Rockbridge Area Network Authority

Request for Proposals - Network Operations

Rockbridge Area Network Authority

RFP#: 160812.RANA

This is not an order. This is a Request for Proposals to manage the network operations of The Rockbridge Area Network Authority (RANA) or Owner. RANA reserves its authority to negotiate terms with any respondents, reject any or all responses, add or delete requirements and to contract services under terms in its own best interests.

The Rockbridge Area Network Authority is a public authority of Rockbridge County, Virginia, and the successful respondent will be required to meet typical public contractual terms for insurance, liability, venue, etc.

Responses are to be sealed with the RFP number clearly marked on the outside of the envelope. Responses must be received by RANA prior to the due date and time. Vendors are encouraged to confirm receipt of their response submission prior to the due date.

Responses will be opened at the date and time indicated.

An open Q&A session will be held by phone and at the RAP on Tuesday, August 16th, 2016 at 1:00PM. Please contact Scott Robertson at 540.464.9990 or ranabroadband@gmail.com for conference call information or to participate on-site and tour the RAP.

All questions asked or answers provided during the Q&A session or in correspondence to RANA via e-mail will be disseminated to all known bidders.

Fax responses will not be accepted.

Contact Information:

Scott Robertson
Executive Director
ranabroadband@gmail.com
540.464.9990

Overview

RANA is soliciting proposals from qualified vendors to operate an Open Access, Active Ethernet, Municipal Fiber Optic Network.

The RANA network consists of approximately 75 miles of fiber backbone and laterals with 275 existing premises connections. The fiber distribution system consists of Calix E7 1Gb Active Ethernet components housed in both in a central data/colocation facility and four remote cabinets. A Juniper MX480 consolidates the third party Internet Service Providers using the network and the remote cabinets.

The network is all Active Ethernet but may be extended with passive (PON) components in the future.

The scope of services includes managing the Calix and Juniper system configurations including provisioning circuits at the request of RANA ISPs, generating reports for system evaluation and billing, technical support of the SPs, monitoring the network for failures and disconnects, and engineering support for network enhancements and infrastructure changes.

The schedule is as follows:

- August 9, 2016 - Publish Request for Proposal
- August 16, 2016, 1:00PM – Open Q&A Conf Call, RAP Tour, at RAP, RSVP for directions
- September 1, 2016, 4:00PM – Response Deadline and Opening, at County Administration Building, 150 S. Main St.
- September 9, 2016 – Proposal Ranking Complete
- September 12, 2016, 2:00PM – RANA Board Meeting and Review; Authorize and begin negotiations and transition.
- September 30, 2016 – Begin Operating Network

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General Information

RANA is a public authority of Rockbridge County authorized by the county, the City of Lexington, and the City of Buena Vista, Virginia, to operate an Open Access gigabit fiber network serving Rockbridge County and the two cities. The network was installed under the terms of a U. S. Federal Government BTOP grant and has been in operation for three years.

Requirements in terms of services expected, technical capabilities, and performance metrics are described in the request along with weightings for evaluation purposes.

Open Access means that access to network services and end points is not restricted except to technical and financial capabilities. RANA is a wholesale Ethernet transport provider. Independent Service Providers qualify to offer Internet or other network services over the RANA infrastructure to customer endpoints on the RANA network.

We seek proposals from vendors capable of operating an open network. Vendors supporting partial solutions are encouraged to respond (e.g. only NOC services for 24/7 monitoring). RANA may choose to take services from more than one vendor. Vendors should clearly indicate if their responses are partial and which services are included in their response.

Vendors should be able to demonstrate core competency and certifications for both Juniper and Calix systems as well as supporting network components such as DC rectifiers, UPS, etc.

The primary roles are to operate, monitor, and manage the network meaning to configure to order using the management systems of Juniper and Calix, capture and report network outages and anomalies including traffic throughput issues, and manage projects for the continued enhancement of the network as required by the RANA Board of Directors.

Most of this effort can be accomplished by remote access. The ability to deliver resources on-site from time to time for project execution is an advantage.

RANA will select one or more qualified vendors to operate and manage the RANA network (this RFP is not a request for equipment).

Definitions

The following definitions are to be used in this bid:

Access Network – Optical delivery network from the RAP to the Customer End Point. The Access Network is Calix E7 Active Ethernet. The CPE is Calix 716GE-I ONT. The network is gigabit capable.

Circuit – A RANA circuit is an Active Ethernet fiber connection between an ONT installed at a customer end point to the RAP. At the RAP, traffic is handed to the SP responsible for the circuit.

Contract - The agreement between the successful Vendor and RANA for the technology partnership.

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Core Network – The Primary network hardware components combining to deliver Ethernet transport. (Except for the specific reference to a pair of Calix E7 shelves in the Layer 2 Transition.)

Core Router/Switch - Network device(s) responsible for aggregating all traffic on the network and delivering that traffic to private sector service providers. Primarily a Juniper MX480 located at the RAP.

CPE - Customer Premise Equipment residing at the customer location (business, institution or residence). Primarily Calix 716GE-I ONT. Other Calix ONT could be deployed in future projects.

Cabinet - Throughout this document "Cabinet" refers to an outside plant telecom equipment enclosure. Details on the cabinet can be found in the network equipment attachments.

FTTP – Fiber-to-the-Premises network

Network Equipment – All of the equipment for the hardware, software, and support systems in the network. This may include an automated service provisioning system and end-user portal for self-registration and service activation.

Open Access (open access) – Technology and policy that enables RANA to provide Ethernet transport to multiple Service Providers or other users so they may deliver unique, competing, any-play services or use the network to augment their own facilities. The Owner provides an infrastructure only, and the Service Providers deliver the consumer and business services.

Operator (or Network Operator) The entity hired by RANA to configure, monitor, manage and enhance the RANA Network.

RAP – The Richard A. Peterson Center in Lexington. The RAP is a Tier 2 data and colocation facility built to house the RANA Core Network and the computer systems of local and regional institutions, Service Providers, and other customers.

RANA – The Rockbridge Area Network Authority. RANA is the "Owner"

Response/Bid - The document and information prepared by the Vendor in response to this RFP.

Service Provider (SP) – An independent business that provides any network or IP service(s), such as voice, video, and/or internet access across the RANA fiber network or uses the RANA network for transport.

Response Contents

To aid us in the evaluation of hardware and software responses, we ask that your response follow this outline:

Note: This is a public bid. Do not include confidential information. RANA cannot guarantee the confidentiality of information in your response.

1. Cover Letter: indicating your firm's interest in the project, and highlighting key points of your response.

2. Company Overview: including company history, number of employees by discipline and servicing locations.

3. Services Overview: A brief description of the services you intend to offer, the location of office(s) where services will delivered, and length of time your firm has provided similar services. Include here your statement that your response includes the expert technical capability to provide the services, the manpower to execute the services either on-site or remotely, and the systems and certifications to operate the network.

4. Proposed Team: List the names of team members expected to provide services to RANA, their bona fides, and management hierarchy.

5. Experience: Indicate your level of experience with Active Ethernet Fiber Optic Broadband networks, particularly your certifications and/or vendor partner level with Juniper and Calix.

6. Describe your approach, methods, tools, and how you will meet the Network Operations Requirements.

7. List the software and/or systems for networks operations required for your service delivery. Include reporting, monitoring, remote access, asset management and any other with vendor and package name. Indicate cost of software to RANA, location for servers, ownership of licenses and intellectual property contained in servers.

8. Time Schedule: Indicate your ability to meet assume responsibility for the network by the dates indicated.

9. Pricing: Indicate your proposed pricing for the Services or Software defined in your response. Include a Service Level Agreement, if applicable. Include a cost rate for staff required for ad hoc or out of contract service.

   NOTE: RANA will give preference to a flat monthly fee to deliver the defined services.

   NOTE: You must respond with separate pricing for the three phases. If your Layer 2 Transition is included in your flat fee, state so clearly.

10. References: Please provide a minimum of three (3) references where your firm and/or your proposed project team have deployed a similar service. Please include client's name, address, phone number, e-mail address, and description of work.

11. Financial Statements: Include information relevant to your financial stability: financial statements, revenues over the past three (3) years, any pending lawsuits or legal actions

against your company, and contact information for your financial institution. Include your coverage for general liability, workers comp, professional liability and errors & omissions insurances.

Selection Process

The Executive Director of RANA will initially evaluate and score the responses. The Business Committee of The Rockbridge Area Network Authority will review the evaluations and make a recommendation to the Board for a decision. The responses will be evaluated and ranked based on the Selection Criteria. RANA will ask the top ranked vendors to attend a presentation interview as part of the evaluation process.

At the conclusion of the evaluation process the vendors will be ranked in priority order with the highest ranking vendor being selected to negotiate a contract with RANA. If a contract satisfactory to both parties cannot be negotiated, RANA will then enter into negotiations with the next highest ranking vendor or restart the process.

Selection Criteria

The Respondents will be evaluated on the following criteria:

- Clarity of response and adherence to format. (5%)
- Total Cost of proposed services (current configuration, Layer 2 transition, future configuration). (20%)
- The Respondent's demonstrated capabilities and certifications with the Core Network deployed by RANA. (30%)
- Respondent's NOC location and ability to provide on-site support as needed. (15%)
- Features and flexibility of the Respondent's technical solution for network monitoring, reporting, control, and specific support of RANA's business operations. (30%)

Special Conditions

Rockbridge Area Network Authority reserves the right, at its sole discretion, to accept or reject any or all statements or responses, or to waive any or all irregularities in any or all statements or responses, and to award a contract to a vendor whose response is most beneficial to RANA.

RANA also reserves the right, at its sole discretion, to request additional information from any or all respondents. While RANA intends to execute a contract for software and/or services listed herein, it is not bound to do so and this document will not be interpreted as binding RANA to enter into an agreement with any vendor.

The successful vendor will enter into negotiations with RANA on the precise Scope of Work (SOW), purchase order (PO) and/or associated fees. Once this negotiation is complete, the vendor will be required to execute a contract with RANA following award of the solicitation by the Rockbridge Area Network Authority Board.

Rockbridge Area Network Authority will provide a Professional Services Agreement with specified terms and conditions. Rockbridge Area Network Authority may, but is not required to, negotiate contract terms and provisions to which the Respondent makes exception, and to negotiate requested or required additional terms and provisions.

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The Professional Services Agreement as finally agreed upon must be in form and content acceptable to RANA.

Submittal

Respondents should submit one (1) paper copy and one (1) digital copy (CD, USB Drive, or FTP) to the address below no later than Thursday, September 1, 2016 at 4PM:

The digital copy may be emailed or posted to a share but is due by the deadline and does not relieve the Respondent from delivering a paper copy by the deadline.

Rockbridge Area Network Authority
Attn: Scott Robertson
150 South Main Street
Lexington, VA 24450

Minority and/or female-owned businesses are encouraged to apply. Rockbridge Area Network Authority is an equal opportunity employer and does not discriminate on the basis of race, color, creed, national origin or against faith-based organizations.

Network Design and Components

Network Description
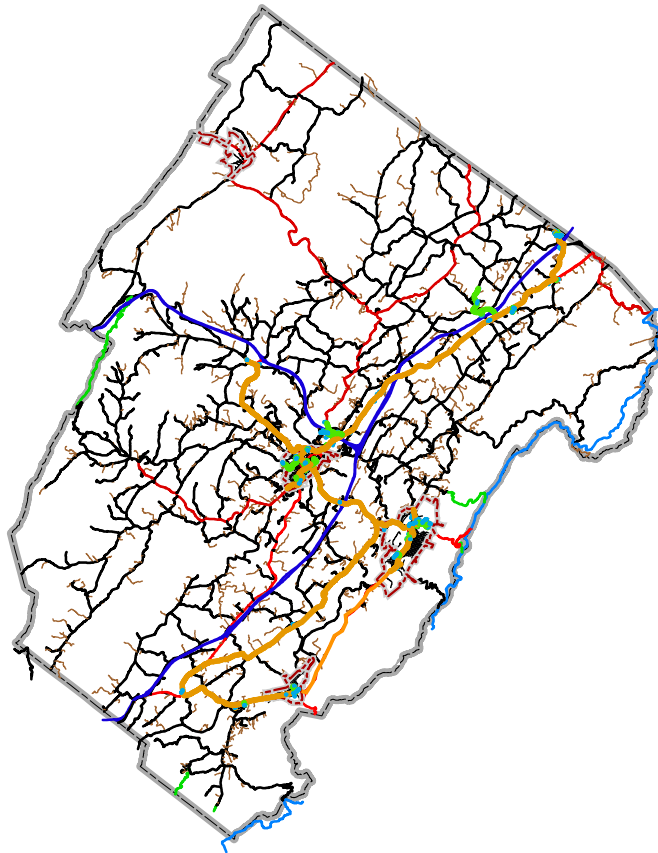
Orange Lines = RANA Backbone

The RANA network consists of a series of 144 strand fiber backbone segments in a star topology centered at the Richard A. Peterson Center (RAP), located on the campus of Washington and Lee University in Lexington.

The Core Network consists of a Juniper MX480 router, configured with two 2x10GE cards and two 20x1GE cards, a 12-port Juniper EX2200-C switch for management purposes, and a Juniper SRX240 firewall to control external access. The Juniper hardware is AC powered in the RAP and monitoring is contained to the specific systems.

Service Providers currently connect to the Juniper and may inject 802.1q VLANs or untagged IP (Internet Protocol) into the RANA Network.

Fiber distribution consists of Calix E7-2 frames with 2x GE24 line cards and 1Gb optics. Calix E7 frames are located in the RAP and in four fiber distribution cabinets in the field. The Calix hardware is powered by Eltek/Valerie V1000A-VC Rectifiers with NIC2001 controllers.

Where more than one E7 Frame is needed in a location, the E7s are stacked and their traffic consolidated as a LAG to the Juniper. Note in the table below the location and current configuration of the Calix equipment and needed changes.

MPLS (Multi-Protocol Label Switching) is used to support the coexistence of multiple services in the network. Each Calix ONT deploys four 1Gb Ethernet ports that can be individually provisioned for different classes of service or different Service Providers.

Cabinet locations contain Calix E7-2 shelve(s) each with 2 GE24 line cards, an Eltek rectifier, and an APC SmartUPS 1500VA Battery Backup. Each distribution site will be connected directly to the Juniper in a hub and spoke topology. Additional Information on the Calix E7 series can be found in the network information attachments.

Site	Location Details
RAP Center (RAP) 1x Juniper MX480, EX2200, SRX240 3x Calix E7, 10Gb LAG to Juniper	311 W. Denny Circle, Lexington 37.793389,-79.44245
Buena Vista (BV Cabinet) 1x Calix E7, 10GB LAG to Juniper	Hazel Ave & E. 3rd Street, Buena Vista 37.71734763,-79.36129010
Fairfield Elementary (FF Cabinet) 2x Calix E7, 1GB LAG to Juniper	20 Fairfield School Road, Fairfield 37.8778122, -79.293417
Glasgow (GL Cabinet) 1x Calix E7, 1GB LAG to Juniper	42 Natural Bridge School Road, Natural Bridge Station 37.622012, -79.49942
Maury River MS (MR Cabinet 1x Calix E7, 1GB LAG to Juniper	600 Waddell Street, Lexington 37.773997, -79.444242

Customer Premise

RANA installs Calix 716GE-Indoor ONT as the CPE.

The Active Ethernet RANA network interfaces one Single Mode Fiber strand to the managed residential CPE (Calix 716GE-I). The CPE contains four Ethernet ports (copper 1000BaseT) capable of delivering and managing disparate services. One port may deliver untagged traffic to a home gateway for basic Internet service while another port(s) may deliver a Metro Ethernet connection over a specifically provisioned RANA VLAN. The CPE also contains two POTS ports (SIP).

Service Provider Interface

A Service Provider maintains their own equipment in the RAP, typically an edge router and/or managed switch and their own connectivity from a carrier to the Internet. RANA itself does not provide Internet Service. Service Providers cross connect to the Juniper router in the RAP on either 1GB or 10GB ports.

The network topology and architecture is transparent to Service Providers. They simply know that a connection exists between an available port at their connection location and the client's CPE. Service Providers may provide untagged traffic for Internet services or may provide (802.1q) tagged traffic for specific services or for specific customers.

The RANA network is intended as an Ethernet Layer 2 network where data traffic is transported between the RAP and an available Ethernet port on an end point CPE (ONT). Data is transported on a specific RANA VLAN assigned to a Service Provider.

Service Separation

In order for the network to support multiple services, Service Providers, and customers, the network needs a way to separate services and to multiplex and demultiplex the traffic.

In the access layer (from the CPE devices into the access ports on the local switches), VLANs (virtual local access network) are used to provide the services.

Each Service Provider is assigned a range of RANA VLANs to separate their and their customer's traffic. For each service to which a customer subscribes, the CPE terminates the service and provides a port on the CPE device. The ports on the CPE device are capable of passing tagged or untagged traffic as well as providing bandwidth management features such as ingress/egress, traffic policing, or shaping. But, typically, RANA will tag traffic coming from a service provider with either the default RANA VLAN for the SP or a specific VLAN assigned by the Service Provider to their customer within the Service Provider range. When the Ethernet Frame exits the RANA network at the CPE end, the RANA tag is removed leaving whatever Service Provider and/or end customer tags.

It is the service provider's responsibility to provide the Layer 3 next-hop (in the case of Internet services) or any other network service they are providing to the customer.

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Network Operations Requirements

The following sections describe the responsibilities and expectations of the Authority for the Operator:

The Operator will have network-engineering resources certified to high levels to manage Juniper and Calix systems and perform the following services. Vendor certification is important to insure that RANA qualifies for support services from the vendors at preferred rates.

This is a three-phase process with different costs associated with each phase.

1. Operate the Current Configuration. The current configuration has a Juniper MX-480 router interfacing to a Calix E7 distribution environment. The Juniper is programmed directly. The Calix systems are managed by the Calix CMS System.

2. Layer 2 Transition. RANA intends to move services off of the Juniper MX-480 and operate a strict Ethernet Layer 2 transport network using just the Calix systems. Below is reference architecture for the additional Calix hardware anticipated and changes in some of the network topology.

3. Operate the Future Configuration. The future configuration will consist of just Calix E7 distribution systems operating a straight Ethernet Layer 2 network.

NOTE: The requirements to operate are the same for Phase 1 and Phase 2 except in Phase 1 the Juniper MX-480 is part of the network. RANA expects the operation of the network to be (much) less expensive without the Juniper MX-480. It is possible that by the time of award, the Layer 2 Transition will be complete and the award will be strictly for Phase 3 services.

Provisioning

The Operator will be required to provision new Services or new Service Providers on the RANA network.

Services will be standard, pre-defined transport of bandwidth and quality/priority service level. For existing service providers the general provisioning process will require provisioning CPE equipment utilizing Calix CMS and provisioning the CPE port(s) to allow specific services over that subscribers edge port.

New Service Providers on the network will require setting up required service templates for that Service Provider's service offerings in both JUNOS Space and defining the templates in the Calix CMS system.

Order Management (OM)

The Operator will be required to deliver order management for new service orders, disconnects, and configure any new Service Providers. It is expected to provide an Order Management process and supporting system. The minimum functionality for Order Management is an order entry front end configured for RANA and/or service provider offerings, a ticket-generating component that alerts all parties to the order, a status function, and an order completion

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notification. The OM system should generate and maintain discrete order numbers and assign circuit IDs.

The OM System should support pre-provisioning, meaning that an order for a circuit to an ONT that has not been brought live on the network yet.

The Network Operator is expected to respond to provisioning orders within 2 business hours and complete provisioning of services within 24 hours (excepting weekends) of an order.

Service Provider Support and OSP

The Network Operator will provide support to RANA Service Providers troubleshooting end customer issues. Typically the SP delivers support to their customers, troubleshooting and remediating service issues. But, in the event that issues are upstream of the SP, the Network Operator is responsible for support by remote access, phone, and email as appropriate.

In the event of a fiber cut or fiber cabinet availability, the Network Operator may have to dispatch the outside plant contractor to repair fiber, replace hardware, or install a generator.

The Network Operator is expected to provide a call ticket system. The minimum functionality for the call ticket system is a front end configured for RANA and/or service provider access, a ticket-generating component that alerts all parties to the support ticket, a status function, and an ticket completion notification. The call ticket system should generate and maintain discrete ticket numbers and produce periodic reports on support call status and metrics.

Remote Access and Monitoring

The Operator provides 24/7 monitoring of the Network.

The Operator is responsible for providing remote access bandwidth sufficient to actively monitor the network and provide internet service to the RAP. The RAP is served by several carriers, Comcast, CenturyLink, Lumos, and Lightower, as well as RANA ISPs Rockbridge Global Village, BRI/Ting, and Lumos.

Monitoring consists of remotely tracking the availability of all components of the network. The Operator will be responsible for maintaining the Network to a high quality standard in line with carrier industry standards.

The Operator will deploy a set of tools to manage network traffic and quality to foresee congestion issues and mitigate in advance.

The Calix E7 frames and blades should be specifically monitored for error conditions and pending or existing failure. The E7s are powered by Eltek/Valere Rectifiers with monitoring ports.

The Rectifiers in the RAP are configured and monitored but those in the Fiber Cabinets will require configuration and setup to by the Network Operator to put monitoring in effect.

The Fiber Cabinets also have APC SmartUPS 1500 units to buffer power during short interruptions. These have APC network management cards in them that need configuration and setup to monitor their status.

Reporting and Service Restoration

The Operator will be responsible for reporting outages and supporting Service Restoration.

Periodic reports of disconnected ONT will be made to Service Providers of ONT with circuits they have provisioned at least daily. Notifications may include fault identification and OSP dispatch in the event of a fiber cut. On service restoration, the Operator will be required to follow up with any dispatches and update the Ticketing system with all actions taken.

The Operator will deploy a capability of identifying ONT provisioned for higher tiers of service and actively report disconnections to the associated SP.

Change Management

The Operator is responsible for providing a change management process and documentation for all network repairs or replacements.

The Operator will have a procedure in place to schedule maintenance that is potentially service disabling during non-peak, non-business hours and to notify Service Providers and other key partners. This is particularly the case with the Layer 2 Transition.

Security

The Operator is responsible for establishing the security of the RANA network, monitoring the network for intrusion or malicious activity, and reporting potential or actual security breaches. The Operator will maintain the systems to the manufacturers recommended (stable) software/firmware levels and deploy carrier industry best practices for access control.

RANA will maintain service and support contracts on all hardware.

Backups

The operator will be responsible for maintaining backup configurations of all network elements and systems after each change with a copy maintained locally and a copy offsite. The network operator will configure and document all log-in access to RANA network systems.

Inventory Management

The Operator will be responsible for updating the inventory log during hardware deployments, replacements, and managing replacement plans for aging or defective equipment.

Billing

The Operator will be responsible for managing billing data, and the process of creating wholesale billing extracts for the Network on a monthly basis, including the implementation of new, or integration with existing billing platforms. RANA is a wholesale transport network and therefore will not have a billing relationship with each end user. The Operator will need to provide RANA with billing data in a fashion that Service Providers can be billed monthly.

At a minimum, billing data will include Service Provider, Service Order and/or Circuit ID, service level, provisioning date, term ending date, and any reductions to rates including service credits due to network outages or other promotional credits.

Billing data is generated at the first of every month.

RAP Center Operations (Data and Colocation Facility)

The RAP is a Tier 2 data center in Lexington built to house the Core Network and other data systems. The RANA fiber backbones terminate in patch panels in the RAP and all of RANA's network traffic is consolidated there. Service Providers rent space for their switchgear and routers to cross connect their service to the RANA network. Long haul carriers rent space in the RAP to cross connect their services to SPs and other RAP customers. The RAP houses data systems for local businesses and institutions such as W&L University, VMI, The City of Lexington, etc.

The RAP is a dark, remotely monitored data center with N+1 or higher capacity. The raised floor space is 2,400 square feet and 100kVA. There are two power busses on the floor with two 100kVA UPS systems and a 350kW standby generator. Access is limited to card key holders.

The Network Operators role in managing the RAP is minimal. Designated Operator staff will have access to RANA's caged space where the patch panels, Calix, Juniper and other hardware is installed.

RANA contracts maintenance coordination for all of the systems at the RAP. The Operators role may be ad hoc for purposes of supporting facility change or installing optics, cross connects, or other network systems.

Property

Any and all information, system files, configuration data, billing reports, etc. generated during the course of the Network Operator's services for RANA are the property of RANA regardless of the system in which they are created and will be delivered to RANA in a suitable format when requested.

Ethernet Layer 2 Transition

A key component of the service is a successful transition to a strict Ethernet Layer 2 transport network.

This effort has been provisionally engineered and described below. RANA will de-emphasize the Juniper MX-480 and add additional Calix E7 shelves and line cards, primarily in the RAP, to:

- Replace the 1Gb and 10Gb ports currently in use on the Juniper;

- Create a 'Core' Calix environment at the RAP for Service Provider, local system connections, and consolidation of 'Access' systems;

- Add capacity to the Calix 'Access' components installed in the RAP or in field cabinets. These primarily host customer Active Ethernet connections and will consolidate traffic to 'Core' systems at the RAP;

- Configure a 10GB ring between the RAP, Glasgow Cabinet, and Buena Vista Cabinet incorporating the two 'Core' shelves;

- Reconfigure the Fairfield and Maury River Cabinet LAGs to Active from Active/Standby, remaining 1Gb.

When complete, all SP connections will be directly to ports on the Calix 'Core' stack in the RAP, either to 1Gb or 10Gb ports, and the E7s in the cabinets will also connect back to the Calix stack in the RAP in the same way. RANA will have a 10Gb ring between Lexington, Glasgow, and Buena Vista and 2x 1Gb LAGs from Fairfield and Maury River.

RANA will provide the hardware to implement the Layer 2 Transition. The Operator will provide the manpower and engineering to deploy.

Additional work in this transition process is to bring the Eltek/Valere rectifiers and the APC UPS units in the cabinets on net and actively monitored.

NOTE: This is the plan. The plan may or may not be implemented by the time the Operator assumes responsibility. If not, the Operator will be expected to contribute their expertise to validate the plan before implementation.

Proposed RANA Network Design Topology Layout
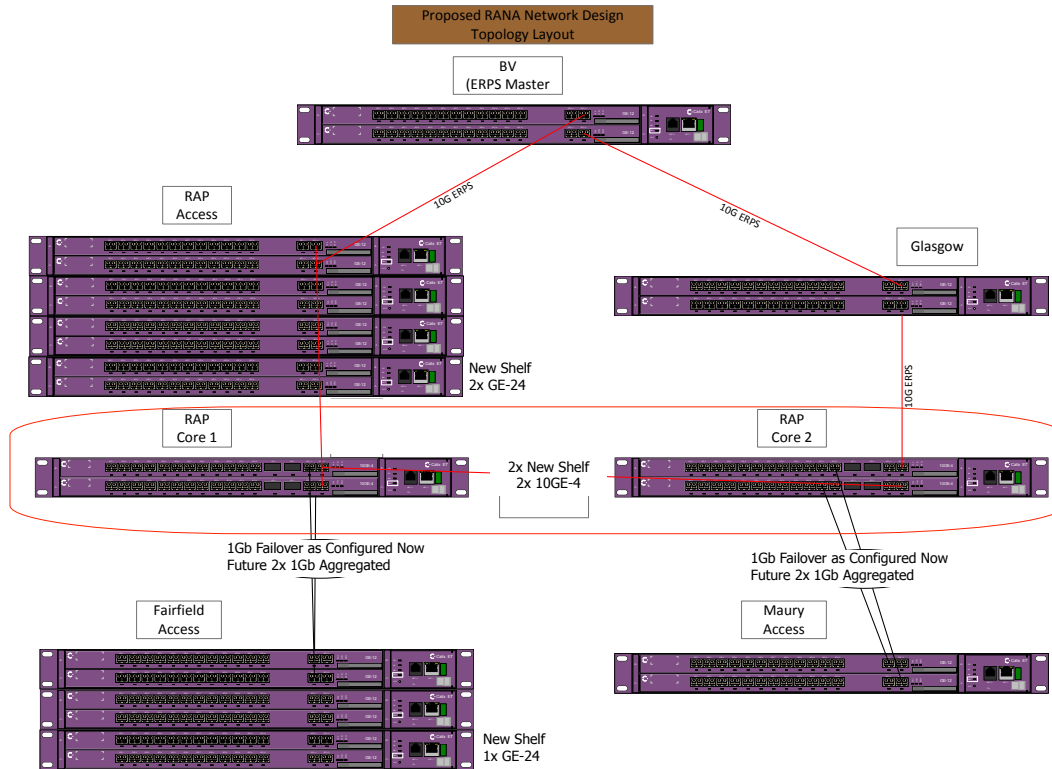
Above shows the arrangement of the RANA Calix systems after the Layer 2 Transition. Core 1 and Core 2 E7 shelves are newly installed in the RAP with 10GE-4 cards. These two shelves host the Service Provider and Access consolidation ports as well as management ports. Details on their connections are on the following page. The Calix E7 Core 1 and Core 2 effectively replace the Juniper MX-480.

The RAP also houses four Calix E7 shelves with GE-24 cards to create an 'Access' stack. Calix 'Access' stacks are used to connect endpoint ONTs for end customer connections.

The RAP Access stack, the Access stack in the Buena Vista Cabinet, the Access stack in the Glasgow Cabinet, and the two Core shelves in the RAP share a 10Gb ring. The Access stack in the Maury River Cabinet will connect to the RAP Core 2 with two 1Gb fiber pairs in an Active configuration. An additional E7 shelf will be installed in the Fairfield Cabinet to expand capacity. The stack will connect to the RAP Core 1 with two 1Gb fiber pairs in an Active configuration.

Proposed RANA Network Design
Core Switch Connections
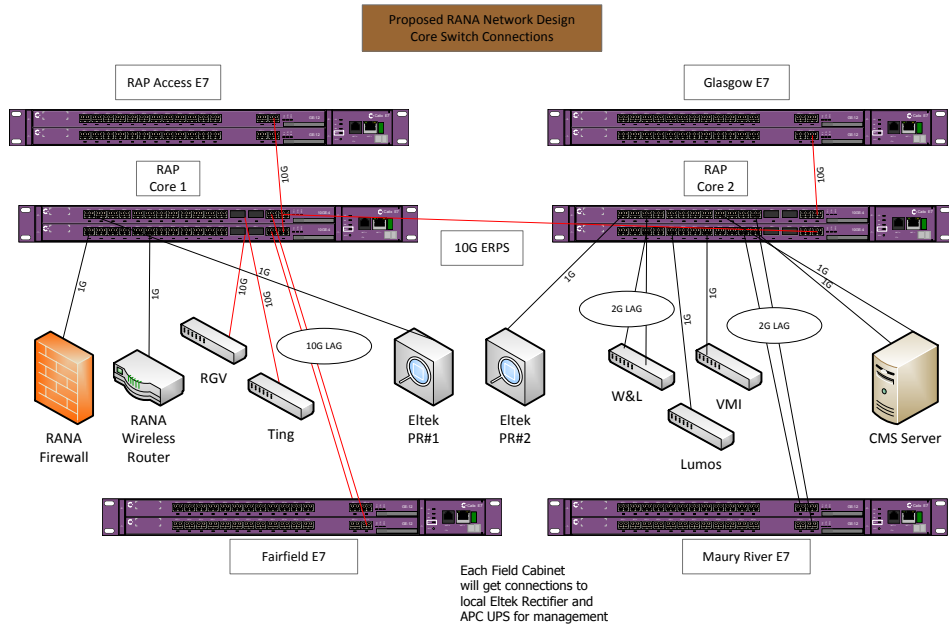
Above the two Core shelves are shown with their 10Gb ring and 1Gb Active connections to Access stacks as well as the various 10Gb and 1Gb Service Provider and other system connections in the RAP.

Attachments

Detailed network equipment information can be found in the attachments. Below is an outline of attachments for network equipment and devices being used in the network.

Attachment A - Insurance Requirements

Attachments D - Network Equipment Information

Juniper

Juniper MX480 Router

Juniper EX2200-C Switch

Juniper SRX-240 Firewall

Calix

Calix E7-2

Calix GE24 (line card)

Calix GE10-4 (line card)

Calix 716GE-I ONT

Calix/Dell CMS Appliance

Spare Dell Poweredge 320 Server

APC SmartUPS 1500VA (Tower Model)

Valere DC Power Rectifier (for Calix E7-2 switches)

Field Distribution Cabinet

Attachment A - Insurance Requirements

The Contractor shall carry Public Liability Insurance in the amount specified below, including contractual liability assumed by the Contractor, and shall deliver Certificate of Insurance from carriers acceptable to the owner specifying such limits. **The Certificate shall show RANA and each of RANA's Constituent Organizations named as an additional insured for the Commercial General Liability and Automobile Liability Policies**, which shall include owned, non-owned and hired car coverage and Umbrella Liability coverage. The coverage shall be provided by a carrier(s) rated "Excellent" by AM Bests. In addition, the insurer shall agree to give the Authority 30 days notice of its decision to cancel coverage.

