

# QFX3600 Switch



## Product Overview

The Juniper Networks QFX3600 switch is a high-performance, low latency, feature rich, 40GbE /10GbE platform that delivers a fabric-ready edge solution for the Juniper Networks QFabric System. Featuring standards-based bridging, routing, and Fibre Channel over Ethernet (FCoE) capabilities in a compact 1 U form factor, the QFX3600 is also a versatile Layer 2 and Layer 3 standalone data center top-of-rack switch.

## Product Description

The Juniper Networks® QFX3600 Switch is the first 40GbE top-of-rack switch in the Juniper Networks switching portfolio, providing a 40GbE/10GbE QFabric Node edge solution for the Juniper Networks QFabric™ System. In standalone switch mode, the QFX3600 addresses a wide range of deployment scenarios, including traditional data centers, virtualized data centers, high-performance computing, network-attached storage, converged server I/O, and cloud computing.

Featuring 16 quad small form-factor pluggable (QSFP+) transceiver ports, the QFX3600 delivers feature rich Layer 2 and Layer 3 connectivity to networked devices such as rack servers, blade servers, storage systems, and other switches in highly demanding, high-performance data center environments. When deployed with other components of the Juniper Networks QFabric family, including the QFX3100 Director and the QFX3600-I QFabric Interconnect (in a QFX3000-M QFabric System) or QFX3008-I QFabric Interconnect (in a QFX3000-G QFabric System), the QFX3600 delivers a fabric-ready QFabric Node edge solution that contributes to a high-performance, low latency, single-tier data center fabric. A highly flexible device, the QFX3600 can also be deployed as part of a Juniper Networks Virtual Chassis or Virtual Chassis Fabric configuration, or in open fabric architectures such as MC-LAG.

For added configuration flexibility, when operating in standalone switch mode, QFX3600 ports can be used as 4x10GbE ports using QSFP+ to SFP+ direct attach copper (DAC) or QSFP+ to SFP+ fiber splitter cables and optics. When operating as a QFabric Node in a QFabric System, the QFX3600 becomes a 10GbE or 40GbE edge device.

Any port on the QFX3600 can be converted to a Virtual Chassis connection, enabling users to leverage all the benefits of Juniper's unique Virtual Chassis technology, including high availability and simplified management and operations. When deployed as a leaf node in Juniper's new Virtual Chassis Fabric architecture, the QFX3600 offers deterministic rack-to-rack throughput, high availability and a smooth transition from 1GbE to 10/40GbE. The QFX3600 can participate in the same Virtual Chassis or Virtual Chassis Fabric configuration with Juniper QFX3500, QFX5100 and EX4300 switches.

For converged server edge access environments, the QFX3600 is also a standards-based FCoE transit switch, protecting investments in existing data center aggregation and Fibre Channel storage area network (SAN) infrastructures.

