 dual core @ 1.2 GHz, 16 MB flash, 1 GB SD Card, 4 GB DDR3 SODIMM

	HPE 5412R-92G-PoE+/2SFP+ (No PSU) v2 zl2 Switch (J9825A)	HPE 5406R-44G-PoE+/4SFP (No PSU) v2 zl2 Switch (J9824A)	HPE 5412R-92G-PoE+/4SFP (No PSU) v2 zl2 Switch (J9826A)
Mounting and enclosure	Mounts in an EIA standard 19-inch telco rack or equipment cabinet (hardware included); Horizontal surface mounting only	Mounts in an EIA standard 19-inch telco rack or equipment cabinet (hardware included); Horizontal surface mounting only	Mounts in an EIA standard 19-inch telco rack or equipment cabinet (hardware included), Horizontal surface mounting only
Performance	IPv6 Ready Certified	IPv6 Ready Certified	IPv6 Ready Certified
1000 Mb Latency	< 2.8 µs (FIFO 64-byte packets)	< 2.8 µs (FIFO 64-byte packets)	< 2.8 µs (FIFO 64-byte packets)
10 Gbps Latency	< 1.8 µs (FIFO 64-byte packets)	< 1.8 µs (FIFO 64-byte packets)	< 1.8 µs (FIFO 64-byte packets)
40 Gbps Latency	< 1.5 µs (FIFO 64-byte packets)	< 1.5 µs (FIFO 64-byte packets)	< 1.5 µs (FIFO 64-byte packets)
Throughput	Up to 1142.8 Mpps	Up to 571.4 Mpps	Up to 1142.8 Mpps
Routing/Switching capacity	1920 Gbps	960 Gbps	1920 Gbps
Switch fabric speed	2030 Gbps	1015 Gbps	2030 Gbps
Routing table size	10000 entries (IPv4), 5000 entries (IPv6)	10000 entries (IPv4), 5000 entries (IPv6)	10000 entries (IPv4), 5000 entries (IPv6)
MAC address table size	64000 entries	64000 entries	64000 entries
Environment			
Operating temperature	32°F to 113°F (0°C to 45°C); 0°C to 40°C with J8177C transceiver installed, 0°C to 35°C with FIPS Opacity Shield installed	32°F to 113°F (0°C to 45°C); 0°C to 40°C with J8177C transceiver installed, 0°C to 35°C with FIPS Opacity Shield installed	32°F to 113°F (0°C to 45°C); 0°C to 40°C with J8177C transceiver installed, 0°C to 35°C with FIPS Opacity Shield installed
Operating relative humidity	15% to 95% @ 113°F (45°C), noncondensing	15% to 95% @ 113°F (45°C), noncondensing	15% to 95% @ 113°F (45°C), noncondensing
Nonoperating/Storage temperature	-40°F to 158°F (-40°C to 70°C)	-40°F to 158°F (-40°C to 70°C)	-40°F to 158°F (-40°C to 70°C)
Nonoperating/Storage relative humidity	15% to 95% @ 149°F (65°C), noncondensing	15% to 95% @ 149°F (65°C), noncondensing	15% to 95% @ 149°F (65°C), noncondensing
Altitude	Up to 10,000 ft (3 km)	Up to 10,000 ft (3 km)	Up to 10,000 ft (3 km)
Acoustic	Power: 49 dB, Pressure: 35.7 dB ISO 7779, ISO 9296	Power: 44 dB, Pressure: 31.7 dB ISO 7779, ISO 9296	Power: 49 dB, Pressure: 35.7 dB ISO 7779, ISO 9296
Electrical characteristics			
Frequency	50/60 Hz	50/60 Hz	50/60 Hz
80plus.org Certification	Gold	Gold	Gold
Description	Does not come with power supply. Four open power supply slots are available; three different power supplies are available. See power supply products for additional specifications.	Does not come with power supply. Two open power supply slots are available; three different power supplies are available. See power supply products for additional specifications.	Does not come with power supply. Four open power supply slots are available; three different power supplies are available. See power supply products for additional specifications.
Maximum heat dissipation	4900 BTU/hr (5169.5 kJ/hr), (max. non-PoE); 7400 BTU/hr (7807 kJ/hr), (max. using PoE)	2450 BTU/hr (2584.75 kJ/hr), (max. non-PoE); 3700 BTU/hr (3903 kJ/hr), (max. using PoE)	4900 BTU/hr (5169.5 kJ/hr), (max. non-PoE); 7400 BTU/hr (7807 kJ/hr), (max. using PoE)
Voltage	110–127/200–240 VAC, rated (Power supply dependent)	110–127/200–240 VAC, rated (Power supply dependent)	110–127/200–240 VAC, rated (Power supply dependent)
Notes	Heat dissipation does not include heat dissipated by the PoE-powered devices themselves. When more than four power cords are installed in a 5412R zl2 switch chassis, additional installation requirements are needed. Refer to the HPE 5400R zl2 Switches Quick Setup Guide and Safety/Regulatory Information manual for details.	Heat dissipation does not include heat dissipated by the PoE-powered devices themselves. When more than four power cords are installed in a 5412R zl2 switch chassis, additional installation requirements are needed. Refer to the HPE 5400R zl2 Switches Quick Setup Guide and Safety/Regulatory Information manual for details.	Heat dissipation does not include heat dissipated by the PoE-powered devices themselves. When more than four power cords are installed in a 5412R zl2 switch chassis, additional installation requirements are needed. Refer to the HPE 5400R zl2 Switches Quick Setup Guide and Safety/Regulatory Information manual for details.

	HPE 5412R-92G-PoE+/2SFP+ (No PSU) v2 zl2 Switch (J9825A)	HPE 5406R-44G-PoE+/4SFP (No PSU) v2 zl2 Switch (J9824A)	HPE 5412R-92G-PoE+/4SFP (No PSU) v2 zl2 Switch (J9826A)
Safety	CSA 22.2 No. 60950; UL 60950; IEC 60950; EN 60950	CSA 22.2 No. 60950; UL 60950; IEC 60950; EN 60950	CSA 22.2 No. 60950; UL 60950; IEC 60950; EN 60950
Emissions	FCC part 15 Class A; EN 55022/CISPR 22 Class A	FCC part 15 Class A; EN 55022/CISPR 22 Class A	FCC part 15 Class A; EN 55022/CISPR 22 Class A
Immunity			
EN	EN 55024, CISPR 24	EN 55024, CISPR 24	EN 55024, CISPR 24
ESD	IEC 61000-4-2; 4 kV CD, 8 kV AD; HPE ENV. 765.002	IEC 61000-4-2; 4 kV CD, 8 kV AD; HPE ENV. 765.002	IEC 61000-4-2; 4 kV CD, 8 kV AD; HPE ENV. 765.002
Radiated	IEC 61000-4-3; 3 V/m	IEC 61000-4-3; 3 V/m	IEC 61000-4-3; 3 V/m
EFT/Burst	IEC 61000-4-4; 1.0 kV (power line), 0.5 kV (signal line) IEC 61000-4-5; 1 kV/2 kV AC, 1 kV signal, 0.5 kV DC	IEC 61000-4-4; 1.0 kV (power line), 0.5 kV (signal line) IEC 61000-4-5; 1 kV/2 kV AC, 1 kV signal, 0.5 kV DC	IEC 61000-4-4; 1.0 kV (power line), 0.5 kV (signal line) IEC 61000-4-5; 1 kV/2 kV AC, 1 kV signal, 0.5 kV DC
Surge	IEC 61000-4-6; 3 Vrms	IEC 61000-4-6; 3 Vrms	IEC 61000-4-6; 3 Vrms
Conducted	IEC 61000-4-8; 1 A/m, 50 or 60 Hz	IEC 61000-4-8; 1 A/m, 50 or 60 Hz	IEC 61000-4-8; 1 A/m, 50 or 60 Hz
Power frequency magnetic field	IEC 61000-4-11; >95% reduction, 0.5 period; 30% reduction, 25 periods	IEC 61000-4-11; >95% reduction, 0.5 period; 30% reduction, 25 periods	IEC 61000-4-11; >95% reduction, 0.5 period; 30% reduction, 25 periods
Harmonics	EN 61000-3-2, IEC 61000-3-2	EN 61000-3-2, IEC 61000-3-2	EN 61000-3-2, IEC 61000-3-2
Flicker	EN 61000-3-3, IEC 61000-3-3	EN 61000-3-3, IEC 61000-3-3	EN 61000-3-3, IEC 61000-3-3
Management	IMC—Intelligent Management Center; Command-line interface; web browser; Configuration menu; Out-of-band management (RJ-45 Ethernet); SNMP Manager; Out-of-band management (serial RS-232C or micro USB) AirWave Network Management	IMC—Intelligent Management Center; Command-line interface; web browser; Configuration menu; Out-of-band management (RJ-45 Ethernet); SNMP Manager; Out-of-band management (serial RS-232C or micro USB) AirWave Network Management	IMC—Intelligent Management Center; Command-line interface; web browser; Configuration menu; Out-of-band management (RJ-45 Ethernet); SNMP Manager; Out-of-band management (serial RS-232C or micro USB) AirWave Network Management
Notes	Supported 1G SFP transceivers are revision "B" or later (product number ends with the letter "B" or later; for example, J9142B, J8177C)	Supported 1G SFP transceivers are revision "B" or later (product number ends with the letter "B" or later; for example, J9142B, J8177C)	Supported 1G SFP transceivers are revision "B" or later (product number ends with the letter "B" or later; for example, J9142B, J8177C)
Services	Refer to the Hewlett Packard Enterprise website at **hpe.com/networking/services** for details on the service-level descriptions and product numbers. For details about services, and response times in your area, please contact your local Hewlett Packard Enterprise sales office.	Refer to the Hewlett Packard Enterprise website at **hpe.com/networking/services** for details on the service-level descriptions and product numbers. For details about services, and response times in your area, please contact your local Hewlett Packard Enterprise sales office.	Refer to the Hewlett Packard Enterprise website at **hpe.com/networking/services** for details on the service-level descriptions and product numbers. For details about services, and response times in your area, please contact your local Hewlett Packard Enterprise sales office.