1.   **Workers' Compensation and Employer's Liability**

Coverage A - Statutory Requirements Coverage B - $1,000,000 Per Occurrence
Coverage C - $1,000,000/$1,000,000 Accident and/or Disease
All States Endorsement

1.   Automobile Liability, including Owned, Non-Owned and Hired Car Coverage

Limits of Liability

Bodily Injury $1,000,000 each person
                                                 $1,000,000 each occurrence

Property Damage $1,000,000 each occurrence

3.   Comprehensive General Liability

Limits of Liability

Bodily Injury $1,000,000 each occurrence

Property Damage $1,000,000 each occurrence
                                          OR

          Single Limit $2,000,000 each occurrence
          Bodily Injury
          Property Damage

          Including:

          A   Completed Operations/Products
          B.   Contractual Liability for Specified Agreement
          C.   Personal Injury
          D.   (XCU) Explosion, Collapse and Underground Coverage
          E.   Broad Form Property Damage

NOTE1: Contractual Liability covers the following indemnity agreement:

"The Contractor shall indemnify and hold harmless the owner against and from all liability, claims, damages and costs, including attorney's fees of every kind and nature and attributable to bodily injury, sickness, disease or death or to damage or destruction of property resulting from or in any manner arising out of or in connection with the project and the performance of the work under this contract."

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NETWORKS

MX SERIES 3D UNIVERSAL EDGE ROUTERS

Product Overview

With continuous technology advances and ongoing standards development, Ethernet is increasingly the technology of choice for enterprises and service providers. Ethernet bandwidth requirements continue to rise as a result of companies needing high-speed connectivity between their geographically dispersed sites. There is an increased reliance on collaborative applications across a globally distributed user base which requires sharing data across the WAN. These are often multimedia applications, including video conferencing and video streaming, and thus require extremely high bandwidth and low latency. To address these requirements, Juniper Networks has introduced the MX Series 3D Universal Edge Routers that deliver a high-performance network infrastructure that provides fast, secure and reliable delivery of the applications that drive business processes while containing cost and increasing operational efficiency.

Ethernet is rapidly becoming the technology of choice for both enterprises and service providers looking to provide connectivity and intelligent services. While in some respects the requirements may be different, today's advanced services are dictating that both enterprises and service providers build networks that meet increasingly stringent requirements regarding quality of service (QoS), network performance and availability.

In addition to these basic requirements, service providers seeking to provide a differentiated user experience are finding they must scale their networks to support increasingly higher amounts of bandwidth, services and subscribers. Scaling the network in these three dimensions will be critical to securing competitive differentiation for the next generation of services.

Scalability is further enhanced by the ability to interconnect and manage multiple chassis as a single, logical device, improving operational efficiency while lowering TCO.

Juniper Networks® MX Series 3D Universal Edge Routers are the only routers designed to provide the 3D scaling necessary to address today's advanced Ethernet requirements. Powered by Juniper Networks Junos® operating system and high-performance silicon such as the I-Chip and Junos Trio chipset, the MX Series enables service providers and enterprises to adapt to—and profit from—Ethernet services in a changing market.

Product Description

MX Series routers are a portfolio of high-performance Ethernet routers, which function as a Universal Edge platform capable of supporting all types of business, mobile and residential services. With powerful switching and security features, the MX Series delivers unmatched flexibility and reliability to support advanced services and applications. MX Series routers also separate control and forwarding functions to provide maximum scale and intelligent service delivery capabilities.

MX Series 3D Universal Edge Routers are optimized for Ethernet and address a wide range of deployments, architectures, port densities and interfaces for both service provider and enterprise environments. In both markets, the MX Series routers provide scalable, high port-density routing and switching required for applications such as data centers. For service providers, MX Series routers surpass the requirements of carrier Ethernet routing and switching as defined by the Metro Ethernet Forum, making Juniper Networks routers

the platforms of choice for service providers seeking 3D scaling in the Universal Edge. These features can also be deployed in high performance enterprise data centers and enterprise campus networks.

Powered by Junos OS, the MX Series provides a consistent operating environment that streamlines network operations and improves the availability, performance, and security of all types of services supported at the Universal Edge. It offers the most complete, advanced routing features in the industry without compromising performance which maximizes investment protection. These features include traffic segmentation and virtualization with MPLS, other sophisticated virtualization techniques such as Virtual Chassis, logical systems, ultra low-latency multicast, as well as comprehensive security and QoS implementations to accelerate delivery of time-sensitive applications and services.

The carrier-class reliability and high availability features available on the MX Series include graceful restart, nonstop routing (NSR), fast reroute (FRR), Unified In-Service Software Upgrade (ISSU) and VPLS multihoming.

The MX Series provides the 3D scale, maximum performance, availability, and service agility that enterprises and service providers need to gain a competitive advantage in today's Ethernet environment.

MX Series 3D Universal Edge Routers for the Midrange

Juniper Networks MX Series routers for the midrange are the most compact members of the MX Series product family. Only 2 rack units (RU) high and built to support optional redundant power supplies and fans, this platform is perfectly suited for environments facing space or power constraints. Midrange routers include the MX5, MX10, MX40, MX80 and MX80-48T. The MX Series 3D midrange routers are software upgradeable and are very attractive to customers who enjoy the flexibility of the available 'pay-as-you-grow' software licenses. More information on the MX Series for the midrange can be found at **www.juniper.net/us/en/local/pdf/datasheets/1000374-en.pdf.**

MX240 3D Universal Edge Router

Juniper Networks MX240 3D Universal Edge Router design delivers increased port density over traditional Ethernet platforms as well as performance of 640 Gbps throughput, scalability and reliability in a space-efficient package. The MX240 offers fully redundant hardware options that include a redundant Switch Control Board (SCB) and Routing Engines (REs) to increase system availability.

MX480 3D Universal Edge Router

Juniper Networks MX480 3D Universal Edge Router provides a dense, highly redundant platform primarily targeted for medium to large enterprise campus and data centers and dense dedicated access aggregation and provider edge services in medium and large Points of Presence (POPs). The MX480 offers common hardware redundancy options including the SCBs, REs, fan trays and power supplies.

MX960 3D Universal Edge Router

Juniper Networks MX960 3D Universal Edge Router is a high density Layer 2 and Layer 3 Ethernet platform designed for deployment in a number of enterprise and service provider Ethernet scenarios. For service providers, the wide range of Universal Edge applications supported by the MX960 include VPLS services for multi-point connectivity, Virtual Leased Line for point-to-point services, full support for MPLS VPNs throughout the Ethernet network, Ethernet aggregation at the campus/enterprise edge, and Ethernet aggregation at the multiservice edge. In the enterprise, the MX960 can be used for campus and data center core and aggregation as well as a WAN Gateway.

The MX960 router is ideal for large applications requiring predictable performance for feature-rich infrastructures. In addition, this platform is ideal where SCB and RE redundancy are required. All major components are field replaceable, increasing system serviceability and reliability, and decreasing mean time to repair.

Table 1: MX Series 3D Universal Edge Routers

ROUTER	MX240	MX480	MX960
System capacity	640 Gbps	1.92 Tbps	2.6 Tbps
Throughput per slot	120 Gbps per slot	120 Gbps per slot	120 Gbps per slot
Packet forwarding capacity	440 Mpps	1.32 Bpps	2.42 Bpps
DPCs and/or MPCs per chassis	2 or 3	6	11 or 12
Chassis per rack	9	6	3

Features and Benefits

MX Series 3D Universal Edge Routers

Key components of each MX Series 3D Universal Edge Router are the Dense Port Concentrators (DPCs), Modular Port Concentrators (MPCs), the Routing Engine, and the Switch Control Board (SCB).

The DPCs are optimized for Ethernet density and are capable of supporting up to 40 GbE or four 10GbE Ethernet ports. The DPC assembly combines packet forwarding and Ethernet interfaces on a single board, with 40 Gbps of packet forwarding capacity.

Designed for flexibility, MPCs leverage the Junos Trio chipset to deliver the industry's highest density GbE and 10GbE, as well as the flexibility of modular interfaces, across the MX Series portfolio. These advanced capabilities allow customers to flexibly mix and match interfaces to create service-specific and "pay as you grow" configurations. The MPC houses the PFEs to deliver up to 120 Gbps of comprehensive Layer 3 routing (IPv4 and IPv6), and Layer 2 switching. These MPCs also support inline services and advanced Heirarchical QoS (H-QoS) per MX Series slot.

The RE provides control plane functions and runs Junos OS. Software processes that run on the RE maintain the routing tables, manage the routing protocols used on the router, control the router interfaces, control some chassis components, and provide the interface for system management and user access to the router.

REs communicate with DPCs and MPCs via dedicated out-of-band management channels, providing a clear distinction between the control and forwarding planes.

Integrated into the SCB is the switch fabric, which interconnects all of the DPCs and MPCs within the chassis. The RE installs directly into the SCB.

Ethernet-based services present a significant new revenue opportunity for service providers across all market segments. These business, mobile and residential services include VPNs, point-to-point connectivity, high-speed Internet access, and video-based offerings. With continuous technology advances and ongoing standards development, Ethernet is increasingly the technology of choice at the service provider edge—and the MX Series 3D Universal Edge Routers are capable of supporting all these services. As an example of Juniper's commitment to delivering a Universal Edge solution to meet the needs of next-generation networks and services, the MX Series offers unmatched scalability, performance, reliability, and QoS for all types of business, mobile and residential services. MX Series 3D routers are the only high-density Layer 2 and Layer 3 Ethernet platforms designed with 3D scaling for deployment in a number of service provider Ethernet edge scenarios.

Examples of the wide range of applications enabled by the MX Series in the Universal Edge include:

- VPLS for multipoint connectivity—high scale BGP and LDP support
- Virtual leased line for point-to-point services—native support for point-to-point services

- RFC 2547.bis IP/MPLS VPN (L3VPN)—full support for MPLS VPNs throughout the Ethernet network
- Video distribution for IPTV services with advanced capabilities such as multicast MPLS VPNS
- Ethernet aggregation at the multiservice edge—supporting up to 480 GbE ports or 176 10GbE ports in a single platform—for maximum Ethernet density
- Residential multiplay services—with subscriber management capabilities as well as high-density Ethernet aggregation, the MX Series can fulfill multiple roles in the delivery of residential services
- Cloud computing—the MX Series provides the perfect platform for connectivity to and between clouds
- Data center consolidation—with advanced multicasting and unicast capabilities, the MX Series can provide data center connectivity and server live-mirroring and migration
- VPLS and MPLS help enable multiple services thereby improving network utilization.
- Mobile backhaul and aggregation—providing cost-effective transport and backhaul of mobile data traffic
- Application monitoring—with integrated performance monitoring systems such as StreamScope eRM and Telchemy Embedded Performance Monitor (TePM), the MX Series can provide advanced application layer diagnostics help service providers deliver a superior user experience for voice, video and other multimedia services

MPLS

MPLS has traditionally been deployed in network backbones, where it provides traffic engineering and allows efficient transport of Layer 2 and Layer 3 traffic such as IP, Frame Relay and ATM. MPLS in Ethernet networks provides complementary capabilities to help deal with more traffic types, provide greater resiliency and QoS, restoration techniques, Operations, Administration & Management (OA&M) diagnostic capabilities. This further enables users to consolidate traffic types on a single, common IP/MPLS network.

As an industry leader in the development and deployment of MPLS, Juniper Networks leads the way in making it possible for enterprises and service providers to implement network architectures and services based on MPLS. The MX Series provides a wide range of MPLS features and functionality powered by Junos OS. The feature richness of Junos OS provides the MX Series an advantage over other operating systems that are either too immature to support the required MPLS feature breadth or architected in a monolithic fashion, making them too complicated or unwieldy to efficiently manage. Additionally, the MX Series is designed to lead the industry in the following areas:

Interface Scalability—each MX Series chassis scales in size with choices of 3, 6 or 12 slots that can be populated with line cards for access or network interfaces. With up to 12 line card slots, the MX960 3D Universal Edge Router supports up to 176 10GbE ports or 480 Gigabit Ethernet ports.

Advanced Packet Processing Performance—MX Series supports up to 2.4 billion pps forwarding.

Service Flexibility—Juniper is an industry leader in both MPLS and VPLS, and the MX Series 3D Universal Edge Routers leverage Junos OS, which is deployed in the leading services providers and Fortune 500 enterprise worldwide. Junos OS provides the MX Series feature richness, stability and service breadth not typically found in Ethernet platforms.

Advanced Hierarchical QoS—the MX Series features superior QoS across the platform, which enables service providers to ensure that applications and services receive the appropriate level of service regardless of traffic conditions. Hierarchical QoS enables traffic shaping at the port, shaping and scheduling among a group of VLANs, and priority-based scheduling at the queue level.

High Availability—the MX Series delivers the full Junos OS continuous systems advantage, ensuring non-stop operations and maximum uptime. As the only carrier Ethernet platform that supports Unified ISSU, the MX Series can be upgraded with new Junos OS features and versions with minimal risk or downtime. The MX Series also provide features such as Graceful Routing Engine Switchover (GRES), and Non-Stop Active Routing (NSR), to provide rapid recovery and network convergence in the event of link or node failures.

Service Protection— detecting failures in the network and rerouting traffic around failures while honoring the SLA requirements with end users. Some of the features available on the MX Series for service protection include: MPLS link, node, path protection; granular BFD hellos (10 msecs) for link failure detection; Ethernet OAM (802.1AG, 802.3AH); ITU G.8032 for Ethernet ring protection and SONET/SDH APS. A combination of these features can be used to provide local or end-end service protection of services configured on the MX Series.

Simplified Management—leveraging Junos OS tools such as J-Web and Junos Script, the MX Series reduces the time and expense of provisioning new services. The Commit Scripts feature provides automated rollback capabilities that virtually eliminate the possibility of downtime based on human configuration errors. With the J-Web web-based GUI, the MX Series provides users with simple to use tools to administer and manage routers.

The MX Series Extends Junos OS in the Network

Junos OS is a world-class operating system with proven stability coupled with industrial-strength routing protocols, flexible policy language and leading MPLS implementation. When building your Ethernet-centric infrastructure, Junos OS can be a tremendous asset as a flexible and reliable operating system.

Junos OS runs on Juniper Networks MX Series 3D Universal Edge Routers, M Series Multiservice Edge Routers, T Series Core Routers, as well as EX Series Ethernet Switches, J Series Services Routers and SRX Series Services Gateways. Junos OS—the first routing operating system developed specifically for the Internet—is especially designed for large production networks. With native support for both IPv4 and IPv6, as well as advanced interworking capabilities, Junos OS also eases the transition to IPv6, and ensures long-term investment protection.

Junos OS offers XML interfaces for advanced scripting capabilities, and has been designed to configure the routing protocols that run on the MX Series and the properties of its interfaces. After a software configuration is activated, Junos OS has been designed to monitor the protocol traffic passing through the MX Series, as well as troubleshooting protocol and network connectivity problems.

Virtual Chassis Technology*

Virtual Chassis technology allows up to eight interconnected physical chassis to be monitored and managed as a single logical device. Virtual Chassis offers the following benefits:

- Simplifies manageability by providing a unified control plane for all physical chassis
- Improves resource utilization by intelligently employing interfaces and service line cards on physically different chassis, providing customers with a "pay-as-you-grow" model.
- Protects user sessions across physical chassis, line card or port failure, using stateful redundancy so users are completely unaware of failures.
- Supports sophisticated resiliency techniques within the Virtual Chassis.

MX Series VPNs

Junos OS supports of the industry's richest portfolio of VPNs:.

- **MPLS Layer 2 VPNs**—the MX Series offers full support for both LDP and BGP-based Virtual Private LAN Services (VPLS), as well as LDP and BGP based pseudowires. With support for up to 1 million MAC addresses and 64,000 VLANs, the MX Series delivers industry-leading scale for Layer 2 VPNs.
- **MPLS Layer 3 VPNs**—with support for all types of IPv4 VPNs, as well as IPV6 VPNs such as 6PE and 6VPE, the MX Series expands the range of services carriers can offer customers. The MX Series supports VPNs with advanced, application-layer features such as Session Border Controller, Dynamic Application Awareness, Intrusion Prevention System and Stateful Firewall Services.
- **Carrier-of-Carrier VPNs**—the MX Series allows a VPN service provider to supply VPN service to a customer who is also a service provider. The latter service provider supplies Internet or VPN service to the end customer.
- **Interprovider VPNs**—Juniper supports standards-based Interprovider VPNs, enabling customers to supply connectivity between two VPNs in separate autonomous systems (ASs). This functionality could be used by a VPN customer with connections to several Internet service providers (ISPs), or different connections to the same ISP in various geographic regions.
- **Virtual router-based VPNs**—with the virtualization capabilities in Junos OS, the MX Series can be divided into multiple virtual or logical routing instances, each supporting an individual VPN. This opens up new possibilities for VPN services or enterprise network segmentation.

*Note: Product roadmap.

Table 2: MX Series Features and Benefits

ADVANTAGE	FEATURES	BENEFITS
High availability	• Fully redundant hardware (cooling, power supplies, Routing Engines, SCBs) • Modular operating system • Separate data and control planes • Graceful restart • Nonstop routing • MPLS fast reroute • VPLS multihoming	• The MX Series design provides the highest level of redundancy and resiliency to ensure that critical services and customers stay connected. • Enables service providers to maximize revenues and ensure customer satisfaction.
High performance	Powered by Juniper's I-Chip ASIC and Junos Trio chipset, the MX Series features include: • Enhanced QoS capabilities • Additional packet processing flexibility • Scaling enhancements that include route lookup, next hop, logical interface scaling, and interface accounting • Enhanced multicast performance	Industry-leading performance enables the MX Series to satisfy critical applications at the edge, including voice, video, and data.
Service flexibility	Simultaneous support for Layer 2 and Layer 3 3D Universal Edge: VPLS, RFC 2547bis IP/MPLS VPNs, Triple Play services	Provides enterprise and residential services from a common platform increases service breadth and optimizes OpEx and CapEx.
Virtualization	The MX Series has a myriad of virtualization features and technologies to address enterprise and service provider requirements. • Network Service Virtualization (Virtualize access to services such as security): Services-such as L2VPN, L3VPN and VPLS allow layering of services on MPLS network. • Chassis Virtualization (Many devices virtualize to One Device): Virtual Chassis • Device Virtualization (One device virtualizes to many devices): Virtual Router, Logical Systems, Virtual Switch - virtualize physical router as multiple logical entities. • Link Virtualization: (Virtualize Physical Links) VLAN, LAG, GRE and MPLS LSP virtualize physical links.	Improves network utilization, device utilization, scalability, and resiliency.

MX240   MX480   MX960

Specifications

This section lists basic specifications by platform. For further details, please refer to the hardware installation manuals on **www.juniper.net/techpubs/hardware**. For more information on the MX5, MX10, MX40, and MX80 midrange routers, please refer to **www.juniper.net/us/en/local/pdf/datasheets/1000374-en.pdf**.

SPECIFICATION	MX240	MX480	MX960
Dimensions and Power			
Physical dimensions (W x H x D)	17.5 x 8.7 x 23.8 in (44.5 x 22.1 x 60.5 cm)	17.5 x 14 x 23.8 in (44.5 x 35.6 x 60.5 cm)	17.5 x 27.8 x 23.5 in (44.5 x 70.5 (16 RU) x 59.7 cm)
Weight (lb/kg) fully configured	130 lb / 59 kg	180 lb / 81.7 kg	334 lb / 151.6 kg
Mounting	Front or center	Front or center	Front or center
Power (DC/AC)	-40 to -72 VDC 100 to 240 VAC	-40 to -72 VDC 100 to 240 VAC	-40 to -72 VDC 200 to 240 VAC
AC power consumption (theoretical aggregate)	1743 W	3383 W	6018 W
DC power consumption (theoretical aggregate)	1420 W	2880 W	5458 W
Operating temperature	32º to 104º F (0º to 40º C)	32º to 104º F (0º to 40º C)	32º to 104º F (0º to 40º C)
Humidity	5% to 90% noncondensing humidity		
Altitude	No performance degradation to 13,000 ft/4,000 m		

Agency Approvals

Safety

- CAN/CSA-22.2 No. 60950-00/UL 1950 Third Edition, Safety of Information Technology Equipment
- EN 60825-1 Safety of Laser Products - Part 1: Equipment Classification, Requirements and User's Guide
- EN 60950 Safety of Information Technology Equipment

EMC

- AS/NZS 3548 Class A (Australia/New Zealand)
- EN 55022 Class A Emissions (Europe)
- FCC Part 15 Class A (USA)
- VCCI Class A (Japan)

NEBS

- GR-63-Core: NEBS, Physical Protection
- GR-1089-Core: EMC and Electrical Safety for Network Telecommunications Equipment

ETSI

- ETS-300386-2 Telecommunication Network Equipment Electromagnetic Compatibility Requirements

Immunity

- EN 61000-3-2 Power Line Harmonics
- EN 61000-3-3 Voltage Fluctuations and Flicker
- EN 61000-4-2 ESD
- EN 61000-4-3 Radiated Immunity
- EN 61000-4-4 EFT
- EN 61000-4-5 Surge
- EN 61000-4-6 Low Frequency Common Immunity
- EN 1000-4-11 Voltage Dips and Sags

Management

Element Management

- Juniper Networks J-Web Software graphical user interface

Policy Management

- Juniper Networks Junos Scope
- Juniper Networks Session and Resource Control Portfolio

Third-Party Management Applications

- HP, IBM, InfoVista, Intelliden, WANDL

SNMP

- SNMP v2/v3 bilingual agent support

Juniper Networks Services and Support

Juniper Networks is the leader in performance-enabling services that are designed to accelerate, extend, and optimize your high-performance network. Our services allow you to maximize operational efficiency while reducing costs and minimizing risk, achieving a faster time to value for your network. Juniper Networks ensures operational excellence by optimizing the network to maintain required levels of performance, reliability, and availability. For more details, please visit **www.juniper.net/us/en/products-services.**

Ordering Information

COMPONENT	MODEL NUMBER		MX240	MX480	MX960
Base unit	DC Chassis AC Chassis		MX240BASE-DC MX240BASE-AC	MX480BASE-DC MX480BASE-AC	MX960BASE-DC MX960BASE-AC
DPC	DPCE-R-40GE-SFP DPCE-R-4XGE-XFP DPCE-X-40GE-SFP DPCE-X-4XGE-XFP DPCE-R-Q-40GE-SFP DPCE-R-Q-4XGE-XFP DPCE-X-Q-40GE-SFP DPCE-X-Q-4XGE-XFP DPCE-R-Q-20GE-SFP DPCE-R-2XGE-XFP DPCE-R-40GE-TX DPCE-X-40GE-TX MX-FPC2 MX-FPC3 MS-DPC	40x1GbE L2/L3 capable 4x10GbE L2/L3 capable 40x1GbE L2+ capable 4x10GbE L2+ capable 40x1GbE L2/L3 capable board with enhanced queuing 4x10GbE L2/L3 capable board with enhanced queuing 40x1GbE L2+ capable board with enhanced queuing 4x10GbE L2+ capable board with enhanced queuing 20x1GbE L2/L3 capable with enhanced queuing 2x10GbE L2/L3 capable 40x 10/100/1000 Ethernet L2/L3 capable with RJ45 40x 10/100/1000 Ethernet L2+ capable with RJ45 DPC with 2 slots for type 2 PICs DPC with 2 slots for type 3 PICs IP services line card for MX Series			
MPC	MX-MPC1-3D MX-MPC2-3D MX-MPC1-3D-Q MX-MPC2-3D-Q MX-MPC2-3D-EQ MPC-3D-16XGE-SFPP	30 GB, port queue, 64 K IFLs 60 GB, port queue, 64 K IFLs 30 GB, rich queue, 128 K queues (max 64 K egress), 32 K IFLs 60 GB, rich queue, 256 K queues (max 128 K egress), 64 K IFLs 60 GB, enhanced queue, 512 K egress (or 256 K ingress/egress), 64 K IFLs 16 port 10GbE MPC requires small form-factor pluggable transceiver (SFP+) interfaces			
MIC	MIC-3D-20GE-SFP MIC-3D-2XGE-XFP MIC-3D-4XGE-XFP MIC-3D-40GE-TX	20 ports of 10/100/1000 Ethernet with small form-factor pluggable transceiver (SFP) interfaces 2 10GbE modular interface card with XFP interfaces 4 10GbE modular interface card with XFP interfaces 40 ports of 10/100/1000 Ethernet with Tx interfaces			
Routing Engine	RE-S-1300-2048-BB RE-S-2000-4096-UPG-BB RE-S-1300-2048-R RE-S-2000-4096-R RE-S-1800X2-8G-R RE-S-1800X2-16G-R RE-S-1800X4-8G-R RE-S-1800X4-16G-R RE-S-1800X2-8G-UPG-BB RE-S-1800X2-16G-UPG-BB RE-S-1800X4-8G-UPG-BB RE-S-1800X4-16G-UPG-BB	1.3 GHz CPU and 2 GB memory, Base Bundle 2 GHz CPU and 4 GB memory, Base Bundle 1.3 GHz CPU and 2 GB memory, Redundant 2 GHz CPU and 4 GB memory, Redundant Dual core 1.8 GHz CPU and 8 GB memory, redundant Dual core 1.8 GHz CPU and 16 GB memory, redundant Quad core 1.8 GHz CPU and 8 GB memory, redundant Quad core 1.8 GHz CPU and 16 GB memory, redundant Dual core 1.8 GHz CPU and 8 GB memory, upgrade for base bundle Dual core 1.8 GHz CPU and 16 GB memory, upgrade for base bundle Quad core 1.8 GHz CPU and 8 GB memory, upgrade for base bundle Quad core 1.8 GHz CPU and 16 GB memory, upgrade for base bundle			
DPC support	DPCE-Q DPCE-X DPCE-R		Yes Yes Yes	Yes Yes Yes	Yes Yes Yes
Routing Engine	1300 2000		Yes Yes	Yes Yes	Yes Yes
SCB	Primary Redundant		Yes Yes	Yes Yes	Yes Yes
Junos OS	USA Worldwide		Junos OS Junos-WW	Junos OS Junos-WW	Junos OS Junos-WW

COMPACT EX2200-C ETHERNET SWITCH

Fanless L2/L3 Switches for Micro Branch, Retail, and Workgroup Deployments

Product Overview

The Juniper Networks Compact EX2200-C Ethernet Switch offers an economical, entry level, simply connected solution in a compact, fanless form factor for access layer deployments in micro-branches, retail, and workgroup environments.

Product Description

The Juniper Networks® EX2200-C Ethernet Switch delivers a compact, silent, and power efficient platform for low-density micro branch deployments and commercial access or enterprise workgroup environments outside the wiring closet.

Featuring 12 10/100/1000BASE-T access ports with and without Power over Ethernet Plus (PoE+) in a fanless design, the EX2200-C switches deliver a powerful solution for supporting services such as unified communications, IP telephony, closed circuit television (CCTV), and other applications in office, classroom, hospitality, and other space and wiring constrained environments. Two front panel, dual-purpose (10/100/1000BASE-T or 100/1000BASE-X) uplinks provide operational flexibility.

Architecture and Key Components

The fixed configuration EX2200 line of Ethernet switches delivers complete Layer 2 and basic Layer 3 switching capabilities to satisfy the low-density branch and low-density wiring closet connectivity requirements of today's high-performance businesses. The EX2200-C models extend that reach into workgroup environments that reside outside the wiring closet, including micro branch offices, retail access applications, education, hospitality, and other locations where the switch is deployed in open areas.

Two models are available. The EX2200-C-12T-2G offers 12 front panel 10/100/1000BASE-T ports for connecting to networked devices. The EX2200-C-12P-2G includes support for the IEEE 802.3at PoE+ standard for powering networked devices such as telephones, video cameras, multiple radio IEEE 802.11n wireless LAN (WLAN) access points, and video phones in converged network environments.

The EX2200-C switches also include two front panel, small form-factor pluggable transceiver (SFP) GbE uplink ports, and two RJ-45 copper GbE uplink ports. Up to two of the uplink ports can be used simultaneously, providing the flexibility to connect to higher layer devices such as aggregation switches or routers over unshielded twisted pair (UTP) or fiber optic cabling. A fixed internal power supply ensures operational simplicity.
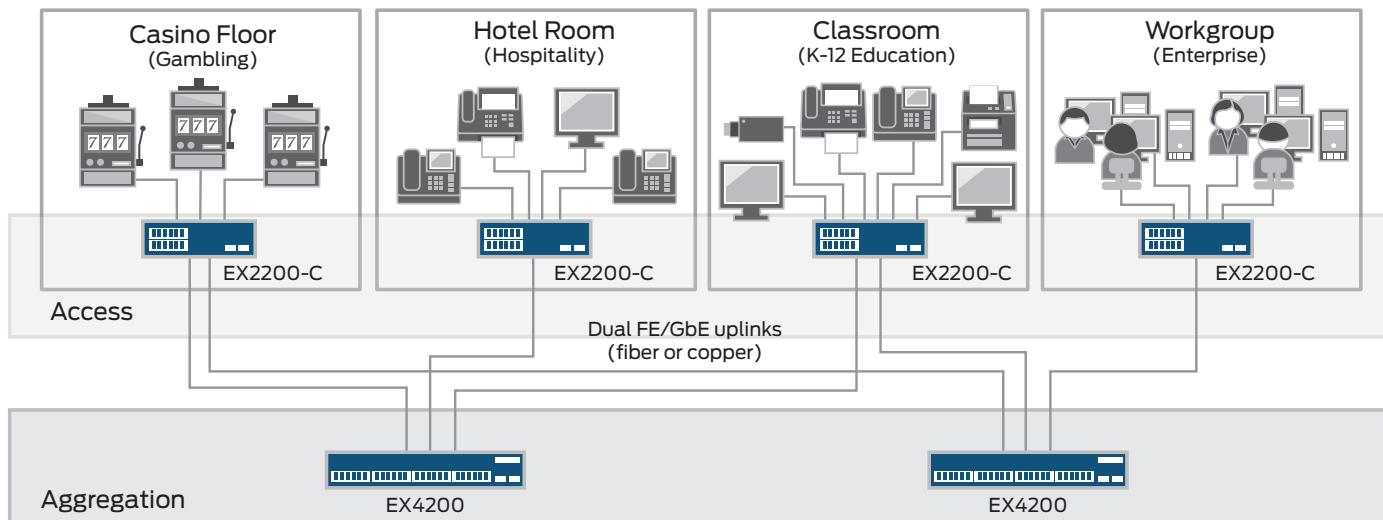
Figure 1: Commercial/enterprise access environments outside the wiring closet

Features and Benefits

The EX2200-C model switches include a number of features that make them ideal for low-density, open space deployments.

Compact Form Factor

At 10.6 inches wide and 9.4 inches deep, EX2200-C switches can be easily and discreetly installed on desktops, on or under shelves, or on walls. An optional magnetic mounting pad is available for securing the EX2200-C switches to metal surfaces. Rack mount kits are also available for installing the switches in standard 19 inch wiring racks. Wall mounting can be done using the flexible mounting slots on the bottom of the chassis to fix to the screws on the wall.

Dual-Purpose Uplinks

Two front panel, dual-purpose (10/100/1000BASE-T or 100/1000BASE-X) uplinks provide operational flexibility.

Silent Operation

The air-cooled EX2200-C switches do not require internal fans, resulting in a silent operating mode suitable for deployments in workgroup areas. The fanless design also reduces power consumption and improves mean time between failures (MTBF) by eliminating moving parts that can fail.

Low Power Consumption

The lack of an internal fan reduces the power consumed by the EX2200-C switches. The hardware has Energy Efficient Ethernet (EEE)-capable ports (with software support available in a future release), providing low power consumption when network link is idle.

