QFX5120 ETHERNET SWITCH

Product Overview

The QFX5120 Ethernet Switch delivers rich, low latency Layer 2/Layer 3 (L2/L3) features and advanced EVPN-VXLAN capabilities, making it an ideal data center top-of-rack and aggregation switch for enterprise multicloud deployments. Featuring L3 gateway capabilities for routing between virtualized and bare-metal servers, the QFX5120 is designed for extremely agile data centers that require support for overlay/underlay network architectures. Native 25GbE with 100GbE uplink ports on the QFX5120-48Y, 10GbE copper with 100GbE uplink ports on the QFX5120-48T, and 32 100GbE ports on the QFX5120-32C make the QFX5120 family ideal for spine-and-leaf network deployments.

Product Description

Featuring L3 gateway capabilities for routing between virtualized and bare-metal servers, the high-performance Juniper Networks® QFX5120 Ethernet Switch provides the ideal foundation for dynamic data centers. Native 25GbE fiber ports on the QFX5120-48Y and 10GbE copper ports on the QFX5120-48T satisfy the growing demand for server access speeds, while high-density fixed-configuration 100GbE ports on the QFX5120-32C satisfy the need for compact, lower power devices in the spine. The QFX5120 is packed with software features that support traditional fabric designs with multichassis link aggregation (MC-LAG) or evolving SDN architectures with Ethernet VPN (EVPN)/Virtual Extensible LAN (VXLAN) on IP fabric underlays.

Architecture and Key Components

The QFX5120, which includes rich L2, L3, EVPN, and MPLS features, runs the same reliable, high-performance Junos® operating system used by all Juniper Networks QFX Series and EX Series Ethernet Switches, Juniper Networks SRX Series Services Gateways, and Juniper Networks routers, ensuring a consistent control plane feature implementation and user experience across the entire Juniper infrastructure.

Product Options

The QFX5120 switch family includes three compact, 1 U platforms that provide wire-speed packet performance, very low latency, and a rich set of Junos OS features:

- The QFX5120-48Y is a 25GbE/100GbE data center access switch offering 48 small form-factor pluggable plus (SFP+) transceiver ports and eight quad SFP (QSFP28/QSFP+) ports that can be configured as 8x40GbE or 8x100GbE ports. For added flexibility, each QSFP28 port can also be configured as 4x25GbE ports using breakout cables, while each QSFP+ port can be configured as 4x10GbE ports using breakout cables, increasing the number of supported 25GbE and 10GbE ports per switch to 80.
- The QFX5120-48T is a 10GbE/100GbE data center access switch offering 48 10GbE RJ-45 copper ports and six 100GbE/40GbE QSFP28/QSFP+ uplink ports. With dual-speed (1GbE/10GbE) capabilities on all 48 host ports and 40GbE/100GbE on the uplink ports, the QFX5120-48T can be deployed as an access switch with a combination of 48 1GbE/10GbE ports for downlink servers and storage connectivity, and six 40GbE/100GbE ports for uplinks to spine switches.
- The QFX5120-32C is a compact 100GbE data center spine switch offering 32 QSFP28 or 32 quad SFP+ (QSFP+) ports. The 100GbE ports can also be configured as 4x25GbE ports using breakout cables, enabling the QFX5120-32C to be used as a high-density 25GbE top-of-rack switch.

QFX5120 Highlights

The QFX5120-48Y switch features the following:

- Up to 48 25GbE ports and eight 100GbE uplink ports in a 1 U platform
- Up to 4 Tbps L2 and L3 performance, with latency as low as 550 nanoseconds
- A 2.2 GHz quad-core Intel CPU with 16 GB memory and 50 GB SSD storage

The QFX5120-48T switch features the following:

- Up to 48 10GbE RJ-45 copper ports and six 100GbE uplink ports in a 1 U platform
- Up to 2.16 Tbps L2 and L3 performance, with latency as low as 550 nanoseconds
- A 2.2 GHz quad-core Intel CPU with 16 GB memory and 100 GB SSD storage

The QFX5120-32C switch features the following:

- Up to 32 100GbE or 40GbE ports in a 1 U platform
- Up to 6.4 Tbps L2 and L3 performance, with latency as low as 550 nanoseconds
- A 2.2 GHz quad-core Intel CPU with 16 GB memory and 64 GB SSD storage

In addition, all QFX5120 switch models include:

- Feature-rich automation capabilities with support for Python and zero-touch provisioning (ZTP)
- Support for VXLAN as an L2 or L3 gateway and Open vSwitch Database (OVSDB) protocol as an L2 gateway
- Advanced Junos OS features such as EVPN, BGP add-path, MPLS, L3 VPN, and IPv6 6PE

Junos OS

The high-performance QFX5120 switch runs Junos OS, Juniper's powerful and robust network operating system that powers all Juniper switches, routers, and firewalls. Key Junos OS features that enhance the functionality and capabilities of the QFX5120 include:

- Software modularity, with process modules running independently in their own protected memory space and with the ability to do process restarts
- Uninterrupted routing and forwarding, with features such as nonstop active routing (NSR) and nonstop bridging (NSB)
- Commit and rollback functionality that ensures error-free network configurations
- A powerful set of scripts for on-box problem detection, reporting, and resolution

Data Center Deployments

Data centers demand high-speed, low-latency, storage-converged and I/O-converged networking solutions that can maximize performance for physical servers, virtual servers, and storage. The QFX5120 addresses these issues with low-latency, lossless, high-density 10GbE, 25GbE, and 100GbE interfaces on a compact 1 U platform. In addition, the QFX5120 offers EVPN-VXLAN L2 and L3 gateway support, making it an ideal solution for either edge routed or centrally routed overlay deployments in the data center. The QFX5120 also supports flexible back-to-front and front-to-back airflow cooling options, ensuring consistency with server designs for hot-aisle or cold-aisle deployments.