HPE 5400R zl2 Switch Series

Specifications (continued)

	HPE 5406R-8XGT/8SFP+ (No PSU) v2 zl2 Switch (J9868A)	HPE 5412R 92GT PoE+/4SFP+ (No PSU) v3 zl2 Switch (JL001A)	HPE 5406R 8-port 1/2.5/5/10GBASE-T PoE+/8-port SFP+ (No PSU) v3 zl2 Switch (JL002A)
Included accessories	1 HPE 5400R zl2 Management Module (J9827A) 1 HPE 5406R zl2 Switch Fan Tray (J9831A) 1 HPE 8-port 10GbE SFP+ v2 zl Module (J9538A) 1 HPE 8-port 10GBASE-T v2 zl Module (J9546A)	1 HPE 5400R zl2 Management Module (J9827A) 1 HPE 5412R zl2 Switch Fan Tray (J9832A) 3 HPE 24-port 10/100/1000BASE-T PoE+ MACsec v3 zl2 Module (J9986A) 1 HPE 20-port 10/100/1000BASE-T PoE+/4-port 1G/10GbE SFP+ MACsec v3 zl2 Module (J9990A)	1 HPE 5400R zl2 Management Module (J9827A) 1 HPE 5406R zl2 Switch Fan Tray (J9831A) 1 HPE 8-port 1G/10GbE SFP+ MACsec v3 zl2 Module (J9993A) 1 HPE 8-port 1/2.5/5/10GBASE-T PoE+ MACsec v3 zl2 Module (J9995A)
I/O ports and slots	8 RJ-45 10GbE ports (IEEE 802.3an-2006 Type 10GBASE-T) 8 open 10GbE SFP+ transceiver slots 4 open module slots Supports a maximum of 144 autosensing 10/100/1000 ports or 144 SFP ports or 48 SFP+ ports or 48 HPE Smart Rate Multi-Gigabit or 12 40GbE ports, or a combination	92 RJ-45 autosensing 10/100/1000 PoE+ ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3ab Type 1000BASE-T, IEEE 802.3at PoE+); Media Type: Auto-MDIX; Duplex: 10BASE-T/100BASE-TX: half or full; 1000BASE-T: full only 4 open 10GbE SFP+ transceiver slots 8 open module slots Supports a maximum of 288 autosensing 10/100/1000 ports or 288 SFP ports or 96 SFP+ ports or 96 HPE Smart Rate Multi-Gigabit or 24 40GbE ports, or a combination	8 RJ-45 HPE Smart Rate Multi-Gigabit ports 8 open 10GbE SFP+ transceiver slots 4 open module slots Supports a maximum of 144 autosensing 10/100/1000 ports or 144 SFP ports or 48 SFP+ ports or 48 HPE Smart Rate Multi-Gigabit or 12 40GbE ports, or a combination
Power supplies	2 power supply slots 1 minimum power supply required (ordered separately)	4 power supply slots 2 minimum power supplies required (ordered separately)	2 power supply slots 1 minimum power supply required (ordered separately)
Fan tray	Includes: 1 x J9831A 1 fan tray slot	Includes: 1 x J9832A 1 fan tray slot	Includes: 1 x J9831A 1 fan tray slot
Physical characteristics			
Dimensions	17.5(w) x 17.75(d) x 6.9(h) in. (44.45 x 45.09 x 17.53 cm) (4U height)	17.5(w) x 17.75(d) x 12.1(h) in. (44.45 x 45.09 x 30.73 cm) (7U height)	17.5(w) x 17.75(d) x 6.9(h) in. (44.45 x 45.09 x 17.53 cm) (4U height)
Weight	28.11 lb (12.75 kg)	45.19 lb (20.5 kg)	28.11 lb (12.75 kg)
Memory and processor			
v3 Gigabit Module	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal
v2 Gigabit Module	ARM 11 @ 450 MHz; Packet buffer size: 18 MB internal	ARM 11 @ 450 MHz; Packet buffer size: 18 MB internal	ARM 11 @ 450 MHz; Packet buffer size: 18 MB internal
v3 10G Module	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal
v2 10G Module	ARM 11 @ 550 MHz; Packet buffer size: 18 MB internal	ARM 11 @ 550 MHz; Packet buffer size: 18 MB internal	ARM 11 @ 550 MHz; Packet buffer size: 18 MB internal
v3 40G Module	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal
Management Module	Freescale P2020 dual core @ 1.2 GHz, 16 MB flash, 1 GB SD Card, 4 GB DDR3 SODIMM	Freescale P2020 dual core @ 1.2 MHz, 16 MB flash, 1 GB SD Card, 4 GB DDR3 SODIMM	Freescale P2020 dual core @ 1.2 GHz, 16 MB flash, 1 GB SD Card, 4 GB DDR3 SODIMM

	HPE 5406R-8XGT/8SFP+ (No PSU) v2 zl2 Switch (J9868A)	HPE 5412R 92GT PoE+/4SFP+ (No PSU) v3 zl2 Switch (JL001A)	HPE 5406R 8-port 1/2.5/5/10GBASE-T PoE+/8-port SFP+ (No PSU) v3 zl2 Switch (JL002A)
Mounting and enclosure	Mounts in an EIA standard 19-inch telco rack or equipment cabinet (hardware included); Horizontal surface mounting only	Mounts in an EIA standard 19-inch telco rack or equipment cabinet (hardware included); Horizontal surface mounting only	Mounts in an EIA standard 19-inch telco rack or equipment cabinet (hardware included), Horizontal surface mounting only
Performance	IPv6 Ready Certified	IPv6 Ready Certified	IPv6 Ready Certified
1000 Mb Latency	< 2.8 µs (FIFO 64-byte packets)	< 2.8 µs (FIFO 64-byte packets)	< 2.8 µs (FIFO 64-byte packets)
10 Gbps Latency	< 1.8 µs (FIFO 64-byte packets)	< 1.8 µs (FIFO 64-byte packets)	< 1.8 µs (FIFO 64-byte packets)
40 Gbps Latency	< 1.5 µs (FIFO 64-byte packets)	< 1.5 µs (FIFO 64-byte packets)	< 1.5 µs (FIFO 64-byte packets)
Throughput	Up to 571.4 Mpps	Up to 1142.8 Mpps	Up to 571.4 Mpps
Routing/Switching capacity	960 Gbps	1920 Gbps	960 Gbps
Switch fabric speed	1015 Gbps	2030 Gbps	1015 Gbps
Routing table size	10000 entries (IPv4), 5000 entries (IPv6)	10000 entries (IPv4), 5000 entries (IPv6)	10000 entries (IPv4), 5000 entries (IPv6)
MAC address table size	64000 entries	64000 entries	64000 entries
Environment			
Operating temperature	32°F to 113°F (0°C to 45°C); 0°C to 40°C with J8177C transceiver installed, 0°C to 35°C with FIPS Opacity Shield installed	32°F to 113°F (0°C to 45°C); 0°C to 40°C with J8177C transceiver installed, 0°C to 35°C with FIPS Opacity Shield installed	32°F to 113°F (0°C to 45°C); 0°C to 40°C with J8177C transceiver installed, 0°C to 35°C with FIPS Opacity Shield installed
Operating relative humidity	15% to 95% @ 113°F (45°C), noncondensing	15% to 95% @ 113°F (45°C), noncondensing	15% to 95% @ 113°F (45°C), noncondensing
Nonoperating/Storage temperature	-40°F to 158°F (-40°C to 70°C)	-40°F to 158°F (-40°C to 70°C)	-40°F to 158°F (-40°C to 70°C)
Nonoperating/Storage relative humidity	15% to 95% @ 149°F (65°C), noncondensing	15% to 95% @ 149°F (65°C), noncondensing	15% to 95% @ 149°F (65°C), noncondensing
Altitude	Up to 10,000 ft (3 km)	Up to 10,000 ft (3 km)	Up to 10,000 ft (3 km)
Acoustic	Power: 44 dB, Pressure: 31.7 dB ISO 7779, ISO 9296	Power: 49 dB, Pressure: 35.7 dB ISO 7779, ISO 9296	Power: 44 dB, Pressure: 31.7 dB ISO 7779, ISO 9296
Electrical characteristics			
Frequency	50/60 Hz	50/60 Hz	50/60 Hz
80plus.org Certification	Gold	Gold	Gold
Description	Does not come with power supply. Two open power supply slots are available; three different power supplies are available. See power supply products for additional specifications.	Does not come with power supply. Four open power supply slots are available; three different power supplies are available. See power supply products for additional specifications.	Does not come with power supply. Two open power supply slots are available; three different power supplies are available. See power supply products for additional specifications.
Maximum heat dissipation	2450 BTU/hr (2584.75 kJ/hr), (max. non-PoE); 3700 BTU/hr (3903 kJ/hr), (max. using PoE)	4900 BTU/hr (5169.5 kJ/hr), (max. non-PoE); 7400 BTU/hr (7807 kJ/hr), (max. using PoE)	2450 BTU/hr (2584.75 kJ/hr), (max. non-PoE); 3700 BTU/hr (3903 kJ/hr), (max. using PoE)
Voltage	110–127/200–240 VAC, rated (Power supply dependent)	110–127/200–240 VAC, rated (Power supply dependent)	110–127/200–240 VAC, rated (Power supply dependent)
Notes	Heat dissipation does not include heat dissipated by the PoE-powered devices themselves. When more than four power cords are installed in a 5412R zl2 switch chassis, additional installation requirements are needed. Refer to the HPE 5400R zl2 Switches Quick Setup Guide and Safety/Regulatory Information manual for details.	Heat dissipation does not include heat dissipated by the PoE-powered devices themselves. When more than four power cords are installed in a 5412R zl2 switch chassis, additional installation requirements are needed. Refer to the HPE 5400R zl2 Switches Quick Setup Guide and Safety/Regulatory Information manual for details.	Heat dissipation does not include heat dissipated by the PoE-powered devices themselves. When more than four power cords are installed in a 5412R zl2 switch chassis, additional installation requirements are needed. Refer to the HPE 5400R zl2 Switches Quick Setup Guide and Safety/Regulatory Information manual for details.