Simplified Operations

Dedicated front panel RJ-45 and USB console ports offer flexible out-of-band management options, while a front panel USB port can be used to easily upload the Juniper Networks Junos® operating system and configuration files. A series of front panel LEDs offer system status information with a button that allows users to toggle through four different modes for reporting link status, link activity, PoE, and speed. A fixed internal power supply ensures operational simplicity.
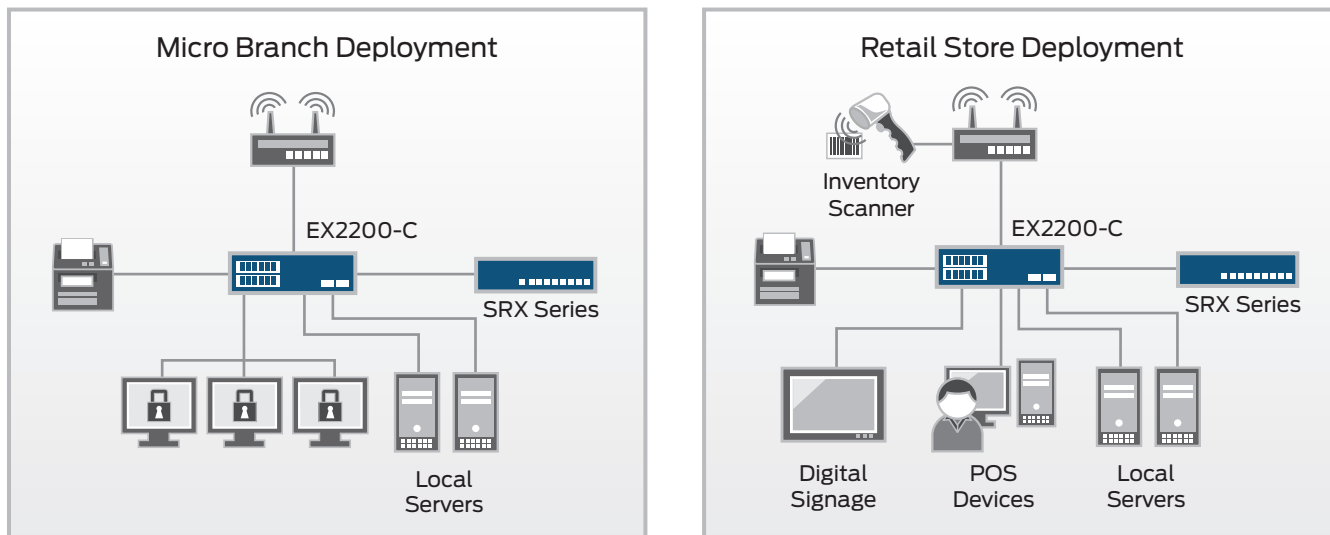

Figure 2: Micro branch and retail store deployment

Easy Provisioning

Auto-configuration and Auto-Image Install features allow the switches to be configured and imaged over the network using the Dynamic Host Configuration Protocol (DHCP) message exchange process. These features eliminate the need to stage devices prior to deployment, dramatically reducing operational expenses. Auto-configuration and Auto Image Install allow new branches and retail stores to rapidly deploy their networks, and also enable software upgrades and security fixes to be performed at the touch of a button.

Access Security

The EX2200-C switches fully interoperate with Juniper Networks Unified Access Control, which consolidates all aspects of a user's identity, device, and location, enabling administrators to enforce access control and security down to the individual port or user levels. Working as an enforcement point within the UAC, the EX2200-C provides standards-based 802.1X port-level access control as well as L2-L4 policy enforcement based on user identity, location, and/or device. If access is granted, the switch assigns the user to a specific VLAN based on authorization levels.

The EX2200-C also provides a full complement of port security features, including DHCP snooping, dynamic ARP inspection (DAI), and media access control (MAC) limiting to defend against internal and external spoofing, man-in-the-middle, and denial-of-service (DoS) attacks.

In addition, the EX2200-C switches are hardware ready (with software support available in a future release) to support IEEE 802.1ae MACSec, providing support for data confidentiality, data integrity, and data origin authentication.

Video and VoIP Ready

The EX2200-C delivers a reliable platform for unifying enterprise communication by providing the highest levels of flexibility and features in its class for the most demanding converged data, voice, and video environments. The EX2200-C switches support plug-and-play deployment with industry-standard Link Layer Discovery Protocol (LLDP) and LLDP-Media Endpoint Discovery (LLDP-MED). In addition, the EX2200-C supports rich quality-of-service (QoS) functionality for prioritizing data, voice, and video traffic. The switches support eight class-of-service (CoS) queues on every port, enabling them to maintain multilevel, end-to-end traffic prioritizations. The EX2200-C also supports a wide range of policy options, including strict priority, low latency, weighted random early detection (WRED), and shaped deficit weighted round-robin (SDWRR) queuing.

Easy Cable Management

A cable guard that affixes to the front of the switch holds attached cables in place and prevents them from being accidentally unplugged or otherwise removed.

Physical Security

Security slots on either side of the switch accept locking devices that physically secure switches, preventing them from being easily removed in open space or unsecured environments

PoE/PoE+ Power Budget

The EX2200-C-12P-2G switch supports the IEEE 802.3af PoE standard, as well as IEEE 802.3at PoE+. The 802.3af standard delivers up to 15.4 watts of Class 3 PoE per port, while the 802.3at PoE+ delivers up to 30 watts of power per port for supporting networked devices such as telephones, video cameras, IEEE 802.11n WLAN access points, and video phones that require more than 15.4 watts.

With a total PoE system budget of 100 watts, the 12-port EX2200-C-12P-2G can provide the full 15.4 watts of Class 3 PoE to a maximum of six ports simultaneously, and the full 30 watts of PoE+ to a maximum of three ports simultaneously. Attached devices draw the necessary power until the PoE power budget is exhausted.

Junos Operating System

The EX2200-C switches run the same Junos OS that is used by other Juniper Networks EX Series Ethernet Switches, as well as Juniper routers and Juniper Networks SRX Series Services Gateways. By using a common operating system, Juniper delivers a consistent implementation and operation of control plane features across all products.

Enhanced Limited Lifetime Warranty

The EX2200-C switches include an enhanced limited lifetime hardware warranty that provides next business day advance hardware replacement for as long as the original purchaser owns the product. The warranty includes lifetime software updates, advanced shipping of spares within one business day, and 24x7 Juniper Networks Technical Assistance Center (JTAC) support for 90 days after the purchase date. Power supplies and fan trays are covered for a period of five years. For complete details, please visit **www.juniper.net/support/warranty**.

Product Options

Table 1: EX2200-C Ethernet Switch Models

Model	Access Port Configuration	Uplink Ports	PoE+ Capable Ports	Height	PoE+ Budget	Power Supply Rating
EX2200-C-12T-2G	12-port 10/100/1000BASE-T	Two dual-personality (10/100/1000BASE-T or 100/1000BASE-X) ports	0	1 RU	N/A	30 W AC
EX2200-C-12P-2G	12-port 10/100/1000BASE-T	Two dual-personality (10/100/1000BASE-T or 100/1000BASE-X) ports	12	1 RU	100 W	180 W AC
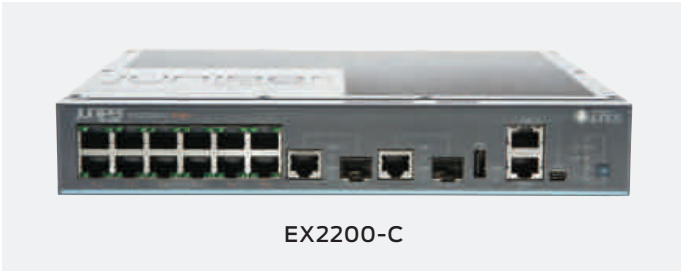
EX2200-C

Specifications

Physical Specifications

Dimensions (W x H x D)
- EX2200-C-12T-2G: 10.6 x 1.75 x 9.0 in (26.9 x 4.4 x 22.8 cm)
- EX2200-C-12P-2G: 10.6 x 1.75 x 9.4 in (26.9 x 4.4 x 23.8 cm)

Power Options
- Fixed internal power supply (AC)

System Weight
- EX2200-C-12T-2G: 4.6 lb
- EX2200-C-12P-2G: 6.4 lb

Environmental Ranges
- Operating temperature: 32º to 104º F (0º to 40º C)[1]
- Storage temperature: -40º to 158º F (-40º to 70º C)
- Operating altitude: up to 5,000 ft (1,524 m)[2]
- Non-operating altitude: up to 16,000 ft (4,877 m)
- Relative humidity operating: 10% to 85% (noncondensing)
- Relative humidity non-operating: 0% to 95% (noncondensing)

Cooling
- Air cooled

Hardware Specifications
- Switching Engine Model: Store and forward
- DRAM: 512 MB
- Flash: 1 GB
- CPU: 800 MHz ARM CPU
- GbE port density per system: 14 (12 access ports + 2 uplink ports)

Physical Layer
- Physical port redundancy: Redundant Trunk Group (RTG)
- Time-domain reflectometry (TDR) for detecting cable breaks and shorts
- Auto medium-dependent interface/medium-dependent interface crossover (MDI/MDIX) support
- Port speed downshift/setting maximum advertised speed on 10/100/1000BASE-T ports

Packet Switching Capacities
- 28 Gbps

Layer 2 Throughput
- 21 Mpps (wire speed)
-

Layer 2 Switching
- Maximum MAC addresses in hardware: 16,000
- Jumbo frames: 9,216 bytes
- Number of VLANs: 1,024 (VLAN IDs: 4,096)
- Port-based VLAN
- MAC-based VLAN
- Voice VLAN
- Private VLAN (PVLAN)
- IEEE 802.1ak: Multiple VLAN Registration Protocol (MVRP)
- Multicast VLAN Registration (MVR)
- Compatible with Per-VLAN Spanning Tree Plus (PVST+)
- RVI (Routed VLAN Interface)
- IEEE 802.1AB: Link Layer Discovery Protocol (LLDP)
- LLDP-MED with VoIP integration
- IEEE 802.1D: Spanning Tree Protocol
- IEEE 802.1p: CoS prioritization
- IEEE 802.1Q: VLAN tagging
- IEEE 802.1Q-in-Q: VLAN Stacking
- IEEE 802.1s: Multiple Spanning Tree Protocol (MSTP)
- Number of MST instances supported: 64
- IEEE 802.1w: Rapid Spanning Tree Protocol (RSTP)
- IEEE 802.1X: Port Access Control
- IEEE 802.3: 10BASE-T
- IEEE 802.3u: 100BASE-T
- IEEE 802.3ab: 1000BASE-T
- IEEE 802.3z: 1000BASE-X
- IEEE 802.3af: PoE
- IEEE 802.3at: PoE+
- IEEE 802.3x: Pause Frames/Flow Control
- IEEE 802.3ad: Link Aggregation Control Protocol (LACP)
- IEEE 802.3ah: Ethernet in the First Mile (EFM)
- IEEE 802.1ag: Connectivity Fault Management (CFM)
- G.8032 (Ethernet Ring Protection)

Layer 3 Features: IPv4
- Maximum number of Address Resolution Protocol (ARP) entries: 2,000
- Maximum number of IPv4 unicast routes in hardware: 6,500
- Routing protocols:
- RIP v1/v2
- OSPF v1/v2 (with 4 active interfaces)
- Static routing
- Routing policy
- Bidirectional Forwarding Detection (BFD)
- IP directed broadcast

Layer 3 Features: IPv6 Management Functionality
- Neighbor discovery, system logging, telnet, SSH, SNMP, Network Time Protocol (NTP), Domain Name System (DNS)
- Static routing

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[1] For supporting operating temperature ranges beyond 40º C up to 45º C at altitudes up to 5,000 ft, extended temperature range SFPs should be used when fiber uplinks are being utilized.

[2] For supporting operating altitude beyond 5,000 ft up to 10,000 ft and supporting temperature ranges beyond 35º C up to 45º C, extended temperature range SFPs should be used when fiber uplinks are being utilized.

Supported RFCs[3]
- RFC 3176 sFlow
- RFC 2925 MIB for remote ping, trace
- RFC 1122 Host requirements
- RFC 768 UDP
- RFC 791 IP
- RFC 783 Trivial File Transfer Protocol (TFTP)
- RFC 792 Internet Control Message Protocol (ICMP)
- RFC 793 TCP
- RFC 826 ARP
- RFC 894 IP over Ethernet
- RFC 903 Reverse ARP (RARP)
- RFC 906 TFTP bootstrap
- RFC 1027 Proxy ARP
- RFC 2068 HTTP server
- RFC 1812 Requirements for IP Version 4 routers
- RFC 1519 Classless Interdomain Routing (CIDR)
- RFC 1256 IPv4 ICMP Router Discovery (IRDP)
- RFC 1058 RIP v1
- RFC 2453 RIP v2
- RFC 1492 TACACS+
- RFC 2138 RADIUS authentication
- RFC 2139 RADIUS accounting
- RFC 3579 RADIUS Extensible Authentication Protocol (EAP) support for 802.1X
- RFC 5176 Dynamic Authorization Extensions to RADIUS
- RFC 2267 Network ingress filtering
- RFC 2030 SNTP, Simple Network Time Protocol
- RFC 854 Telnet client and server
- RFC 951, 1542 BootP
- RFC 2131 BOOTP/DHCP relay agent and DHCP server
- RFC 1591 Domain Name System (DNS)
- RFC 2474 DiffServ Precedence, including 8 queues per port
- RFC 2598 DiffServ Expedited Forwarding (EF)
- RFC 2597 DiffServ Assured Forwarding (AF)
- LLDP Media Endpoint Discovery (LLDP-MED), ANSI/TIA-105 7, draft 0

High Availability
- Link Aggregation
- 802.3ad (LACP) support:
  - Number of LAGs supported: 32
  - Maximum number of ports per LAG: 8
- LAG load sharing algorithm—Bridged Unicast Traffic:
  - IP: S/D MAC, S/D IP
  - TCP/UDP: S/D MAC, S/D IP, S/D port
  - Non-IP: S/D MAC
- LAG sharing algorithm—Routed Unicast Traffic:
  - IP: S/D IP
  - TCP/UDP: S/D IP, S/D port
- LAG load sharing algorithm—Bridged Multicast Traffic:
  - IP: S/D MAC, S/D IP
  - TCP/UDP: S/D MAC, S/D IP, S/D port
  - Non-IP: S/D MAC
- LAG sharing algorithm—Routed Multicast Traffic:
  - IP: S/D IP
  - TCP/UDP: S/D IP, S/D port
- Tagged ports support in LAG
- Uplink Failure Detection (UFD)

Multicast
- Internet Group Management Protocol (IGMP) snooping entries: 1,000
- IGMP: v1, v2, v3
- IGMP snooping
- Protocol Independent Multicast-Sparse Mode (PIM-SM), PIM Source-Specific Multicast (PIM-SSM), PIM Dense Mode (PIM-DM)

Quality of Service (QoS)
- Layer 2 QoS
- Layer 3 QoS
- Ingress policing: 1 rate 2 color
- Hardware queues per port: 8
- Scheduling methods (egress): Strict Priority (SP), shaped deficit weighted round-robin (SDWRR)
- 802.1p: DSCP /IP precedence trust and marking
- L2-L4 classification criteria: Interface, MAC address, Ethertype, 802.1p, VLAN, IP address, DSCP/IP precedence, TCP/UDP port numbers
- Congestion avoidance capabilities: Tail drop

Security
- MAC limiting
- Allowed MAC addresses—configurable per port
- Sticky MAC (persistent MAC address learning)
- Dynamic ARP inspection (DAI)
- Proxy ARP
- Static ARP support
- DHCP snooping
- IP source guard
- 802.1X port-based
- 802.1X multiple supplicants
- 802.1X with VLAN assignment
- 802.1X with authentication bypass access (based on host MAC address)
- 802.1X with VoIP VLAN support
- 802.1X dynamic access control list (ACL) based on RADIUS attributes
- 802.1X Supported EAP types: Message Digest 5 (MD5), Transport Layer Security (TLS), Tunneled Transport Layer Security (TTLS), Protected Extensible Authentication Protocol (PEAP)
- Captive Portal
- Static MAC authentication
- MAC-RADIUS
- Fallback Authentication
- Trusted Network Connect (TNC) certified
- Control plane DoS protection

Access Control Lists (ACLs) (Junos OS firewall filters)
- Port-based ACL (PACL)—ingress
- VLAN-based ACL (VACL)—ingress and egress
- Router-based ACL (RACL)—ingress and egress
- ACL entries (ACE) in hardware per system: 1,500
- ACL counter for denied packets
- ACL counter for permitted packets
- Ability to add/remove/change ACL entries in middle of list (ACL editing)
- L2-L4 ACL

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[3] Unless explicitly specified for any particular MIB table or variables, Junos OS does not support SNMP set operations.

Services and Manageability

- Junos OS command-line interface (CLI)
- Web interface: Junos Web (planned for future release)
- Out-of-band management: Serial, 10/100BASE-T Ethernet
- ASCII configuration
- Rescue configuration
- Configuration rollback
- Image rollback
- Element management tools: Juniper Networks Network and Security Manager
- Proactive services support via Advanced Insight Solutions
- SNMP: v1, v2c, v3
- Remote monitoring (RMON) (RFC 2819) Groups 1, 2, 3, 9
- Network Time Protocol (NTP)
- DHCP server
- DHCP client and DHCP proxy
- DHCP relay and helper
- RADIUS authentication
- SSHv2
- Secure copy
- HTTP/HTTPs
- DNS resolver
- System logging
- Temperature sensor
- Configuration backup via FTP/secure cop
- Real-time performance monitoring (RPM)
- Interface range

Supported MIBs[4]

- RFC1155 Structure of Management Information (SMI)
- RFC 1157 SNMPv1
- RFC 1905 RFC 1907 SNMP v2c, SMIv2, and revised MIB-II RFC 2570-2575 SNMPv3, user-based security, encryption, and authentication
- RFC 2576 Coexistence between SNMP V1, V2, and V3
- RFC 1212, RFC 1213, RFC 1215 MIB-II, Ethernet-like MIB, and SNMP TRAPs
- RFC 2578 SNMP Structure of Management Information MIB
- RFC 2579 SNMP Textual Conventions for SMIv2
- RFC 2925 Ping/traceroute MIB
- RFC 2665 Ethernet-like interface MIB
- RFC 1643 Ethernet MIB
- RFC 1493 Bridge MIB
- RFC 2096 IPv4 Forwarding Table MIB
- RFC 2011 SNMPv2 for IP using SMIv2
- RFC 2012 SNMPv2 for transmission control protocol using SMIv2
- RFC 2013 SNMPv2 for user datagram protocol using SMIv2
- RFC 2863 Interface MIB
- RFC 3413 SNMP Application MIB
- RFC 3414 User-based security model for SNMPv3
- RFC 3415 View-based Access Control Model for SNMP
- RFC 3621 PoE-MIB (PoE switches only)
- RFC 1724 RIPv2 MIB
- RFC 2863 Interface Group MIB
- RFC 2819 RMON MIB

- RFC 2287 System Application Packages MIB
- RFC 4188 STP and extensions MIB
- RFC 4363 Definitions of managed objects for bridges with traffic classes, multicast filtering, and VLAN extensions
- RFC 2922 LLDP MIB
- Draft - blumenthal - aes - usm - 08
- Draft - reeder - snmpv3 - usm - 3desede -0

Troubleshooting

- Debugging: CLI via console, telnet, or SSH
- Diagnostics: Show and debug command statistics
- Traffic mirroring (port)
- Traffic mirroring (VLAN)
- Filter-based mirroring
- Mirroring destination ports per system: 1
- LAG port monitoring
- Multiple destination ports monitored to one mirror (N:1)
- Maximum number of mirroring sessions: 1
- Mirroring to remote destination (over L2): 1 destination VLAN
- IP tools: Extended ping and trace
- Juniper Networks commit and rollback

Telecom Quality Management

- TL9000

Environmental

- Reduction of Hazardous Substances (ROHS) 6

Warranty

- Enhanced limited lifetime switch hardware warranty

Safety Certifications

- UL-UL60950-1 (Second Edition)
- C-UL to CAN/CSA 22.2 No.60950-1 (Second Edition)
- TUV/GS to EN 60950-1 (Second Edition)
- CB-IEC60950-1 (Second Edition with all country deviations)
- EN 60825-1 (Second Edition)

Electromagnetic Compatibility Certifications

- FCC 47CFR Part 15 Class A
- EN 55022 Class A
- ICES-003 Class A
- VCCI Class A
- AS/NZS CISPR 22 Class A
- CISPR 22 Class A
- EN 55024
- EN 300386
- CE

Noise Specifications

- 0 db (fanless)
- Noise measurements based on operational tests taken from bystander position (front) and performed at 25º C in compliance with ISO 7779

Telco

- CLEI code

Juniper Networks Services and Support

Juniper Networks is the leader in performance-enabling services that are designed to accelerate, extend, and optimize your high-performance network. Our services allow you to maximize operational efficiency while reducing costs and minimizing risk, achieving a faster time to value for your network. Juniper Networks ensures operational excellence by optimizing the network to maintain required levels of performance, reliability, and availability. For more details, please visit **www.juniper.net/us/en/ products-services**.

About Juniper Networks

Juniper Networks is in the business of network innovation. From devices to data centers, from consumers to cloud providers, Juniper Networks delivers the software, silicon and systems that transform the experience and economics of networking. The company serves customers and partners worldwide. Additional information can be found at **www.juniper.net**.

Ordering Information

Model Number	Description
Switches[5]	
EX2200-C-12T-2G	EX2200-C compact, fanless switch with 12-port 10/100/1000BASE-T and 2 dual-purpose (10/100/1000BASE-T or SFP) uplink ports
EX2200-C-12P-2G	EX2200-C compact, fanless switch with 12-port 10/100/1000 BASE-T (12-ports PoE+) and 2 dual-purpose (10/100/1000BASE-T or SFP) uplink ports
Options	
EX-CBL-CON-USB	Console Cable with USB Type A and mini-B connectors
EX-CBL-GRD	Cable Guard
EX-MGNT-MNT	Magnet Mount
EX-RMK2	Rack Mount Kit
Enhanced Feature License	
EX-12-EFL	Enhanced Feature License for OSPF v1/v2, IGMP v1/v2/v3, PIM, IEEE 802.1Q-in-Q, Bidirectional Forwarding Detection (BFD), Real-time Performance Monitoring (RPM), IEEE 802.1ag (Connectivity Fault Management).
Optics	
EX-SFP-1FE-FX	SFP 100BASE-FX; LC connector; 1310 nm; 2 km reach on multimode fiber
EX-SFP-1FE-FX-ET	Extended Temperature SFP 100BASE-FX; LC connector; 1310 nm; 2 km reach on multimode fiber
EX-SFP-1GE-SX	SFP 1000BASE-SX; LC connector; 850 nm; 550 m reach on multimode fiber
EX-SFP-1GE-SX-ET	Extended Temperature SFP 1000BASE-SX; LC connector; 850 nm; 550 m reach on multimode fiber
EX-SFP-1GE-LX	SFP 1000BASE-LX; LC connector; 1310 nm; 10 km reach on single-mode fiber
EX-SFP-1GE-LH	SFP 1000BASE-LH; LC connector; 1550 nm; 70 km reach on single-mode fiber

[5] Each switch comes with a RJ-45-to-DB-9 serial port adapter, power cord retainer and four rubber feet. Each system also ships with a power cord for the country to which it is shipped.

SRX Series Services Gateways for the Branch

SRX100, SRX110, SRX210, SRX220, SRX240, SRX550, and SRX650

Product Overview

SRX Series Services Gateways for the branch are next-generation security gateways that provide essential capabilities that connect, secure, and manage workforce locations sized from handfuls to hundreds of users. By consolidating fast, highly available switching, routing, security, and next generation firewall capabilities in a single device, enterprises can protect their resources as well as economically deliver new services, safe connectivity, and a satisfying end-user experience. All SRX Series Services Gateways, including products scaled for Enterprise branch, Enterprise edge, and Data Center applications, are powered by Junos OS—the proven operating system that provides unmatched consistency, better performance with services, and superior infrastructure protection at a lower total cost of ownership.

Product Description

The Juniper Networks® SRX Series Services Gateways for the branch combine next generation firewall and unified threat management (UTM) services with routing and switching in a single, high-performance, cost-effective network device.

- SRX Series for the branch runs Juniper Networks Junos® operating system, the proven OS that is used by core Internet routers in all of the top 100 service providers around the world. The rigorously tested carrier-class routing features of IPv4/IPv6, OSPF, BGP, and multicast have been proven in over 15 years of worldwide deployments.

- SRX Series for the branch provides perimeter security, content security, application visibility, tracking and policy enforcement, user role-based control, threat intelligence through integration with Juniper Networks Spotlight Secure*, and network-wide threat visibility and control. Using zones and policies, network administrators can configure and deploy branch SRX Series gateways quickly and securely. Policy-based VPNs support more complex security architectures that require dynamic addressing and split tunneling. The SRX Series also includes wizards for firewall, IPsec VPN, Network Address Translation (NAT), and initial setup to simplify configurations out of the box.

- For content security, SRX Series for the branch offers a complete suite of next generation firewall, unified threat management (UTM) and threat intelligence services consisting of: intrusion prevention system (IPS), application security (AppSecure), user role-based firewall controls, on-box and cloud-based antivirus, antispam, and enhanced Web filtering to protect your network from the latest content-borne threats. Integrated threat intelligence via Spotlight Secure offers adaptive threat protection against command and control (C&C) related botnets and policy enforcement based on GeoIP and attacker fingerprinting technology (the latter for Web application protection)—all of which are based on Juniper provided feeds. Customers may also leverage their own custom and third-party feeds for protection from advanced malware and other threats. The branch SRX Series integrates with other Juniper security products to deliver enterprise-wide unified access control (UAC) and adaptive threat management.

- SRX Series for the branch are secure routers that bring high performance and proven deployment capabilities to enterprises that need to build a worldwide network of thousands of sites. The wide variety of options allow configuration of performance, functionality, and price scaled to support from a handful to thousands of users. Ethernet, serial, T1/E1, DS3/E3, xDSL, Wi-Fi, and 3G/4G LTE wireless are all available options for WAN or Internet connectivity to securely link your sites. Multiple form factors allow you to make cost-effective choices for mission-critical deployments. Managing the network is easy using the proven Junos OS command-line interface (CLI), scripting capabilities, a simple-to-use Web-based GUI, or Juniper Networks Junos® Space Security Director for centralized management.

*Available on SRX550 and higher devices

Your ideas. Connected.™

Architecture and Key Components

Key Hardware Features of the Branch SRX Series Products

Product	Description
SRX100 Services Gateway	• Eight 10/100 Ethernet LAN ports and 1 USB port (support for 3G USB) • Full UTM[1]; antivirus[1], antispam[1], enhanced Web filtering[1], and content filtering • Intrusion prevention system[1], AppSecure[1] • 2 GB DRAM, 2 GB flash default
SRX110 Services Gateway	• VDSL/ADSL2+ and Ethernet WAN interfaces • Eight 10/100 Ethernet LAN ports and two USB port (support for 3G USB) • Full UTM[1]; antivirus[1], antispam[1], enhanced Web filtering[1], intrusion prevention system[1], AppSecure[1] • Unified Access Control (UAC) and content filtering • 2 GB DRAM, 2 GB CF default
SRX210 Services Gateway	• Two 10/100/1000 Ethernet and 6 10/100 Ethernet LAN ports, 1 Mini-PIM slot, and 2 USB ports (support for 3G USB) • Factory option of 4 dynamic Power over Ethernet (PoE) ports 802.3af • Support for T1/E1, serial, ADSL/2/2+, VDSL, G.SHDSL, and Ethernet small form-factor pluggable transceiver (SFP) • Content Security Accelerator hardware for faster performance of IPS and ExpressAV (with high memory version) • Full UTM[1]; antivirus1, antispam[1], enhanced Web filtering[1], and content filtering • Intrusion prevention system[1], User role-based firewall, and AppSecure[1] • 2 GB DRAM, 2 GB flash default
SRX220 Services Gateway	• Eight 10/100/1000 Ethernet LAN ports, 2 Mini-PIM slots • Factory option of 8 PoE ports; PoE+ 802.3at, backwards compatible with 802.3af • Support for T1/E1, serial, ADSL2/2+, VDSL, G.SHDSL, and Ethernet SFP • Content Security Accelerator hardware for faster performance of IPS and ExpressAV • Full UTM[1]; antivirus[1], antispam[1], enhanced Web filtering[1], and content filtering • Intrusion prevention system[1], User role-based firewall and AppSecure[1] • 2 GB DRAM, 2 GB CF default
SRX240 Services Gateway	• 16 10/100/1000 Ethernet LAN ports, 4 Mini-PIM slots • Factory option of 16 PoE ports; PoE+ 802.3at, backwards compatible with 802.3af • Support for T1/E1, serial, ADSL2/2+, VDSL, G.SHDSL, and Ethernet SFP • Content Security Accelerator hardware for faster performance of IPS and ExpressAV • Full UTM[1]; antivirus1, antispam[1], enhanced Web filtering[1], and content filtering • Intrusion prevention system[1], AppSecure[1]
SRX550 Services Gateway	• Ten fixed Ethernet ports (6 10/100/1000 copper, 4 SFP), 2 Mini-PIM slots, 6 GPIM slots or multiple GPIM and XPIM combinations • Support for T1/E1, serial, ADSL2/2+, VDSL, G.SHDSL, DS3/E3, Gigabit Ethernet ports; supports up to 52 Ethernet ports including SFP; 40 switch ports with optional PoE including 802.3at, PoE+, backwards compatible with 802.3af (or 50 non-PoE 10/100/1000 copper ports) • Content Security Accelerator hardware for faster performance of IPS and ExpressAV • Full UTM[1]; antivirus[1], antispam[1], enhanced Web filtering[1], and content filtering • Intrusion prevention system[1], User role-based firewall, and AppSecure[1] • Threat intelligence for protection from command and control (C&C) botnets, Web application threats, and advanced malware, and policy enforcement based on GeoIP data • 2 GB DRAM default, 2 GB compact flash default (SRX550) • 4 GB DRAM default, 8 GB compact flash default (SRX550 High Memory) • Optional redundant AC power; standard AC power supply that is PoE-ready; PoE power up to 250 watts single power supply or 500 watts dual power supply
SRX650 Services Gateway	• Four fixed ports 10/100/1000 Ethernet LAN ports, 8 GPIM slots or multiple GPIM and XPIM combinations • Support for T1, E1, DS3/E3, Ethernet ports; supports up to 52 Ethernet ports including SFP; 48 switch ports with optional PoE including 802.3at, PoE+, backwards compatible with 802.3af (or 52 non-PoE 10/100/1000 copper ports) • Content Security Accelerator hardware for faster performance of IPS and ExpressAV • Full UTM[1]; antivirus[1], antispam[1], enhanced Web filtering[1], and content filtering • Intrusion prevention system[1], User role-based firewall, and AppSecure[1] • Threat intelligence for protection from command and control (C&C) botnets, Web application threats, and advanced malware, and policy enforcement based on GeoIP data • Modular Services and Routing Engine; future internal failover and hot-swap • 2 GB DRAM default, 2 GB compact flash default, external compact flash slot for additional storage • Optional redundant AC power; standard AC power supply that is PoE-ready; PoE power up to 250 watts single power supply or 500 watts dual power supply

Network Deployments

The SRX Series Services Gateways for the branch are deployed at remote, branch and Enterprise edge locations in the network to provide all-in-one secure WAN connectivity, and connection to local PCs and servers via integrated Ethernet switching.

[1] Unified Threat Management—antivirus, antispam, Web filtering, AppSecure, and IPS require a subscription license option to use the feature. UTM is not supported on the low memory version. Please see the ordering section for options. Content Filtering and UAC are part of the base software with no additional license.

Features and Benefits

Next Generation Firewall

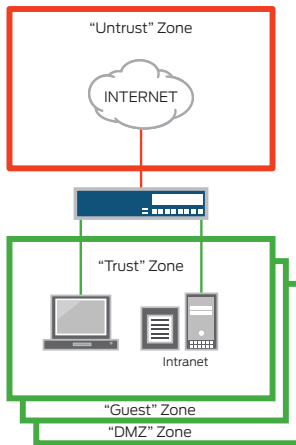SRX Series Services Gateways deliver next generation firewall protection with application awareness and extensive user role-based control options plus best-of-breed UTM to protect and control your business assets. Next generation firewalls are able to perform full packet inspection and can apply security policies based on layer 7 information. This means you can create security policies based on the application running across your network, the user who is receiving or sending network traffic or the content that is traveling across your network to protect your environment against threats, manage how your network bandwidth is allocated, and control who has access to what.

"Untrust" Zone

INTERNET

"Trust" Zone

Intranet

"Guest" Zone

"DMZ" Zone

Figure 1: Firewalls, zones, and policies

AppSecure

AppSecure is a suite of application security capabilities for Juniper Networks SRX Series services Gateways that identifies applications for greater visibility, enforcement, control, and protection of the network.