Data Center Server Access

The QFX5120-48Y supports tri-speed 1GbE/10GbE/25GbE, making it a perfect fit for top-of-rack deployments. The 48 ports of native 10GbE/25GbE for server connectivity, plus up to eight 40GbE or 100GbE ports for uplink connectivity, provide very low oversubscription of 1.5:1 from access to aggregation.

The QFX5120-48T supports dual-speed 1GbE/10GbE, also making it a perfect fit for top-of-rack deployments. The 48 native 10GbE RJ-45 copper ports for server connectivity, plus up to six 40GbE or 100GbE ports for uplink connectivity, provide unsubscribed (0.8:1) access-to-aggregation ratio.

The QFX5120-32C can also be used for high-density 25GbE server connectivity, with an option to break out the 100GbE ports into four 25GbE ports.

Data Center Spine

The QFX5120-32C, with 32 ports of 100GbE, serves as spine in small to medium-sized enterprise data centers. The QFX5120-32C, QFX5120-48Y, and QFX5120-48T can be deployed in a three-stage IP CLOS with EVPN-VXLAN overlay to support as many as 1500 server access ports.

The QFX5120 can operate in both cut-through and store-and-forward modes, delivering sustained wire-speed switching with sub-microsecond latency and low jitter for any packet size (including jumbo frames) in either mode. With features such as MC-LAG, the QFX5120 supports active/active server dual-homing and can use full bisectional bandwidth from server to switch.

Equipped with Junos OS, the QFX5120 supports the most advanced and robust routing capabilities in the industry, including RIP and OSPF for both IPv4 and IPv6, as well as advanced routing capabilities such as IS-IS and BGP. With additional capabilities such as 64-way equal-cost multipath (ECMP) and BGP add path, the QFX5120 is an ideal building block for deploying the most robust L3 underlay for SDN.

Features and Benefits

- **Automation**: The QFX5120 supports a number of network automation and plug-and-play operation features, including ZTP and event scripts, automatic rollback, and Python scripting.
- **Flexible forwarding table**: The QFX5120 switch includes a unified forwarding table (UFT), which allows the hardware table to be carved into configurable partitions of L2 media access control (MAC), L3 host, and longest prefix match (LPM) tables. In a pure L2 environment, the QFX5120 supports 288,000 MAC addresses. In L3 mode, the table can support 208,000 host entries. In LPM mode, it can support 351,000 prefixes. Junos OS provides configurable options through a CLI

that can optimize the QFX5120 for various deployment scenarios.

- **Intelligent buffer management**: The QFX5120 features a total of 32 MB of shared buffers. While 25% of the total buffer space is dedicated, the rest is shared among all ports and is user-configurable. The intelligent buffer mechanism in the QFX5120 effectively absorbs traffic bursts while providing deterministic performance, significantly increasing performance over static allocation
- **MPLS**: A broad set of MPLS features, including L3 VPN, IPv6 provider edge router (6PE), RSVP traffic engineering, and LDP allow standards-based network segmentation and virtualization, enabling the QFX5120 to be deployed as a low-latency MPLS label-switching router (LSR).
- **VXLAN overlays**: The QFX5120 switch is capable of both L2 and L3 gateway services. Customers can deploy overlay networks to provide L2 adjacencies for applications over L3 fabrics. The overlay networks use VXLAN in the data plane and EVPN or Open vSwitch Database (OVSDB) for programming the overlays, which can operate without a controller or be orchestrated with an SDN controller like Contrail® Enterprise Multicloud.

Junos Telemetry Interface

The QFX5120 supports Junos telemetry interface (JTI), a modern telemetry streaming tool designed for performance monitoring in complex, dynamic data centers. Streaming data to a performance management system enables network administrators to measure trends in link and node utilization, and troubleshoot such issues as network congestion in real time. JTI delivers the following features:

- Application visibility and performance management by provisioning sensors to collect and stream data and analyze application and workload flow paths through the network
- Capacity planning and optimization by proactively detecting hotspots and monitoring latency and microbursts
- Troubleshooting and root cause analysis via high-frequency monitoring and correlation of overlay and underlay networks

Monitoring and Analytics with Contrail Insights

Contrail Insights (formerly Juniper AppFormix®), a network and device monitoring platform, provides comprehensive visualization and smart analytics for the QFX5120 switch. Powered by machine learning and artificial intelligence, Contrail Insights automatically learns network and device performance profiles, detects faults, and facilitates preventative remediation in real time at scale.

Based on a distributed policy and analytics architecture, Contrail Insights seamlessly collects and analyzes telemetry in real time from the QFX5120 platform via JTI, generating events and alert notifications and providing the operator with actionable insights.