	HPE 5406R-8XGT/8SFP+ (No PSU) v2 zl2 Switch (J9868A)	HPE 5412R 92GT PoE+/4SFP+ (No PSU) v3 zl2 Switch (JL001A)	HPE 5406R 8-port 1/2.5/5/10GBASE-T PoE+/8-port SFP+ (No PSU) v3 zl2 Switch (JL002A)
Safety	CSA 22.2 No. 60950; UL 60950; IEC 60950; EN 60950	CSA 22.2 No. 60950; UL 60950; IEC 60950; EN 60950	CSA 22.2 No. 60950; UL 60950; IEC 60950; EN 60950
Emissions	FCC part 15 Class A; EN 55022/CISPR 22 Class A	FCC part 15 Class A; EN 55022/CISPR 22 Class A	FCC part 15 Class A; EN 55022/CISPR 22 Class A
Immunity			
EN	EN 55024, CISPR 24	EN 55024, CISPR 24	EN 55024, CISPR 24
ESD	IEC 61000-4-2; 4 kV CD, 8 kV AD; HPE ENV. 765.002	IEC 61000-4-2; 4 kV CD, 8 kV AD; HPE ENV. 765.002	IEC 61000-4-2; 4 kV CD, 8 kV AD; HPE ENV. 765.002
Radiated	IEC 61000-4-3; 3 V/m	IEC 61000-4-3; 3 V/m	IEC 61000-4-3; 3 V/m
EFT/Burst	IEC 61000-4-4; 1.0 kV (power line), 0.5 kV (signal line) IEC 61000-4-5; 1 kV/2 kV AC, 1 kV signal, 0.5 kV DC	IEC 61000-4-4; 1.0 kV (power line), 0.5 kV (signal line) IEC 61000-4-5; 1 kV/2 kV AC, 1 kV signal, 0.5 kV DC	IEC 61000-4-4; 1.0 kV (power line), 0.5 kV (signal line) IEC 61000-4-5; 1 kV/2 kV AC, 1 kV signal, 0.5 kV DC
Surge	IEC 61000-4-6; 3 Vrms	IEC 61000-4-6; 3 Vrms	IEC 61000-4-6; 3 Vrms
Conducted	IEC 61000-4-8; 1 A/m, 50 or 60 Hz	IEC 61000-4-8; 1 A/m, 50 or 60 Hz	IEC 61000-4-8; 1 A/m, 50 or 60 Hz
Power frequency magnetic field	IEC 61000-4-11; >95% reduction, 0.5 period; 30% reduction, 25 periods	IEC 61000-4-11; >95% reduction, 0.5 period; 30% reduction, 25 periods	IEC 61000-4-11; >95% reduction, 0.5 period; 30% reduction, 25 periods
Harmonics	EN 61000-3-2, IEC 61000-3-2	EN 61000-3-2, IEC 61000-3-2	EN 61000-3-2, IEC 61000-3-2
Flicker	EN 61000-3-3, IEC 61000-3-3	EN 61000-3-3, IEC 61000-3-3	EN 61000-3-3, IEC 61000-3-3
Management	IMC—Intelligent Management Center; Command-line interface; web browser; Configuration menu; Out-of-band management (RJ-45 Ethernet); SNMP Manager; Out-of-band management (serial RS-232C or micro USB) AirWave Network Management	IMC—Intelligent Management Center; Command-line interface; web browser; Configuration menu; Out-of-band management (RJ-45 Ethernet); SNMP Manager; Out-of-band management (serial RS-232C or micro USB) AirWave Network Management	IMC—Intelligent Management Center; Command-line interface; web browser; Configuration menu; Out-of-band management (RJ-45 Ethernet); SNMP Manager; Out-of-band management (serial RS-232C or micro USB) AirWave Network Management
Notes	Supported 1G SFP transceivers are revision "B" or later (product number ends with the letter "B" or later; for example, J9142B, J8177C)	Supported 1G SFP transceivers are revision "B" or later (product number ends with the letter "B" or later; for example, J9142B, J8177C)	Supported 1G SFP transceivers are revision "B" or later (product number ends with the letter "B" or later; for example, J9142B, J8177C) HPE Smart Rate Multi-Gigabit Cabling; 1000BASE-T, 2.5 Gigabit, and 5 Gigabit Ethernet: Category 5e or better UTP or STP; 10GBASE-T: Category 6 or better (CAT6A recommended) UTP or STP
Services	Refer to the Hewlett Packard Enterprise website at **hpe.com/networking/services** for details on the service-level descriptions and product numbers. For details about services, and response times in your area, please contact your local Hewlett Packard Enterprise sales office.	Refer to the Hewlett Packard Enterprise website at **hpe.com/networking/services** for details on the service-level descriptions and product numbers. For details about services, and response times in your area, please contact your local Hewlett Packard Enterprise sales office.	Refer to the Hewlett Packard Enterprise website at **hpe.com/networking/services** for details on the service-level descriptions and product numbers. For details about services, and response times in your area, please contact your local Hewlett Packard Enterprise sales office.

HPE 5400R zl2 Switch Series

Specifications (continued)

	HPE 5406R 44GT PoE+/4SFP+ (No PSU) v3 zl2 Switch (JL003A)	HPE 5406R 16-port SFP+ (No PSU) v3 zl2 Switch (JL095A)
Included accessories	1 HPE 5400R zl2 Management Module (J9827A) 1 HPE 5406R zl2 Switch Fan Tray (J9831A) 1 HPE 24-port 10/100/1000BASE-T PoE+ MACsec v3 zl2 Module (J9986A) 1 HPE 20-port 10/100/1000BASE-T PoE+/4-port 1G/10GbE SFP+ MACsec v3 zl2 Module (J9990A)	1 HPE 5400R zl2 Management Module (J9827A) 1 HPE 5406R zl2 Switch Fan Tray (J9831A) 2 HPE 8-port 1G/10GbE SFP+ MACsec v3 zl2 Module (J9993A)
I/O ports and slots	44 RJ-45 autosensing 10/100/1000 PoE+ ports (IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3ab Type 1000BASE-T, IEEE 802.3at PoE+); Media Type: Auto-MDIX; Duplex: 10BASE-T/100BASE-TX: half or full; 1000BASE-T: full only 4 open 10GbE SFP+ transceiver slots 4 open module slots Supports a maximum of 144 autosensing 10/100/1000 ports or 144 SFP ports or 48 SFP+ ports or 48 HPE Smart Rate Multi-Gigabit or 12 40GbE ports, or a combination	16 open 10GbE SFP+ transceiver slots 4 open module slots Supports a maximum of 144 autosensing 10/100/1000 ports or 144 SFP ports or 48 SFP+ ports or 48 HPE Smart Rate Multi-Gigabit or 12 40GbE ports, or a combination
Power supplies	2 power supply slots 1 minimum power supply required (ordered separately)	2 power supply slots 1 minimum power supply required (ordered separately)
Fan tray	Includes: 1 x J9831A 1 fan tray slot	Includes: 1 x J9831A 1 fan tray slot
Physical characteristics		
Dimensions	17.5(w) x 17.75(d) x 6.9(h) in. (44.45 x 45.09 x 17.53 cm) (4U height)	17.5(w) x 17.75(d) x 6.9(h) in. (44.45 x 45.09 x 17.53 cm) (4U height)
Weight	28.11 lb (12.75 kg)	28.11 lb (12.75 kg)
Memory and processor		
v3 Gigabit Module	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal
v2 Gigabit Module	ARM 11 @ 450 MHz; Packet buffer size: 18 MB internal	ARM 11 @ 450 MHz; Packet buffer size: 18 MB internal
v3 10G Module	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal
v2 10G Module	ARM 11 @ 550 MHz; Packet buffer size: 18 MB internal	ARM 11 @ 550 MHz; Packet buffer size: 18 MB internal
v3 40G Module	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal	Dual ARM Coretex A9 @ 1 GHz; Packet buffer size: 13.5 MB internal
Management Module	Freescale P2020 dual core @ 1.2 GHz, 16 MB flash, 1 GB SD Card, 4 GB DDR3 SODIMM	Freescale P2020 dual core @ 1.2 GHz, 16 MB flash, 1 GB SD Card, 4 GB DDR3 SODIMM
Mounting and enclosure	Mounts in an EIA standard 19-inch telco rack or equipment cabinet (hardware included); Horizontal surface mounting only	Mounts in an EIA standard 19-inch telco rack or equipment cabinet (hardware included); Horizontal surface mounting only

	HPE 5406R 44GT PoE+/4SFP+ (No PSU) v3 zl2 Switch (JL003A)	HPE 5406R 16-port SFP+ (No PSU) v3 zl2 Switch (JL095A)
Performance	IPv6 Ready Certified	IPv6 Ready Certified
1000 Mb Latency	< 2.8 µs (FIFO 64-byte packets)	< 2.8 µs (FIFO 64-byte packets)
10 Gbps Latency	< 1.8 µs (FIFO 64-byte packets)	< 1.8 µs (FIFO 64-byte packets)
40 Gbps Latency	< 1.5 µs (FIFO 64-byte packets)	< 1.5 µs (FIFO 64-byte packets)
Throughput	Up to 571.4 Mpps	Up to 571.4 Mpps
Routing/Switching capacity	960 Gbps	960 Gbps
Switch fabric speed	1015 Gbps	1015 Gbps
Routing table size	10000 entries (IPv4), 5000 entries (IPv6)	10000 entries (IPv4), 5000 entries (IPv6)
MAC address table size	64000 entries	64000 entries
Environment		
Operating temperature	32°F to 113°F (0°C to 45°C); 0°C to 40°C with J8177C transceiver installed, 0°C to 35°C with FIPS Opacity Shield installed	32°F to 113°F (0°C to 45°C); 0°C to 40°C with J8177C transceiver installed, 0°C to 35°C with FIPS Opacity Shield installed
Operating relative humidity	15% to 95% @ 113°F (45°C), noncondensing	15% to 95% @ 113°F (45°C), noncondensing
Nonoperating/Storage temperature	-40°F to 158°F (-40°C to 70°C)	-40°F to 158°F (-40°C to 70°C)
Nonoperating/Storage relative humidity	15% to 95% @ 149°F (65°C), noncondensing	15% to 95% @ 149°F (65°C), noncondensing
Altitude	Up to 10,000 ft (3 km)	Up to 10,000 ft (3 km)
Acoustic	Power: 44 dB, Pressure: 31.7 dB ISO 7779, ISO 9296	Power: 44 dB, Pressure: 31.7 dB ISO 7779, ISO 9296
Electrical characteristics		
Frequency	50/60 Hz	50/60 Hz
80plus.org Certification	Gold	Gold
Description	Does not come with power supply. Two open power supply slots are available; three different power supplies are available. See power supply products for additional specifications.	Does not come with power supply. Two open power supply slots are available; three different power supplies are available. See power supply products for additional specifications.
Maximum heat dissipation	2450 BTU/hr (2584.75 kJ/hr), (max. non-PoE); 3700 BTU/hr (3903 kJ/hr), (max. using PoE)	2450 BTU/hr (2584.75 kJ/hr), (max. non-PoE); 3700 BTU/hr (3903 kJ/hr), (max. using PoE)
Voltage	110–127/200–240 VAC, rated (Power supply dependent)	110–127/200–240 VAC, rated (Power supply dependent)
Notes	Heat dissipation does not include heat dissipated by the PoE-powered devices themselves. When more than four power cords are installed in a 5412R zl2 switch chassis, additional installation requirements are needed. Refer to the HPE 5400R zl2 Switches Quick Setup Guide and Safety/Regulatory Information manual for details.	Heat dissipation does not include heat dissipated by the PoE-powered devices themselves. When more than four power cords are installed in a 5412R zl2 switch chassis, additional installation requirements are needed. Refer to the HPE 5400R zl2 Switches Quick Setup Guide and Safety/Regulatory Information manual for details.