Intrusion Prevention

The intrusion prevention system (IPS) understands application behaviors and weaknesses to prevent application-borne security threats that are difficult to detect and stop.

Unified Threat Management (UTM)

SRX Series can include comprehensive content security against malware, viruses, phishing attacks, intrusions, spam and other threats with unified threat management (UTM). Get a best-of-breed solution with anti-virus, anti-spam, web filtering and content filtering at a great value by easily adding these services to your SRX Series Services Gateway. Cloud-based and on-box solutions are both available.

User Firewall

Juniper offers a range of user role-based firewall control solutions that support dynamic security policies. User role-based firewall capabilities are integrated with the SRX Series Services Gateways for standard next generation firewall controls. More extensive, scalable, granular access controls for creating dynamic policies are available through the integration of SRX with a Juniper Unified Access Control solution.

Adaptive Threat Intelligence

To address the evolving threat landscape that has made it imperative to integrate external threat intelligence into the firewall for thwarting advanced malware and other threats, some SRX Series Services Gateways include threat intelligence via integration with Spotlight Secure. The Spotlight Secure threat intelligence platform aggregates threat feeds from multiple sources to deliver open, consolidated, actionable intelligence to SRX Series Services Gateways across the organization for policy enforcement. These sources include Juniper threat feeds, third party threat feeds and threat detection technologies that the customer can deploy.

Administrators are able to define enforcement policies from all feeds via a single, centralized management point, Junos Space Security Director.

Secure Routing

Many organizations use both a router and a firewall/VPN at their network edge to fulfill their networking and security needs. For many organizations, the SRX Series for the branch can fulfill both roles with one solution. Juniper built best-in-class routing, switching and firewall capabilities into one product.

SRX Series for the branch checks the traffic to see if it is legitimate and permissible, and only forwards it on when it is. This reduces the load on the network, allocates bandwidth for all other mission-critical applications, and secures the network from malicious users.

The main purpose of a secure router is to provide firewall protection and apply policies. The firewall (zone) functionality inspects traffic flows and state to ensure that originating and returning information in a session is expected and permitted for a particular zone. The security policy determines if the session can originate in one zone and traverse to another zone. Due to the architecture, SRX Series receives packets from a wide variety of clients and servers and keeps track of every session, of every application, and of every user. This allows the enterprise to make sure that only legitimate traffic is on its network and that traffic is flowing in the expected direction.

High Availability

Junos Services Redundancy Protocol (JSRP) is a core feature of the SRX Series for the branch. JSRP enables a pair of SRX Series systems to be easily integrated into a high availability network architecture, with redundant physical connections between the systems and the adjacent network switches. With link redundancy, Juniper Networks can address many common causes of system failures, such as a physical port going bad or a cable getting disconnected, to ensure that a connection is available without having to fail over the entire system. This is consistent with a typical active/standby nature of routing resiliency protocols.
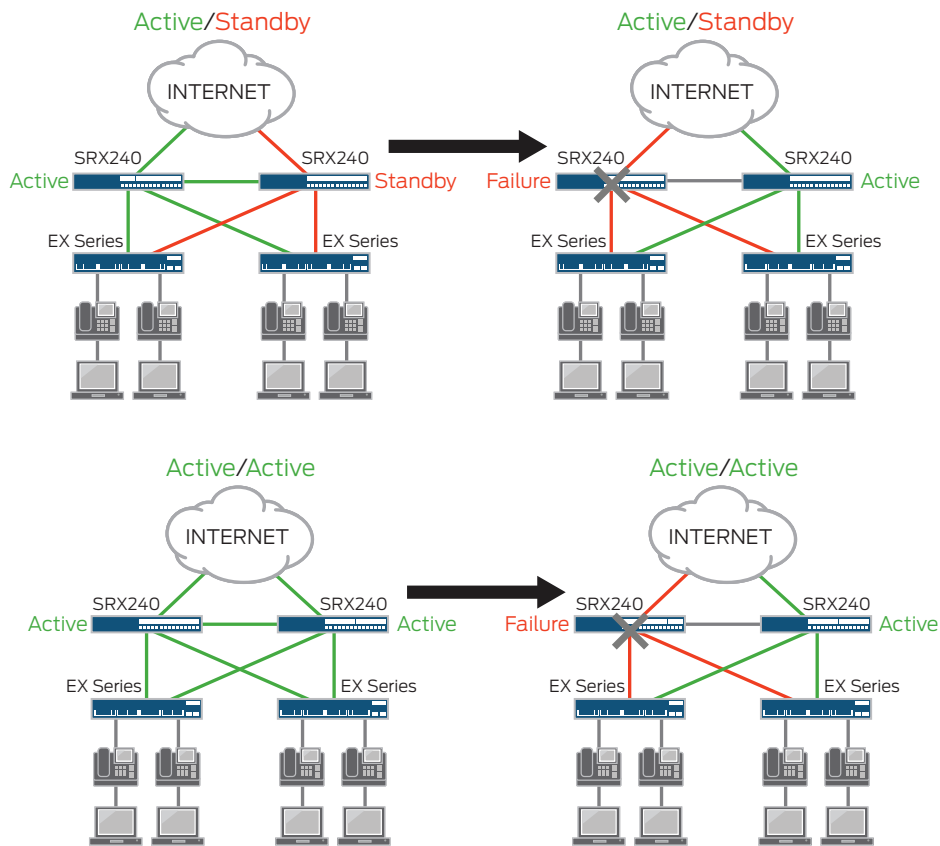
Figure 2: High availability

When SRX Series Services Gateways for the branch are configured as an active/active HA pair, traffic and configuration is mirrored automatically to provide active firewall and VPN session maintenance in case of a failure. The branch SRX Series synchronizes both configuration and runtime information. As a result, during failover, synchronization of the following information is shared: connection/session state and flow information, IPSec security associations, Network Address Translation (NAT) traffic, address book information, configuration changes, and more. In contrast to the typical router active/standby resiliency protocols such as Virtual Router Redundancy Protocol (VRRP), all dynamic flow and session information is lost and must be reestablished in the event of a failover. Some or all network sessions will have to restart depending on the convergence time of the links or nodes. By maintaining state, not only is the session preserved, but security is kept intact. In an unstable network, this active/active configuration also mitigates link flapping affecting session performance.

Session-Based Forwarding Without the Performance Hit

In order to optimize the throughput and latency of the combined router and firewall, Junos OS implements session-based forwarding, an innovation that combines the session state information of a traditional firewall and the next-hop forwarding of a classic router into a single operation. With Junos OS, a session that is permitted by the forwarding policy is added to

the forwarding table along with a pointer to the next-hop route. Established sessions have a single table lookup to verify that the session has been permitted and to find the next hop. This efficient algorithm improves throughput and lowers latency for session traffic when compared with a classic router that performs multiple table lookups to verify session information and then to find a next-hop route.

Figure 3 shows the session-based forwarding algorithm. When a new session is established, the session-based architecture within Junos OS verifies that the session is allowed by the forwarding policies. If the session is allowed, Junos OS will look up the next-hop route in the routing table. It then inserts the session and the next-hop route into the session and forwarding table and forwards the packet. Subsequent packets for the established session require a single table lookup in the session and forwarding table, and are forwarded to the egress interface.
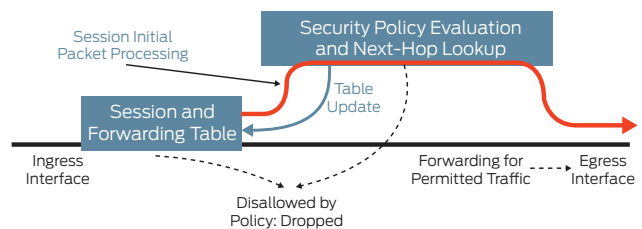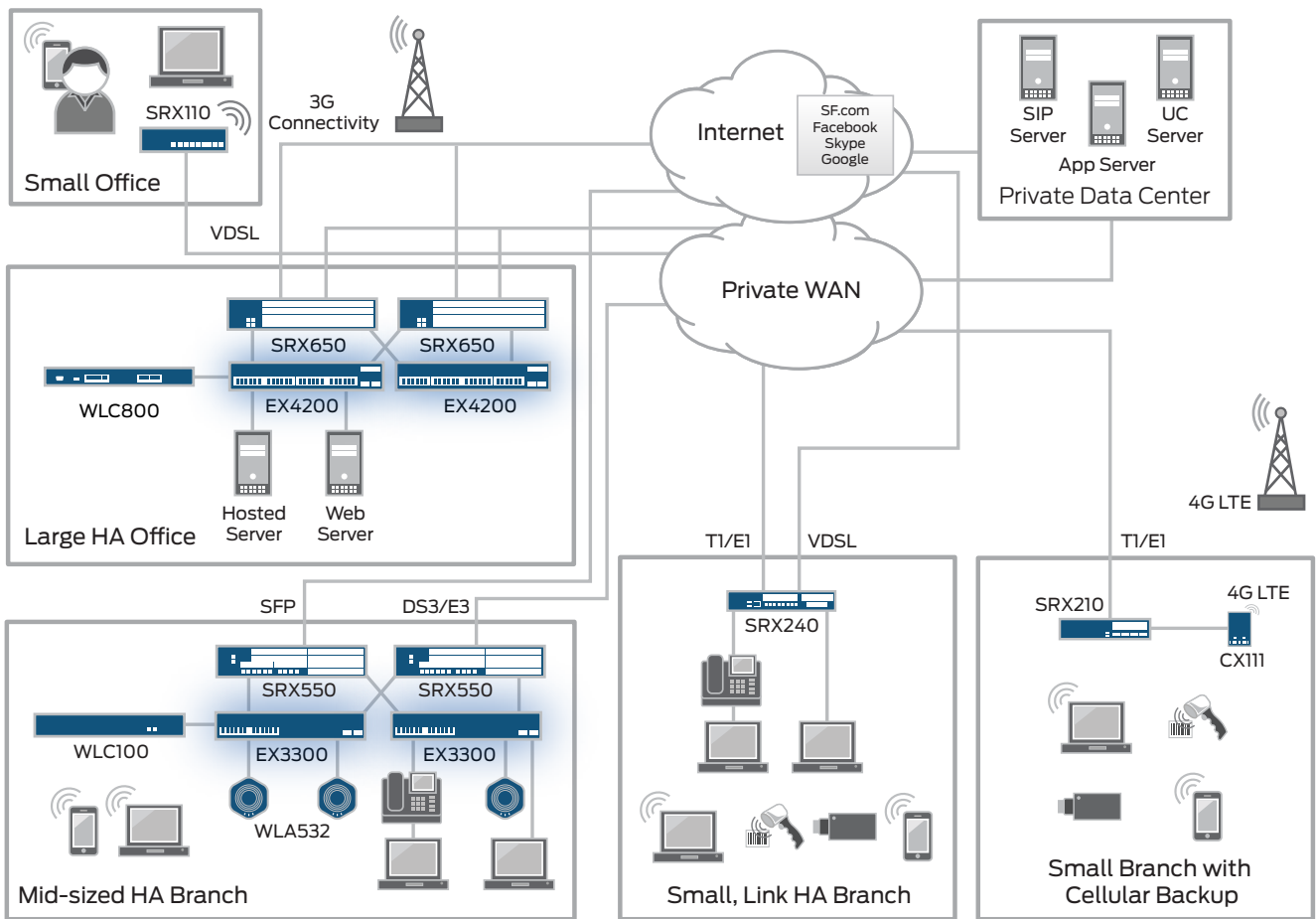

Figure 3: Session-based forwarding algorithm

Figure 4: The distributed enterprise

Specifications

Protocols

- IPv4, IPv6, ISO Connectionless Network Service (CLNS)

Routing and Multicast

- Static routes
- RIPv2 +v1
- OSPF/OSPFv3
- BGP
- BGP Router Reflector[1]
- IS-IS
- Multicast (Internet Group Management Protocol (IGMPv1/2/3), PIM-SM/DM/SSM, Session Description Protocol (SDP), Distance Vector Multicast Routing Protocol (DVMRP), source-specific, Multicast inside IPsec tunnel), MSDP
- MPLS (RSVP, LDP, Circuit Cross-connect (CCC), Translational Cross-connect (TCC), Layer 2 VPN (VPLS), Layer 3 VPN, VPLS, NGMVPN)

IP Address Management

- Static
- DHCP, PPPoE client
- Internal DHCP server, DHCP Relay

Address Translation

- Source NAT with Port Address Translation (PAT)
- Static NAT
- Destination NAT with PAT
- Persistent NAT, NAT64

Encapsulations

- Ethernet (MAC and VLAN tagged)
- Point-to-Point Protocol (PPP) (synchronous)
  - Multilink Point-to-Point Protocol (MLPPP)
- Frame Relay
  - Multilink Frame Relay (MLFR) (FRF.15, FRF.16), FRF.12, LFI
- High-Level Data Link Control (HDLC)
- Serial (RS-232, RS-449, X.21, V.35, EIA-530)
- 802.1q VLAN support
- Point-to-Point Protocol over Ethernet (PPPoE)

L2 Switching[2]

- 802.1Q, 802.1D, RSTP, MSTP, 802.3ad (LACP)
- 802.1x, LLDP, 802.1ad (Q-in-Q), IGMP Snooping
- Layer 2 switching with high availability

Traffic Management Quality of Service (QoS)

- 802.1p, DSCP, EXP
- Marking, policing, and shaping
- Class-based queuing with prioritization

- Weighted random early detection (WRED)
- Queuing based on VLAN, data-link connection identifier (DLCI), interface, bundles, or multi-field (MF) filters
- Guaranteed bandwidth
- Maximum bandwidth
- Ingress traffic policing
- Priority-bandwidth utilization
- DiffServ marking
- Virtual channels

Security

Firewall

- Firewall, zones, screens, policies
- Stateful firewall, stateless filters
- Network attack detection
- Screens denial of service (DoS) and provides distributed denial of service (DDoS) protection (anomaly-based)
- Prevent replay attack; Anti-Replay
- Unified Access Control
  - TCP reassembly for fragmented packet protection
  - Brute force attack mitigation
  - SYN cookie protection
  - Zone-based IP spoofing
  - Malformed packet protection

NGFW/UTM[3]

- Intrusion Prevention System (IPS)
  - Protocol anomaly detection
  - Stateful protocol signatures
  - Intrusion prevention system (IPS) attack pattern obfuscation
  - User role-based policies
- Customer signatures creation
- Multiple times a week and emergency updates
- AppSecure
  - AppTrack (application visibility and tracking)
  - AppFirewall (policy enforcement by application name)
  - Custom signatures
  - AppQoS (network traffic prioritization and bandwidth management)
  - Dynamic signature updates
  - User-based application policy enforcement
- Antivirus
  - Express AV (stream-based AV, not available on SRX100 and SRX110)
  - File-based antivirus
    - Signature database
    - Protocols scanned: POP3, HTTP, SMTP, IMAP, FTP

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[1] BGP Route Reflector supported on SRX550 and SRX650. See ordering section for more information.

[2] As of Junos 15.1X49-D40, the SRX550 High Memory unit does not support xSTP, LLDP, 802.1x, Q-in-Q, IGMP Snooping and L2 switching with HA

[3] Unified Threat Management — antivirus, antispam, Web filtering, AppSecure, and IPS require individual subscription license. UTM is not supported on the low memory version. Please see the ordering section for options.

- · Antispyware
- · Anti-adware
- · Antikeylogger
  - – Cloud-based antivirus
- · Antispam
- · Integrated enhanced Web filtering
  - – Category granularity (90+ categories)
  - – Real time threat score
- · Redirect Web filtering
- · Content Security Accelerator in SRX210 high memory, SRX220, SRX240, SRX550, and SRX650[4]
- · ExpressAV option in SRX210 high memory, SRX220 high memory, SRX240, SRX550, and SRX650[4]
- · Content filtering
  - – Based on MIME type, file extension, and protocol commands

VPN

- · Auto VPN (Zero Touch Hub)
- · Tunnels (GRE, IP-IP, IPsec)
- · IPsec, Data Encryption Standard (DES) (56-bit), triple Data Encryption Standard (3DES) (168-bit), Advanced Encryption Standard (AES) (128-bit+) encryption
- · Message Digest 5 (MD5),SHA-1 , SHA-128, SHA-256 authentication
- · Junos Pulse Dynamic VPN client; browser-based remote access feature requiring a license
- · IPv4 and IPv6 VPN
- · Multi-Proxy ID for site-to-site VPN

Multimedia Transport

- · Compressed Real-Time Transport Protocol (CRTP)

High Availability

- · VRRP
- · JSRP
- · Stateful failover and dual box clustering
- · SRX550/SRX650:
  - – Redundant power (optional)
  - – GPIM hot swap
  - – Future internal failover and SRE hot swap (OIR) on SRX650
- · Backup link via 3G/4G LTE wireless or other WAN
- · Active/active—L3 mode[5]
- · Active/passive—L3 mode[5]
- · Configuration synchronization[5]
- · Session synchronization for firewall and VPN[5]
- · Session failover for routing change[5]
- · Device failure detection[5]
- · Link failure detection[5]
- · IP Monitoring with route and interface failover

IPv6

- · OSPFv3
- · RIPng
- · IPv6 Multicast Listener Discovery (MLD)
- · BGP
- · ISIS

Wireless

- · CX111 Cellular 3G/4G/LTE Broadband Data Bridge supported on all branch SRX Series devices
- · 3G USB modem support for SRX100, SRX110, and SRX210

SLA, Measurement, and Monitoring

- · Real-time performance monitoring (RPM)
- · Sessions, packets, and bandwidth usage
- · Juniper J-Flow monitoring and accounting services
- · IP Monitoring

Logging

- · Syslog
- · Traceroute
- · Extensive control- and data-plane structured and unstructured syslog

Administration

- · Juniper Networks Network and Security Manager support (NSM)
- · Juniper Networks Junos Space Security Director support
- · Juniper Networks STRM Series Security Threat Response Managers support
- · Juniper Networks Advanced Insight Solutions support
- · External administrator database (RADIUS, LDAP, SecureID)
- · Auto-configuration
- · Configuration rollback
- · Rescue configuration with button
- · Commit confirm for changes
- · Auto-record for diagnostics
- · Software upgrades (USB upgrade option)
- · Juniper Networks J-Web
- · Command-line interface
- · Smart image download

Certifications

- · NEBS Compliance for SRX240, SRX650[6]
- · Department of Defense (DoD) Certification for SRX Series Services Gateways, including testing and certification by the Department of Defense Joint Interoperability Test Command (JITC) for interoperability with DoD networks and addition of the SRX Series Services Gateways to the Unified Capabilities Approved Product List (UC APL)

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[4] Unified Threat Management – antivirus, antispam, Web filtering, AppSecure and IPS require individual subscription license. UTM is not supported on the low memory version. Please see the ordering section for options.
[5] SRX100B installed with 1 GB DRAM, with 512 MB accessible. Optional upgrade to 1 GB DRAM is available with purchase of memory software license key.
[6] Coming soon for SRX110 and SRX550.

Product Comparison

	SRX100	SRX110	SRX210	SRX220	SRX240	SRX550	SRX650
Maximum Performance and Capacity							
Junos OS version tested	Junos OS 12.1X44-D15	Junos OS 12.1X44-D15	Junos OS 12.1X44-D15	Junos OS 12.1X44-D15	Junos OS 11.4R5	Junos OS 12.1/15.1[7]	Junos OS 11.4R5
Firewall performance (large packets)	700 Mbps	700 Mbps	850 Mbps	950 Mbps	1.8 Gbps	7 Gbps	7 Gbps
Firewall performance (IMIX)	200 Mbps	200 Mbps	250 Mbps	300 Mbps	600 Mbps	2 Gbps	2.5 Gbps
Firewall + routing PPS (64 Byte)	70 Kpps	70 Kpps	95 Kpps	125 Kpps	200 Kpps	700 Kpps	850 Kpps
Firewall performance[8] (HTTP)	100 Mbps	100 Mbps	290 Mbps	350 Mbps	830 Mbps	2 Gbps	2 Gbps
IPsec VPN throughput (large packets)	65 Mbps	65 Mbps	85 Mbps	100 Mbps	300 Mbps	1.0 Gbps	1.5 Gbps
IPsec VPN tunnels	128	128	256	512	1,000	2,000	3,000
AppSecure firewall throughput[8]	90 Mbps	90 Mbps	250 Mbps	300 Mbps	750 Mbps	2.0 Gbps	1.9 Gbps
IPS (intrusion prevention system)	75 Mbps[9]	75 Mbps	65 Mbps	80 Mbps	230 Mbps	800 Mbps	1 Gbps
Antivirus	25 Mbps (Sophos AV)	25 Mbps (Sophos AV)	30 Mbps (Sophos AV)	35 Mbps (Sophos AV)	85 Mbps (Sophos AV)	300 Mbps (Sophos AV)	350 Mbps (Sophos AV)
Connections per second	1,800	1,800	2,200	2,800	8,500	27,000	35,000
Maximum concurrent sessions	32 K[7]	32 K[7]	64 K[7]	96 K[7]	256 K[7]	375 K	512 K
DRAM options	2 GB DRAM	2 GB DRAM	2 GB DRAM	2 GB DRAM	2 GB DRAM	2 GB/4 GB[7] DRAM	2 GB DRAM
Maximum security policies	384	384	512	2,048	4,096	8,000	8,192
Maximum users supported	Unrestricted	Unrestricted	Unrestricted	Unrestricted	Unrestricted	Unrestricted	Unrestricted
Network Connectivity							
Fixed I/O	8 x 10/100	8 x 10/100 VDSL/ADSL2+ WAN (Annex A or B)	2 x 10/100/1000 BASE-T + 6 x 10/100	8 x 10/100/1000 BASE-T	16 x 10/100/1000 BASE-T	6 x 10/100/1000 BASE-T + 4 SFP	4 x 10/100/1000 BASE-T
I/O slots	N/A	N/A	1 x SRX Series Mini-PIM	2 x SRX Series Mini-PIM	4 x SRX Series Mini-PIM	2 x SRX Series Mini-PIM, 6 x GPIM or multiple GPIM and XPIM combinations	8 x GPIM or multiple GPIM and XPIM combinations
Services and Routing Engine slots	No	No	No	No	No	No	2[10]
WAN/LAN interface options	N/A	N/A	See ordering information	See ordering information	See ordering information	See ordering information	See ordering information
Maximum number of PoE ports (PoE optional on some SRX Series models)	N/A	N/A	Up to 4 ports of 802.3af with maximum 50 W	Up to 8 ports of 802.3af/at with maximum 120 W	Up to 16 ports of 802.3af/at with maximum 150 W	Up to 40 ports of 802.3af/at with maximum 247 W	Up to 48 ports of 802.3af/at with maximum 247 W
USB	1	2	2	2	2	2	2 per SRE

[7] Based on 2 GbE memory models, which require Junos OS 12.1X44-D15 (exception: Junos OS 11.4r5 for SRX240 only).
[8] Throughput numbers based on HTTP traffic with 44 kilobyte transaction size.
[9] Use software based IPS engine which has higher performance and less capacity
[10] SRX650 supports a single Services and Routing Engine (SRE) as of software release 11.4.

	SRX100	SRX110	SRX210	SRX220	SRX240	SRX550	SRX650
Routing							
Routing (Packet Mode) PPS	100Kpps	100Kpps	150Kpps	200Kpps	300Kpps	1000Kpps	1000Kpps
BGP instances	5	5	10	16	20	56	64
BGP peers	8	8	16	16	32	192	256
BGP routes	8 K	8 K	16 K	32 K	600 K	712 K	800 K
OSPF instances	4	4	10	16	20	56	64
OSPF routes	8 K	8 K	16 K	32 K	200 K	200 K	200 K
RIP v1 / v2 instances	4	4	10	16	20	56	64
RIP v2 routes	8 K	8 K	16 K	32 K	32 K	32 K	32 K
Static routes	8 K	8 K	16 K	32 K	100 K	100 K	100 K
Source-based routing	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Policy-based routing	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Equal-cost multipath (ECMP)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Reverse path forwarding (RPF)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IPsec VPN							
Concurrent VPN tunnels	128	128	256	512	1,000	2,000	3,000
Tunnel interfaces	10	10	64	64	128	456	512
DES (56-bit), 3DES (168-bit) and AES (256-bit)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MD-5, SHA-1 and SHA-2 authentication	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Manual key, Internet Key Exchange (IKE v1+v2), public key infrastructure (PKI) (X.509)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Perfect forward secrecy (DH Groups)	1, 2, 5	1, 2, 5	1, 2, 5	1, 2, 5	1, 2, 5	1, 2, 5	1, 2, 5
Prevent replay attack	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dynamic remote access VPN	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IPsec NAT traversal	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Redundant VPN gateways	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of remote access users	25 users	25 users	50 users	150 users	250 users	500 users	500 users
User Authentication and Access Control							
Third-party user authentication	RADIUS, RSA SecureID, LDAP	RADIUS, RSA SecureID, LDAP	RADIUS, RSA SecureID, LDAP	RADIUS, RSA SecureID, LDAP	RADIUS, RSA SecureID, LDAP	RADIUS, RSA SecureID, LDAP	RADIUS, RSA SecureID, LDAP
RADIUS accounting	Yes	Yes	Yes	Yes	Yes	Yes	Yes
XAUTH VPN, Web-based, 802.X authentication	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PKI certificate requests (PKCS 7 and PKCS 10)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Certificate Authorities supported	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Virtualization							
Maximum number of security zones	10	10	12	24	64	96	128
Maximum number of virtual routers	3	3	10	15	64	128	128
Maximum number of VLANs	16	16	64	128	2,000	3,967	3,967

	SRX100	SRX110	SRX210	SRX220	SRX240	SRX550	SRX650
Encapsulations							
PPP/MLPPP	N/A	N/A	Yes	Yes	Yes	Yes	Yes
PPPoE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PPPoA	N/A	Yes	Yes	Yes	Yes	Yes	Yes
MLPPP maximum physical interfaces	N/A	N/A	1	2	4	12	12
Frame Relay	N/A	N/A	Yes	Yes	Yes	Yes	Yes
MLFR (FRF .15, FRF .16)	N/A	N/A	Yes	Yes	Yes	Yes	Yes
MLFR maximum physical interfaces	N/A	N/A	1	2	4	12	12
HDLC	N/A	N/A	Yes	Yes	Yes	Yes	Yes
Wireless							
CX111 3G /4G LTE Bridge support	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Junos/SRX Series management of CX111	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Flash and Memory							
Memory (DRAM)	2 GB (SRX100H2)	2 GB (SRX110H2)	2 GB (SRX210HE2)	2 GB (SRX220H2)	2 GB (SRX240H2)	2 GB/4 GB[11]	2 GB (SRX650)
Memory slots	Fixed memory	Fixed memory	Fixed memory	Fixed memory	Fixed memory	2 DIMM	4 DIMM
Flash memory	2 GB	2 GB CF, externally accessible	2 GB	2 GB CF, externally accessible	2 GB	2 GB/8 GB[11] CF internal	2 GB CF internal on SRE, external slot empty, up to 2 GB CF supported
USB port for external storage	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dimensions and Power							
Dimensions (W x H x D)	8.5 x 1.4 x 5.8 in (21.6 x 3.6 x 14.7 cm)	11.02 x 1.72 x 8.385 in (28 x 4.37 x 21.3 cm)	11.02 x 1.73 x 7.12 in (28.0 x 4.4 x 18.1 cm)	14.31 x 1.73 x 7.11 in (36.3 x 4.4 x 18.1 cm)	17.5 x 1.75 x 15.1 in (44.4 x 4.4 x 38.5 cm)	17.5 x 3.5 x 18.2 in (44.4 x 8.8 x 46.2 cm)	17.5 x 3.5 x 18.2 in (44.4 x 8.8 x 46.2 cm)
Weight (device and power supply)	2.5 lb (1.1 kg)	6.7 lb (3.06 kg)	3.3 lb (1.5 kg) non-PoE / 4.4 lb (2 kg) PoE No interface modules	3.43 lb (1.56 kg) non-PoE No interface modules	For LM and HM-AC: 11.2 lb (5.1 kg) For HM - DC: 12.56 lb (5.7 kg) / 12.3 lb (5.6 kg) PoE No interface modules	21.96 lb (9.96 kg) No interface modules 1 power supply	24.9 lb (11.3 kg) No interface modules 1 power supply
Rack-mountable	Yes, 1 RU	Yes, 1 RU	Yes, 1 RU	Yes, 1 RU	Yes, 1 RU	Yes, 2 RU	Yes, 2 RU
Power supply (AC)	100-240 VAC, 30 W	100-240 VAC, 60 W	100–240 VAC, 60 W non-PoE/ 150 W PoE	100–240 VAC, 60 W non-PoE / 200 W PoE	150 W for LM and HM 190 W for HM with DC 360 W for PoE	100–240 VAC, single 645 W or dual 645 W	100–240 VAC, single 645 W or dual 645 W
Maximum PoE power	N/A	N/A	50 W	120 W	150 W	247 W redundant, or 494 W non-redundant	247 W redundant, or 494 W non-redundant

[11] 7: 4 GB DRAM and 8 GB CF is default on the SRX550 High Memory SKUs

	SRX100	SRX110	SRX210	SRX220	SRX240	SRX550	SRX650
Average power consumption	10 W	24 W	28 W, 84 W (PoE)	28 W	SRX240H2 – 74 W SRX240H2-DC – 72 W SRX240H2-PoE- 86 W	85 W	122 W
Input frequency	50-60 Hz	50-60 Hz	50-60 Hz	50-60 Hz	50-60 Hz	50-60 Hz	50-60 Hz
Maximum current consumption	0.25 A @ 100 VAC	1.75 A @ 100 VAC	0.44 A @ 100 VAC, 1.13 A @ 100 VAC (PoE)	0.44 A @ 100 VAC	1.1 A @ 100 VAC, 3.0 A @ 100 VAC (PoE)	7.5 A @ 100 VAC with single PSU with PoE, 10.5 A @ 100 VAC with dual PSU with PoE	5.3 A @ 100 VAC with single PSU with PoE, 8.3 A @ 100 VAC with dual PSU with PoE
Maximum inrush current	60 A	70 A	80 A, 60 A for PoE	80 A	40 A, 45 A for PoE	45 A for ½ cycle	45 A for ½ cycle
Average heat dissipation	35 BTU/hr	81 BTU/hr	95 BTU/hr (SRX210HE2) 116 BTU/hr (SRX210HE2-PoE)	104 BTU/hour (SRX220H2)	253 BTU/hr (SRX240H2) 246 BTU/hr (SRX240H2-DC 294 BTU/hr (SRX40H2-PoE)	238 BTU/hr	319 BTU/hr
Maximum heat dissipation	80 BTU/hr	99 BTU/hr	126 BTU/hr (SRX210HE2) 157 BTU/hr (SRX210HE2-PoE)	126 BTU/hour (SRX220H2)	427 BTU/hr (SRX240H2) 409 BTU/hr (SRX240H2-DC) 560 BTU/hr (SRX240H2-PoE)	1,449 BTU/hr	699 BTU/hr
Redundant power supply (hot swappable)	No	No	No	No	No	Yes (up to maximum capacity of single PSU)	Yes (up to maximum capacity of single PSU)
Acoustic noise level (Per ISO 7779 Standard)	0 dB (fanless)	0 dB (fanless)	29.1 dB	51.1 dB	70.0 dB	51.8 dB	60.9 dB

Environment

	SRX100	SRX110	SRX210	SRX220	SRX240	SRX550	SRX650
Operational temperature	32º to 104º F (0º to 40º C)	32º to 104º F (0º to 40º C)	32º to 104º F (0º to 40º C)	32º to 104º F (0º to 40º C)	32º to 104º F (0º to 40º C)	32º to 104º F (0º to 40ºC)	32º to 104º F (0º to 40ºC)
Nonoperational temperature	4º to 158º F, (–20º to 70º C)	4º to 158º F, (–20º to 70º C)	4º to 158º F, (–20º to 70º C)	4º to 158º F, (–20º to 70º C)	–40º to 158º F, (–40º to 70º C)	4º to 158º F, (–20º to 70º C)	4º to 158º F, (–20º to 70º C)
Humidity (operating)	10% to 90% noncondensing						
Humidity (nonoperating)	5% to 95% noncondensing						
Mean time between failures (Telcordia model)	24.8 years	24.8 years	14.03 years (SRX210HE2) 10.26 years (SRX210HE2-PoE)	13.46 years (SRX220H2) 11.06 years (SRX220H2-PoE)	11.63 years (SRX240H2) 9.92 years (SRX240H2-PoE)	9.6 years with redundant power	9.6 years with redundant power

	SRX100	SRX110	SRX210	SRX220	SRX240	SRX550	SRX650
Certifications and Network Homologation							
USA							
Safety certifications	UL 60950-1	UL 60950-1	UL 60950-1	UL 60950-1	UL 60950-1	UL 60950-1	UL 60950-1
EMC certifications	FCC Class B	FCC Class B	FCC Class B[1]	FCC Class A	FCC Class A	FCC Class A	FCC Class A
Network homologation	TIA-968	TIA-968	TIA-968	TIA-968	TIA-968	TIA-966	TIA-966
Canada							
Safety certifications	CSA 60950-1	CSA 60950-1	CSA 60950-1	CSA 60950-1	CSA 60950-1	CSA 60950-1	CSA 60950-1
EMC certifications	ICES class B	ICES class B	ICES class B[1]	ICES Class A	ICES class A	ICES class A	ICES class A
Network homologation	CS-03	CS-03	CS-03	CS-03	CS-03	CS-03	CS-03
Australia							
Safety certifications	AS / NZS 60950-1	AS / NZS 60950-1	AS / NZS 60950-1	AS / NZS 60950-1	AS / NZS 60950-1	AS / NZS 60950-1	AS / NZS 60950-1
EMC certifications	AS / NZS CISPR22 Class B	AS / NZS CISPR22 Class B	AS / NZS CISPR22 Class B[1]	AS / NZS CISPR22 Class A	AS / NZS CISPR22 Class A	AS / NZS CISPR22 Class A	AS / NZS CISPR22 Class A
Network homologation	AS / ACIF S 002, S 016, S 043.1, S043.2	AS / ACIF S 016, S 043.1, S043.2	AS / ACIF S 016, S 043.1, S043.2	AS / ACIF S 002, S 016, S 043.1, S043.2	AS / ACIF S 002, S 016, S 043.1, S043.2	AS / ACIF S 016	AS / ACIF S 016
New Zealand							
Safety certifications	AS / NZS 60950-1	AS / NZS 60950-1	AS / NZS 60950-1	AS / NZS 60950-1	AS / NZS 60950-1	AS / NZS 60950-1	AS / NZS 60950-1
EMC certifications	AS / NZS CISPR22 Class B	AS / NZS CISPR22 Class B	AS / NZS CISPR22 Class B[1]	AS / NZS CISPR22 Class A	AS / NZS CISPR22 Class A	AS / NZS CISPR22 Class A	AS / NZS CISPR22 Class A
Network homologation	PTC 217, PTC 273	PTC 217, PTC 273	PTC 217, PTC 273	PTC 217, PTC 273	PTC 217, PTC 273	PTC 217	PTC 217
Japan							
Safety certifications			Comply safety certifications (UL/CUL/CSA) by CB Scheme				
EMC certifications	VCCI Class B	VCCI Class B	VCCI Class B[1]	VCCI Class A	VCCI Class A	VCCI Class A	VCCI Class A
European Union							
Safety certifications	EN 60950-1	EN 60950-1	EN 60950-1	EN 60950-1	EN 60950-1	EN 60950-1	EN 60950-1
EMC certifications	EN 55022 Class B, EN 300 386	EN 55022 Class B, EN 300 386	EN 55022 Class B[12], EN 300 386	EN 55022 Class A, EN 300 386	EN 55022 Class A, EN 300 386	EN 55022 Class A, EN 300 386	EN 55022 Class A, EN 300 386
Network homologation	CTR 12/13, CTR 21, DoC	CTR 12/13, CTR 21, DoC	CTR 12/13, CTR 21, DoC	CTR 12/13, CTR 21, DoC	CTR 12/13, CTR 21, DoC	CTR 12/13, DoC	CTR 12/13, DoC
Software Certifications							
NIST FIPS-140-2 Level 2	Yes	Yes	Yes	Yes	Yes	In Progress	Yes
ISO Common Criteria NDPP+TFFW EP	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ICSA Network Firewall	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ICSA IPsec	Yes	Yes	Yes	Yes	Yes	Yes	Yes
USGv6	Yes	Yes	Yes	Yes	Yes	Yes	Yes

[12] SRX210H-POE is class A.