Contrail Insights delivers the following features and benefits:

- **Real-time metrics and alarms**: Contrail Insights collects and analyzes comprehensive metrics in real time for monitored networks and devices, displaying them in the Contrail Insights dashboard as real-time charts and graphs. With Contrail Insights, an operator can also configure alarms for individual or groups of metrics that are triggered when specific values or conditions are met, or when anomalies occur, notifying the operator in real time. Contrail Insights software plots these alarms on both real-time and historical charts, giving the operator a holistic view of current status as well as prevailing trends.
- **SLA Monitor**: The Contrail Insights dashboard includes an SLA Monitor pane that provides operators with an overview showing the current state of the network and devices. The service-level agreement (SLA) status indicates whether the network and the device are currently operating outside a user-defined performance threshold, while risk predicts whether the device may be unhealthy in the future based on historical trends.
- **Notifications**: Contrail Insights can be configured to notify external systems when events and alarms are triggered. For each event or alarm, Contrail Insights can post a structured description of the event as a JavaScript Object Notation (JSON) payload to an external HTTP endpoint. These notifications can initiate an action or workflow, whether corrective, preventive, or otherwise, to keep the network and devices operating in an optimal state. For operator convenience, Contrail Insights comes preconfigured with some of the industry's most popular incident management and collaboration platforms, including PagerDuty, ServiceNow, and Slack.
- **Reports**: Contrail Insights reports allow users to analyze how networks and devices are being consumed over time. The dashboard displays reports in both graphical and tabular formats. Users may also download the data as an HTML-formatted report, raw comma-separated values (CSV) file, or JSON-formatted statistics for further analysis.
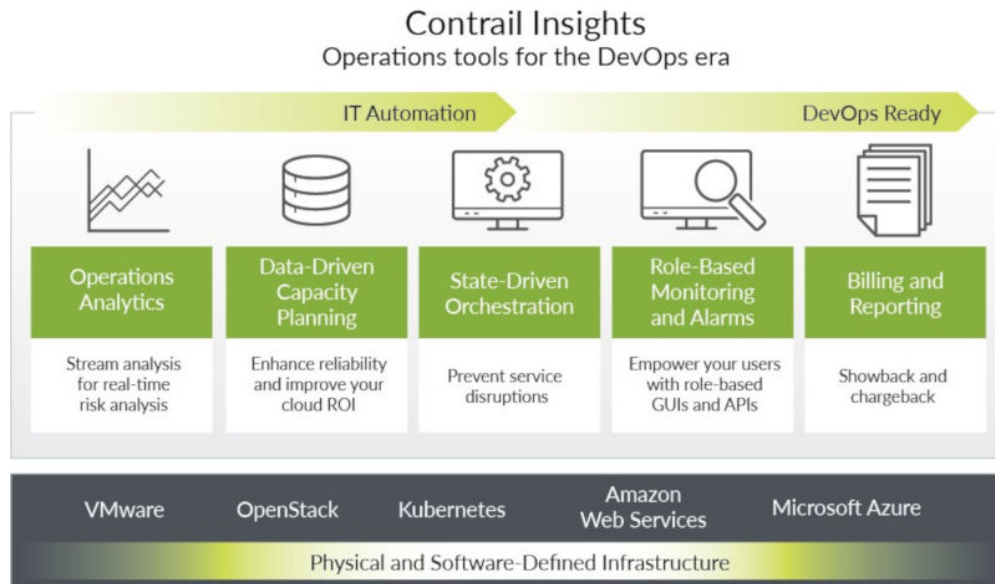
Figure 1: Contrail Insights overview

Contrail Enterprise Multicloud

Contrail Enterprise Multicloud is a single platform that handles all overlay and underlay management; heterogeneous compute environments, including bare-metal servers, virtual machines, containers, and networking devices; private and public clouds; networking and security orchestration policies, including microsegmentation; and advanced analytics.

Contrail Enterprise Multicloud automates data center fabrics built on the QFX5120-32C, QFX5120-48Y, and QFX5120-48T using a common and consistent data model for configuring devices.

Key capabilities include:

- Infrastructure, multicloud interconnect, and service life-cycle management
- Open, scalable, and standards-based support for protocols such as EVPN-VXLAN, BGP, Network Configuration Protocol/ remote procedure call (NETCONF/RPC), sFlow/gRPC/SNMP
- Autodiscovery, ZTP, zero-touch replacement (ZTR), and upgrades of data center fabrics including QFX5120 switches
- Overlay and underlay management from a single orchestration layer
- Seamless connection between legacy and cloud-native workloads
- Network and device topology discovery with role configuration
- BGP EVPN across QFX Series switches and virtual routers

QFX5120 Deployment Options

The following table shows just two of the many QFX5120 deployment possibilities.

Port Combinations	Switch	Deployment
48x10GbE + 8x40GbE	QFX5120-48Y	10GbE access or leaf
48x25GbE + 8x100GbE	QFX5120-48Y	25GbE access or leaf
48x10GbE + 6x40GbE	QFX5120-48T	10GbE access or leaf
48x10GbE + 6x100GbE	QFX5120-48T	10GbE access or leaf
32x100GbE	QFX5120-32C	25GbE access or leaf with 25GbE break out
32x100GbE	QFX5120-32C	100GbE spine

The following figures show various data center architectures where the QFX5120 serves as a network building block. In Figure 2, the QFX5120 is deployed as a leaf that is acting as an edge-routed gateway. In this topology, the VXLAN tunnel encapsulation and decapsulation take place on the QFX5120 leaf switches, while QFX5200-32C or QFX5210-64C spine switches are used as an IP transit. QFX5110-32Q switches can also be used in the spine to build a 40GbE fabric.
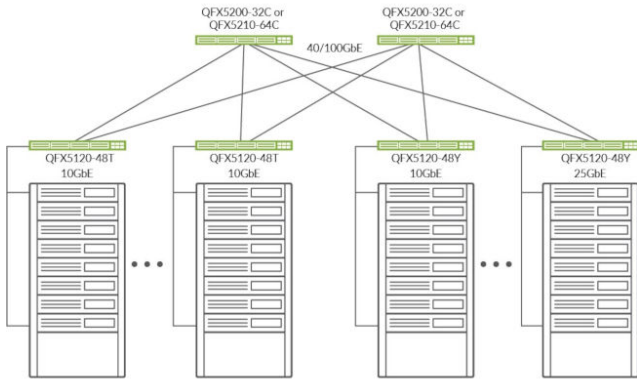
Figure 2: Edge-routed gateway at leaf with QFX5200-32C/QFX5210-64C as spine