	HPE 5406R 44GT PoE+/4SFP+ (No PSU) v3 zl2 Switch (JL003A)	HPE 5406R 16-port SFP+ (No PSU) v3 zl2 Switch (JL095A)
Safety	CSA 22.2 No. 60950; UL 60950; IEC 60950; EN 60950	CSA 22.2 No. 60950; UL 60950; IEC 60950; EN 60950
Emissions	FCC part 15 Class A; EN 55022/CISPR 22 Class A	FCC part 15 Class A; EN 55022/CISPR 22 Class A
Immunity		
EN	EN 55024, CISPR 24	EN 55024, CISPR 24
ESD	IEC 61000-4-2; 4 kV CD, 8 kV AD; HPE ENV. 765.002	IEC 61000-4-2; 4 kV CD, 8 kV AD; HPE ENV. 765.002
Radiated	IEC 61000-4-3; 3 V/m	IEC 61000-4-3; 3 V/m
EFT/Burst	IEC 61000-4-4; 1.0 kV (power line), 0.5 kV (signal line)	IEC 61000-4-4; 1.0 kV (power line), 0.5 kV (signal line)
Surge	IEC 61000-4-5; 1 kV/2 kV AC, 1 kV signal, 0.5 kV DC	IEC 61000-4-5; 1 kV/2 kV AC, 1 kV signal, 0.5 kV DC
Conducted	IEC 61000-4-6; 3 Vrms	IEC 61000-4-6; 3 Vrms
Power frequency magnetic field	IEC 61000-4-8; 1 A/m, 50 or 60 Hz	IEC 61000-4-8; 1 A/m, 50 or 60 Hz
Voltage dips and interruptions	IEC 61000-4-11; >95% reduction, 0.5 period; 30% reduction, 25 periods	IEC 61000-4-11; >95% reduction, 0.5 period; 30% reduction, 25 periods
Harmonics	EN 61000-3-2, IEC 61000-3-2	EN 61000-3-2, IEC 61000-3-2
Flicker	EN 61000-3-3, IEC 61000-3-3	EN 61000-3-3, IEC 61000-3-3
Management	IMC–Intelligent Management Center; Command-line interface; web browser; Configuration menu; Out-of-band management (RJ-45 Ethernet); SNMP Manager; Out-of-band management (serial RS-232C or micro USB) AirWave Network Management	IMC–Intelligent Management Center; Command-line interface; web browser; Configuration menu; Out-of-band management (RJ-45 Ethernet); SNMP Manager; Out-of-band management (serial RS-232C or micro USB) AirWave Network Management
Notes	Supported 1G SFP transceivers are revision "B" or later (product number ends with the letter "B" or later; for example, J9142B, J8177C)	Supported 1G SFP transceivers are revision "B" or later (product number ends with the letter "B" or later; for example, J9142B, J8177C)
Services	Refer to the Hewlett Packard Enterprise website at **hpe.com/networking/services** for details on the service-level descriptions and product numbers. For details about services, and response times in your area, please contact your local Hewlett Packard Enterprise sales office.	Refer to the Hewlett Packard Enterprise website at **hpe.com/networking/services** for details on the service-level descriptions and product numbers. For details about services, and response times in your area, please contact your local Hewlett Packard Enterprise sales office.

Standards and Protocols
(applies to all products in series)

BGP	RFC 1997 BGP Communities Attribute RFC 2918 Route Refresh Capability RFC 4271 A Border Gateway Protocol 4 (BGP-4)	RFC 4456 BGP Route Reflection: An Alternative to Full Mesh Internal BGP (IBGP)	RFC 5492 Capabilities Advertisement with BGP-4
Device management	RFC 1591 DNS (client)	HTML and telnet management	RFC 2576 (Coexistence between SNMP v1, v2, v3) RFC 2579 (SMIv2 Text Conventions) RFC 2580 (SMIv2 Conformance) RFC 3416 (SNMP Protocol Operations v2) RFC 3417 (SNMP Transport Mappings)
General protocols	IEEE 802.1ad Q-in-Q IEEE 802.1AX-2008 Link Aggregation IEEE 802.1D MAC Bridges IEEE 802.1p Priority IEEE 802.1Q VLANs IEEE 802.1s Multiple Spanning Trees IEEE 802.1v VLAN classification by Protocol and Port IEEE 802.1w Rapid Reconfiguration of Spanning Tree IEEE 802.3ad Link Aggregation Control Protocol (LACP) IEEE 802.3af Power over Ethernet IEEE 802.3x Flow Control	RFC 768 UDP RFC 783 TFTP Protocol (revision 2) RFC 792 ICMP RFC 793 TCP RFC 826 ARP RFC 854 TELNET RFC 868 Time Protocol RFC 951 BOOTP RFC 1058 RIPv1 RFC 1350 TFTP Protocol (revision 2) RFC 1519 CIDR	RFC 1542 BOOTP Extensions RFC 1918 Address Allocation for Private Internet RFC 2030 Simple Network Time Protocol (SNTP) v4 RFC 2131 DHCP RFC 2453 RIPv2 RFC 2548 (MS-RAS-Vendor only) RFC 3046 DHCP Relay Agent Information Option RFC 3575 IANA Considerations for RADIUS RFC 3576 Ext to RADIUS (CoA only) RFC 3768 VRRP RFC 4675 RADIUS VLAN & Priority UDLD (Uni-Directional Link Detection) RFC 5880 BFD RFC 5905 NTP Client
IP multicast	RFC 3376 IGMPv3	RFC 3973 PIM Dense Mode	RFC 4601 PIM Sparse Mode
IPv6	RFC 1981 IPv6 Path MTU Discovery RFC 2375 IPv6 Multicast Address RFC 2080 RIPng RFC 2081 RIPng Protocol Applicability RFC 2082 RIP-2 MD5 Assignments RFC 2460 IPv6 Specification RFC 2464 Transmission of IPv6 over Ethernet Networks RFC 2710 Multicast Listener Discovery (MLD) for IPv6 RFC 2925 Definitions of Managed Objects for Remote Ping, Traceroute, and Lookup Operations (Ping only) RFC 3019 MLDv1 MIB RFC 3315 DHCPv6 (client and relay) RFC 3484 Default Address Selection for IPv6	RFC 3587 IPv6 Global Unicast Address Format RFC 3596 DNS Extension for IPv6 RFC 3810 MLDv2 for IPv6 RFC 4022 MIB for TCP RFC 4087 IP Tunnel MIB RFC 4113 MIB for UDP RFC 4213 Basic Transition Mechanisms for IPv6 Hosts and Routers RFC 4251 SSHv6 Architecture RFC 4252 SSHv6 Authentication RFC 4253 SSHv6 Transport Layer RFC 4254 SSHv6 Connection RFC 4291 IP Version 6 Addressing Architecture RFC 4293 MIB for IP	RFC 4294 IPv6 Node Requirements RFC 4419 Key Exchange for SSH RFC 4443 ICMPv6 RFC 4541 IGMP & MLD Snooping Switch RFC 4861 IPv6 Neighbor Discovery RFC 4862 IPv6 Stateless Address Auto-configuration RFC 5095 Deprecation of Type 0 Routing Headers in IPv6 RFC 5340 OSPFv3 for IPv6 RFC 5453 Reserved IPv6 Interface Identifiers RFC 5519 Multicast Group Membership Discovery MIB (MLDv2 only) RFC 5722 Handling of Overlapping IPv6 Fragments RFC 6620 FCFS SAVI draft-ietf-savi-mix

Standards and Protocols (continued)
(applies to all products in series)

MIBs	IEEE 802.1ap (MSTP and STP MIB's only) IEEE 8021-Bridge-MIB (2008) IEEE 8021-Q-Bridge-MIB (2008) RFC 1155 Structure & ID of Mgmt Info for TCP/IP Internets RFC 1213 MIB II RFC 1493 Bridge MIB RFC 1724 RIPv2 MIB RFC 1850 OSPFv2 MIB RFC 2021 RMONv2 MIB RFC 2096 IP Forwarding Table MIB	RFC 2578 Structure of Management Information Version 2 (SMIv2) RFC 2613 SMON MIB RFC 2618 RADIUS Client MIB RFC 2620 RADIUS Accounting MIB RFC 2665 Ethernet-Like-MIB RFC 2668 802.3 MAU MIB RFC 2674 802.1p and IEEE 802.1Q Bridge MIB RFC 2737 Entity MIB (Version 2)	RFC 2787 VRRP MIB RFC 2863 The Interfaces Group MIB RFC 2925 Ping MIB RFC 2932 IP (Multicast Routing MIB) RFC 2933 IGMP MIB RFC 4292 IP Forwarding Table MIB RFC 4836 Managed Objects for 802.3 Medium Attachment Units (MAU) RFC 7331 BFD MIB
Network management	IEEE 802.1AB Link Layer Discovery Protocol (LLDP) RFC 2819 Four groups of RMON: 1 (statistics), 2 (history), 3 (alarm), and 9 (events)	RFC 3176 sFlow RFC 3411 SNMP Management Frameworks RFC 3412 Message Processing and Dispatching for the Simple Network Management Protocol (SNMP) RFC 3413 Simple Network Management Protocol (SNMP) Applications RFC 3414 User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3) RFC 3415 View-based Access Control Model (VACM) for the Simple Network Management Protocol (SNMP) RFC 3418 Management Information Base (MIB) for the Simple Network Management Protocol (SNMP) RFC 5424 Syslog Protocol ANSI/TIA-1057 LLDP Media Endpoint Discovery (LLDP-MED)	SNMPv1/v2c/v3 XRMON
OSPF	RFC 2328 OSPFv2	RFC 3101 OSPF NSSA	RFC 5340 OSPFv3 for IPv6
QoS/CoS	RFC 2474 DiffServ Precedence, including 8 queues/port RFC 2475 DiffServ Architecture	RFC 2597 DiffServ Assured Forwarding (AF)	RFC 2598 DiffServ Expedited Forwarding (EF)
Security	IEEE 802.1AE MAC Security Standard (MACsec) IEEE 802.1X Port Based Network Access Control RFC 1492 TACACS+	RFC 1321 The MD5 Message-Digest Algorithm RFC 2818 HTTP Over TLS RFC 2865 RADIUS (client only) RFC 2866 RADIUS Accounting RFC 3579 RADIUS Support For Extensible Authentication Protocol (EAP)	Secure Sockets Layer (SSL) SSHv2 Secure Shell