*There are several models available for the SRX210 and SRX240 including the enhanced version. Please contact your Juniper or partner account representative for more information.

Interface Modules Compatibility Matrix

Component	Description	SRX100	SRX110	SRX210	SRX220	SRX240	SRX550	SRX650
SRX-GP-16GE	16-port 10/100/1000BASE-T XPIM	X	X	X	X	X	✓[13]	✓
SRX-GP-16GE-POE	16-port 10/100/1000BASE-T PoE XPIM	X	X	X	X	X	✓	✓
SRX-GP-24GE	24-port 10/100/1000BASE-T XPIM, includes 4 SFP slots	X	X	X	X	X	✓[13]	✓
SRX-GP-24GE-POE	24-port 10/100/1000BASE-T PoE XPIM, includes 4 SFP slots	X	X	X	X	X	✓[13]	✓
SRX-GP-8SFP	8-port GbE copper, fiber SFP XPIM	X	X	X	X	X	✓	✓
SRX-GP-DUAL-T1-E1	Dual T1/E1 GPIM	X	X	X	X	X	✓	✓
SRX-GP-QUAD-T1-E1	Quad T1/E1 GPIM	X	X	X	X	X	✓	✓
SRX-GP-1DS3-E3	1-port clear channel DS3/E3 GPIM single GPIM slot	X	X	X	X	X	✓	✓
SRX-GP-8SERIAL	Eight-port Sync Serial GPIM	X	X	X	X	X	✓[13]	✓
SRX-MP-1SERIAL	1-port Sync Serial Mini-PIM	X	X	✓	✓	✓	✓[13]	X
SRX-MP-1ADSL2-A	1-port ADSL2+ Mini-PIM supporting ADSL/ADSL2/ADSL2+ Annex A	X	X	✓	✓	✓	✓[13]	X
SRX-MP-1ADSL2-B	1-port ADSL2+ Mini-PIM supporting ADSL/ADSL2/ADSL2+ Annex B	X	X	✓	✓	✓	✓[13]	X
SRX-MP-1VDSL2-A	1-port VDSL2 Mini-PIM supporting Annex A, with fallback to ADSL2/ADSL2+	X	X	✓	✓	✓	✓[13]	X
SRX-MP-8GSHDSL	8-wire (4-pair) G.SHDSL Mini-PIM	X	X	✓	✓	✓	✓[13]	X
SRX-MP-1SFP-GE	1-port SFP Mini-PIM	X	X	✓	✓	✓	✓[13]	X
SRX-MP-1T1E1	1-port T1 or E1 Mini-PIM	X	X	✓	✓	✓	✓[13]	X
SRX-MP-1T1E1-R	1-port T1 or E1 Mini-PIM (ROHS version)	X	X	X	X	X	✓[14]	X
SRX-MP-1VDSL2-R	1-port VDSL2 Mini-PIM supporting Annex A, with fallback to ADSL2/ADSL2+ (ROHS version)	X	X	X	X	X	✓[14]	X
SRX-MP-1SERIAL-R	1-port Sync Serial Mini-PIM (ROHS version)	X	X	X	X	X	✓[14]	X

[13] Not supported on the SRX550 High Memory
[14] Only supported on the SRX550 High Memory

Juniper Networks Services and Support

Juniper Networks is the leader in performance-enabling services that are designed to accelerate, extend, and optimize your high-performance network. Our services allow you to maximize operational efficiency while reducing costs and minimizing risk, achieving a faster time to value for your network. Juniper Networks ensures operational excellence by optimizing the network to maintain required levels of performance, reliability, and availability. For more details, please visit www.juniper.net/us/en/products-services.

Ordering Information

Model Number	Description
SRX650 Base System	
SRX650-BASE-SRE6-645AP	SRX650 Services Gateway with SRE 6, 645 W AC PoE PSU; includes 4 onboard 10/100/1000BASE-T ports, 2 GB DRAM, 2 GB CF, 247 W PoE power, fan tray, power cord and rack-mount kit
SRX650-BASE-SRE6-645DP	SRX650 Services Gateway with SRE 6, 645 W DC PoE PSU; includes 4 onboard 10/100/1000BASE-T ports, 2 GB DRAM, 2 GB CF, 247 W PoE power, fan tray, power cord and rack-mount kit
SRX650B-SRE6-645AP-TAA	Trade Agreement Act-compliant SRX650 Services Gateway with SRE 6, 645 W AC PoE PSU; includes 4 onboard 10/100/1000BASE-T ports, 2 GB DRAM, 2 GB CF, 247 W PoE power, fan tray, power cord and rack-mount kit
SRX650 Power Supplies and Accessories	
SRX600-PWR-645AC-POE	Spare 645 W AC PoE power supply unit for SRX650, SRX550 systems—one is included in SRX650, SRX550 base system (SRX650-BASE-SRE6-645AP, SRX550-645AP)
SRX600-PWR-645DC-POE	645 W DC source power supply for SRX550 and SRX650; provides 397 W system power @ 12 V and 248 W PoE power @ 50 VDC; works with 43-56 VDC input—no power cord
SRX600-SRE6H	Spare SRE6-H for SRX650—one is included in SRX650 base system (SRX650-BASE-SRE6-645AP)
SRX650-CHAS	SRX650 chassis including fan tray—no system processor (SRE) and no power supply unit
SRX650-FAN-01	Spare SRX650 fan tray, one is included in SRX650 chassis spare (SRX650-CHAS), and included in SRX650 base system (SRX650-BASE-SRE6-645AP)
SRX650-FILT-01	Not included in SRX650 chassis spare (SRX650-CHAS), and not included in SRX650 base system (SRX650-BASE-SRE6-645AP)—optional, as this is not required for normal operations, but recommended for dusty environments
SRX650 Additional Software Feature Licenses	
SRX650-K-AV	One year subscription for Juniper-Kaspersky antivirus updates on SRX650
SRX650-S-AV	One year subscription for Juniper-Sophos antivirus updates on SRX650
SRX650-IDP	One year subscription for IDP updates on SRX650
SRX650-S2-AS	One year subscription for Juniper-Sophos antispam updates on SRX650
SRX650-W-WF	One year subscription for Juniper-Websense Web filtering updates on SRX650
SRX650-SMB4-CS	One year security subscription for enterprise—includes Kaspersky AV, enhanced WF, Sophos AS, AppSecure and IDP on SRX650
SRX650-S-SMB4-CS	One year security subscription for enterprise—includes Sophos AV, enhanced WF, Sophos AS, AppSecure and IDP on SRX650
SRX650-K-AV-3	Three year subscription for Juniper-Kaspersky AV updates on SRX650

Model Number	Description
SRX650-S-AV-3	Three year subscription for Juniper-Sophos AV updates on SRX650
SRX650-IDP-3	Three year subscription for IDP updates on SRX650
SRX650-S2-AS-3	Three year subscription for Juniper-Sophos antispam updates on SRX650
SRX650-W-WF-3	Three year subscription for Juniper-Websense Web filtering updates on SRX650
SRX650-SMB4-CS-3	Three year security subscription for enterprise—includes Kaspersky AV, enhanced WF, Sophos AS, AppSecure and IDP on SRX650
SRX650-S-SMB4-CS-3	Three year security subscription for enterprise—includes Sophos AV, enhanced WF, Sophos AS, AppSecure and IDP on SRX650
SRX-BGP-ADV-LTU	Advanced BGP License for SRX650 only
SRX650-K-AV-5	Five year subscription for Juniper-Kaspersky AV updates on SRX650
SRX650-S-AV-5	Five year subscription for Juniper-Sophos AV updates on SRX650
SRX650-IDP-5	Five year license for IDP updates for SRX650
SRX650-W-WF-5	Five year subscription for Juniper-Websense Web filtering updates on SRX650
SRX650-SMB4-CS-5	Five year security subscription for enterprise—includes Kaspersky AV, enhanced WF, Sophos AS, AppSecure and IDP on SRX650
SRX650-S-SMB4-CS-5	Five year security subscription for enterprise—includes Sophos AV, enhanced WF, Sophos AS, AppSecure and IDP on SRX650
SRX-RAC-5-LTU	Dynamic VPN Client: 5 simultaneous users for SRX100, SRX110, SRX210, SRX220, SRX240, SRX550, and SRX650
SRX-RAC-10-LTU	Dynamic VPN Client: 10 simultaneous users for SRX100, SRX110, SRX210, SRX220, SRX240, SRX550, and SRX650
SRX-RAC-25-LTU	Dynamic VPN Client: 25 simultaneous users for SRX100, SRX110, SRX210, SRX220, SRX240, SRX550, and SRX650
SRX-RAC-50-LTU	Dynamic VPN Client: 50 simultaneous users for SRX210, SRX220, SRX240, SRX550, and SRX650 only
SRX-RAC-100-LTU	Dynamic VPN Client: 100 simultaneous users for SRX220, SRX240, SRX550, and SRX650 only
SRX-RAC-150-LTU	Dynamic VPN Client: 150 simultaneous users for SRX220, SRX240, SRX550, and SRX650 only
SRX-RAC-250-LTU	Dynamic VPN Client: 250 simultaneous users for SRX240, SRX550, and SRX650 only
SRX-RAC-500-LTU	Dynamic VPN Client: 500 simultaneous users for SRX550 and SRX650 only
SRX650-APPSEC-A-1	One year subscription for Application Security and IPS updates for SRX650
SRX650-APPSEC-A-3	Three year subscription for Application Security and IPS updates for SRX650
SRX650-APPSEC-A-5	Five year subscription for Application Security and IPS updates for SRX650

Model Number	Description
SRX550 Base System	
SRX550-645AP-M	SRX550 Services Gateway with 4 GB DRAM and 8 GB CF, 2 RU height, 6 GPIM slots, 2 Mini-PIM slots, 6 10/100/1000BASE-T ports, 4GbE SFP ports, dual PS slots, fans; ships with one 645 watt AC power supply with 247 W PoE power (power cord and rack-mount kit included)
SRX550-645DP-M	SRX550 Services Gateway with 4 GB DRAM and 8 GB CF, 2 RU height, 6 GPIM slots, 2 Mini-PIM slots, 6 10/100/1000BASE-T ports, 4GbE SFP ports, dual PS slots, fans; ships with one 645 watt DC power supply with 247 W PoE power (no power cord or rack-mount kit included)
SRX550- 645AP	SRX550 Services Gateway, 2 RU height, 6 GPIM slots, 2 Mini-PIM slots, 6 10/100/1000BASE-T ports, 4GbE SFP ports, dual PS slots, fans; ships with one 645 watt AC power supply with 247 W PoE power (power cord and rack-mount kit included)
SRX550- 645DP	SRX550 Services Gateway, 2 RU height, 6 GPIM slots, 2 Mini-PIM slots, 6 10/100/1000BASE-T ports, 4GbE SFP ports, dual PS slots, fans; ships with one 645 watt DC power supply with 247 W PoE power (no power cord and rack-mount kit Included)
SRX550 Power Supplies and Accessories	
SRX600-PWR-645AC-POE	Spare 645 W AC PoE power supply unit for SRX550 and SRX650 systems—one is included in SRX550 and SRX650 base systems (SRX650-BASE-SRE6-645AP, SRX550-645AC)
SRX600-PWR-645DC-POE	645 W DC source power supply for SRX550, SRX650 provides 397 W system power @ 12 V and 248 W PoE power @ 50 VDC; works with 43-56 VDC input—no power cord
SRX550-CHAS	SRX550 Services Gateway, 2 RU height, 6 GPIM slots, 2 Mini-PIM slots, 6 10/100/1000BASE-T ports, 4 GbE SFP ports, dual PS slots, fans (power supply not included)
SRX550-FILT-01	Not included in SRX550 systems, optional, as this is not required for normal operations, but recommended for dusty environments
SRX550 Additional Software Feature Licenses	
SRX550-K-AV	One year subscription for Juniper-Kaspersky antivirus updates on SRX550
SRX550-S-AV	One year subscription for Juniper-Sophos antivirus updates on SRX550
SRX550-IDP	One year subscription for IDP updates on SRX550
SRX550-S2-AS	One year subscription for Juniper-Sophos antispam updates on SRX550
SRX550-W-WF	One year subscription for Juniper-Websense Web filtering updates on SRX550
SRX550-SMB4-CS	One year security subscription for enterprise—includes Kaspersky AV, enhanced WF, Sophos AS, AppSecure and IDP on SRX550
SRX550-S-SMB4-CS	One year security subscription for enterprise—includes Sophos AV, enhanced WF, Sophos AS, AppSecure and IDP on SRX550
SRX550-K-AV-3	Three year subscription for Juniper-Kaspersky AV updates on SRX550
SRX550-S-AV-3	Three year subscription for Juniper-Sophos AV updates on SRX550
SRX550-IDP-3	Three year subscription for IDP updates on SRX550

Model Number	Description
SRX550-S2-AS-3	Three year subscription for Juniper-Sophos antispam updates on SRX550
SRX550-W-WF-3	Three year subscription for Juniper-Websense Web filtering updates on SRX550
SRX550-SMB4-CS-3	Three year security subscription for enterprise—includes Kaspersky AV, enhanced WF, Sophos AS, AppSecure and IDP on SRX550
SRX550-S-SMB4-CS-3	Three year security subscription for enterprise—includes Sophos AV, enhanced WF, Sophos AS, AppSecure and IDP on SRX550
SRX550-K-AV-5	Five year subscription for Juniper-Kaspersky AV updates on SRX550
SRX550-S-AV-5	Five year subscription for Juniper-Sophos AV updates on SRX550
SRX550-IDP-5	Five year license for IDP updates for SRX550
SRX550-W-WF-5	Five year subscription for Juniper-Websense Web filtering updates on SRX550
SRX550-SMB4-CS-5	Five year security subscription for enterprise—includes Kaspersky AV, enhanced WF, Sophos AS, AppSecure and IDP on SRX550
SRX550-S-SMB4-CS-5	Five year security subscription for enterprise—includes Sophos AV, enhanced WF, Sophos AS, AppSecure and IDP on SRX550
SRX-RAC-5-LTU	Dynamic VPN Client: 5 simultaneous users for SRX100, SRX110, SRX210, SRX220, SRX240, SRX550, and SRX650
SRX-RAC-10-LTU	Dynamic VPN Client: 10 simultaneous users for SRX100, SRX110, SRX210, SRX220, SRX240, SRX550, and SRX650
SRX-RAC-25-LTU	Dynamic VPN Client: 25 simultaneous users for SRX100, SRX110, SRX210, SRX220, SRX240, SRX550, and SRX650
SRX-RAC-50-LTU	Dynamic VPN Client: 50 simultaneous users for SRX210, SRX220, SRX240, SRX550, and SRX650 only
SRX-RAC-100-LTU	Dynamic VPN Client: 100 simultaneous users for SRX220, SRX240, SRX550, and SRX650 only
SRX-RAC-150-LTU	Dynamic VPN Client: 150 simultaneous users for SRX220, SRX240, SRX550, and SRX650 only
SRX-RAC-250-LTU	Dynamic VPN Client: 250 simultaneous users for SRX240, SRX550, and SRX650 only
SRX-RAC-500-LTU	Dynamic VPN Client: 500 simultaneous users for SRX550 and SRX650 only
SRX550-APPSEC-A-1	One year subscription for Application Security and IPS updates for SRX550
SRX550-APPSEC-A-3	Three year subscription for Application Security and IPS updates for SRX550
SRX550-APPSEC-A-5	Five year subscription for Application Security and IPS updates for SRX550
SRX240 Base System	
SRX240H2	SRX240 Services Gateway with 16 x GbE ports, 4x mini-PIM slots, and high memory (2 GB DRAM, 2 GB Flash); integrated power supply with power cord, and 19" rack mount kit included
SRX240H2-POE	SRX240 Services Gateway with 16 x GbE ports, 4x mini-PIM slots, and high memory (2 GB RAM, 2 GB Flash), with 16 ports PoE (150 W); integrated power supply with power cord, and 19" rack mount kit included

Model Number	Description
SRX240H2-DC	SRX240 Services Gateway with 16 x GbE ports, 4x mini-PIM slots, and high memory (2 GB RAM, 2 GB Flash); integrated -48 V DC power supply with 19" rack mount kit included
SRX240-RMK	SRX240 rack-mount kit for 19 in rack (holds one unit)
SRX240H-TAA	Trade Agreement Act-compliant SRX240 Services Gateway with 16 GbE ports, 4 Mini-PIM slots, and high memory (1 GB RAM, 1 GB Flash)
SRX240H-POE-TAA	Trade Agreement Act-compliant SRX240 Services Gateway with 16 GbE ports, 4 Mini-PIM slots, and high memory (1 GB RAM, 1 GB Flash), with 16 ports PoE (150 W)

SRX240 Additional Software Feature Licenses

Model Number	Description
SRX240-K-AV	One year subscription for Juniper-Kaspersky antivirus updates on SRX240
SRX240-S-AV	One year subscription for Juniper-Sophos antivirus updates on SRX240
SRX240-IDP	One year subscription for IDP updates on SRX240
SRX240-S2-AS	One year subscription for Juniper-Sophos antispam updates on SRX240
SRX240-W-WF	One year subscription for Juniper-Websense Web filtering updates on SRX240
SRX240-SMB4-CS	One year security subscription for enterprise—includes Kaspersky AV, enhanced WF, Sophos AS, AppSecure and IDP on SRX240
SRX240-S-SMB4-CS	One year security subscription for enterprise—includes Sophos AV, enhanced WF, Sophos AS, AppSecure and IDP on SRX240
SRX240-K-AV-3	Three year subscription for Juniper-Kaspersky antivirus updates on SRX240
SRX240-S-AV-3	Three year subscription for Juniper-Sophos antivirus updates on SRX240
SRX240-IDP-3	Three year subscription for IDP updates on SRX240
SRX240-S2-AS-3	Three year subscription for Juniper-Sophos antispam updates on SRX240
SRX240-W-WF-3	Three year subscription for Juniper-Websense Web filtering updates on SRX240
SRX240-SMB4-CS-3	Three year security subscription for enterprise—includes Kaspersky AV, enhanced WF, Sophos AS, AppSecure and IDP on SRX240
SRX240-S-SMB4-CS-3	Three year security subscription for enterprise—includes Sophos AV, enhanced WF, Sophos AS, AppSecure and IDP on SRX240
SRX240-K-AV-5	Five year subscription for Juniper-Kaspersky antivirus updates on SRX240
SRX240-S-AV-5	Five year subscription for Juniper-Sophos antivirus updates on SRX240
SRX240-IDP-5	Five year subscription for IDP updates on SRX240
SRX240-S2-AS-5	Five year subscription for Juniper-Sophos antispam updates on SRX240
SRX240-W-WF-5	Five year subscription for Juniper-Websense Web filtering updates on SRX240

Model Number	Description
SRX240-SMB4-CS-5	Five year security subscription for enterprise—includes Kaspersky AV, enhanced WF, Sophos AS, AppSecure and IDP on SRX240
SRX240-S-SMB4-CS-5	Five year security subscription for enterprise—includes Sophos AV, enhanced WF, Sophos AS, AppSecure and IDP on SRX240
SRX240-S2-AS-5	Five year subscription for Juniper-Sophos antispam updates on SRX240
SRX240-W-WF-5	Five year subscription for Juniper-Websense Web filtering updates on SRX240
SRX240-SMB2-CS-5	Five year security subscription for enterprise—includes Kaspersky antivirus, Web filtering, Sophos antispam, and IDP on SRX240
SRX240-S-SMB-CS-5	Five year security subscription for enterprise—includes Sophos antivirus, Web filtering, Sophos antispam and IPS on SRX240
SRX-RAC-5-LTU	Dynamic VPN Client: 5 simultaneous users for SRX100, SRX110, SRX210, SRX220, SRX240, SRX550, and SRX650
SRX-RAC-10-LTU	Dynamic VPN Client: 10 simultaneous users for SRX100, SRX110, SRX210, SRX220, SRX240, SRX550, and SRX650
SRX-RAC-25-LTU	Dynamic VPN Client: 25 simultaneous users for SRX100, SRX110, SRX210, SRX220, SRX240, SRX550, and SRX650
SRX-RAC-50-LTU	Dynamic VPN Client: 50 simultaneous users for SRX210, SRX22, SRX240, SRX550 and SRX650 only
SRX-RAC-100-LTU	Dynamic VPN Client: 100 simultaneous users for SRX220, SRX240, SRX550, and SRX650 only
SRX-RAC-150-LTU	Dynamic VPN Client: 150 simultaneous users for SRX220, SRX240, SRX550, and SRX650 only
SRX-RAC-250-LTU	Dynamic VPN Client: 250 simultaneous users for SRX240, SRX550, and SRX650 only
SRX240-APPSEC-A-1	One year subscription for Application Security and IPS updates for SRX240
SRX240-APPSEC-A-3	Three year subscription for Application Security and IPS updates for SRX240
SRX240-APPSEC-A-5	Five year subscription for Application Security and IPS updates for SRX240

SRX220 Base System

Model Number	Description
SRX220H2	SRX220 Services Gateway with 8 GbE ports, 2 Mini-PIM slots, and high memory (2 GB RAM, 2 GB Flash)—external power supply and cord included
SRX220H2-POE	SRX220 Services Gateway with 8 GbE ports, 2 Mini-PIM slots, and high memory (2 GB RAM, 2 GB Flash), with 8 ports PoE (120 W)*
SRX220-RMK	SRX220 rack-mount kit for 19 in rack (holds one unit)
SRX220-WALL-KIT	SRX220 wall mount kit (holds one unit)
SRX220-PWR-60W*	Spare SRX220 switching power supply, 60 W (non-POE)

*See price list for country-specific power cord model numbers.

Model Number	Description
SRX220 Additional Software Feature Licenses	
SRX220-K-AV	One year subscription for Juniper-Kaspersky antivirus updates on SRX220
SRX220-S-AV	One year subscription for Juniper-Sophos antivirus updates on SRX220
SRX220-IDP	One year subscription for IDP updates on SRX220
SRX220-S2-AS	One year subscription for Juniper-Sophos antispam updates on SRX220
SRX220-W-WF	One year subscription for Juniper-Websense Web filtering updates on SRX220
SRX220-SMB4-CS	One year security subscription for enterprise—includes Kaspersky AV, enhanced WF, Sophos AS, AppSecure and IDP on SRX220
SRX220-S-SMB4-CS	One year security subscription for enterprise—includes Sophos AV, enhanced WF, Sophos AS, AppSecure and IDP on SRX220
SRX220-K-AV-3	Three year subscription for Juniper-Kaspersky antivirus updates on SRX220
SRX220-S-AV-3	Three year subscription for Juniper-Sophos antivirus updates on SRX220
SRX220-IDP-3	Three year subscription for IDP updates on SRX220
SRX220-S2-AS-3	Three year subscription for Juniper-Sophos antispam updates on SRX220
SRX220-W-WF-3	Three year subscription for Juniper-Websense Web filtering updates on SRX220
SRX220-SMB4-CS-3	Three year security subscription for enterprise—includes Kaspersky AV, enhanced WF, Sophos AS, AppSecure and IDP on SRX220
SRX220-S-SMB4-CS-3	Three year security subscription for enterprise—includes Sophos AV, enhanced WF, Sophos AS, AppSecure and IDP on SRX220
SRX220-K-AV-5	Five year subscription for Juniper-Kaspersky antivirus updates on SRX220
SRX220-S-AV-5	Five year subscription for Juniper-Sophos antivirus updates on SRX220
SRX220-IDP-5	Five year subscription for IDP updates on SRX220
SRX220-W-WF-5	Five year subscription for Juniper-Websense Web filtering updates on SRX220
SRX220-SMB4-CS-5	Five year security subscription for enterprise—includes Kaspersky AV, enhanced WF, Sophos AS, AppSecure and IDP on SRX220
SRX220-S-SMB4-CS-5	Five year security subscription for enterprise—includes Sophos AV, enhanced WF, Sophos AS, AppSecure and IDP on SRX220
SRX-RAC-5-LTU	Dynamic VPN Client: 5 simultaneous users for SRX100, SRX110, SRX210, SRX220, SRX240, SRX550, and SRX650
SRX-RAC-10-LTU	Dynamic VPN Client: 10 simultaneous users for SRX100, SRX110, SRX210, SRX220, SRX240, SRX550, and SRX650
SRX-RAC-25-LTU	Dynamic VPN Client: 25 simultaneous users for SRX100, SRX110, SRX210, SRX220, SRX240, SRX550, and SRX650
SRX-RAC-50-LTU	Dynamic VPN Client: 50 simultaneous users for SRX210, SRX220, SRX240, SRX550, and SRX650
SRX-RAC-100-LTU	Dynamic VPN Client: 100 simultaneous users for SRX220, SRX240, SRX550, and SRX650

Model Number	Description
SRX-RAC-150-LTU	Dynamic VPN Client: 150 simultaneous users for SRX220, SRX240, SRX550, and SRX650
SRX220-APPSEC-A-1	One year subscription for Application Security and IPS updates for SRX220
SRX220-APPSEC-A-3	Three year subscription for Application Security and IPS updates for SRX220
SRX220-APPSEC-A-5	Five year subscription for Application Security and IPS updates for SRX220
SRX210 Base System	
SRX210HE2	SRX210 Services Gateway with 2 GbE+ 6 Fast Ethernet ports, 1 Mini-PIM slot, 1 ExpressCard slot and high memory (2 GB RAM, 2 GB Flash)
SRX210HE2-POE	SRX210 Services Gateway with 2 GbE + 6 Fast Ethernet ports, 1 Mini-PIM slot, 1 ExpressCard slot and high memory (2 GB RAM, 2 GB Flash), with 4 ports PoE (50 W)
SRX210 Additional Hardware	
SRX210-DESK-STAND	SRX210 desk top stand (holds one unit)
SRX210-RMK	SRX210 rack-mount kit for 19 in rack (holds one unit)
SRX210-WALL-KIT	SRX210 wall mount kit (holds one unit)
SRX210-PWR-60W-*	Spare SRX210 switching power supply, 60 W (non-PoE)
SRX210-PWR-150W-*	Spare SRX210 switching power supply, 150 W (PoE)
SRX210 Additional Software Feature Licenses	
SRX210-K-AV	One year subscription for Juniper-Kaspersky antivirus updates on SRX210
SRX210-S-AV	One year subscription for Juniper-Sophos antivirus updates on SRX210
SRX210-IDP	One year subscription for IDP updates on SRX210
SRX210-S2-AS	One year subscription for Juniper-Sophos antispam updates on SRX210
SRX210-W-WF	One year subscription for Juniper-Websense Web filtering updates on SRX210
SRX210-SMB4-CS	One year security subscription for enterprise—includes Kaspersky AV, enhanced WF, Sophos AS, AppSecure and IDP on SRX210
SRX210-S-SMB4-CS	One year security subscription for enterprise—includes Sophos AV, enhanced WF, Sophos AS, AppSecure and IDP on SRX210
SRX210-K-AV-3	Three year subscription for Juniper-Kaspersky antivirus updates on SRX210
SRX210-S-AV-3	Three year subscription for Juniper-Sophos antivirus updates on SRX210
SRX210-IDP-3	Three year subscription for IDP updates on SRX210
SRX210-S2-AS-3	Three year subscription for Juniper-Sophos antispam updates on SRX210
SRX210-W-WF-3	Three year subscription for Juniper-Websense Web filtering updates on SRX210
SRX210-SMB4-CS-3	Three year security subscription for enterprise—includes Kaspersky AV, enhanced WF, Sophos AS, AppSecure and IDP on SRX210
SRX210-S-SMB4-CS-3	Three year security subscription for enterprise—includes Sophos AV, enhanced WF, Sophos AS, AppSecure and IDP on SRX210

Model Number	Description
SRX210-K-AV-5	Five year subscription for Juniper-Kaspersky antivirus updates on SRX210
SRX210-S-AV-5	Five year subscription for Juniper-Sophos antivirus updates on SRX210
SRX210-IDP-5	Five year subscription for IDP updates on SRX210
SRX210-S2-AS-5	Five year subscription for Juniper-Sophos antispam updates on SRX210
SRX210-W-WF-5	Five year subscription for Juniper-Websense Web filtering updates on SRX210
SRX210-SMB4-CS-5	Five year security subscription for enterprise—includes Kaspersky AV, enhanced WF, Sophos AS, AppSecure and IDP on SRX210
SRX210-S-SMB4-CS-5	Five year security subscription for enterprise—includes Sophos AV, enhanced WF, Sophos AS, AppSecure and IDP on SRX210
SRX-RAC-5-LTU	Dynamic VPN Client: 5 simultaneous users for SRX100, SRX110, SRX210, SRX220, SRX240, SRX550, and SRX650
SRX-RAC-10-LTU	Dynamic VPN Client: 10 simultaneous users for SRX100, SRX110, SRX210, SRX220, SRX240, SRX550, and SRX650
SRX-RAC-25-LTU	Dynamic VPN Client: 25 simultaneous users for SRX100, SRX110, SRX210, SRX220, SRX240, SRX550, and SRX650
SRX-RAC-50-LTU	Dynamic VPN Client: 50 simultaneous users for SRX210, SRX220, SRX240, SRX550, and SRX650 only
SRX210-APPSEC-A-1	One year subscription for Application Security and IPS updates for SRX210
SRX210-APPSEC-A-3	Three year subscription for Application Security and IPS updates for SRX210
SRX210-APPSEC-A-5	Five year subscription for Application Security and IPS updates for SRX210

Small Form Factor Pluggable (SFP) Transceivers

SRX-SFP-1GE-LH	SFP 1000BASE-LH Optical Transceiver
SRX-SFP-1GE-LX	SFP 1000BASE-LX Optical Transceiver
SRX-SFP-1GE-SX	SFP 1000BASE-SX Optical Transceiver
SRX-SFP-1GE-T	SFP 1000BASE-T Copper Transceiver
SRX-SFP-FE-FX	SFP 100BASE-FX Optical Transceiver
SRX-MP-1SFP-GE	Single-port SFP Mini-PIM
SRX-GP-8SFP	8-port GbE copper, fiber SFP XPIM

SRX110 Base System

SRX110H2-VA	SRX110 Services Gateway with 8xFE ports, 2 GB RAM and Flash, 1-port VDSL2/ADSL2+ over POTS, USB port for cellular modem connectivity, and external PS and cord included
SRX110H2-VB	SRX110 Services Gateway with 8xFE ports, 2 GB RAM and Flash, 1-port VDSL2/ADSL2+ over ISDN BRI, USB port for cellular modem connectivity, and external PS and cord included

Model Number	Description

SRX110 Additional Hardware

SRX110-DESK-STAND	SRX110 desktop stand; holds one unit
SRX110-RMK	SRX110 rack-mount kit; holds one unit
SRX110-WALL-KIT	SRX110 wall mount kit; holds one unit

SRX100 Base System

SRX100H2	SRX100 Services Gateway with 8xFE ports and high memory (2 GB RAM, 2 GB Flash)

SRX100 Additional Hardware

SRX100-PWR-30W-*	Spare SRX100 switching power supply, 30 W (non-PoE)
SRX-100-RMK	SRX100 19" rack-mount kit (holds two units)
SRX100-WALL-KIT	SRX100 wall mount kit (holds one unit)
SRX100-DESK-STAND	SRX100 desk stand (holds one unit)

SRX100/SRX110 Dynamic VPN Client

SRX-RAC-5-LTU	5 simultaneous users for SRX100, SRX110, SRX210, SRX220, SRX240, SRX550, and SRX650
SRX-RAC-10-LTU	10 simultaneous users for SRX100, SRX110, SRX210, SRX220, SRX240, SRX550, and SRX650
SRX-RAC-25-LTU	25 simultaneous users for SRX100, SRX110, SRX210, SRX220, SRX240, SRX550, and SRX650

SRX100/SRX110 Additional Software Feature Licenses **

SRX1XX-K-AV	One year subscription for Juniper-Kaspersky AV updates
SRX1XX-K-AV-3	Three year subscription for Juniper-Kaspersky AV updates
SRX1XX-K-AV-5	Five year subscription for Juniper-Kaspersky AV updates
SRX1XX-S-AV	One year subscription for Juniper-Sophos AV updates
SRX1XX-S-AV-3	Three year subscription for Juniper-Sophos AV updates
SRX1XX-S-AV-5	Five year subscription for Juniper-Sophos AV updates
SRX1XX-S2-AS	One year subscription for Juniper-Sophos antispam updates
SRX1XX-S2-AS-3	Three year subscription for Juniper-Sophos antispam updates
SRX1XX-S2-AS-5	Five year subscription for Juniper-Sophos antispam updates
SRX1XX-W-EWF	One year subscription for Juniper-Websense enhanced Web filtering updates
SRX1XX-W-EWF-3	Three year subscription for Juniper-Websense enhanced Web filtering updates
SRX1XX-W-EWF-5	Five year subscription for Juniper-Websense enhanced Web filtering updates
SRX1XX-SMB4-CS	One year security subscription for enterprise—includes Kaspersky AV, enhanced WF, Sophos AS, AppSecure and IDP
SRX1XX-SMB4-CS-3	Three year security subscription for Kaspersky AV, enhanced WF, Sophos AS, AppSecure and IDP

*See price list for country-specific power cord model numbers.