In Figure 3, the QFX5120-48T and QFX5120-48Y are deployed as top-of-rack switches with QFX10000 or QFX5120-32C spine switches acting as centrally routed gateways. In this topology, the VXLAN tunnel encapsulation and decapsulation occur on the spine switches. In addition to the QFX5120-48T and QFX5120-48Y, QFX5110-32Q, QFX5110-48S, and QFX5120-32C switches (not shown in Figure 3) can also be configured as leaf nodes in this deployment.
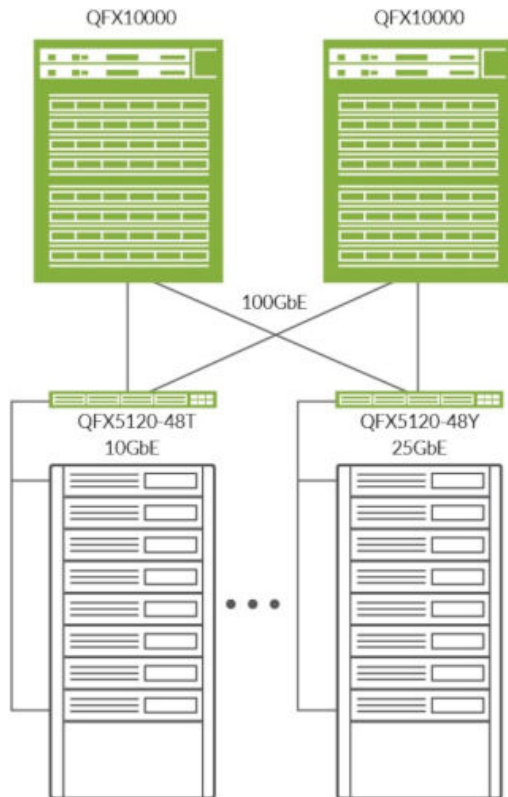

Figure 3: QFX5120-48Y and QFX5120-48T in a leaf-and-spine deployment

QFX5120 Switch Specifications

Hardware

Switching Capacity

- QFX5120-48Y: 4 Tbps (bidirectional)/1.31 Bpps
- QFX5120-48T: 2.16 Tbps (bidirectional)/1001.7 Mpps
- QFX5120-32C: 6.4 Tbps (bidirectional)/2 Bpps
- Switching mode (all models): Cut-through and store-and-forward

Weight

- QFX5120-48Y: 23.7 lb (10.75 kg)
- QFX5120-48T: 24.25 lb (11 kg)
- QFX5120-32C: 21.12 lb (9.58 kg)

Dimensions (H x W x D)

- QFX5120-48Y: 1.72 x 17.36 x 20.48 in (4.37 x 44.09 x 52.02 cm)
- QFX5120-48T: 1.72 x 17.36 x 20.48 in (4.37 x 44.09 x 52.02 cm)
- QFX5120-32C: 1.7 x 17.26 x 20.27 in (4.32 x 43.84 x 51.5 cm)

Power Consumption

- QFX5120-48Y
  - Max load: 450 W
  - Typical load: 260 W
- QFX5120-48T
  - Max load: 450 W
  - Typical load: 300 W
- QFX5120-32C
  - Max load: 515 W
  - Typical load: 380 W

Airflow

- Front-to-back (airflow out) for hot aisle deployment
- Back-to-front (airflow in) for cold aisle deployment

Interface Options

- QFX5120-48Y
  - 2 management ports: 2 x RJ-45 ports
  - 1GbE SFP: 48 (24 copper 1GbE)
  - 10GbE SFP+: 48/80 (with breakout cable)
  - 25GbE SFP: 48/80 (with breakout cable)
  - 40GbE QSFP+: 8 (each QSFP+ port can be configured as a 4 x 10GbE interface or as a 40 Gbps port)
  - 100GbE QSFP28: 8 (each QSFP28 port can be configured as a 4 x 25GbE interface or as a 100 Gbps port)
  - SFP GbE optical and copper module
  - SFP+ 10GbE optical modules
  - SFP+ direct attach copper (DAC) cables: 1/3/5 m twinax copper and 1/3/5/7 m active twinax copper
  - SFP28 DAC cables: 1/3 m twinax copper
  - SFP28 Optics: Short reach (SR), long reach (LR)
  - QSFP+ to SFP+: 10GbE direct attach breakout copper (1/3 m twinax copper cable)
- QFX5120-48T
  - 1 management port: 1 x RJ-45 port
  - 1GbE RJ45 (copper): 48 (each port is dual-speed supporting 1GbE/10GbE)
  - 40GbE QSFP+: 6 (ports 50 and 51 can be configured as a 4 x 10GbE interface or as 40 Gbps interfaces)
  - 100GbE QSFP28: 6 (ports 50 and 51 can be configured as a 4 x 25GbE interface or as 100 Gbps interfaces)
- QFX5120-32-C
  - 2 management ports: 2 x RJ-45 ports
  - 10GbE SFP+: 2 native ports plus 124 (with 4 x 10GbE breakout cable)
  - 25GbE SFP: 124 (with breakout cable)
  - 40GbE QSFP+: 32 (ports 0-30 can be configured as a 4 x 10GbE interface)
  - 100GbE QSFP28: 32 (ports 0-30 can be configured as a 4 x 25GbE interface)
  - SFP GbE optical and copper module
  - SFP+ 10GbE optical modules
  - SFP+ DAC cables: 1/3/5 m twinax copper and 1/3/5/7 m active twinax copper
  - SFP28 DAC cables: 1/3 m twinax copper
  - SFP28 Optics: SR, LR
  - QSFP+ to SFP+: 10GbE direct attach breakout copper (1/3 m twinax copper cable)