HPE 5400R zl2 Switch Series accessories

Modules	HPE 8-port 1/2.5/5/10GBASE-T PoE+ MACsec v3 zl2 Module (J9995A) HPE 8-port 10GBASE-T v2 zl Module (J9546A) HPE 8-port 1G/10GbE SFP+ MACsec v3 zl2 Module (J9993A) HPE 8-port 10GbE SFP+ v2 zl Module (J9538A) HPE 12-port 10/100/1000BASE-T PoE+/12-port 1GbE SFP MACsec v3 zl2 Module (J9989A) HPE 12-port Gig-T PoE+/12-port SFP v2 zl Module (J9637A) HPE 20-port Gig-T/4-port SFP v2 zl Module (J9549A) HPE 20-port Gig-T/2-port 10GbE SFP+ v2 zl Module (J9548A) HPE 20-port 10/100/1000BASE-T PoE+/4-port 1G/10GbE SFP+ MACsec v3 zl2 Module (J9990A) HPE 20-port Gig-T PoE+/2-port 10GbE SFP+ v2 zl Module (J9536A) HPE 20-port Gig-T PoE+/4-port SFP v2 zl Module (J9535A) HPE 20-port 10/100/1000BASE-T PoE+/4p 1/2.5/5/10GBASE-T PoE+ MACsec v3 zl2 Module (J9991A) HPE 20-port 10/100/1000BASE-T PoE+ MACsec/1-port 40GbE QSFP+ v3 zl2 Module (J9992A) HPE 24-port 10/100 PoE+ v2 zl Module (J9547A) HPE 24-port 10/100/1000BASE-T MACsec v3 zl2 Module (J9987A) HPE 24-port Gig-T v2 zl Module (J9550A) HPE 24-port 10/100/1000BASE-T PoE+ MACsec v3 zl2 Module (J9986A) HPE 24-port Gig-T PoE+ v2 zl Module (J9534A) HPE 24-port 1GbE SFP MACsec v3 zl2 Module (J9988A) HPE 24-port SFP v2 zl Module (J9537A) HPE 2-port 40GbE QSFP+ v3 zl2 Module (J9996A) HPE Advanced Services v2 zl Module with HDD (J9857A) HPE Advanced Services v2 zl Module with SSD (J9858A) HPE 5400R zl2 Management Module (J9827A)
Transceivers	HPE X111 100M SFP LC FX Transceiver (J9054C) HPE X131 10G X2 SC LR Transceiver (J8437A) HPE X132 10G SFP+ LC SR Transceiver (J9150A) HPE X132 10G SFP+ LC LR Transceiver (J9151A) HPE X132 10G SFP+ LC LRM Transceiver (J9152A) HPE X121 1G SFP LC LH Transceiver (J4860C) HPE X121 1G SFP LC SX Transceiver (J4858C) HPE X121 1G SFP LC LX Transceiver (J4859C) HPE X121 1G SFP RJ45 T Transceiver (J8177C) HPE X122 1G SFP LC BX-D Transceiver (J9142B) HPE X122 1G SFP LC BX-U Transceiver (J9143B) HPE X132 10G SFP+ LC ER Transceiver (J9153A) HPE X142 40G QSFP+ MPO SR4 Transceiver (JH231A) HPE X142 40G QSFP+ LC LR4 SM Transceiver (JH232A) HPE X142 40G QSFP+ MPO eSR4 300M XCVR (JH233A)

HPE 5400R zl2 Switch Series accessories (continued)

Cables	HPE X242 10G SFP+ to SFP+ 1m Direct Attach Copper Cable (J9281B) HPE X242 10G SFP+ to SFP+ 3m Direct Attach Copper Cable (J9283B) HPE X242 10G SFP+ to SFP+ 7m Direct Attach Copper Cable (J9285B) HPE X244 10G XFP to SFP+ 1m Direct Attach Copper Cable (J9300A) HPE X244 10G XFP to SFP+ 3m Direct Attach Copper Cable (J9301A) HPE X244 10G XFP to SFP+ 5m Direct Attach Copper Cable (J9302A) HPE 0.5 m Multimode OM3 LC/LC Optical Cable (AJ833A) HPE 1 m Multimode OM3 LC/LC Optical Cable (AJ834A) HPE 2 m Multimode OM3 LC/LC Optical Cable (AJ835A) HPE 5 m Multimode OM3 LC/LC Optical Cable (AJ836A) HPE 15 m Multimode OM3 LC/LC Optical Cable (AJ837A) HPE 30 m Multimode OM3 LC/LC Optical Cable (AJ838A) HPE 50 m Multimode OM3 LC/LC Optical Cable (AJ839A) HPE Premier Flex LC/LC Multi-mode OM4 2 fiber 1m Cable (QK732A) HPE Premier Flex LC/LC Multi-mode OM4 2 fiber 2m Cable (QK733A) HPE Premier Flex LC/LC Multi-mode OM4 2 fiber 5m Cable (QK734A) HPE Premier Flex LC/LC Multi-mode OM4 2 fiber 15m Cable (QK735A) HPE Premier Flex LC/LC Multi-mode OM4 2 fiber 30m Cable (QK736A) HPE Premier Flex LC/LC Multi-mode OM4 2 fiber 50m Cable (QK737A) HPE X242 40G QSFP+ to QSFP+ 1m DAC Cable (JH234A) HPE X242 40G QSFP+ to QSFP+ 3m DAC Cable (JH235A) HPE X242 40G QSFP+ to QSFP+ 5m DAC Cable (JH236A)
Power supply	HPE 5400R 700W PoE+ zl2 Power Supply (J9828A) HPE 5400R 1100W PoE+ zl2 Power Supply (J9829A) HPE 5400R 2750W PoE+ zl2 Power Supply (J9830A)
Mounting kit	HPE X450 4U/7U Universal 4-Post Rack Mounting Kit (J9852A)
WLAN	HPE MSM775 zl Premium Controller Module (J9840A)

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Hewlett Packard
Enterprise

DATA SHEET

ARUBA 320 SERIES ACCESS POINTS

Bringing a switch like experience to 802.11ac

Multifunctional 320 series wireless APs provide the best 802.11ac Wi-Fi connectivity and user experience. Featuring Aruba enhanced ClientMatch and Aruba Beacon technologies, the 320 series enables the highest capacity performance, and efficiency in extremely high-density environments.

With a maximum concurrent data rate of 1,733 Mbps in the 5 GHz band and 800 Mbps in the 2.4 GHz band (aggregated date rate of 2.5 Gbps), 320 Series Access Points deliver best-in-class next-generation .11ac Wi-Fi infrastructure for the highest density environments.

The high performance and high density 802.11ac 320 series supports multi-user MIMO (MU-MIMO) and 4 spatial Access Point streams (4SS). It provides simultaneous data transmission to multiple devices, maximizing data throughput and improving network efficiency.

The 320 series includes the patent-pending enhanced ClientMatch technology that extends the client steering technology with MU-MIMO client awareness. It automatically identifies MU-MIMO capable mobile devices and steers those devices to the closest MU-MIMO capable Aruba access point. By grouping MU-MIMO capable mobile devices together, the network starts taking advantage of the simultaneous transmission to these devices, increasing its overall capacity. These dynamic roaming policies that are based on device types, help customers achieve the best WLAN performance in a mixed device environment during the technology transition period.

The 320 series has an integrated Bluetooth Aruba Beacon that simplifies the remote management of a network of large-scale battery-powered Aruba beacons while also providing advanced location and indoor way finding, and proximity-based push notification capabilities. It enables businesses to leverage mobility context to develop applications that will deliver an enhanced user experience and increase the value of the wireless network for organizations.

UNIQUE BENEFITS

- Dual radio 4x4 802.11ac access point with multi-user MIMO
  - Supports up to 1,733 Mbps in the 5 GHz band (with 4SS/VHT80 clients) and 800 Mbps in the 2.4 GHz band (with 4SS/VHT40 clients).
- 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.
  - Simplifies battery-powered Aruba beacon management.
- 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 communication apps
  - Supports priority handling and policy enforcement for unified communication apps, including Microsoft Skype for Business with encrypted videoconferencing, voice, chat, and desktop sharing.
- RF Management
  - Adaptive Radio Management (ARM) technology automatically assigns channel and power settings, provides airtime fairness, and ensures that APs stay clear of all sources of RF interference to deliver reliable, high-performance WLANs.
  - The Aruba 320 Series Access Points can be configured to provide part-time or dedicated air monitoring for spectrum analysis and wireless intrusion protection, VPN tunnels to extend remote locations to corporate resources, and wireless mesh connections where Ethernet drops are not available

- 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.
- Intelligent app visibility and control
  - AppRF technology leverages deep packet inspection to classify and block, prioritize or limit bandwidth for over 1,500 enterprise apps or groups of apps.
- Security
  - Integrated wireless intrusion protection 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.
  - Integrated Trusted Platform Module (TPM) for secure storage of credentials and keys.
  - SecureJack-capable for secure tunneling of wired Ethernet traffic.