**The additional software feature licenses apply to both the SRX100 and the SRX110.

Model Number	Description	Model Number	Description
SRX1XX-SMB4-CS-5	Five year security subscription for enterprise—includes Kaspersky AV, enhanced WF, Sophos AS, AppSecure and IDP	SRX1XX-SMB4-CS-R	One year renewal security subscription for enterprise—includes Kaspersky AV, enhanced WF, Sophos AS, AppSecure and IDP
SRX1XX-S-SMB4-CS	One year security subscription for enterprise—includes Sophos AV, enhanced WF, Sophos AS, AppSecure, AppSecure and IDP	SRX1XX-SMB4-CS-3-R	Three year renewal security subscription for enterprise—includes Kaspersky AV, enhanced WF, Sophos AS, AppSecure and IDP
SRX1XX-S-SMB4-CS-3	Three year security subscription for enterprise—includes Sophos AV, enhanced WF, Sophos AS, AppSecure and IDP	SRX1XX-SMB4-CS-5-R	Five year renewal security subscription for enterprise—includes Kaspersky AV, enhanced WF, Sophos AS, AppSecure and IDP
SRX1XX-S-SMB4-CS-5	Five year security subscription for enterprise—includes Sophos AV, enhanced WF, Sophos AS, AppSecure and IDP	SRX1XX-S-SMB4-CS-R	One year renewal security subscription for enterprise—includes Sophos AV, enhanced WF, Sophos AS, AppSecure and IDP
SRX1XX-IDP	One year license for IDP updates	SRX1XX-S-SMB4-CS-3-R	Three year renewal security subscription for enterprise—includes Sophos AV, enhanced WF, Sophos AS, AppSecure and IDP
SRX1XX-IDP-3	Three year license for IDP updates		
SRX1XX-IDP-5	Five year license for IDP updates	SRX1XX-S-SMB4-CS-5-R	Five year renewal security subscription for enterprise—includes Sophos AV, enhanced WF, Sophos AS, AppSecure and IDP
SRX1XX-K-AV-3-R	Three year renewal subscription for Juniper-Kaspersky AV updates		
SRX1XX-K-AV-5-R	Five year renewal subscription for Juniper-Kaspersky AV updates	SRX1XX-IDP-R	One year renewal subscription for IDP Signature service
SRX1XX-K-AV-R	One year renewal subscription for Juniper-Kaspersky AV updates	SRX1XX-IDP-3-R	Three year renewal subscription for IDP Signature service
SRX1XX-S-AV-3-R	Three year renewal subscription for Juniper-Sophos AV updates	SRX1XX-IDP-5-R	Five year renewal subscription for IDP Signature service
SRX1XX-S-AV-5-R	Five year renewal subscription for Juniper-Sophos AV updates	SRX100-APPSEC-A-1	One year subscription for Application Security and IPS updates for SRX100
SRX1XX-S-AV-R	One year renewal subscription for Juniper-Sophos AV updates	SRX100-APPSEC-A-3	Three year subscription for Application Security and IPS updates for SRX100
SRX1XX-S2-AS-3-R	Three year renewal subscription for Juniper-Sophos antispam updates	SRX100-APPSEC-A-5	Five year subscription for Application Security and IPS updates for SRX100
SRX1XX-S2-AS-5-R	Five year renewal subscription for Juniper-Sophos antispam updates		
SRX1XX-S2-AS-R	One year renewal subscription for Juniper-Sophos antispam updates		
SRX1XX-W-EWF-3-R	Three year renewal subscription for Juniper-enhanced Websense enhanced Web filtering updates		
SRX1XX-W-EWF-5-R	Five year renewal subscription for Juniper-enhanced Websense enhanced Web filtering updates		
SRX1XX-W-EWF-R	One year renewal subscription for Juniper-enhanced Websense enhanced Web filtering updates		

** The additional software feature licenses apply to both the SRX100 and the SRX110.

About Juniper Networks

Juniper Networks is in the business of network innovation. From devices to data centers, from consumers to cloud providers, Juniper Networks delivers the software, silicon and systems that transform the experience and economics of networking. The company serves customers and partners worldwide. Additional information can be found at www.juniper.net.

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JUNIPER
NETWORKS

P R O D U C T   D A T A S H E E T

Calix E7-2 Ethernet Service Access Platform

P R O D U C T   O V E R V I E W

The Calix E7 Ethernet Service Access Platform integrates IP service delivery and Ethernet transport into a compact, high availability, carrier-class modular system that delivers high-performance, scalable network solutions for service providers. The 1RU E7-2 platform delivers Gigabit Passive Optical Network (GPON) and point-to-point Gigabit Ethernet (GE) services with redundant 10-Gigabit Ethernet (10GE) transport and aggregation within a single integrated 2-slot chassis. The E7 enables service providers to deliver differentiated triple play services, advanced business services, and mobile backhaul from a single converged network that revolutionizes the economics of networking by enabling new services and market expansion with a flexible, scalable, pay-as-you-grow solution.

E 7   P R O D U C T   D E S C R I P T I O N

ETHERNET SERVICES ACCESS NETWORK:

Residential and business services are converging as more subscribers work from home offices, and internet "over the top" video services consume an increasing percentage of both enterprise and service provider network capacity. IP and Ethernet are the dominant network and transport protocols, and all services – voice, data, and video – are rapidly migrating to a packet-based architecture. High performance applications demand high performance solutions; the Calix E7-2 Ethernet Service Access Platform meets the demanding requirements of Ethernet services access networks.

The Calix E7 delivers a wide array of high performance applications, including 10GE Ethernet transport, delivery of high density residential triple play services over GPON and point-to-point Ethernet, Metro Ethernet Forum (MEF) compliant business services, mobile backhaul, and protected GE aggregation of Calix E7, C7 and E5 platforms.

HIGH DENSITY SUBSCRIBER ACCESS: With two

cards per system, the E7-2 provides flexible, high density subscriber access options in a 1RU shelf:

- 8 GPON and 16 GE ports (528 ONTs)

- 24 point-to-point GE ports (24 ONTs)

With Multi-dwelling unit (MDU) ONTs, the subscribers per 1RU system can exceed several thousand.

### CHASSIS FEATURES IN A STACKABLE FORMAT:

The Calix E7-2 combines the most advantageous attributes of a small form factor product with a large chassis-based system, while eliminating the disadvantages of each.

- 1RU design can expand from a single slot, for very low first install cost, to multiple chassis, to add subscriber growth yielding a near linear cost curve

- Twenty line cards are managed as a single chassis for operational efficiency

- Mix and match line cards in a common chassis – no common control equipment required

- Line cards can be added or replaced without uninstalling/installing power, alarms, or cables – reducing MTR from hours to minutes

- Subscribers are easily aggregated and network resources efficiently shared across protected trunk facilities

- Hardened 1RU system delivers GPON and Ethernet with 10GE transport from CO, cabinet or pole mount

- Resilient, hot-swappable line cards and fan tray

With the E7-2, service providers no longer need to decide between a single service product and a high growth chassis solution. E7-2 provides low first install cost, operational efficiency and near linear incremental cost per subscriber, enabling Calix customers to maximize their business return.

P R O D U C T   D A T A S H E E T

Calix E7-2 Ethernet Service Access Platform

A R C H I T E C T U R E   A N D   K E Y   A T T R I B U T E S
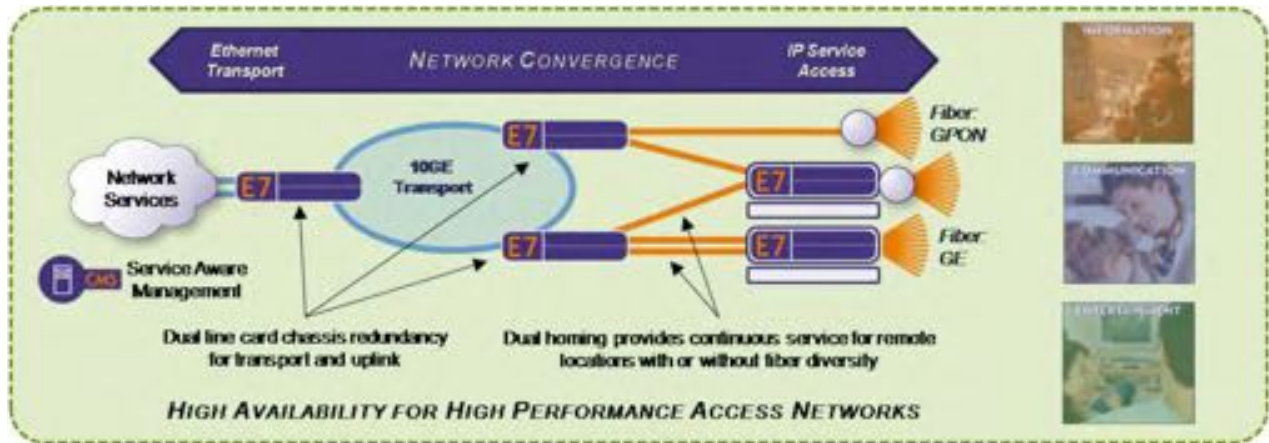
FULL SPECTRUM OF SERVICES: The E7 delivers a full spectrum of access services over GPON and Point-to-Point Ethernet using the family of Calix 700 ONTs, including Single Family Unit (SFU), Small Business Unit (SBU), Multi-Dwelling Unit (MDU), and rack-mount models.

- IPTV – broadcast and Video on Demand (VoD)
- MEF compliant business services
- High-Speed Internet (HSI) access
- Voice – Native SIP/VoIP and TDM Gateway support
- T1 services
- CATV video: RF video overlay with RF return

Calix 700GX ONTs support auto sensing GPON and GE network interfaces, allowing service providers to manage service changes without subscriber onsite technical support.

DELIVERING "QUALITY OF EXPERIENCE": The E7 provides per-subscriber and per-service hierarchical QoS to deliver uncompromised triple play and business services. A powerful collection of classification, policing, queuing and scheduling algorithms let operators manage per-subscriber and per-service traffic flows to maintain priority/delay/loss service differentiation within the E7 network.

SCALABLE IPTV SUPPORT: IPTV services are by far the most demanding in terms of quality, and user expectations are very high. The E7 supports industry standard IGMP snooping to identify and replicate multicast video sent between the set-top box and the video distribution network, providing efficient, scalable, high-quality IPTV distribution on both GPON and Ethernet interfaces

INTEGRATED HIGH-CAPACITY AGGREGATION: The E7 is built on a core Layer 2 and Layer 3 switch capable of full-duplex, line rate forwarding at all frame sizes and traffic types across all interfaces. This capacity makes the E7 ideal for aggregation and transport of IP/Ethernet services across the access network. The E7 platform supports industry standard pluggable modules for all service and network interfaces, including ITU G.984 compliant GPON, Small Form-Factor Pluggable (SFP) Gigabit Ethernet, XFP 10GE ports, and SFP+ 10GE ports.

NETWORK RESILIENCY: The Calix E7 supports a flexible set of standards-based network topology protocols for use in aggregation, ring-based transport, and uplink applications.

- ITU G.8032 Ethernet Ring Protection Switching (ERPS)
- IEEE 802.1w Rapid Spanning Tree Protocol (RSTP)
- IEEE 802.3ad/802.1AX Link Aggregation

SERVICE AWARE MANAGEMENT: The E7, along with the Calix Management System (CMS), allows operators to manage services while understanding their relationship to the network infrastructure. Service-oriented management includes rapid service provisioning, service templates and policies, and service assurance. Comprehensive network management tools let operators create physical and logical topology maps, engineer traffic flows, and manage network commissioning and software upgrades. Network inventory, alarm surveillance and PM collection are enabled by the E7 system. The E7 provides locally hosted Web GUI, CLI, and SNMP interfaces.

Calix.

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S P E C I F I C A T I O N S

Calix E7-2 Ethernet Service Access Platform

SUBSCRIBER AND NETWORK PORTS

Subscriber and network port count is determined by the line cards placed in the E7-2's two universal card slots.

E7-2 Card	Line Cards per E7-2	GPON Ports	GE SFP/CSFP Ports	10GE XFP Ports	10GE SFP+ Ports	VDSL2/ADSL2+	POTS
10GE-4	2	0	12	2	2	N/A	N/A
GPON-4	2	4	8	2	2	N/A	N/A
GE-12	2	0	12	0	2	N/A	N/A
GE-24	2	0	24	0	2	N/A	N/A
VDSL2-48	1	0	4	0	2	48	*Splitters*
VDSL2-48C	2	0	2	0	2	48	48

BACKPLANE BANDWIDTH

100 Gbps between slots

SLOTS

2 universal line card slots
1 FTA slot

DIMENSIONS (W x H x D)

17.5 x 1.7 x 11.45 inches
44.5 x 4.3 x 29.1 cm
Height is 1 RU

WEIGHT

5.9 lb (2.7 kg) E7 shelf
7.4 lb (3.4 kg) shelf with Fan Tray

OPERATING ENVIRONMENT

Temperature: -40 to +65° C
    (-40° F to +149° F)
Humidity: 10 to 95%
    (non-condensing)
Operating altitude: 10,000 ft
    (3,049 m)

STORAGE ENVIRONMENT

Temperature: -40 to +85° C
    (-40° F to +185° F)
Humidity: 5 to 95%

MANAGEMENT SUPPORT

Calix CMS network management
Calix CLI and Web GUI for local
    management interface
SNMP v2c AND v3 performance and
    fault monitoring

MANAGEMENT INTERFACES

Ethernet 10/100 (RJ-45 connector on
    Calix E7-2 Fan Tray)
Ethernet 10/100 (RJ-45 connector on
    back of Calix E7-2)
RS-232 (RJ-11 connector on Calix
    E7-2 Fan Tray)

SYNCHRONIZATION

Synchronization is enabled by the E7-
    2 line cards as required
External reference timing
Built-in Stratum-3 clock
Hardware-ready to support
    Synchronous Ethernet

ALARM I/O INTERFACES

Wire wrap pin access on E7 back
User definable alarm
    inputs: 7; outputs: 1

FIBER INTERFACES

All optical ports use pluggable optics
    (SFP, XFP, SFP+)
LC or SC connectors on modules

ANALOG/METALLIC INTERFACES

Two standard 25-pair RJ-21
    connectors per slot

TIMING I/O INTERFACES

Access through wire wrap pins on the
    back of the Calix E7
BITS clock (sink and source)

STANDARDS COMPLIANCE

NEBS Level 3 compliance
    (GR-63-CORE, GR-1089-CORE,
    GR-3028)
UL 60950
FCC Part 15 Class A

POWER FEEDS

Integrated power management on
    Calix E7-2 line cards
Redundant –48/60 VDC battery
    feeds (A and B)
Input Range: -42.5VDC to -72VDC
Fuse: 7.5 Amps (A and B)

S P E C I F I C A T I O N S

Calix E7 Ethernet Service Access Platform

F A N   T R A Y   A S S E M B L Y

FANS

4 fans housed in fan tray
Resilient design maintains system
    cooling with one fan failure

MANAGEMENT INTERFACES

Ethernet 10/100 (RJ-45 connector)
RS-232 (RJ-11 connector)

SYSTEM INFORMATION

7-segment LCD display
System Controller (MGT) – GREEN

SHELF ALARM INDICATOR

Critical (CR) - RED
Major (MJ) - RED
Minor (MN) - AMBER
Alarm Cut-Off (ACO) button

POWER SPECIFICATIONS

Typical CO Environment
    Power: 22 Watts
    Heat dissipation: 6 Watts
RT Environment
    Power: 65 Watts
    Heat dissipation: 18 Watts

MAINTENANCE

Field-replaceable air filter
    (not used in RT locations)
Hot-swappable fan tray assembly

O R D E R I N G   I N F O R M A T I O N

CALIX E7 ETHERNET SERVICE ACCESS PLATFORM

000-00372......................... E7 Chassis with Fan Tray Assembly and Installation Kit

CALIX E7 LINE CARDS

100-01771......................... E7 10GE-4 (2x10GE XFP, 2x10GE SFP+, 12xGE SFP)
100-01772......................... E7 GE-12 (12xGE SFP, 2x10GE SFP+)
100-01773......................... E7 GPON-4 (4xGPON OIM, 8xGE SFP, 2x10GE XFP, 2x10GE SFP+)

CALIX E7 FAN TRAY ASSEMBLY

100-01451......................... E7 Fan Tray Assembly
000-00228......................... E7 Fan Tray Assembly Filter, Package of 10 units

CALIX PLUGGABLE TRANSCEIVER MODULES

The E7-2 supports pluggable modules for all service and network interfaces. Refer to the Calix Optical Transceiver Modules Datasheet (#250-00191) for a complete list of modules and specifications.

CSFP Option 2..................... 1GE optical dual-port Compact Small Form-factor Pluggable (CSFP) Option 2 modules
SFP....................................... 1GE and 2.5GE optical and copper Small Form-factor Pluggable (SFP) modules
SFP+..................................... 10GE optical Enhanced Small Form-factor Pluggable (SFP+) modules
Direct Attach....................... Multi-rate copper Small Form-factor Pluggable (SFP/SFP+) cables
XFP....................................... 10GE optical Small Form-factor Pluggable (XFP) modules
GPON OIM........................... 2.5Gbps GPON (Class B+ ODN with minimum 28dB link budget, up to 1:64 splits)
ER-GPON OIM..................... 2.5Gbps Extended Reach GPON (up to 40 km with 1:8 split)

Notes: For GPON OIM, 10GE XFP, 10GE SFP+ pluggable transceivers, Direct Attach cables, and all transceivers used in CSFP Option 2 sockets, only products purchased directly from Calix are supported.
-    SFP modules may also be used in CSFP Option 2 sockets, and in SFP+ sockets at 1GE rate.
-    Copper Direct Attach cables can operate in SFP, CSFP Option 2, and SFP+ sockets at 1GE, 2.5GE, and 10GE data rates as supported by the card type.

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250-00170, Rev.11

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Calix E7-2 GE-24

D E S C R I P T I O N

The Calix E7-2 GE-24 line card delivers high-density point-to-point Ethernet (Active Ethernet) services from the compact 1RU E7-2 platform. Paired with the line of Calix Active Ethernet ONTs, the GE-24 delivers dedicated high-speed services to residential and business subscribers. The GE-24 can also be used to aggregate Calix E3 and E5 Ethernet Service Access Nodes, extending the breadth of applications served from a single E7-2 location. High-density central office deployments can leverage the E7-2's modular chassis design to deliver 480 GE ports, all managed as a single logical network element.

C A L I X   E 7 - 2   G E - 2 4   K E Y   A T T R I B U T E S

POINT-TO-POINT ETHERNET: Point-to-point Ethernet, or Active Ethernet (AE), is a complimentary network design to point-to-multipoint GPON access networks. With point-to-point Ethernet, network operators can provide individual subscribers with very high-bandwidth, dedicated symmetric services utilizing a fiber network that is flexible and simple to design.

The Calix E7-2 GE-24 card provides multiservice capability over IP/Ethernet-based networks. Each GE-24 card provides 24 GE ports and can be paired to aggregate up to 48 point-to-point Ethernet ONT subscribers per 1RU E7-2 chassis. The E7-2's modular chassis design allows equipping the system with twenty GE-24 cards, to aggregate up to 480 Calix 700GX/700GE ONTs. GE interfaces on the GE-24 card can also be used to provide point-to-point and ring protected aggregation of Calix E3 or E5 Ethernet Service Access Nodes and other GE-capable network devices.

The GE-24 card includes two 10GE ports supporting industry standard SFP+ modules for use as uplink or transport for the local E7-2 system, or as part of the stacking ring within an E7-2 modular chassis.

IP SERVICES DELIVERY: In conjunction with the Calix family of Active Ethernet ONTs, the E7-2 GE-24 card delivers a full spectrum of access services over point-to-point Ethernet networks.

- IPTV – broadcast and Video on Demand (VoD)
- MEF compliant business services
- High-Speed Internet (HSI) access
- Voice – Native SIP/VoIP and TDM Gateway support
- T1 business services and Mobile Backhaul access

DOUBLE-DENSITY OPTICS MODULES: Industry standard pluggable modules are used for all E7-2 service and network interfaces. The GE-24 supports CSFP (Compact SFP) modules that are mechanically compatible with the industry-ubiquitous SFP module. Each CSFP module supports two independent bidirectional transceivers (1490nm Tx / 1310nm Rx), each capable of operating at a 1 Gbps bi-directional rate.

The E7-2 GE-24 card is compatible with CSFP Option 2 modules. Option 2 of the CSFP Multisource Agreement (MSA) was released in October 2009 and provides backward compatibility to the SFP MSA. As a result, the GE-24 can operate with single-port SFP modules in any of the 12 CSFP module sockets to reach more distant locations. High-density, dual-port CSFP modules have a maximum range of 20km, while single port SFPs can be used to reach AE ONTs and Ethernet Service Access Nodes up to 60 km distant.

The GE-24's 10GE SFP+ ports support all GE SFP modules, extending the versatility of the SFP+ ports to provide additional GE services or GE transport flexibility.

CALIX 700 ONT: The E7-2 GE-24 card operates with the family of Calix 700GX and 700GE ONTs, including Single Family Unit (SFU), Small Business Unit (SBU), Multi-Dwelling Unit (MDU), and rack-mount models.

INTEGRATED HIGH-CAPACITY SWITCH: The E7-2 GE-24 card is built on a core Layer 2/3 switch capable of full-duplex, line rate forwarding at all frame sizes and traffic types across all GE and 10GE ports.

SCALABLE IPTV SUPPORT: The GE-24 supports IGMP Snooping for multicast video transport between the set-top box and multicast router, providing efficient, scalable, high-quality IPTV distribution on all Ethernet interfaces.

Calix E7-2 GE-24

MINIMUM SOFTWARE RELEASE

Calix E7-2 shelf support only, two
GE-24 line cards per shelf
Calix E7-2 Release 1.2

PORTS

24 CSFP 1GE ports (12 CSFP
sockets, also support SFP
modules)
2 SFP+ ports supporting 1GE/10GE

PACKET SWITCHING CAPACITY

Wire speed forwarding across all
10GE and GE ports
32,000 MAC addresses
9,000 byte MTU
4,094 VLANs
800 IGMP Multicast channels

QUALITY OF SERVICE

Service classification based on port,
SVLAN-ID, CVLAN-ID, p-bit
Port and flow-based policing to
1Mbps increments
8 CoS queues per port
Strict priority scheduling with
minimum bandwidth guarantee
Congestion avoidance: Tail Drop

STANDARDS AND rfC suPPORT

TR101 VLAN Service models
IEEE 802.1ag Connectivity Fault
Management (G.8032 support)
IEEE 802.1D Rapid Spanning Tree
IEEE 802.1p CoS Prioritization
IEEE 802.1 MAC Bridges
IEEE 802.1Q VLAN tagging
IEEE 802.1ad VLAN stacking (Q-in-
Q) support
IEEE 802.1w Rapid reconfiguration
of Spanning Tree (RSTP)
IEEE 802.3ad/802.1AX Link
Aggregation
RFC 2236 IGMP v2
RFC 3046 DHCP Relay Agent
Information Option ("Option 82")
RFC 4541 IGMP snooping
ITU-T G.8032 Ethernet Ring
Protection Switching

COMPLIANCE

NEBS Level 3 compliance
(GR-63-CORE, GR-1089-CORE,
GR-3028)
UL 60950
FCC Part 15 Class A

POWER SPECIFICATIONS

GE-24 with optics max power: 50
Watts
Heat dissipation: 171 BTU/Hour

OPERATING ENVIRONMENT

Temperature: -40 to +65° C (-40° F
to +149° F)
Humidity: 10 to 95% (non-
condensing)

STORAGE ENVIRONMENT

Temperature: -40 to +85° C (-40° F
to +185° F)
Humidity: 5 to 95%

S P E C I F I C A T I O N S

Calix E7-2 GE-24

C A L I X   7 0 0   S e r i e s   O N T s

The E7-2 GE-12 card supports operation with the Calix 700GX and 700GE family of ONTs, including Single Family Unit (SFU), Small Business Unit (SBU), Multi-Dwelling Unit (MDU), and rack-mount models.

O R D E R I N G   I N F O R M A T I O N

CALIX E7-2 LINE CARDS

100-01949.........................E7-2 GE-24 card (24xGE CSFP, 2x10GE SFP+)

CALIX PLUGGABLE TRANSCEIVER MODULES

The E7-2 supports pluggable modules for all service and network interfaces. Refer to the Calix Optical Transceiver Modules Datasheet (#250-00191) for a complete list of modules and specifications.

CSFP Option 2..................... 1GE optical dual-port Compact Small Form-factor Pluggable (CSFP) Option 2 modules
SFP....................................... 1GE and 2.5GE optical and copper Small Form-factor Pluggable (SFP) modules
SFP+..................................... 10GE optical Enhanced Small Form-factor Pluggable (SFP+) modules
Direct Attach...................... Multi-rate copper Small Form-factor Pluggable (SFP/SFP+) cables

Notes:... For 10GE SFP+ pluggable transceivers, Direct Attach cables, and all transceivers used in CSFP Option 2 sockets, only products purchased directly from Calix are supported.
SFP modules may also be used in CSFP Option 2 sockets, and in SFP+ sockets at 1GE rate.
Copper Direct Attach cables can operate in SFP, CSFP Option 2, and SFP+ sockets at 1GE and 10GE data rates as supported by the card type.

1035 N. McDowell Blvd., Petaluma CA 94954
TEL: 877.766.3500 WWW.CALIX.COM

250-00189, Rev.11

Calix E7-2 10GE-4
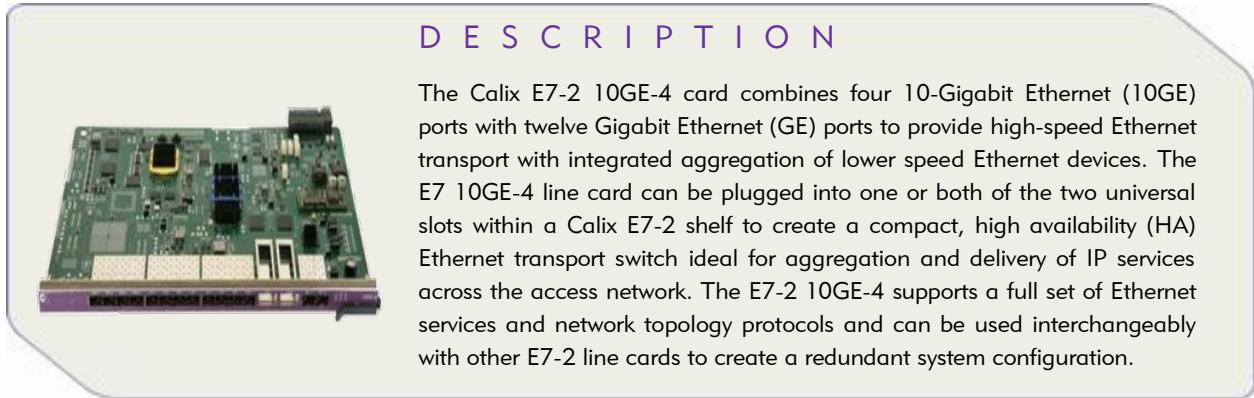
D E S C R I P T I O N

The Calix E7-2 10GE-4 card combines four 10-Gigabit Ethernet (10GE) ports with twelve Gigabit Ethernet (GE) ports to provide high-speed Ethernet transport with integrated aggregation of lower speed Ethernet devices. The E7 10GE-4 line card can be plugged into one or both of the two universal slots within a Calix E7-2 shelf to create a compact, high availability (HA) Ethernet transport switch ideal for aggregation and delivery of IP services across the access network. The E7-2 10GE-4 supports a full set of Ethernet services and network topology protocols and can be used interchangeably with other E7-2 line cards to create a redundant system configuration.