- Common to All Models
  - 1 USB 2.0 port
  - 1 RS-232 console port
  - Supported transceiver and direct attach cable
    - QSFP+ DAC cables: 1/3 m twinax copper
    - QSFP+ Optics: SR4, LX4, ESR4, ER4, LR4
    - QSFP28 Optics: SR4, ER4, PSM4, CWDM4, LR4

Rack Installation Kit

- Versatile four post mounting options for 19-in server rack or datacom rack

Airflow

- Redundant (N+1) and hot-pluggable fan modules for front-to-back and back-to-front airflow
- Redundant variable-speed fans to reduce power draw

Power Supply and Fan Modules

- Dual redundant (1+1) and hot-pluggable 650 W AC/DC power supplies
- 100-240 V single phase AC power
- -48 to -60 V DC power supply
- Redundant 4+1 (QFX5120-48Y and QFX5120-48T) or 5+1 (QFX5120-32C) and hot-pluggable fan modules for front-to-back or back-to-front airflow

Performance Scale (Unidimensional)

- MAC addresses per system: 288,000
- VLAN IDs: 4093
- Number of link aggregation groups (LAGs):
  - 80 (QFX5120- 48Y, QFX5120-32C)
  - 64 (QFX5120-48T)
- Number of ports per LAG: 64
- IPv4 unicast routes: 351,000 prefixes; 208,000 host routes; 64 ECMP paths
- IPv4 multicast routes: 104,000
- IPv6 unicast routes: 168,000 prefixes; 104,000 host routes
- IPv6 multicast routes: 52,000
- Address Resolution Protocol (ARP) entries: 64,000
- Jumbo frame: 9216 bytes
- Spanning Tree Protocol (STP)
  - Multiple Spanning Tree Protocol (MSTP) instances: 64
  - VLAN Spanning Tree Protocol (VSTP) instances: 509
- Traffic mirroring
  - Mirroring destination ports per switch: 4
  - Maximum number of mirroring sessions: 4
  - Mirroring destination VLANs per switch: 4

Software Features Supported

Layer 2 Features

- STP—IEEE 802.1D (802.1D-2004)
- Rapid Spanning Tree Protocol (RSTP) (IEEE 802.1w); MSTP (IEEE 802.1s)
- Bridge protocol data unit (BPDU) protect
- Loop protect
- Root protect
- RSTP and VSTP running concurrently
- VLAN—IEEE 802.1Q VLAN trunking
- Routed VLAN interface (RVI)
- Port-based VLAN
- Private VLAN (PVLAN)
- VLAN translation
- Static MAC address assignment for interface
- Per VLAN MAC learning (limit)
- MAC learning disable
- Link Aggregation and Link Aggregation Control Protocol (LACP) (IEEE 802.3ad)

Link Aggregation

- Multichassis link aggregation (MC-LAG)
- LAG load sharing algorithm—bridged or routed (unicast or multicast) traffic:
    - IP: Session Initiation Protocol (SIP), Dynamic Internet Protocol (DIP), TCP/UDP source port, TCP/UDP destination port
    - Layer 2 and non-IP: MAC SA, MAC DA, Ethertype, VLAN ID, source port

Layer 3 Features (IPv4)

- Static routing
    - Routing protocols (RIP, OSPF, IS-IS, BGP)
    - Virtual Router Redundancy Protocol (VRRP)
    - Bidirectional Forwarding Detection (BFD) protocol
    - Virtual router
    - Dynamic Host Configuration Protocol (DHCP) relay
    - Proxy Address Resolution Protocol (ARP)

Multicast Features

- Internet Group Management Protocol (IGMP): v1, v2, v3
- IGMP snooping: v1, v2, and v3 (Layer 2 only)
- IGMP Filter
- PIM-SM, PIM-SSM, PIM-DM
- Multicast Source Discovery Protocol (MSDP)

Security and Filters

- Secure interface login and password
- RADIUS
- TACACS+
- Ingress and egress filters: Allow and deny, port filters, VLAN filters, and routed filters, including management port filters
- Filter actions: Logging, system logging, reject, mirror to an interface, counters, assign forwarding class, permit, drop, police, mark
- SSH v1, v2
- Static ARP support
- Storm control, port error disable, and autorecovery
- Sticky MAC address
- DHCP snooping

Quality of Service (QoS)

- L2 and L3 QoS: Classification, rewrite, queuing
- Rate limiting:
    - Ingress policing: Single-rate two-color policer, two-rate three-color policer
    - Egress policing: Policer, policer mark down action
    - Egress shaping: Per queue on each port
- 10 hardware queues per port (8 unicast and 2 multicast)
- Strict-priority queuing (SPQ), shaped-deficit weighted round-robin (SDWRR), weighted random early detection (WRED), weighted tail drop
- 802.1p remarking
- Layer 2 classification criteria: Interface, MAC address, Ethertype, 802.1p, VLAN
- Congestion avoidance capabilities: WRED
- Trust IEEE 802.1p (ingress)
- Remarking of bridged packets

Data Center Bridging (DCB)

- Priority-based flow control (PFC)—IEEE 802.1Qbb
- Data Center Bridging Capability Exchange (DCBX), DCBX Fibre Channel over Ethernet (FCoE), and iSCSI type, length, and value (TLVs)