CHOOSE YOUR OPERATING MODE

Aruba 320 Series Access Points offer a choice of operating modes to meet your unique management and deployment requirements.

- Controller-managed mode – When managed by Aruba Mobility Controllers, Aruba 320 Series Access Points offer centralized configuration, data encryption, policy enforcement, and network services, as well as distributed and centralized traffic forwarding.
- Aruba Instant mode – In Aruba Instant mode, a single AP automatically distributes the network configuration to other Instant APs in the WLAN. Simply power-up one Instant AP, configure it over the air, and plug in the other APs – the entire process takes about five minutes. If WLAN requirements change, a built-in migration path allows 320 series Instant APs to become part of a WLAN that is managed by a Mobility Controller.
- Remote AP (RAP) for branch deployments.
- Air monitor (AM) for wireless IDS, rogue detection, and containment.
- Spectrum analyzer, dedicated or hybrid, for identifying sources of RF interference.
- Secure enterprise mesh.

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, Instant APs are factory-shipped to any site and configure themselves when powered up.

AP-320 SERIES SPECIFICATIONS

- AP-325 and IAP-325
  - 5 GHz (1,733 Mbps max rate) and 2.4 GHz (800 Mbps max rate) radios, each with 4x4 MIMO support and a total of eight integrated omni-directional downtilt antennas.
- AP-324 and IAP-324
  - 5 GHz (1,733 Mbps max rate) and 2.4 GHz (800 Mbps max rate) radios, each with 4x4 MIMO support and a total of four combined, diplexed (dual-band) external RP-SMA antenna connectors.

WI-FI RADIO SPECIFICATIONS

- AP type: Indoor, dual radio, 5 GHz 802.11ac and 2.4 GHz 802.11n 4x4 MIMO.
- Software-configurable dual radio supports 5 GHz (Radio 0) and 2.4 GHz (Radio 1).
- Four spatial stream SU-MIMO for up to 1,733 Mbps wireless data rate to a single client device.
- Three spatial stream MU-MIMO for up to 1,300 Mbps wireless data rate to up to three MU-MIMO capable client devices simultaneously.
- 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
- 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
- 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 GHz band: +24 dBm (18 dBm per chain)
  - Note: conducted transmit power levels exclude antenna gain. For total (EIRP) transmit power, add antenna gain
- 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 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 beamforming (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: 6.5 to 450 (MCS0 to MCS23)
  - 802.11ac: 6.5 to 1,733 (MCS0 to MCS9, NSS = 1 to 4)
- 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

WI-FI ANTENNAS

- AP-324/IAP-324: Four RP-SMA connectors for external dual band antennas. Internal loss between radio interface and external antenna connectors (due to diplexing circuitry): 2.5 dB in 2.4 GHz and 1.5 dB in 5 GHz.
- AP-325/IAP-325: Eight integrated downtilt omni- directional antennas for 4x4 MIMO with peak antenna gain of 3.5 dBi in 2.4 GHz and 5.0 dBi in 5 GHz. Built-in antennas are optimized for horizontal ceiling- mounted orientation of the AP. The downtilt angle for maximum gain is ~ 30 degrees. Combining the patterns of each of the antennas of the MIMO radios, the peak gain of the effective per-antenna pattern is 1.5dBi in 2.4GHz and 2.1dBi in 5GHz.

OTHER INTERFACES

- Two 10/100/1000BASE-T Ethernet network interfaces (RJ-45)
  - Auto-sensing link speed and MDI/MDX
  - Link Aggregation support to achieve platform throughput up to 2 Gbps
  - 802.3az Energy Efficient Ethernet (EEE)
  - PoE-PD: 48 Vdc (nominal) 802.3af or 802.3at PoE
- DC power interface, accepts 2.1/5.5-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 4dBm transmit power (class 2) and -94dBm receive sensitivity
  - Integrated antenna, -5dBi gain (30 degrees downtilt)
  - Can be disabled with configuration
- Visual indicators (tri-color LEDs): For system and radio status
- Reset button: Factory reset (during device power up)
- Serial console interface (RJ-45)
- Kensington security slot

POWER

- Maximum (worst-case) power consumption: 20W (802.3at PoE), 13.5W (802.3af PoE) or 18.5W (DC)
  - Excludes power consumed by external USB device (and internal overhead); this could add up to 6W (POE) or 5.5W (DC) for 5W/1A USB device
- Maximum (worst-case) power consumption in idle mode: 8W (PoE) or 7W (DC)
- Direct DC source: 12 Vdc nominal, +/- 5%
- Power over Ethernet (PoE): 48 Vdc (nominal) 802.3af/802.3at compliant source
  - Unrestricted functionality with 802.3at PoE
  - Power-save mode with reduced functionality from 802.3af PoE
    - > USB port disabled
    - > Second Ethernet port disabled
    - > 2.4 GHz radio in 1x1:1 mode
- Power sources sold separately
- When both power sources are available, DC power takes priority

MOUNTING

- The AP ships with two (white) 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 for details.

MECHANICAL

- Dimensions/weight (unit, excluding mount accessories):
  - 203mm (W) x 203mm (D) x 57mm (H)
    8.0" (W) x 8.0" (D) x 2.2" (H)
  - 950g/34 oz
- Dimensions/weight (shipping):
  - 315mm(W) x 265mm(D) x 100mm (H)
    12.4" (W) x 10.4" (D) x 3.9" (H)
  - 1,350g/48 oz

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)

REGULATORY

- FCC/Industry of Canada
- CE Marked
- R&TTE Directive 1995/5/EC
- Low Voltage Directive 72/23/EEC
- EN 300 328
- EN 301 489
- EN 301 893
- UL/IEC/EN 60950
- EN 60601-1-1, EN60601-1-2

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

RELIABILITY

MTBF: 739,935 hrs (84.5yrs) at +25C operating temperature (AP-325)

REGULATORY MODEL NUMBERS

- AP-324 and IAP-324: APIN0324
- AP-325 and IAP-325: APIN0325

CERTIFICATIONS

- CB Scheme Safety, cTUVus
- UL2043 plenum rating
- Wi-Fi Alliance (WFA) certified 802.11a/b/g/n/ac
- Bluetooth SIG interoperability certification

WARRANTY

- Aruba limited lifetime warranty

MINIMUM OPERATING SYSTEM SOFTWARE VERSIONS

- ArubaOS 6.4.4.0

  320 Series Access Points are not supported on 650 Series Mobility Controllers.

- Aruba InstantOS 4.2.2.0

RF PERFORMANCE TABLE

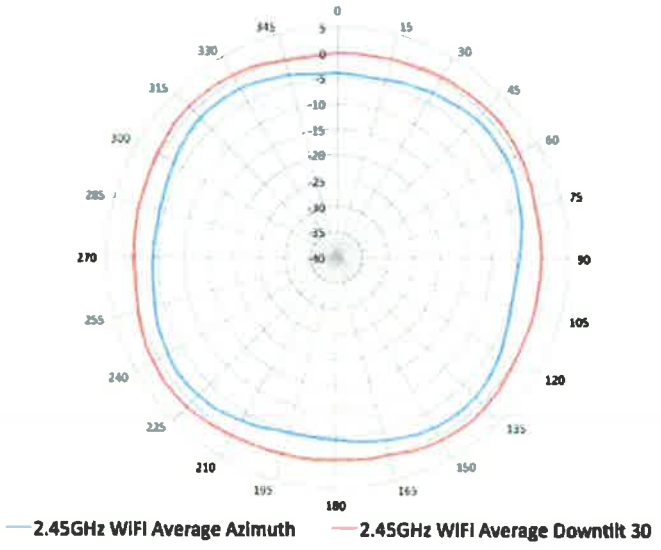
	Maximum transmit power (dBm) per transmit chain	Receiver sensitivity (dBm) per receive chain
802.11b 2.4 GHz		
1 Mbps	18.0	-97.0
11 Mbps	18.0	-89.0
802.11g 2.4 GHz		
6 Mbps	18.0	-93.0
54 Mbps	18.0	-75.0
802.11n HT20 2.4 GHz		
MCS0/8/16	18.0	-92.0
MCS7/15/23	16.0	-72.0
802.11n HT40 2.4 GHz		
MCS0/8/16	18.0	-90.0
MCS7/15/23	16.0	-70.0
802.11a 5 GHz		
6 Mbps	18.0	-93.0
54 Mbps	16.5	-75.0
802.11n HT20 5 GHz		
MCS0/8/16	18.0	-92.0
MCS7/15/23	16.0	-72.0
802.11n HT40 5 GHz		
MCS0/8/16	18.0	-89.0
MCS7/15/23	16.0	-69.0
802.11ac VHT20 5 GHz		
MCS0	18.0	-92.0
MCS9	14.0	-65.0
802.11ac VHT40 5 GHz		
MCS0	18.0	-89.0
MCS9	14.0	-62.0
802.11ac VHT80 5 GHz		
MCS0	18.0	-86.0
MCS9	14.0	-59.0

Maximum capability of the hardware provided (excluding antenna gain). Maximum transmit power is limited by local regulatory settings.