C A L I X   E 7 - 2   1 0 G E - 4   K E Y   A T T R I B U T E S

HIGH AVAILABILITY ETHERNET TRANSPORT: The Calix E7 system bridges the gap between traditional IP service access nodes and Ethernet aggregation switches. Designed to provide transport and aggregation for any Ethernet-based access network, the E7-2 10GE-4 card is the core element of the E7 Ethernet networking solution.

The 10GE-4 card includes four 10GE ports for use as uplink and transport for the local E7 system; or to subtend additional E7-2 chassis from the primary E7 system. Multiple E7-2 shelves can be linked together using low cost 10GE SFP+ copper cables, resulting in a high-speed 10Gbps transport ring with aggregated, high-density GPON and point-to-point Ethernet subscriber services.

Each 10GE-4 card provides 12 GE ports that can be used to:

- Build GE access rings
- Aggregate Calix E7, C7 and E5 platforms
- Provide business services and point-to-point Ethernet

INTEGRATED HIGH-CAPACITY SWITCH: The E7-2 10GE-4 card is built on a core Layer 2 and Layer 3 switch capable of full-duplex, line rate forwarding at all frame sizes and traffic types across all interfaces. This capacity makes the E7 ideal for aggregation and transport of IP/Ethernet services across the access network.

INTERFACE OPTIONS: Industry standard pluggable modules are used for all E7-2 10GE-4 service and network interfaces, including Small Form-Factor Pluggable (SFP) optical and copper Gigabit Ethernet, XFP 10GE, and SFP+ 10GE modules. SFP+ ports also support GE SFP modules, extending the versatility of the SFP+ ports to allow additional GE services or GE transport flexibility.

METRO ETHERNET BUSINESS SERVICES: The E7 can be used to deliver Metro Ethernet Forum (MEF) certified business services. The E7-2 10GE-4 supports up to 4,092 Ethernet Virtual Connections (EVCs) and can be configured for E-Line and E-LAN business services. The 10GE-4 can also deliver a full spectrum of ONT-based IP services over Point-to-Point Ethernet, including IPTV, High-Speed Internet (HSI) access, Voice (SIP/VoIP and TDM Gateway support), and T1 services (asynchronous clear channel).

NETWORK RESILIENCY: All Calix E7 cards support a flexible set of standards-based network topology protocols for use in aggregation, ring-based transport and uplink applications.

- ITU G.8032 Ethernet Ring Protection Switching (ERPS)
- IEEE 802.1w Rapid Spanning Tree Protocol (RSTP)
- IEEE 802.3ad/802.1AX Link Aggregation

With multiple 10GE interfaces, the 10GE-4 card acts as the central aggregation point for 10Gbps ERPS rings with Link Aggregation RSTP-protected uplink to network services.

DELIVERING "QUALITY OF EXPERIENCE": The E7 provides per-subscriber and per-service hierarchical QoS to deliver uncompromised triple play and business services. A powerful collection of classification, policing, queuing and scheduling algorithms let operators manage per-subscriber and per-service traffic flows to maintain priority/delay/loss differentiation within the E7 network.

SCALABLE IPTV SUPPORT: The E7 supports industry standard IGMP snooping to identify and replicate multicast video sent between the set-top box and the video distribution network, providing efficient, scalable, high-quality IPTV distribution on both GPON and Ethernet interfaces.

Calix

Calix E7-2 10GE-4

MINIMUM SYSTEM REQUIREMENTS

Calix E7-2 shelf support only, two 10GE-4 line cards per shelf
Calix E7 Software Release 1.0

DIMENSIONS (W x H x L)

14 x 10.1 x 0.78 inches
35.6 x 25.7 x 2 cm

WEIGHT

2.06 lbs. (0.93 kg)

PORTS

2 XFP ports supporting 10GE
2 SFP+ ports supporting 10GE and GE modules
12 SFP ports for optical GE and 100/1000BaseT copper modules

PACKET SWITCHING CAPACITY

Wire speed forwarding across all 10GE and GE ports
32,000 MAC addresses per system
9,000 byte jumbo frames
4,096 VLANs
800 IGMP multicast channels

QUALITY OF SERVICE

Service classification based on port, SVLAN-ID, CVLAN-ID, p-bit
Port and flow-based policing to 1Mbps increments
8 CoS queues per port
Strict priority scheduling with minimum bandwidth guarantee
Congestion avoidance: Tail Drop

STANDARDS AND RFC SUPPORT

TR101 VLAN Service models
IEEE 802.1ag Connectivity Fault Management (G.8032 support)
IEEE 802.1D Rapid Spanning Tree
IEEE 802.1p CoS Prioritization
IEEE 802.1 MAC Bridges
IEEE 802.1Q VLAN tagging
IEEE 802.1ad VLAN stacking (Q-in-Q) support
IEEE 802.1w Rapid reconfiguration of Spanning Tree (RSTP)
IEEE 802.3ad/802.1AX Link Aggregation
RFC 2236 IGMP v2
RFC 2376 IGMP v3
RFC 3046 DHCP Relay Agent Information Option ("Option 82")
RFC 4541 IGMP snooping
ITU-T G.8032 Ethernet Ring Protection Switching (ERPS)/Enhanced EAPS

COMPLIANCE

NEBS Level 3 compliance (GR-63-CORE, GR-1089-CORE, GR-3028)
UL 60950
FCC Part 15 Class A

POWER SPECIFICATIONS

10GE-4 power/heat dissipation: 55 Watts

OPERATING ENVIRONMENT

Temperature: −40 to +65° C (−40° F to +149° F)
Humidity: 10 to 95% (non-condensing)

STORAGE ENVIRONMENT

Temperature: −40 to +85° C (−40° F to +185° F)
Humidity: 5 to 95%

S P E C I F I C A T I O N S
Calix **E7-2 10GE-4**

C A L I X   7 0 0 G X   O N T

The E7-2 10GE-4 card supports operation with a family of Calix 700GX ONTs, including Single Family Unit (SFU), Small Business Unit (SBU), Multi-Dwelling Unit (MDU), and rack-mount models.

O R D E R I N G   I N F O R M A T I O N

CALIX E7 Line cards

100-01771 .... E7-2 10GE-4 (2x10GE XFP, 2x10GE SFP+, 12xGE SFP)

CALIX Pluggable Transceiver Modules

The E7-2 supports pluggable modules for all service and network interfaces. Refer to the Calix Optical Transceiver Modules Datasheet (#250-00191) for a complete list of modules and specifications.

SFP .... 1GE and 2.5GE optical and copper Small Form-factor Pluggable (SFP) modules
SFP+ .... 10GE optical Enhanced Small Form-factor Pluggable (SFP+) modules
Direct Attach .... Multi-rate copper Small Form-factor Pluggable (SFP/SFP+) cables
XFP .... 10GE optical Small Form-factor Pluggable (XFP) modules

Notes: For 10GE XFP, 10GE SFP+ pluggable transceivers, and Direct Attach cables only products purchased directly from Calix are supported. The use of GPON OIM, 10GE XFP, 10GE SFP+ pluggable transceivers and Direct Attach cables not purchased directly from Calix is not supported and will void all product warranties covering the Calix equipment to which such third-party materials are connected.

SFP modules may also be used in SFP+ sockets at 1GE rate. Copper Direct Attach cables can operate in SFP and SFP+ sockets at 1GE, 2.5GE, and 10GE data rates as supported by the card type.

C< Calix

1 0 3 5   N .   M c D o w e l l   B l v d . ,   P e t a l u m a   C A   9 4 9 5 4
T E L :   8 7 7 . 7 6 6 . 3 5 0 0   www.calix.com

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250-00171, Rev. 13

Page 3

716GE-I Indoor Optical Network Terminal

D E S C R I P T I O N

The Calix 716GE-I optical network terminal (ONT) is an indoor, 2.5 Gbps GPON and 1.0 Gbps Active Ethernet (AE) auto-detect ONT that delivers business and residential services to the subscriber. This high-performance ONT sets the standard with four Gigabit Ethernet (GE) interfaces that provide unmatched IPTV video and data services. The versatile 716GE-I ONT also features two POTS lines via an integrated VOIP or TDM gateway.

The 716GE-I ONT is designed for the industry-leading Calix C-Series, E-Series and B-Series OLT platforms. The 716GE-I ONT terminates a GPON or AE fiber link at the subscriber's location and provides industry-standard interfaces for the customer premises equipment. The ONT enables subscribers to receive broadband data, IP video, and VOIP or TDM gateway voice on a single fiber. At the ONT, the optical signal is converted to the appropriate electrical signals for transmission over the residence's existing twisted pair, and CAT5 cables.

The 716GE-I ONT is easy to install, activate, and maintain. Featuring innovative software management tools, the ONT can be configured, activated and upgraded quickly from a remote location. Extensive troubleshooting capabilities, remote software downloads, and easy-to-use service profile menus ensure that services are delivered and ONTs are maintained without needless truck rolls and hardware upgrades. Employing a 716GE-I ONT allows service providers to install the ONT once and support network upgrades with a simple, remote software download.

Remote ONT Activation (RONTA) is one example of an innovative software tool from Calix. RONTA simplifies ONT installation and turn-up by using a basic handset to configure and activate the ONT at the customer premises. The craftsperson can install and activate the ONT without assistance from the central office or use of special equipment.

Calix also expands the reach of GPON beyond the traditional 20 km boundary. Extended reach GPON supports links between the ONT and OLT of up to 40 km. This additional coverage allows service providers to edge-out their GPON networks and economically serve sparsely populated outlying locales without adding remote cabinets.

ONT power options include a simple 120-240 VAC, 50-60 Hz to 15 VDC converter or a 120-240 VAC, 50-60 Hz AC to 12 VDC uninterruptible power supply (UPS) that provides battery backup of lifeline POTS in the event of local AC power loss. As with all Calix ONTs, battery status, charge and battery life are monitored and reported through the Calix Management System (CMS).

716GE-I Optical Network Terminal

KEY ATTRIBUTES

- Standards-based Full Service Access Network (FSAN), ITU-T GPON and IEEE AE compliant

- 2.5 Gbps GPON and 1.0 Gbps AE, with auto-detect optics enables a seamless transition between WAN interfaces

- Four Gigabit Ethernet (GE) interfaces with symmetrical GE bandwidth for IPTV and data services

- 10/100/1000 BaseT Ethernet ports are auto-negotiating and fully independent for service separation

- VOIP or TDM POTS, two lines via SIP, H.248 or GR-303/TR-08 mode II/ GR-57 TDM gateway

- Indoor mounting options:
  - Wall mount
  - Structured Wiring Enclosure (SWE) mount
  - Desktop mount: horizontal or vertical

- Wide temperature range for a variety of indoor locations

- Optional lifeline service power source with in-home battery backup and alarm monitoring

- AC to 15 VDC wall transformer available

- Complete OAM&P support via Calix Management System (CMS)

- Supports multiple data service profiles

- Traffic Management and Quality of Service (QOS):
  - 802.1Q VLANs
  - 802.1p Service Prioritization
  - Q-in-Q Tagging
  - Multiple VLANs
  - Per-Port Rate Shaping
  - Rate Limiting

- MEF-UNI support for Ethernet demarcation applications:
  - MEF EVCs for E-Line and E-LAN
  - L2-VPNs using MEF service models

SERVICES SUPPORTED

Calix 700GE-I ONT delivers high-speed data, POTS, and IPTV video.

- Supports voice, video and data services on a single fiber

- Voice: Two VOIP or TDM POTS lines, via SIP, H.248 or GR-303/TR-08/GR-57 TDM gateway, full lifeline telephony support (CLASS and E911)

- Video: IPTV—supports IGMP multicasting and proxy

- Data: Four 10/100/1000 BaseT Ethernet ports with service separation and GE bandwidth

S P E C I F I C A T I O N S
716GE-I Optical Network Terminal

DIMENSIONS

Height: 6.8 in (17.3 cm)
Width: 6.8 in (17.3 cm)
Depth: 1.5 in (3.8 cm)
 Weight: 14 oz (.4 kg)

PON CHARACTERISTICS

Max. split: 64 GPON
Max. reach: 40 km (25 miles)
Maximum Attenuation:
    GPON – Class B+, 28 dB
1490 ± 10 nm optical receiver:
    –27.0 to –8.0 dBm
1310 ± 50 nm optical transmitter:
    0.5 to 5.0 dBm

POINT-TO-POINT (AE) CHARACTERISTICS

Max. reach: 50 km (31 miles)
1490 nm optical receiver:
    –27.0 to –8.0 dBm
1310 nm optical transmitter:
    –5.5 to 0.0 dBm

INTERFACES

Telephony: RJ-11
Data/IPTV: 10/100/1000 BaseT
    Ethernet ports, RJ-45 connectors
AE/PON: Single 9/125 μm (single
    mode) fiber, SC/APC connector,
    minimum 50 dB return loss
Power: 9-pin DIN jack

TELEPHONY

General: POTS via SIP, H.248 or
    TDM gateway
Number of lines: 2
RENs per line: 5 maximum
RENs per unit: 10 maximum
Subscriber premises—physical
    connection: RJ-11 jack (one per
    line)
Drop length: Maximum 1000 feet
    (305 m)
DS0 Output: 25 mA
Ring Voltage: 56–84 VAC

DATA

Drop length: 328 feet (100 m)
    maximum using CAT5 cable
Auto MDI/MDIX crossover for
    1000BASE-TX, 100BASE-TX,
    and 10BASE-T ports
Traffic Management and QOS:
    802.1Q VLAN; 802.1p Voice,
    Video, Data and Management
    Priorities; Q-in-Q tagging; Per-Port
    Rate Shaping; Rate Limiting

ENVIRONMENTAL

Operating temperature: Indoor
    ambient temperature: -5° to 50°C
Operating/storage relative humidity:
    0 to 95 % non-condensing
Altitude: –200 to 10,000 feet
    (–61 to 3,048 m) above sea level

CERTIFICATION AND COMPLIANCE

Emissions: FCC Part 15 Class B,
    IC ICES-003 Class B, CISPR-22
Safety: UL 60950 and UL 1697
    approved, CE Mark
Telcordia: GR-1089
IEEE: 802.3, 802.3AB, 802.3U,
    802.1p, 802.1Q
MEF: 9 and 14

POWER AND ALARMS

9-pin DIN connector with
    7-conductor power and alarm
    cable

POWERING

Input voltage: 12 VDC (nominal),
    10 VDC (min.), 16 VDC (max.)
Input current: 750 mA (nominal)
Residential battery backup source
    (local): UPS mounted at
    subscriber's residence
Battery backup time rated capacity:
    8 hours based on Telcordia
    GR-909 calculation methods using
    recommended UPS. Contact Calix
    for recommended UPS

716GE-I Optical Network Terminal

Calix 716GE-I Optical Network Terminal

716GE-I ONT (100-02040) ....Indoor ONT, 2 POTS, 4 Gigabit Ethernet

Calix 700GE-I Optical Network Terminal Accessories

PS 15V 9DIN-A (100-02042)….Power Supply 700GE-I Indoor 100-240 VAC 50/60 Hz to 12 VDC, 9-pin DIN, AM Type A
PS 15V 9DIN-C (100-03238)….Power Supply 700GE-I Indoor 100-240 VAC 50/60 Hz to 15 VDC, 9-pin DIN, EU/BR Type C
PS 15V 9DIN-G (100-03239)….Power Supply 700GE-I Indoor 100-240 VAC 50/60 Hz to 15 VDC, 9-pin DIN, UK Type G
PS 15V 9DIN-I (100-03240)…..Power Supply 700GE-I Indoor 100-240 VAC 50/60 Hz to 15 VDC, 9-pin DIN, AU/NZ Type I

Indoor PWR Cord 4B (100-02063) ....Indoor UPS Power Cord, 7-pin Connector to 9-pin DIN Male, 4' Black
Indoor PWR Cord 10B (100-02064) ....Indoor UPS Power Cord, 7-pin Connector to 9-pin DIN Male, 10' Black
Indoor PWR NT Cord 20B (100-03296) ....Indoor UPS Power Cord, Un-terminated to 9-pin DIN Male, 20' Black

S E R V I C E   D A T A S H E E T

CMS Appliance

D E S C R I P T I O N

CMS Appliance is a Unified Access service management platform that simplifies fiber access service delivery by bundling all the hardware and software necessary for turn-key deployments on a single, fault tolerant, rack-mountable PowerEdge™ R410 Server. High availability features include dual power and four Ethernet connections with redundant hard drives. CMS Appliance can also be deployed in pairs, providing ultimate system redundancy.

CMS Appliance is preconfigured with software templates that enable zero touch activation using Calix Remote ONT Activation (RONTA), dramatically simplifying residential and commercial fiber deployments.
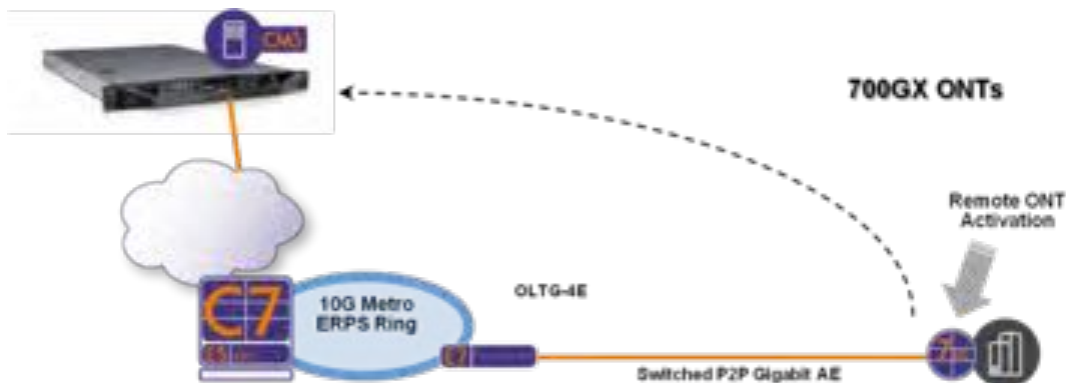
V A L U E   P R O P O S I T I O N

CMS Appliance reduces the complexity related to fiber service deployment, allowing communications service providers (CSPs) to quickly deploy revenue-generating broadband services. Key advantages include:

- *Accelerated Service Velocity:* Improve time-to-market – time-to-revenue.
  - o Automated activation using Remote ONT Activation (RONTA)
  - o Commercial templates bundling Metro Ethernet, VoIP, and commercial video
  - o Residential service templates bundling video, SIP, and triple-play
- *Reduced Operational Expenses (OPEX):* Automate repetitive tasks.
  - o Automated logging, reporting and alarm notification tools
  - o Automated database and network configuration backup
- *Business Tools and Capacity Planning:* Auto-generate pre-configured reports.
  - o Export weekly reports for review, including such as bandwidth inventory and capacity utilization.

CMS Appliance includes a complete version of the latest Calix Management System (CMS) server software.

Page 1

S P E C I F I C A T I O N S

CMS Appliance

BASE UNIT

Intel® Xeon® 5600-Series
    Processor

MEMORY (RAM)

6 GB 1333 MHz (3 x 2 GB), RDIMM

HARD DRIVE

Dual 146 GB, 15 K RPM SAS Hot-
    Plug Drives (RAID 1)

HARD DRIVE CONTROLLER

PERC6i SAS RAID Controller Internal
    with Battery

POWER SUPPLY

Redundant 500 Watts

MANAGEMENT

iDRAC6 Enterprise

MOUNTING

2/4 – Static Post Rails

OTHER FEATURES

Gigabyte Ethernet Interfaces
DVD-ROM SATA
Keyboard and Mouse, USB

OPERATING SYSTEM

Current version of CentOS, preinstalled

SOFTWARE CONFIGURATION

Current version of Calix Management
    System (CMS), preinstalled
All Software necessary for deploying
    AE and SIP services are bundled
    with CMS Appliance

SERVICE

Dell™ Limited Warranty
Business Hours 7 x 24
Next Business Day Onsite
Post Problem Diagnosis
3 Years

Note: Service may be provided by third-party. Technician will be dispatched if necessary following phone-based troubleshooting. Subject to parts availability, geographical restrictions and terms of service contract. Service timing dependent upon time of day call placed to Dell. U.S. only.

Calix Part #	Part Description	Warranty	Extended Warranty	Maximum Years	Manufacturer's Datasheet
100-01913	CMS Appliance Dell R410 Server configured with OS, CMS, DHCP, FTP, TFTP, SFTP, NTP, and Syslog server software	3 Years	Contact Dell	Contact Dell	Dell™ PowerEdge™ R410 Server Datasheet at www.dell.com

FOR HARDWARE ISSUES, CONTACT DELL

Technical Product Support
Toll-Free: 1-800-456-3355

Dell will ask for the 7 or 8 alphanumeric
system identifier located on the back of the server.

FOR CMS ISSUES, CONTACT CALIX

Technical and RMA Support
Toll-Free: 1-877-766-3500
FAX: 1-707-283-3772; RMA 766-3773
E-mail: tech.support@calix.com
E-mail: rma@calix.com

1035 N. McDowell Blvd., Petaluma CA 94954
TEL: 877.766.3500 WWW.CALIX.COM

Print Summary

PowerEdge R320

Starting Price   **$2,025.00**

As low as **$51.00**/mo.

Dell Business Credit | Apply

Preliminary Ship Date: **6/22/2012**

My Selections   **All Options**

- **PowerEdge R320**

Date	6/1/2012 2:09:05 PM Central Standard Time
Catalog Number	4 Retail 04

Catalog Number / Description	Product Code	Qty	SKU	Id
Chassis Configuration: 3.5" Chassis with up to 4 Cabled Hard Drives and Embedded SATA	4CBSATA	1	[318-2037] [331-6958]	1530
Processor: Intel® Pentium® 1403 2.60GHz, 5M Cache, 2C, 80W, Max Mem 1066MHz	IP1403	1	[317-9824] [317-9826]	1550
Memory Configuration Type: Performance Optimized	PEOPT	1	[331-4428]	1562
Memory DIMM Type and Speed: 1333 MHz UDIMMs	1333UD	1	[331-4423]	1561
Memory Capacity: 4GB UDIMM, 1333 MHz, Low Volt, Dual Rank, x8	4U3LDR	2	[317-6881]	1560
Operating System: No Operating System	NOOS	1	[420-6320]	1650
OS Media Kits: No Media Required	NOMED	1	[421-5736]	1652
RAID Configuration: No RAID with Embedded SATA (1-4 SATA HDD) with Cabled Chassis	NRS110C	1	[331-6986]	1540
RAID Controller: Embedded SATA	NCTRLR	1	[341-3933]	1541
Hard Drives: 500GB 7.2K RPM SATA 3.5in Cabled Hard Drive	500S35C	1	[341-9247]	1570
Embedded Systems Management: Basic Management	BMC	1	[331-3482]	1515

Add-in Network Adapter: On-Board Dual Gigabit Network Adapter	OBNIC	1	[430-4715]	1514
Add-in Network Adapter: Broadcom 5719 QP 1Gb Network Interface Card, Low Profile	5719LP	1	[430-4426]	1514
Power Supply: Single, Cabled Power Supply, 350W	SCPS350	1	[331-7025]	1620
Power Cords: NEMA 5-15P to C13 Wall Plug, 125 Volt, 15 AMP, 10 Feet (3m), Power Cord	125V10F	1	[310-8509]	1621
Rack Rails: ReadyRails™ Static Rails for 2/4-post Racks	STATIC	1	[331-4764]	1610
Bezel: Bezel	BEZEL	1	[318-1431]	1532
Internal Optical Drive: DVD Internal for 4HD Chassis	DVD12	1	[318-2099]	1600
System Documentation: Electronic System Documentation and OpenManage DVD Kit for R320	EDOCS	1	[331-6962]	1590
Hardware Support Services: 3Yr Basic Hardware Warranty Repair: 5x10 HW-Only, 5x10 NBD Onsite	U3OS	1	[938-3184] [939-6767] [939-6857] [939-6947] [994-4019] [995-8451]	29
Installation Services: No Installation	NOINSTL	1	[900-9997]	32
PowerEdge R320: PowerEdge R320	R320	1	[225-2955]	1
Shipping: PowerEdge R320 Shipping	SHIP	1	[331-6952]	1500

🖶 Print

snFG10

APC Smart-UPS 1500VA USB & Serial 120V

APC Smart-UPS, 1440VA/980W, Input 120V/Output 120V, Interface Port DB-9 RS-232, SmartSlot, USB

Includes: CD with software, Smart UPS signalling RS-232 cable, USB cable, User Manual

Part Number : **SUA1500**

[Configure Now]

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🕐 Runtime Chart
✉ Email Technical Specifications
🖨 Printer Friendly

Additional Information
Product Overview
User Manual & Installation Guides
Product Distribution

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Technical Specifications

⊟ Output

Output power capacity	1440 VA
Output power capacity	980 Watts
Max Configurable Power	1440 VA
Max Configurable Power	980 Watts
Nominal output voltage	120V
Output Voltage Distortion	Less than 5% at full load
Output Frequency (sync to mains)	47 - 53 Hz for 50 Hz nominal,57 - 63 Hz for 60 Hz nominal
Crest Factor	up to 5 : 1
Waveform type	Sine wave
Output Connections	(8) NEMA 5-15R

⊟ Input

Nominal input voltage	120V
Input frequency	50/60 Hz +/- 3 Hz (auto sensing)
Input Connection Type	NEMA 5-15P
Cord Length	6 feet (1.83 meters)
Input voltage range for main operations	82 - 144V

Options:
- Other Versions
- Automatic Transfer Switches
- Interface Connections
- Management Devices
- Rack Power Distribution
- Replacement Battery Cartridges
- Services
- Software

Features:
- Disconnected battery notification
- Front-access servicing
- USB connectivity

General Features:
- Adjustable voltage sensitivity
- Adjustable voltage-transfer points
- Audible alarms
- Automatic restart of loads after UPS shutdown
- Automatic self-test
- Boost and Trim Automatic Voltage Regulation (AVR)
- Cold-start capable
- Generator compatible
- Hot-swappable batteries
- Intelligent battery management
- LED status indicators
- Network manageable
- Power conditioning
- Predictive failure notification

Input voltage adjustable range for mains operation	75 - 154V

Batteries & Runtime

Battery type	Maintenance-free sealed Lead-Acid battery with suspended electrolyte : leakproof
Replacement battery cartridge	RBC7
RBC™ Quantity	1
Typical backup time at half load	23.9 minutes (490 Watts)
Typical backup time at full load	6.7 minutes (980 Watts)
Runtime Chart	Smart-UPS

Communications & Management

Interface port	DB-9 RS-232,SmartSlot,USB
Available Smart Slot Interface Quantity	1
Control panel	LED status display with load and battery bar-graphs and On Line : On Battery : Replace Battery : and Overload Indicators
Audible alarm	Alarm when on battery : distinctive low battery alarm : configurable delays
Emergency Power Off (EPO)	Optional

Surge Protection and Filtering

Surge energy rating	459 Joules
Filtering	Full time multi-pole noise filtering : 0.3% IEEE surge let-through : zero clamping response time : meets UL 1449

Physical

Maximum height	8.50 inches (216 mm)
Maximum width	6.70 inches (170 mm)
Maximum depth	17.30 inches (439 mm)
Net weight	53.00 lbs. (24.09 kg)
Shipping Weight	58.00 lbs. (26.36 kg)
Shipping Height	15.00 inches (381 mm)
Shipping Width	13.00 inches (330 mm)
Shipping Depth	23.00 inches (584 mm)
Color	Black
Units per Pallet	24.00

Environmental

Operating Environment	0 - 40 °C (32 - 104 °F)
Operating Relative Humidity	0 - 95%
Operating Elevation	0-10000 feet (0-3000 meters)
Storage Temperature	-15 - 45 °C (5 - 113 °F)
Storage Relative Humidity	0 - 95%
Storage Elevation	0-50000 feet (0-15000 meters)
Online thermal dissipation	135 BTU/hr

○ Resettable circuit breakers
○ Safety-agency approved
○ Serial Connectivity
○ SmartSlot
○ Temperature-compensated battery charging
    more details....

Topology: Line Interactive

Valere DC Power System

JK-series Shelf

24 x7 Installation and Technical Support
1-866-240-6614

Table of Contents

1 Safety and Recommended Practices

1.1 General Practices

For use in restricted access locations only. Suitable for mounting on concrete or other non-combustible surfaces. This equipment is intended for rack mounting. Refer to the method of mounting detailed in the installation instructions to reduce the risk of operator access to hazardous energy during installation.

This product accepts an AC Voltage between 90 and 264 VAC, 47 to 63 Hz, and produces a regulated output of 42-56 VDC capable of delivering a max of 90 Amperes DC, in an ambient operating temperature range of -40°C to +50°C (derating 2%/°C after 50°C up to 70°C). HAZARDOUS VOLTAGE AND ENERGY LEVELS ARE PRESENT WHICH CAN PRODUCE SERIOUS SHOCKS AND BURNS. Only authorized, qualified, and trained personnel should attempt to work on this equipment. Refer to datasheets for full product specifications.

Observe all local and national electrical, environmental, and workplace codes.

Each power shelf should be fed from a dedicated AC branch circuit of a TN power system.

If a line cord(s) is (are) used as the AC connection means, the plug end of the cord is considered to be the primary disconnect means, and reasonable access must be given to the plug and receptacle area. The receptacle must be fed with a breaker and wire sizes according to Table 3.

For hard-wired AC connections, a readily accessible disconnect device shall be incorporated in the building installation wiring. Select a wall breaker and wire sizes according to Table 3.

CAUTION: ALL RECTIFIERS EMPLOY INTERNAL DOUBLE POLE/NEUTRAL FUSING

Use single or double hole, UL listed lugs for the bulk DC connections, based on shelf circuit, to prevent lug rotation and inadvertent contact with other circuits. Terminal strip connections are compression screws.

Class 1 wire is recommended for all DC connections. Minimum wire sizes are shown in Table 4 and Table 5. In practice, loop voltage drop considerations will usually dictate larger than Minimum safe wire size.

The alarm contacts are rated for a maximum voltage of 60 VDC and a maximum continuous current of 0.5 A.

Connection and mounting torque requirements are listed in Table 6.

Valere does not recommend transporting or shipping the power shelf with the rectifiers installed. Rectifiers should be shipped in separate boxes provided by Valere Power.

1.2 FCC Compliance Statement

Note: This device complies with Part 15 of FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and

2. This device must accept any interference received, including interference that may cause undesired operation.

These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

1.2.1 Warning

Changes or modifications to this unit not expressly approved by the party responsible for the compliance could void the user's authority to operate this equipment.

2   Product Section

2.1 Rectifier Specifications

Table 1 shows the DC voltage range and max current for each model of rectifier for this system.

Model	AC Input Range(Nominal)	Voltage Min/Max	Rated Current
J0600A1	100VAC-240VAC	42VDC-56VDC	12amps
J1500A1	100VAC-185VAC	42VDC-56VDC	25amps
J1500A1	185VAC-264VAC	42VDC-56VDC	30amps

Table 1 - Rectifier Specifications

2.2 Heat Dissipation

Table 2 displays the typical and maximum heat dissipation for the Valere Power rectifiers. "Typical" is calculated at AC 240 V, and typical DC voltage and current values for the rectifier. "Maximum" is calculated at AC 180 V and maximum DC voltage and current values for the rectifier.

Model	Typical		Maximum	
48V Rectifiers	BTU/hr	Watts	BTU/hr	Watts
J0600A1	243	71	373	109
J1500A1 (low line)	507	148	778	228
J1500A1 (high line)	608	178	933	273

Table 2 - Heat Dissipation

2.3 AC Input Requirements

2.3.1   AC Input Diagrams

This system utilizes a single feed AC architecture (as shown in Figure 1) via rear accessed, terminal block inputs.   See Table 3 for maximum input current ratings.

The AC architecture can be determined from the model number of the shelf. The model number of the shelf can be found on the right side, near the rear of the shelf. The sticker will have a Valere Power logo on it. To determine the circuit number, find the model number, i.e. Model: JK35S-ZNL-VT. The fifth character (in this case the character S) in the first section is your AC type. The valid AC architecture is 'S' for single. Find the corresponding AC wiring diagram on the next page.