High Availability

- Bidirectional Forwarding Detection (BFD)
- Uplink failure detection

MPLS

- Static label-switched paths (LSPs)
- RSVP-based signaling of LSPs
- LDP-based signaling of LSPs
- LDP tunneling (LDP over RSVP)
- MPLS class of service (CoS)
- MPLS LSR support
- IPv6 tunneling (6PE) (via IPv4 MPLS backbone)
- IPv4 L3 VPN (RFC 2547, RFC 4364)

Server Virtualization Management and SDN-Related Protocols

- VXLAN OVSDB
- EVPN VXLAN

Management and Operations

- Role-based CLI management and access
- CLI via console, telnet, or SSH
- Extended ping and traceroute
- Junos OS configuration rescue and rollback
- Image rollback
- SNMP v1/v2/v3
- Junos XML management protocol
- sFlow v5
- Beacon LED for port and system
- ZTP
- OpenStack Neutron Plug-in
- Python
- Junos OS event, commit, and OP scripts
- JTI

Traffic Mirroring

- Port-based
- LAG port
- VLAN-based
- Filter-based
- Mirror to local
- Mirror to remote destinations (L2 over VLAN)

Standards Compliance

IEEE Standard

- IEEE 802.1D
- IEEE 802.1w
- IEEE 802.1
- IEEE 802.1Q
- IEEE 802.1p
- IEEE 802.1ad
- IEEE 802.3ad
- IEEE 802.1AB

- IEEE 802.3x
- IEEE 802.1Qbb
- IEEE 802.1Qaz

T11 Standards

- INCITS T11 FC-BB-5

Supported RFCs

- RFC 768 UDP
- RFC 783 Trivial File Transfer Protocol (TFTP)
- RFC 791 IP
- RFC 792 ICMP
- RFC 793 TCP
- RFC 826 ARP
- RFC 854 Telnet client and server
- RFC 894 IP over Ethernet
- RFC 903 RARP
- RFC 906 TFTP Bootstrap
- RFC 951 1542 BootP
- RFC 1058 Routing Information Protocol
- RFC 1112 IGMP v1
- RFC 1122 Host requirements
- RFC 1142 OSI IS-IS Intra-domain Routing Protocol
- RFC 1256 IPv4 ICMP Router Discovery Protocol (IRDP)
- RFC 1492 TACACS+
- RFC 1519 Classless Interdomain Routing (CIDR)
- RFC 1587 OSPF not-so-stubby area (NSSA) Option
- RFC 1591 Domain Name System (DNS)
- RFC 1745 BGP4/IDRP for IP—OSPF Interaction
- RFC 1772 Application of the Border Gateway Protocol in the Internet
- RFC 1812 Requirements for IP Version 4 Routers
- RFC 1997 BGP Communities Attribute
- RFC 2030 SNTP, Simple Network Time Protocol
- RFC 2068 HTTP server
- RFC 2131 BOOTP/DHCP relay agent and Dynamic Host
- RFC 2138 RADIUS Authentication
- RFC 2139 RADIUS Accounting
- RFC 2154 OSPF with Digital Signatures (Password, MD-5)
- RFC 2236 IGMP v2
- RFC 2267 Network ingress filtering
- RFC 2328 OSPF v2 (edge mode)
- RFC 2338 VRRP
- RFC 2362 PIM-SM (edge mode)
- RFC 2370 OSPF Opaque LSA Option
- RFC 2385 Protection of BGP Sessions via the TCP MD5 Signature Option
- RFC 2439 BGP Route Flap Damping
- RFC 2453 RIP v2

- RFC 2474 Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers
- RFC 2597 Assured Forwarding PHB (per-hop behavior) Group
- RFC 2598 An Expedited Forwarding PHB
- RFC 2697 A Single Rate Three Color Marker
- RFC 2698 A Two Rate Three Color Marker
- RFC 2796 BGP Route Reflection—An Alternative to Full Mesh IBGP
- RFC 2918 Route Refresh Capability for BGP-4
- RFC 3065 Autonomous System Confederations for BGP
- RFC 3376 IGMP v3 (source-specific multicast include mode only)
- RFC 3392 Capabilities Advertisement with BGP-4
- RFC 3446 Anycast RP
- RFC 3569 SSM
- RFC 3618 MSDP
- RFC 3623 Graceful OSPF Restart
- RFC 4271 Border Gateway Protocol 4 (BGP-4)
- RFC 4360 BGP Extended Communities Attribute
- RFC 4456 BGP Route Reflection: An Alternative to Full Mesh Internal BGP (IBGP)
- RFC 4486 Subcodes for BGP Cease Notification Message
- RFC 4724 Graceful Restart Mechanism for BGP
- RFC 4812 OSPF Restart Signaling
- RFC 4893 BGP Support for Four-octet AS Number Space
- RFC 5176 Dynamic Authorization Extensions to RADIUS
- RFC 5396 Textual Representation of Autonomous System (AS) Numbers
- RFC 5668 4-Octet AS Specific BGP Extended Community
- RFC 5880 Bidirectional Forwarding Detection (BFD) Dynamic Host Configuration Protocol (DHCP) server

Supported MIBs

- RFC 1155 SMI
- RFC 1157 SNMPv1
- RFC 1212, RFC 1213, RFC 1215 MIB-II, Ethernet-Like MIB and TRAPs
- RFC 1850 OSPFv2 MIB
- RFC 1901 Introduction to Community-based SNMPv2
- RFC 2011 SNMPv2 for Internet Protocol using SMIv2
- RFC 2012 SNMPv2 for the Transmission Control Protocol using SMIv2
- RFC 2013 SNMPv2 for the User Datagram Protocol using SMIv2
- RFC 2233 The Interfaces Group MIB using SMIv2
- RFC 2287 System Application Packages MIB
- RFC 2570 Introduction to Version 3 of the Internet-standard Network Management Framework