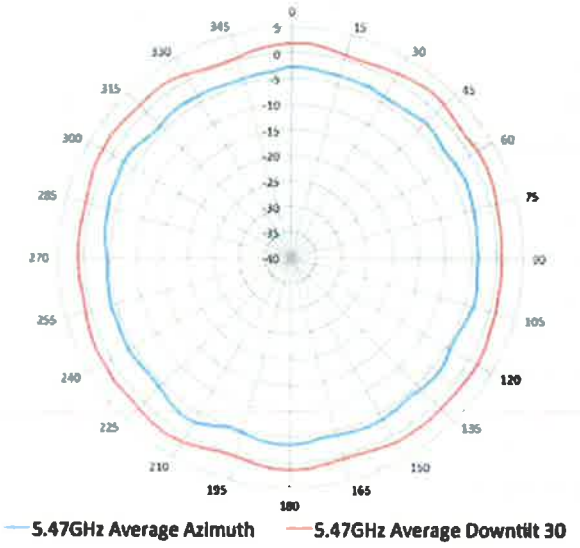
AP-320 ANTENNA PATTERN PLOTS

Horizontal planes (top view, AP facing forward)

Showing azimuth (0 degrees) and 30 degrees downtilt pattern



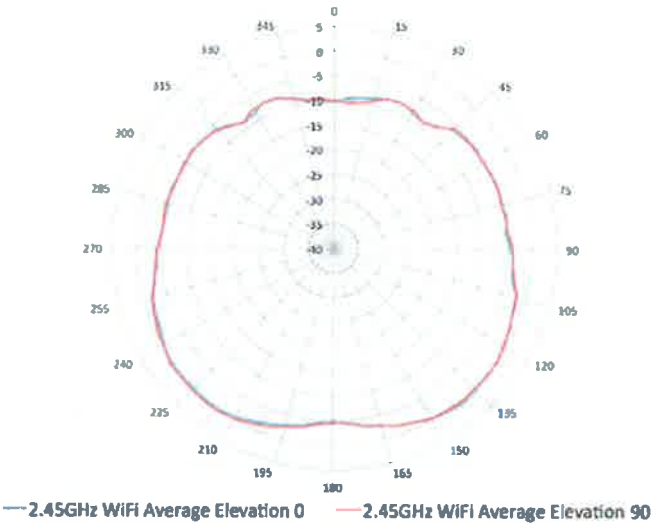
2.45GHz Wi-Fi (antennas 1,2,3,4)



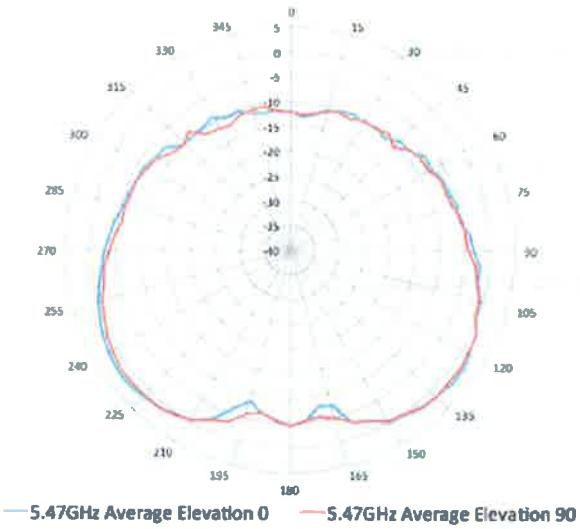
5.5GHz Wi-Fi (antennas A,B,C,D)

Elevation planes (side view, AP facing down)

Showing side view with AP rotated 0 and 90 degrees



2.45GHz Wi-Fi (antennas 1,2,3,4)



5.5GHz Wi-Fi (antennas A,B,C,D)

ORDERING INFORMATION

Part Number	Description
AP-320 Series Access Points	
JW184A	Aruba AP-324 802.11n/ac 4x4:4 MU-MIMO Dual Radio Antenna Connectors AP
JW185A	Aruba AP-324 FIPS/TAA-compliant 802.11n/ac Dual 4x4:4 MU-MIMO Dual Radio Antenna Connectors AP
JW319A	Aruba Instant IAP-324 (RW) 802.11n/ac Dual 4x4:4 MU-MIMO Radio Antenna Connectors AP
JW321A	Aruba Instant IAP-324 (US) 802.11n/ac Dual 4x4:4 MU-MIMO Radio Antenna Connectors AP
JW318A	Aruba Instant IAP-324 (JP) 802.11n/ac Dual 4x4:4 MU-MIMO Radio Antenna Connectors AP
JW317A	Aruba Instant IAP-324 (IL) 802.11n/ac Dual 4x4:4 MU-MIMO Radio Antenna Connectors AP
JW186A	Aruba AP-325 802.11n/ac 4x4:4 MU-MIMO Dual Radio Integrated Antenna AP
JW187A	Aruba AP-325 FIPS/TAA-compliant 802.11n/ac Dual 4x4:4 MU-MIMO Dual Radio Integrated Antenna AP
JW325A	Aruba Instant IAP-325 (RW) 802.11n/ac Dual 4x4:4 MU-MIMO Radio Integrated Antenna AP
JW327A	Aruba Instant IAP-325 (US) 802.11n/ac Dual 4x4:4 MU-MIMO Radio Integrated Antenna AP
JW324A	Aruba Instant IAP-325 (JP) 802.11n/ac Dual 4x4:4 MU-MIMO Radio Integrated Antenna AP
JW323A	Aruba Instant IAP-325 (IL) 802.11n/ac Dual 4x4:4 MU-MIMO Radio Integrated Antenna AP
AP-320 Series Access Points	
JW320A	Aruba Instant IAP-324 (RW) FIPS/TAA 802.11n/ac Dual 4x4:4 MU-MIMO Radio Antenna Connectors AP
JW322A	Aruba Instant IAP-324 (US) FIPS/TAA 802.11n/ac Dual 4x4:4 MU-MIMO Radio Antenna Connectors AP
JW326A	Aruba Instant IAP-325 (RW) FIPS/TAA 802 11n/ac Dual 4x4:4 MU-MIMO Radio Integrated Antenna AP
JW328A	Aruba Instant IAP-325 (US) FIPS/TAA 802.11n/ac Dual 4x4:4 MU-MIMO Radio Integrated Antenna AP
JY745A	Aruba Instant IAP-324 (JP) FIPS/TAA 802.11n/ac Dual 4x4:4 MU-MIMO Radio Antenna Connectors AP
JY746A	Aruba Instant IAP-325 (JP) FIPS/TAA 802.11n/ac Dual 4x4:4 MU-MIMO Radio Integrated Antenna AP
Mounting Accessories	
JW044A	AP-220-MNT-C1 2x Ceiling Grid Rail Adapter for Basic Flat Rails Mount Kit
JW045A	AP-220-MNT-C2 2x Ceiling Grid Rail Adapter for Interlude and Silhouette Mt Kit
JX961A	AP-MNT-CM1 Industrial Grade Indoor Access Point Metal Suspended Ceiling Rail Mount Kit
JW046A	AP-220-MNT-W1 Flat Surface Wall/Ceiling Black AP Basic Flat Surface Mount Kit
JW047A	AP-220-MNT-W1W Flat Surface Wall/Ceiling White AP Basic Flat Surface Mount Kit
JY706A	AP-220-MNT-W3 White Low Profile Box Style Secure Large AP Flat Surface Mount Kit

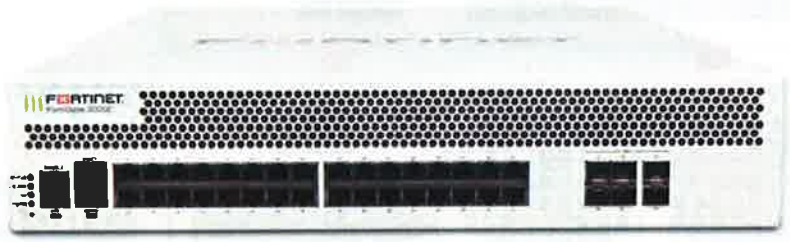
ORDERING INFORMATION

Part Number	Description
Other Accessories	
JW076A	325-CVR-20 20-pk for AP-325 with Holes for LED Indicators White Non-glossy Snap-on Covers
JX990A	AP-AC-12V30B 12V/30W AC/DC Desktop Style 2.1/5.5/9.5mm Circular 90 Deg Plug DoE Level VI Adapter 96
JW629A	PD-9001GR-AC 30W 802.3at PoE+ 10/100/1000 Ethernet Indoor Rated Midspan Injector
Antennas	See info on the Aruba website for antenna part numbers

aruba
a Hewlett Packard Enterprise company
www.arubanetworks.com

3333 SCOTT BLVD | SANTA CLARA, CA 95054
1.844.473.2782 | T: 1.408.227.4500 | FAX: 1.408.227.4550 | INFO@ARUBANETWORKS.COM

FortiGate® 2000E



The Fortinet Enterprise Firewall Solution delivers end-to-end network security with one platform, one network security operating system and unified policy management with a single pane of glass — for **the industry's best protection against the most advanced security threats and targeted attacks**.

Security Fabric Integration

FortiGate appliances, interconnected with the Fortinet Security Fabric, form the backbone of the Fortinet Enterprise Solution.

80 Gbps
Firewall

20 Million
Concurrent Sessions

11.5 Gbps
IPS

9 Gbps
NGFW

5.4 Gbps
Threat Protection

Multiple GE RJ45 and 10 GE SFP+ slots

Deployment Modes

Next Generation Firewall
Internal Segmentation Firewall
Data Center Firewall

Hardware Acceleration

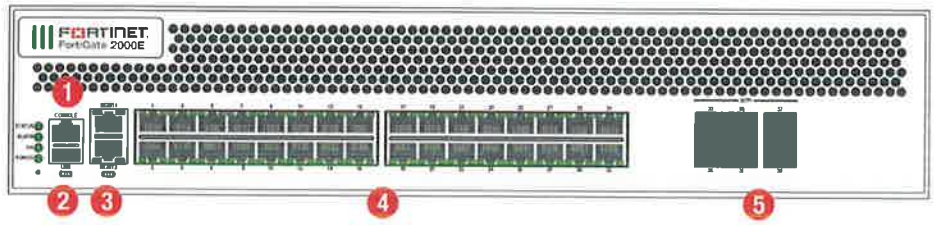
SPU NP6 and CP9

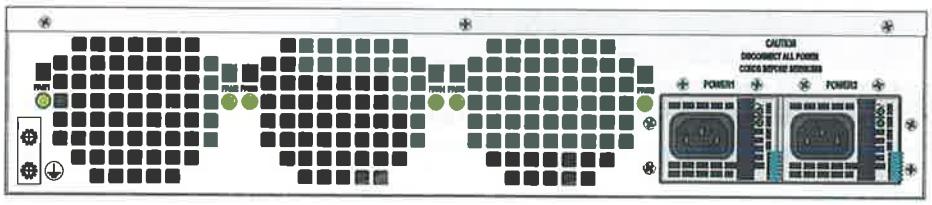
Third-Party Certifications

ICSA labs ICSA labs ICSA labs
ICSA labs ICSA labs

HARDWARE

FortiGate 2000E





Interfaces

1. Console Port
2. USB Port
3. 2x GE RJ45 Management Ports
4. 32x GE RJ45 Ports
5. 6x 10 GE SFP+ Slots

NP Direct

By removing the Internal Switch Fabric, the NP Direct architecture provides direct access to the SPU-NP for the lowest latency forwarding. NGFW deployments require some attention to network design to ensure optimal use of this technology.