2.3.1.1 Single feed

N+1 DC Out

Rectifiers
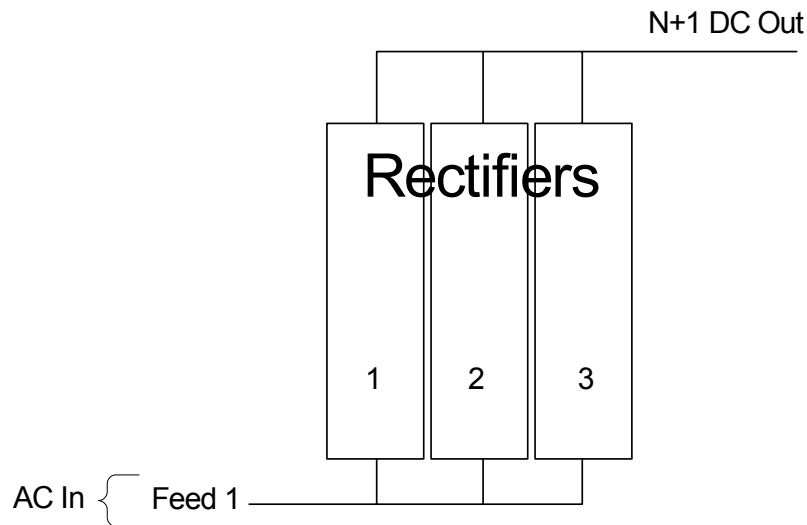
1   2   3

AC In { Feed 1

Figure 1 - Single Feed AC Wiring Architecture

A single feed architecture powers all three rectifier slots on one AC feed. Connect the feed, sized according to Table 3, onto the compression screws as seen in Figure 5. The AC terminal block on the rear of the shelf will accept wire between 24 AWG and 8 AWG connections should be torque to 4 in-lbs. A 1" knockout is provided for cable entry to the AC block. This knockout will accept either a Valere provide AC cord grip or a customer supplied conduit.

2.3.2 AC Wire Sizing

Use Table 3 to size your AC feed properly. Failure to size the AC breaker and wiring properly can result in nuisance breaker trips or even fire. If you anticipate future growth, size the AC breaker and wiring for the expected future capacity. ALWAYS FOLLOW NEC RULES AND YOUR LOCAL COMPANY PRACTICES WHEN SELECTING AC WIRING AND PROTECTION.

Follow the example below for determining AC breaker and wire sizing.

EXAMPLE:
    1. Use section 2.3.1 above to determine the AC input type, for example a single feed.
    2. Determine the quantity and model number of the rectifiers, for example three J1500A1 (48V, 30A).
    3. Use Table 1 to determine the required AC input voltage. The J1500A1 rectifier will accept either low line or high line AC voltage.
    4. Using Table 3, this system will require a 50 amp breaker with 8 AWG wire, at low line, or a 50 amp breaker with 8 AWG wire at high line.

NOTE: Under-sizing your AC breaker and wiring could cause nuisance breaker trips and system outages.

Table 3 uses a minimum nominal input voltage to determine AC current requirements. 90Vac corresponds to a nominal low line voltage of 120Vac and 180Vac corresponds to a nominal highline voltage of 208 Vac.

Fully Equipped Shelf	Number of Rectifiers on each AC Feed	Model Number of Rectifier	Minimum Input Voltage	Maximum rated AC Current	Minimum circuit breaker	90 °C Minimum Wire Gauge to use at 30 °C ambient	
			Volts	Amps	Amps	AWG	mm²
Use only if 1 rectifier is the maximum that will be installed on a single AC feed	1	J0600A1	90	8.1	15	14	2.5
		J0600A1	180	4.4	15	14	2.5
		J1500A1	90	16.8	20	12	4.0
		J1500A1	180	10.9	15	14	2.5
Use only if 2 rectifiers are the maximum that will be installed on a single AC feed	2	J0600A1	90	16.2	20	12	4.0
		J0600A1	180	8.7	15	14	2.5
		J1500A1	90	33.7	50	8	10.0
		J1500A1	180	21.9	30	10	6.0
Single feed	3	J0600A1	90	24.2	30	10	6.0
		J0600A1	180	13.1	15	14	2.5
		J1500A1	90	50.5	60	6	16.0
		J1500A1	180	32.8	50	8	10.0

Table 3 - Recommended AC Circuit Breaker and Wire Sizes

2.4 DC Output Requirements

2.4.1 DC Circuit Drawings

The DC circuit number can be determined from the model number of the shelf. The model number of the shelf can be found on the right side of the shelf near the rear of the shelf. The sticker will have a Valere Power logo on it. To determine the circuit number, find the model on the shelf, i.e. Model: JK35S-ZNL-VT. The middle digits in the first section (in this case the number 35) are your circuit number. Valid circuits include circuit 35. Find the corresponding figure in the following sections for your circuit number.

This circuit is available with an option for a battery LVD. You can determine if a system has an LVD and shunt from the model number of the shelf. The model number of the shelf can be found on the right side of the system, near the rear. From the model number above, the third character in the second section (in this case the letter L) indicates the system has a battery LVD & shunt.
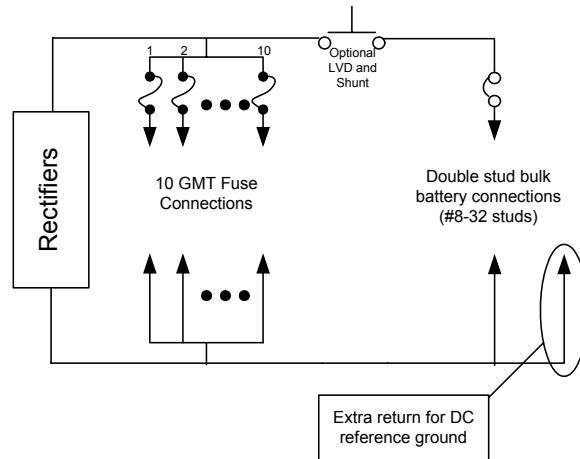
2.4.1.1 Circuit 35

Figure 2 - DC Wire Diagram (Circuit 35)

Each system is equipped with 10 GMT fused connections and one battery circuit breaker protected fused connection with an optional battery LVD and shunt shown in Figure 2. The GMT fuse connections are made on a "lugless" terminal block with compression screws. The GMT terminal block will accept wires sizes up to 12 AWG and a max fuse of 15A. All circuit breaker connection are a double #8-32 studs with 5/8" centers. These connections have a max tongue width of 0.42". Do not connect load equipment in series with a battery LVD and shunt protected output. An extra return position is provided for a DC reference ground (See section 2.4.2). Size wires based on the total rectifier capacity and choose conductor size according to Table 5.

Note: The battery LVD and shunt have a maximum continuous current capacity of 80 amps.

2.4.2 DC Reference Ground

The Valere Power system is a fully floating system. This means that the DC return bus bar is not tied to the chassis or an earth ground. An external reference or earth ground may be connected to any return position or to the "DC reference ground" connection. The DC reference ground attachment point is internally hard wired connected to all fuse, circuit breaker, and bulk return points. As always follow your company's guidelines for sizing and attaching a reference ground.

2.4.3 DC Wire sizing

There are two main considerations for sizing DC wire, ampacity and voltage drop. Ampacity refers to a safe current carrying level as specified by non-profit organizations such as Underwriters Laboratories and the National Fire Prevention Association, which publishes the National Electric Code. Voltage drop is simply the amount of voltage loss in a length of wire due to ohmic resistance of the conductor. DC wire may be sized for either ampacity or voltage drop depending on branch load

loop length and conductor heating. In general, ampacity considerations will drive wire selection for short loop lengths (less than 50 feet) and voltage drop will drive wire selection for long loop lengths (greater than 50 feet). The National Electric Code table 310.16 provides ampacity values for various sizes, bundles, and insulation temperature rated wire. ALWAYS FOLLOW NEC RULES AND YOUR LOCAL COMPANY PRACTICES WHEN SELECTING DC WIRING AND PROTECTION. Table 5 shows recommended wire sizes based on ampacity.

2.4.3.1   GMT Fuses Connections

Fuse protected wires shall be based on the protector size rating. For example, using Table 4 below, a 10 A fuse requires #20 AWG wire.

GMT fuse Rating	Wire & Lug Gauge (AWG) using 90° C wire (NEC Table 310.16)	
Amps	AWG	mm^2
1	24	0.25
2	24	0.25
5	24	0.25
7.5	22	0.5
10	20	0.75
15	18	1.0

Single conductor in free air 30° C ambient temperature

Table 4 - Minimum Recommended DC Wire Size

2.4.3.2   Circuit Breaker Connections

Circuit breaker protected output wires shall be based on the protector size rating. For example, using Table 5 below, a 20 A breaker requires a #12 AWG wire.

Current Protector Rating	Wire & Lug Gauge (AWG) using 90° C wire (NEC Table 310.16)	
Amps	AWG	mm^2
5*	18	1.0
10*	16	1.5
20	12	4.0
30	10	6.0
40	8	10.0
50	8	10.0

* - Wire sizing for circuits less than 15 A are based on Table 3B - Sizes of Conductors, UL60950, "Safety of Information Technology Equipment", Dec., 2000 for non-building wiring.

Table 5 – Minimum Recommended DC Wire Size

2.5 Torque Settings

Table 6 shows recommended torque settings for all mechanical and electrical connections according to screw or nut size.

Screw or Nut Size	Torque (in-lbs)	Torque (n-m)
4-40	6	1
6-32	12	1.5
8-32	22	3
10-32	37	4.25
12-24	50	5.75
¼-20	65	7.5

Table 6 - Recommended Torque Settings

2.6 Required Tools

Valere rectifiers are designed to be installed with a minimum number of commonly available tools:

- #1 & #2 flat blade screwdrivers
- Torque wrench
- 5/16" or 7/16" socket
- Wire and cable strippers
- Wire and cable crimpers

3 Site and Equipment Preparation

Before unpacking the DC power plant, note any physical package damage that could indicate potential damage to the contents. After removing DC Power Plant from boxes and packing material, inspect for shipping and/or other damage. Contact sales or technical support immediately if any damage is present. Have all tools, wire, cables, hardware, etc., within easy reach. To the extent possible, ensure a clean (free of debris, dust, foreign material, etc.) work environment. Care should be taken in the installation process to prevent exposure of the equipment to wire clippings. If possible, the rectifiers should remained sealed in their shipping boxes until the shelf wiring is complete. Ensure all AC and DC power sources are off and disconnected.

4 Power Plant Mounting and Wiring

4.1 Mechanical Mounting

This equipment is intended for normal operations and is to be installed in a standard 19" telecommunications rack. It is recommended that one person lift the shelf into place while another installs the supplied mounting hardware. Torque mounting hardware according to Table 6.

Mounting brackets

Slot 1 Slot 2 Slot 3

Figure 3 - Front View

NIC controller slot

In shelf distribution

TRIO including alarms

Figure 4 - Rear view

DC connections

AC input section with removable cover
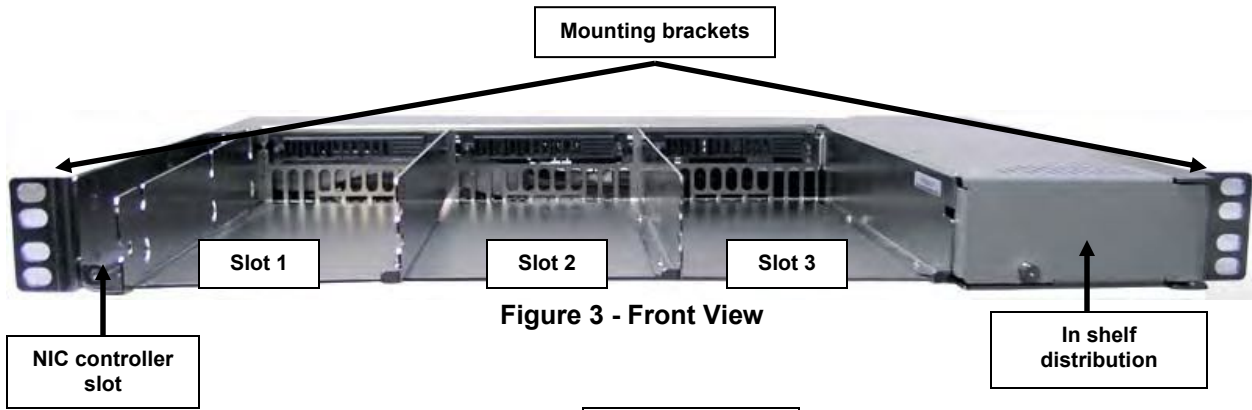
4.2 AC input

4.2.1 Single Feed

Remove safety cover over the AC section. Remove the knockout and install an AC cord grip or conduit to feed AC wires to the terminal block. Feed AC wires through knockout and connect wires from AC cord into the appropriate positions labeled in Figure 5. Connect your AC ground first, followed by the line/hot to Line 1, and your second line or neutral to Line 2/N. Tighten screws to 13 in-lbs and replace AC section safety cover.

Line 2/N

Line 1

Ground

AC terminal block

1" Knockout
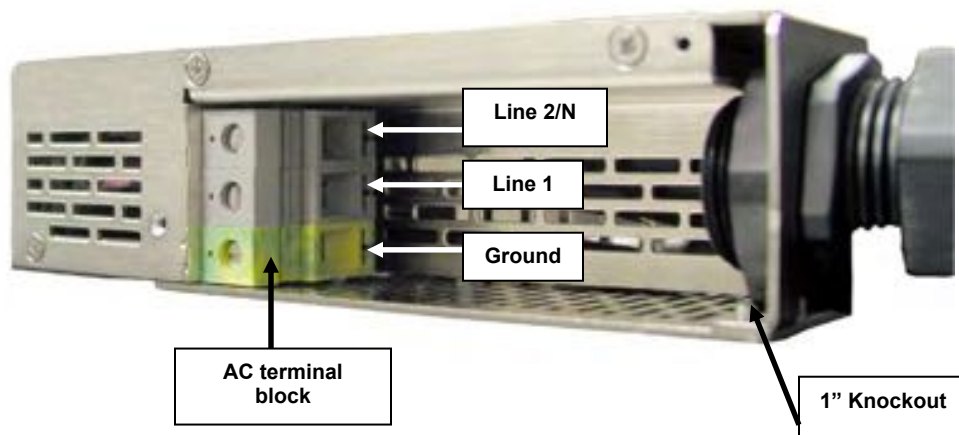
Figure 5 - Rear View (AC Connections – Single Feed)

4.3 DC Output

4.3.1 Circuit 35

Both GMT fused outputs and circuit breaker outputs are located on the rear of the system, while actual fuses and circuit breakers are installed on the front of the system. Place wires in the output connections labeled 1 – 10 on Figure 7 and corresponding return, and compress the screws to 4 in-lbs. Place a fuse into the corresponding position into the fuse holder in Figure 6. For the circuit breaker connection, place lugged wire on the corresponding output and return studs and secure the connection with the provided nuts and washers. Install circuit breaker in battery circuit breaker slot.
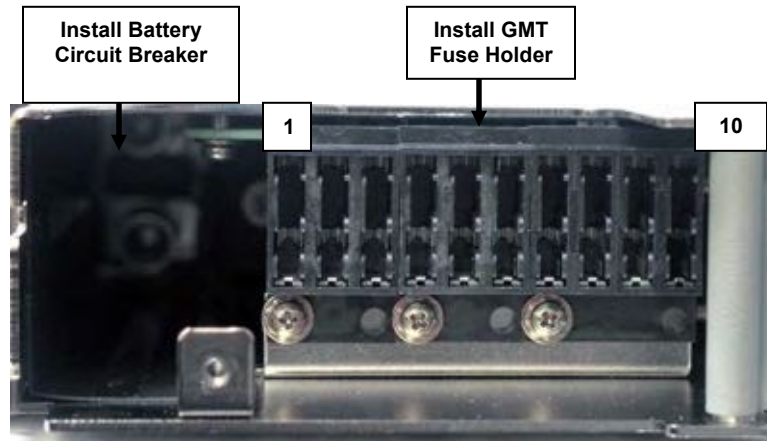
Figure 6 - Front View Distribution Inputs (Circuit 35)
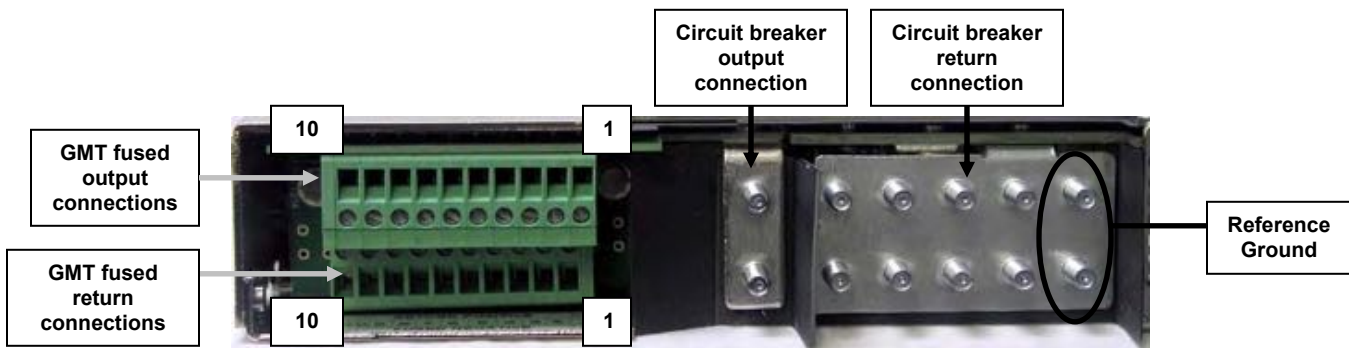
Figure 7 - Rear View DC Connections (Circuit 35)

4.3.2 Alarm connections

Alarm connections are available with the TRIO included on the rear of the shelf.

The four form C contacts are available through a connector, labeled as "alarm relay cable connections", as shown in Figure 8. The cable has a shelf mating connector (Valere side) on one end and bare tin wire (customer end) on the other. Contacts may be used in parallel in locations where alarm transport capacity is limited.
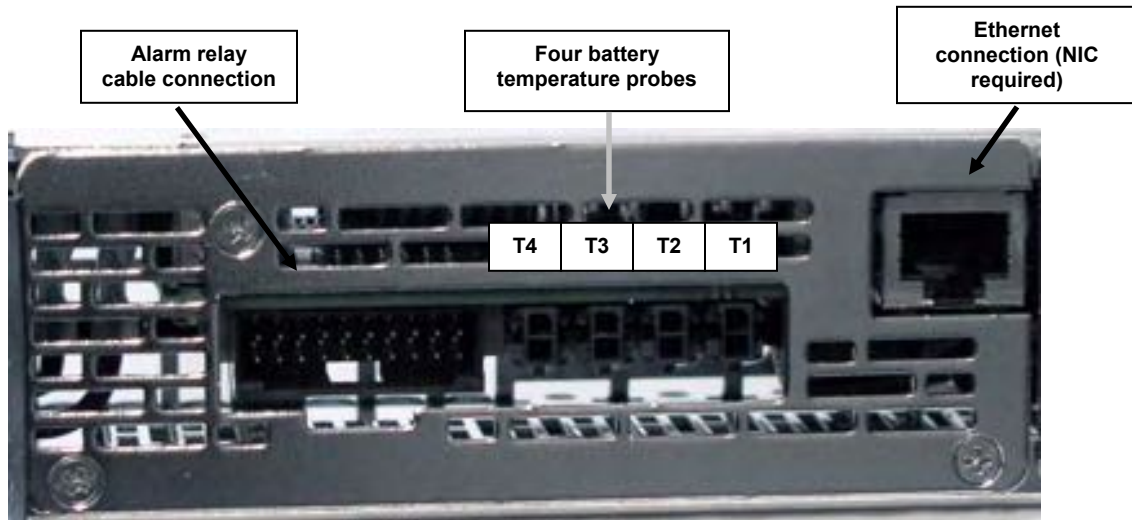
Figure 8 – TRIO board

Table 7 lists the wire color code for the form C relays available with the TRIO board, based on the default profile in a system without a NIC. See DO600000201 - NIC controller manual for information on alarm relays with a NIC installed.

| Alarm Channel | CA210203**104** | | Alarm Behavior |
	Functional Designation	Wire Color	
A (DC output failure)	NC	Orange/White stripe	Contact Opens On Alarm
	C	Orange	Common
	NO	Orange/Black stripe	Contact Closes On Alarm
B (AC input failure)	NC	Red/White stripe	Contact Opens On Alarm
	C	Red	Common
	NO	Red/Black stripe	Contact Closes On Alarm
C (Fuse or circuit breaker open)	NC	Green/White stripe	Contact Opens On Alarm
	C	Green	Common
	NO	Green/Black stripe	Contact Closes On Alarm
D (Auxiliary input alarm)	NC	Yellow/White stripe	Contact Opens On Alarm
	C	Yellow	Common
	NO	Yellow/Black stripe	Contact Closes On Alarm

Table 7 - Alarm Cable Color Code

4.3.3 Auxiliary Input Alarms

The temperature probe ports on the TRIO are operational as auxiliary input alarms without a NIC installed and are set to accept a normally open contact closure. To use a temperature probe input port as an external alarm channel, simply connect a dry contact relay into any of the input connectors using the cable, CA210022376. The system will automatically detect a contact closure and trigger an alarm on relay D. See DO600000201 – NIC controller manual for procedure to setup temperature probe inputs for other configurations (NIC required).

4.3.4 Temperature Probes

The temperature probe ports on the TRIO are only operational with a NIC installed. The temperature probe (sold separately) consists of a cable with a two pin Molex connector on each end and a thermistor. Place the thermistor onto the batteries, and connect the temp probe wire into the thermistor. Then connect the other end into the TRIO (temp probe on Figure 8) at any open temperature probe positions pointed out in Figure 8. Repeat for additional battery string(s). The temperature probes are used to monitor temperature of the batteries and for temperature compensation. See NIC manual for procedure to setup temperature probes

4.3.5 Ethernet Connections

Access to the NIC (Optional) can be accomplished via the rear accessed Ethernet connection (Figure 8), if a NIC is installed. Connect to the Ethernet port according to Application Bulletin 200 "Quick Start Guide: Connecting to the LAN Port". The NIC will be installed in the slot pointed out in Figure 3 behind the front accessed distribution door. See NIC manual D0600000201 for operation instruction.

5   Test and Turn-Up

5.1 Power Up

After all input and output connections have been secured and checked, activate all input breakers. When input breakers are on, install each rectifier sequentially by sliding the rectifier into position and closing the latch as shown in Figure 9. **Rectifier latches must be open for installation. Attempting to install rectifiers with latches closed can result in mechanical damage to the rectifiers and the shelf.** Rectifier fans will start in high-speed mode and reduce their speed according to the ambient and plant conditions within 10 seconds. If an LVD is installed an LVD alarm may be present for 20 seconds, until the LVD contactor closes.

If a NIC is installed it will automatically recognize the rectifiers and set itself appropriately.

6   Replacement Items

The rectifiers and the NIC are designed as modular, field replaceable units. The following section outlines the procedure to replace a rectifier. The TRIO is not a field replaceable item. See DO600000201 – NIC controller manual for NIC replacement instructions.

6.1 Rectifiers

In the event that a rectifier needs to be removed, press the latch button on the front of the rectifier, and pull the handle until the rectifier slides out of the slot. With the latch open on the replacement rectifier, slide the rectifier in until it connects with the backplane. Once inserted press the latch button closed. The rectifier will power up and configure itself.
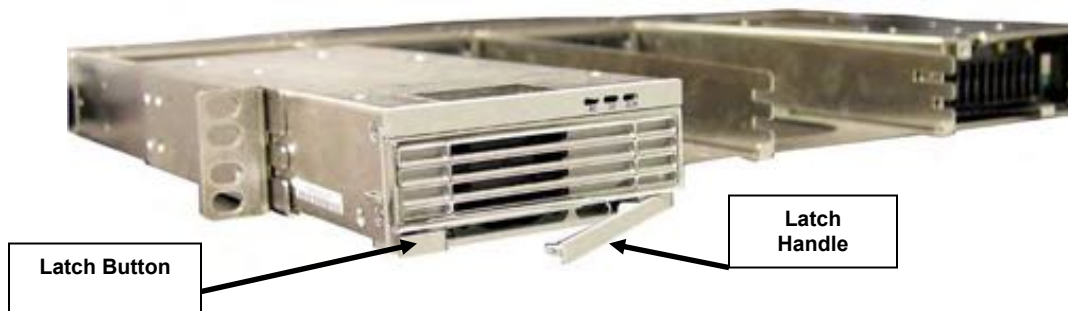
Figure 9 - Rectifier removal

7   Troubleshooting

The modular, plug-n-play nature of this plant makes diagnostics and repair very easy. Make sure that all rectifiers are properly seated and latched into their respective slots. Make sure that all power and signal connectors are properly mated. The following table is a list of problems and solutions Table 8 is for systems without a NIC; see NIC installation manual for troubleshooting with NIC.

Note: Troubleshooting without a NIC

| Alarm	Problem	Solutions
DC Fail and DC OK LED is extinguished	A rectifier has stopped outputting power	Replace failed rectifier
AC Fail and all LEDs are extinguished	Commercial power has been lost to the specified rectifiers.	Reset commercial circuit breaker to the dedicated AC circuit that feeds system. Seek alternative power source until power is restored.
Fuse open	A fuse is in an open state	Replace open fuse

Table 8 - Problems and Solutions without NIC

This is the OD-50DX(C) Outdoor Rack Mount Enclosure. This cabinet comes standard with the following components:

- (2) Poly-Filters
- (1) Set of 19" EIA Standard Racking Rails
- (2) 3 Point Locking Handles

Options for this cabinet include:
- Air Conditioner
- Back Up Fan Unit
- Mounting Brackets
- Bases:
  - Pad
  - Pedestal
- J-Hooks
- Casters
- C-Channel Reel
- Spoolbox
- Windlocks
- Alarm Switches
- Lexan Windows
- Fan Kits
- Lightbars
- Power Strips
- Junction Boxes
- 2 Outlet 110V Receptacles
- 4 Outlet 110V Receptacles
- GR Outlets
  - Covered, Uncovered
  - Switched, Unswitched
  - Dual GR, Single GR w/ 2 outlet 110V recept.
- 220V Twist
- Flex Heaters
  - 100w, 300w, 600w
- HVL (400w Fan Heater)
- Insulation
- Grounding Studs
- Extra 19" EIA Standard Rails
- 23" EIA Standard Rails
- Vibrasbobbins
- Shelves
  - 3AC, M1, Slaft Fan
- Battery Trays
  - Center Racked, Not Racked
- Batteries
  - Various Amp-Hours Available
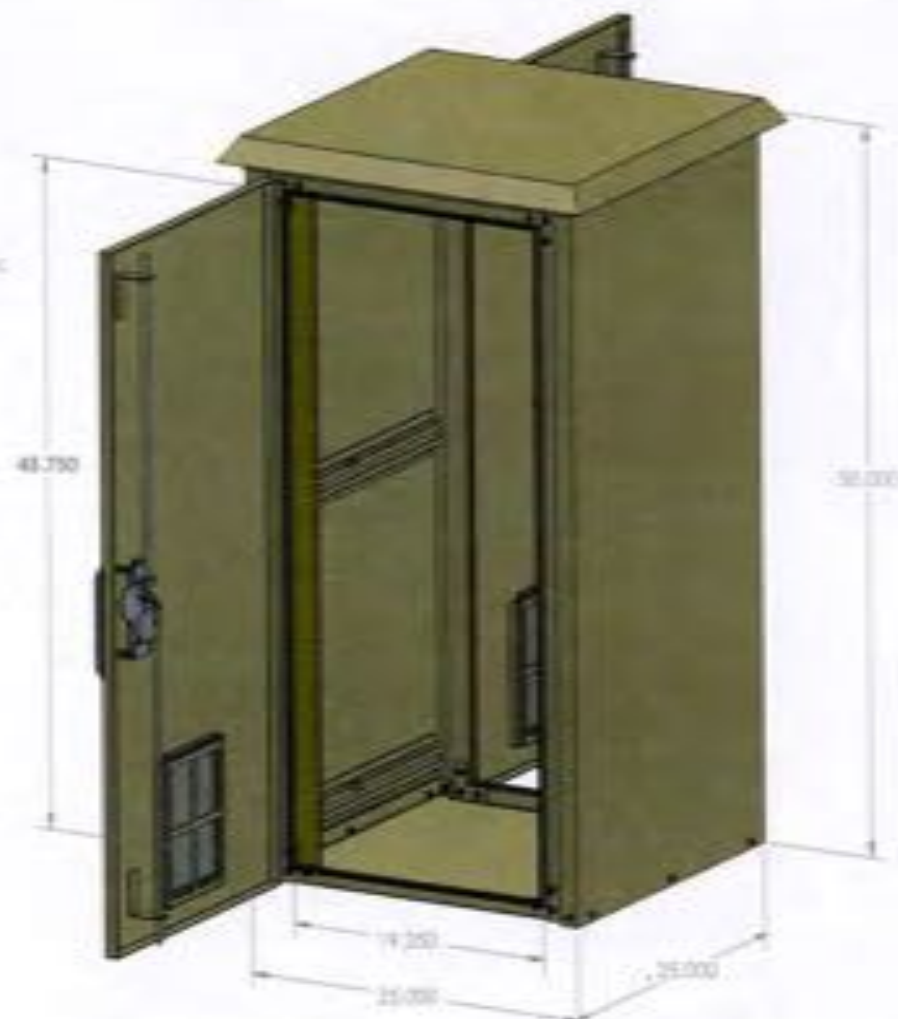
The 50 inch tall cabinet has a usable racking space of 29Ru. The racking space is centered in the door opening. The opening for the door is 19.25 inches wide by 45.75 inches high.

48.750

50.000

19.250

23.000

25.000

DDB Unlimited Inc.

Height:	50 inches	
Width:	25 inches	
Depth:	25 inches	**Aluminum**
Color:	Powder Baked Cream/Unpainted	

TITLE: **OD**

SIZE: **A** DWG. NO. 50DX(C) REV. 2

Scale 1:8 Weight ~120 lbs Sheet 9 of 26

Handle Side

Front Door

Top
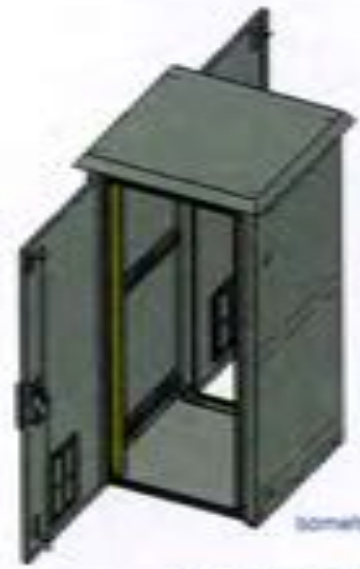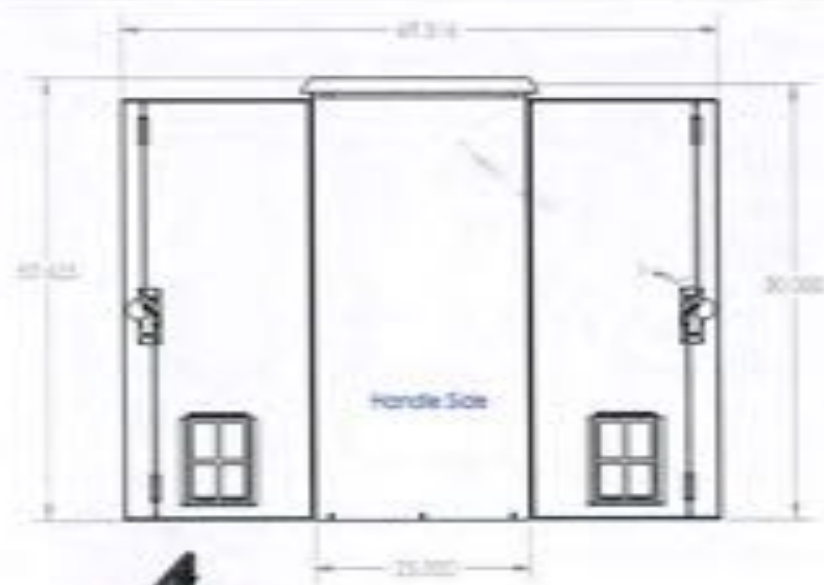
Isometric View

The dimensions shown above and to the left of these views represent the total occupied space of the cabinet with both doors opened. The dimensions below and to the right of these views are the actual dimensions of the cabinet itself. The view shown is the "Plain Jane" versions of the cabinet without any added accessories.

Accessories will alter the total space or the weight of the cabinet. The weight identified in the legend represents the raw weight of the cabinet.

Dimension	Cabinet only	Total Occupied Space
Height:	30 inches	52.63 inches
Width:	25 inches	27.34 inches
Depth:	25 inches	69.52 inches
Color:	Unpainted/Powder Baked Cream	

Base Material: **Aluminum**

NEMA Rating: 4, 4X

DDB Unlimited Inc.

OD

DWG. NO.: 50OD(C)   REV. 2

Weight: ~120 lbs