- RFC 2571 An Architecture for describing SNMP Management Frameworks (read-only access)
- RFC 2572 Message Processing and Dispatching for the SNMP (read-only access)
- RFC 2576 Coexistence between SNMP Version 1, Version 2, and Version 3
- RFC 2578 SNMP Structure of Management Information MIB
- RFC 2579 SNMP Textual Conventions for SMIv2
- RFC 2580 Conformance Statements for SMIv2
- RFC 2665 Ethernet-like Interface MIB
- RFC 2787 VRRP MIB
- RFC 2790 Host Resources MIB
- RFC 2819 RMON MIB
- RFC 2863 Interface Group MIB
- RFC 2932 IPv4 Multicast MIB
- RFC 3410 Introduction and Applicability Statements for Internet Standard Management Framework
- RFC 3411 An Architecture for Describing SNMP Management Frameworks
- RFC 3412 Message Processing and Dispatching for the SNMP
- RFC 3413 Simple Network Management Protocol (SNMP) Applications—(all MIBs are supported except the Proxy MIB
- RFC 3414 User-based Security Model (USM) for version 3 of SNMPv3
- RFC 3415 View-based Access Control Model (VACM) for the SNMP
- RFC 3416 Version 2 of the Protocol Operations for the SNMP
- RFC 3417 Transport Mappings for the SNMP
- RFC 3418 Management Information Base (MIB) for the SNMP
- RFC 3584 Coexistence between Version 1, Version 2, and Version 3 of the Internet-standard Network Management Framework
- RFC 3826 The Advanced Encryption Standard (AES) Cipher Algorithm in the SNMP User-based Security Model
- RFC 4188 Definitions of Managed Objects for Bridges
- RFC 4318 Definitions of Managed Objects for Bridges with Rapid Spanning Tree Protocol
- RFC 4363b Q-Bridge VLAN MIB

Approvals

Safety

- CAN/CSA-C22.2 No. 62368-1-14 Information Technology Equipment – Safety
- UL 62368-1 Information Technology Equipment – Safety
- EN 62368-1: 2014 Information Technology Equipment – Safety
- IEC 62368-1: 2014 2nd Edition Information Technology Equipment – Safety (All country deviations): CB Scheme

EMC

- EN 300 386 V1.6.1 (2012-09) Electromagnetic compatibility and Radio spectrum Matters (ERM) Telecommunication network equipment
- EN 300 386 V2.1.1 (2016-07) Telecommunication network equipment; EMC requirements; Harmonized Standard covering the essential requirements of the Directive 2014/30/EU
- EN 55032:2012 (CISPR 32:2012) Electromagnetic compatibility of multimedia equipment—Emission requirements
- EN 55024:2010 (CISPR 24:2010) Information technology equipment—Immunity characteristics—Limits and methods of measurement
- IEC/EN 61000 Immunity Test
- AS/NZS CISPR 32:2015 Australia/New Zealand Radiated and Conducted Emissions
- FCC 47 CFR Part 15 USA Radiated and Conducted Emissions
- ICES-003 Canada Radiated and Conducted Emissions
- VCCI-CISPR 32:2016 Japanese Radiated and Conducted Emissions
- BSMI CNS 13438 Taiwan Radiated and Conducted Emissions (at 10 meters)
- KN32/KN35 Korea Radiated Emission and Immunity Characteristics (at 10 meters)
- KN61000 Korea Immunity Test
- TEC/SD/DD/EMC-221/05/OCT-16 India EMC standard

Environmental Compliance

Restriction of Hazardous Substances (ROHS) 6/6

China Restriction of Hazardous Substances (ROHS)

Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)

Waste Electronics and Electrical Equipment (WEEE)

Recycled material

80 Plus Silver PSU Efficiency

Telco

- Common Language Equipment Identifier (CLEI) code

Environmental Ranges

- Operating temperature: 32° to 104° F (0° to 40° C)
- Storage temperature: -40° to 158° F (-40° to 70° C)
- Operating altitude: Up to 6000 ft (1829 m)
- Relative humidity operating: 5% to 90% (noncondensing)
- Relative humidity nonoperating: 0% to 95% (noncondensing)

Juniper Networks Services and Support

Juniper Networks leads the market in performance-enabling services designed to accelerate, extend, and optimize your deployments. Our services enable you to maximize operational efficiency, reduce costs, and minimize risk while achieving a faster time-to-value for your network.

By leveraging best practices from across the industry, you get the maximum levels of system performance, designed and delivered by the world's leading professional technology experts.

For more information, please visit www.juniper.net/us/en/products-services.

Installation and Implementation Service

Juniper Professional Services offers a Data Center Switching QuickStart program to ensure that the solution is operational and the customer has a complete understanding of areas such as configuration and ongoing operations. The QuickStart service provides an onsite consultant who works with the client team to quickly develop the initial configuration and deployment of a small Juniper Networks data center switching environment. A knowledge transfer session, which is intended as a review of local implementation and configuration options, is also included, but is not intended as a substitute for formalized training.