Powered by SPU

- Custom SPU processors deliver the power you need to detect malicious content at multi-Gigabit speeds
- Other security technologies cannot protect against today's wide range of content- and connection-based threats because they rely on general-purpose CPUs, causing a dangerous performance gap
- SPU processors provide the performance needed to block emerging threats, meet rigorous third-party certifications, and ensure that your network security solution does not become a network bottleneck

Network Processor

Fortinet's new, breakthrough SPU NP6 network processor works inline with FortiOS functions delivering:

- Superior firewall performance for IPv4/IPv6, SCTP and multicast traffic with ultra-low latency down to 2 microseconds
- VPN, CAPWAP and IP tunnel acceleration
- Anomaly-based intrusion prevention, checksum offload and packet defragmentation
- Traffic shaping and priority queuing

Content Processor

Fortinet's new, breakthrough SPU CP9 content processor works outside of the direct flow of traffic and accelerates the inspection of computationally intensive security features:

- Enhanced IPS performance with unique capability of full signature matching at ASIC
- SSL Inspection capabilities based on the latest industry mandated cipher suites
- Encryption and decryption offloading

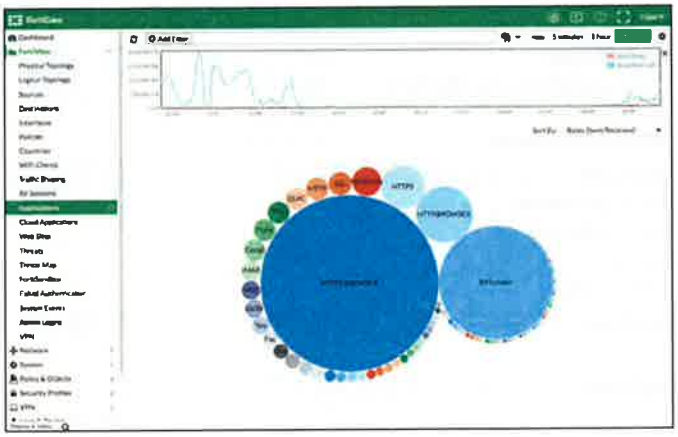
10 GE Connectivity

High speed connectivity is essential for network security segmentation at the core of data networks. The FortiGate 2000E provides high 10 GE port densities, simplifying network designs without relying on additional devices to bridge desired connectivity.

SOFTWARE

FortiOS

Control all the security and networking capabilities across the entire FortiGate platform with one intuitive operating system. Reduce operating expenses and save time with a truly consolidated next generation security platform.



- A truly consolidated platform with one OS for all security and networking services for all FortiGate platforms.
- Industry-leading protection: NSS Labs Recommended, VB100, AV Comparatives and ICSA validated security and performance.
- Control thousands of applications, block the latest exploits, and filter web traffic based on millions of real-time URL ratings.
- Detect, contain and block advanced attacks automatically in minutes with integrated advanced threat protection framework.
- Solve your networking needs with extensive routing, switching, WiFi, LAN and WAN capabilities.
- Activate all the SPU-boosted capabilities you need on the fastest firewall platform available.

For more information, please refer to the FortiOS data sheet available at www.fortinet.com

SERVICES

FortiGuard™ Security Services

FortiGuard Labs offers real-time intelligence on the threat landscape, delivering comprehensive security updates across the full range of Fortinet's solutions. Comprised of security threat researchers, engineers, and forensic specialists, the team collaborates with the world's leading threat monitoring organizations, other network and security vendors, as well as law enforcement agencies:

- **Real-time Updates** — 24x7x365 Global Operations research security intelligence, distributed via Fortinet Distributed Network to all Fortinet platforms.
- **Security Research** — FortiGuard Labs have discovered over 170 unique zero-day vulnerabilities to date, totaling millions of automated signature updates monthly.
- **Validated Security Intelligence** — Based on FortiGuard intelligence, Fortinet's network security platform is tested and validated by the world's leading third-party testing labs and customers globally.

FortiCare™ Support Services

Our FortiCare customer support team provides global technical support for all Fortinet products. With support staff in the Americas, Europe, Middle East and Asia, FortiCare offers services to meet the needs of enterprises of all sizes:

- **Enhanced Support** — For customers who need support during local business hours only.
- **Comprehensive Support** — For customers who need around-the-clock mission critical support, including advanced exchange hardware replacement.
- **Advanced Services** — For global or regional customers who need an assigned Technical Account Manager, enhanced service level agreements, extended software support, priority escalation, on-site visits and more.
- **Professional Services** — For customers with more complex security implementations that require architecture and design services, implementation and deployment services, operational services and more.

Enterprise Bundle

FortiGuard Labs delivers a number of security intelligence services to augment the FortiGate firewall platform. You can easily optimize the protection capabilities of your FortiGate with the FortiGuard Enterprise Bundle. This bundle contains the full set of FortiGuard security services plus FortiCare service and support offering the most flexibility and broadest range of protection all in one package.

SPECIFICATIONS

	FORTIGATE 2000E
Hardware Specifications	
Hardware Accelerated 10 GE SFP+ Slots	6
Hardware Accelerated GE RJ45 Ports	32
GE RJ45 Management / HA Ports	2
USB Ports	1
Console Port	1
Onboard Storage	480 GB
Included Transceivers	2x SFP+ (SR 10GE)
System Performance	
IPv4 Firewall Throughput (1518 / 512 / 64 byte, UDP)	90 / 90 / 60 Gbps
IPv6 Firewall Throughput (1518 / 512 / 86 byte, UDP)	90 / 90 / 60 Gbps
Firewall Latency (64 byte, UDP)	2 µs
Firewall Throughput (Packet per Second)	90 Mpps
Concurrent Sessions (TCP)	20 Million
New Sessions/Second (TCP)	500,000
Firewall Policies	100,000
IPsec VPN Throughput (512 byte)	65 Gbps
Gateway-to-Gateway IPsec VPN Tunnels	20,000
Client-to-Gateway IPsec VPN Tunnels	50,000
SSL-VPN Throughput	6 Gbps
Concurrent SSL-VPN Users (Recommended Maximum)	10,000
IPS Throughput (HTTP / Enterprise Mix) [1]	25 / 11.5 Gbps
SSL Inspection Throughput [2]	12.5 Gbps
Application Control Throughput [3]	15 Gbps
NGFW Throughput [4]	9 Gbps
Threat Protection Throughput [5]	5.4 Gbps
CAPWAP Throughput [6]	21 Gbps
Virtual Domains (Default / Maximum)	10 / 500
Maximum Number of FortiAPs (Total / Tunnel)	4,096 / 1,024
Maximum Number of FortiTokens	5,000
Maximum Number of Registered Endpoints	8,000
High Availability Configurations	Active-Active, Active-Passive, Clustering

	FORTIGATE 2000E
Dimensions	
Height x Width x Length (inches)	3.5 x 17.4 x 21.9
Height x Width x Length (mm)	89 x 442 x 555
Weight	37.0 lbs (16.8 kg)
Form Factor	Rack Mount, 2 RU
Power	
AC Power Supply	100–240V AC, 50–60 Hz
Maximum Current	9A
Power Consumption (Average / Maximum)	280 / 430 W
Heat Dissipation	1,467 BTU/h
Redundant Power Supplies	Yes, Hot swappable
Environment	
Operating Temperature	32–104°F (0–40°C)
Storage Temperature	-31–158°F (-35–70°C)
Humidity	20–90% non-condensing
Operating Altitude	Up to 7,400 ft (2,250 m)
Compliance	
	FCC Part 15 Class A, C-Tick, VCCI, CE, UL/cUL, CB
Certifications	
	ICSA Labs: Firewall, IPsec, IPS, Antivirus, SSL-VPN

Note: All performance values are "up to" and vary depending on system configuration. IPsec VPN performance is based on 512 byte UDP packets using AES-256-SHA1. 1. IPS performance is measured using 1 Mbyte HTTP and Enterprise Traffic Mix. 2. SSL Inspection is measured with IPS enabled and HTTP traffic, using TLS v1.2 with AES256-SHA. 3. Application Control performance is measured with 64 Kbytes HTTP traffic. 4. NGFW performance is measured with IPS and Application Control enabled, based on Enterprise Traffic Mix. 5. Threat Protection performance is measured with IPS and Application Control and Malware protection enabled, based on Enterprise Traffic Mix. 6. CAPWAP performance is based on 1444 byte UDP packets. LAG support and redundant interfaces are limited to certain port configurations, please refer to technical documentation.

For complete, up-to-date and detailed feature set, please refer to the Administration Handbook and FortiOS Datasheet.

ORDER INFORMATION

Product	SKU	Description
FortiGate 2000E	FG-2000E	6x 10 GE SFP+ slots, 34x GE RJ45 ports (including 32x ports, 2x management/HA ports), SPU NP6 and CP9 hardware accelerated, 480 GB SSD onboard storage.
Optional Accessories		
10 GE SFP+ transceiver module, short range	FG-TRAN-SFP+SR	10 GE SFP+ transceiver module, long range for all systems with SFP+ and SFP/SFP+ slots.
10 GE SFP+ transceiver module, long range	FG-TRAN-SFP+LR	10 GE SFP+ transceiver module, long range for all systems with SFP+ and SFP/SFP+ slots.
10 GE SFP+ active direct attach cable, 10m / 32.8 ft	SP-CABLE-ADASFP+	10 GE SFP+ active direct attach cable, 10m / 32.8 ft for all systems with SFP+ and SFP/SFP+ slots.
Rack mount sliding rails	SP-FG3040B-RAIL	Rack mount sliding rails for FG-1000C/-DC, FG-1200D, FG-1500D/DC, FG-2000E, FG-2500E, FG-3040B/-DC, FG-3140B/-DC, FG-3240C/-DC, FG-3000D/-DC, FG-3100D/-DC, FG-3200D/-DC, FG-3700D/-DC, FG-3700DX, FG-3810D/-DC, FG-3815D/-DC and FG-3950B/-DC
AC power supply	SP-FG2000E-PS	AC power supply for FG-2000E and FG-2500E.

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FST-PROD-DS-GT20K

FG-2000E-DAT-R4-201701