Ordering Information

Product	Description
Switch Hardware	
QFX5120-48Y-AFI2	QFX5120-48Y, 48x25GbE+8x100GbE, 1 U, AC airflow in
QFX5120-48Y-AFO2	QFX5120-48Y, 48x25GbE+8x100GbE, 1 U, AC airflow out
QFX5120-48Y-DC-AFI2	QFX5120-48Y, 48x25GbE+8x100GbE, 1 U, DC airflow in
QFX5120-48Y-DC-AFO2	QFX5120-48Y, 48x25GbE+8x100GbE, 1 U, DC airflow out
QFX5120-48T-AFI	QFX5120-48T, 48x10GbE+6x100GbE, 1 U, AC airflow in
QFX5120-48T-AFO	QFX5120-48T, 48x10GbE+6x100GbE, 1 U, AC airflow out
QFX5120-48T-DC-AFI	QFX5120-48T, 48x25GbE+6x100GbE, 1 U, DC airflow in
QFX5120-48T-DC-AFO	QFX5120-48T, 48x25GbE+6x100GbE, 1 U, DC airflow out
QFX5120-32C-AFI	QFX5120-32C, 32x100GbE, 1 U, AC airflow in
QFX5120-32C-AFO	QFX5120-32C, 32x100GbE, 1 U, AC airflow out
QFX5120-32C-DC-AFI	QFX5120-32C, 32x100GbE, 1 U, DC airflow in
QFX5120-32C-DC-AFO	QFX5120-32C, 32x100GbE, 1 U, DC airflow out
QFX5110-FANAFI	FANAFI fan model, back-to-front airflow
QFX5110-FANAFO	FANAFO fan model, front-to-back airflow
EX-4PST-RMK	4 post rack mount
Optics and Transceivers	
JNP-SFP-25G-SR	SFP28 25GBASE-SR Optics for up to 100 m transmission over serial multimode fiber-optic (MMF) OM4 fiber (QFX5120-48Y)
JNP-SFP-25G-LR	SFP28 25GBASE-SR Optics for up to 10 km transmission over serial single-mode fiber-optic (SMF) (QFX5120-48Y)
JNP-SFP-25G-DAC-1M	25GbE SFP to SFP copper cable, 1 m (QFX5120-48Y)
JNP-SFP-25G-DAC-3M	25GbE SFP to SFP copper cable, 3 m (QFX5120-48Y)
JNP-QSFP-100G-SR4	QSFP28 100GbE, SR4, 100 m (all models)
JNP-QSFP-100G-PSM4	QSFP28 100GBASE-PSM4 optics for up to 500 m transmission over parallel SMF (all models)
JNP-QSFP-100G-CWDM	QSFP28 100GbE, CWDM4, 2 km (all models)
JNP-QSFP-100G-LR4	QSFP28 100GbE, LR4, 10 km (all models)
JNP-100G-DAC-1M	QSFP28 to QSFP28 Ethernet Direct Attach Copper (twinax copper cable), 1 m (all models)
JNP-100G-DAC-3M	QSFP28 to QSFP28 Ethernet Direct Attach Copper (twinax copper cable), 3 m (all models)
JNP-100G-4X25G-1M	QSFP28 to SFP+ 25GbE Direct Attach Breakout Copper (twinax copper cable), 1 m (all models)
JNP-100G-4X25G-3M	QSFP28 to SFP+ 25GbE Direct Attach Breakout Copper (twinax copper cable), 3 m (all models)

Product	Description
Software Feature Licenses	
S-QFX5K-C1-A1-3	QFX5120 Advanced 1 (OSPF/BGP/ISIS/MC-LAG), three-year term license with support (QFX5120-48Y, QFX5120-48T)
S-QFX5K-C1-A2-3	QFX5120 Advanced 2 (Multicast, Virtual Chassis, EVPN-VXLAN), three-year term license with support (QFX5120-48Y, QFX5120-48T)
S-QFX5K-C1-P1-3	QFX5120 Premium 1 (RSVP, LDP, L3VPN), three-year term license with support (QFX5120-48Y, QFX5120-48T)
S-QFX5K-C1-A1-5	QFX5120 Advanced 1 (OSPF/BGP/ISIS/MC-LAG), five-year term license with support (QFX5120-48Y, QFX5120-48T)
S-QFX5K-C1-A2-5	QFX5120 Advanced 2 (Multicast, Virtual Chassis, EVPN-VXLAN), five-year term license with support (QFX5120-48Y, QFX5120-48T)
S-QFX5K-C1-P1-5	QFX5120 Premium 1 (RSVP, LDP, L3VPN), five-year term license with support (QFX5120-48Y, QFX5120-48T)
S-QFX5K-C2-A1-3	QFX5120 Advanced 1 (OSPF/BGP/ISIS/MC-LAG), three-year term license with support (QFX5120-32C)
S-QFX5K-C2-A2-3	QFX5120 Advanced 2 (Multicast, Virtual Chassis, EVPN-VXLAN), three-year term license with support (QFX5120-32C)
S-QFX5K-C2-P1-3	QFX5120 Premium 1 (RSVP, LDP, L3VPN), three-year term license with support (QFX5120-32C)
S-QFX5K-C2-A1-5	QFX5120 Advanced 1 (OSPF/BGP/ISIS/MC-LAG), five-year term license with support (QFX5120-32C)
S-QFX5K-C2-A2-5	QFX5120 Advanced 2 (Multicast, Virtual Chassis, EVPN-VXLAN), five-year term license with support (QFX5120-32C)
S-QFX5K-C2-P1-5	QFX5120 Premium 1 (RSVP, LDP, L3VPN), five-year term license with support (QFX5120-32C)

About Juniper Networks

Juniper Networks brings simplicity to networking with products, solutions and services that connect the world. Through engineering innovation, we remove the constraints and complexities of networking in the cloud era to solve the toughest challenges our customers and partners face daily. At Juniper Networks, we believe that the network is a resource for sharing knowledge and human advancement that changes the world. We are committed to imagining groundbreaking ways to deliver automated, scalable and secure networks to move at the speed of business.

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