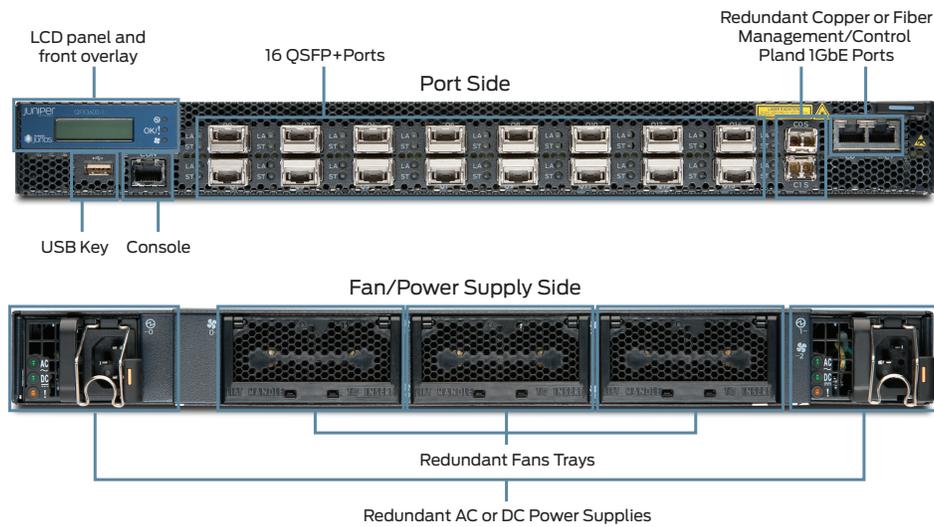


Figure 1: QFX3600 Switch

### Data Center Deployments

Today's data centers are built with high-performance, small form-factor, multi-core blade and rack servers. The greater compute capacity and server densities enabled by these devices is increasing traffic levels, creating the need for a high-speed, low latency, storage- and I/O-converged networking solution that can maximize performance for physical servers, virtual servers, and storage in the data center.

The QFX3600 switch delivers the ultra low latency, lossless high-density 10GbE and 40GbE interfaces to connect to infrastructure transitioning from 10GbE to 40GbE—all in a compact form factor designed to support high-performance converged data center access networks. The QFX3600's low power consumption optimizes the switch's power use effectiveness (PUE) ratio to reduce data center operating costs, while front-to-back and back-to-front air flow meets hot and cold aisle isolation requirements.

The QFX3600 is an ideal platform for:

- Fabric edge deployments in the Juniper Networks QFabric or Virtual Chassis Fabric architectures
- 40GbE aggregation switch deployments in a two-tier switching infrastructure
- High-performance Ethernet L2 and L3 access environments

### QFabric Architecture and Key Components

The QFX3600 delivers a fabric-ready solution that serves as a building block for the Juniper Networks QFabric architecture. The QFX3600 is the only 40GbE switch in the industry that can work as a standalone 10GbE/40GbE switch in a two-tier data center networking infrastructure as well as provide a fabric edge 10GbE/40GbE solution in a single tier QFabric architecture.

The QFX3600 switch can be used in both QFX3000-M as well as QFX3000-G systems as a 10GbE/40GbE QFabric Node.

### QFX3600 in a QFX3000-M System

The QFX3000-M is an entry-level QFabric System that scales to 16 QFabric Nodes with the 1 U QFX3600-I QFabric Interconnect. Both the QFX3500 Switch and QFX3600 switch can be used as QFabric Nodes in a QFX3000-M QFabric System.

When used in a QFX3000-M system, a single QFX3600 platform can provide up to 56 10GbE ports, or 48 10GbE ports and 32 GbE ports using QFSP+ to 4x10 SFP+ breakout direct attach copper (DAC) cables. A flexible device, the QFX3600 can support two, four, or eight uplinks to the QFX3600-I Interconnect, configured by the user. The default number of uplinks on the QFX3600 switch is four when used as a QFabric Node. In a QFX3000-M, any combination of QFX3500 and QFX3600 QFabric Nodes can be supported. If QFX3600 Nodes are used exclusively, the QFX3000-M system can scale to support 896 10GbE ports. When eight uplinks are used on the QFX3600 QFabric Node to connect to the QFX3600-I Interconnect, the QFX3600 can support up to 32 ports of non-oversubscribed 10GbE ports for a total of 256 wire-speed ports in a 16-node QFX3000-M system.

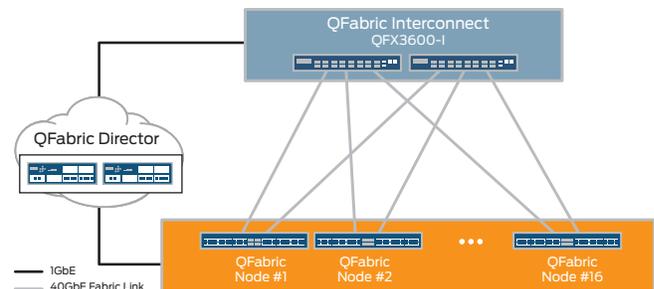


Figure 2: QFX3000-M System with mix of QFX3500 and QFX3600 QFabric Nodes

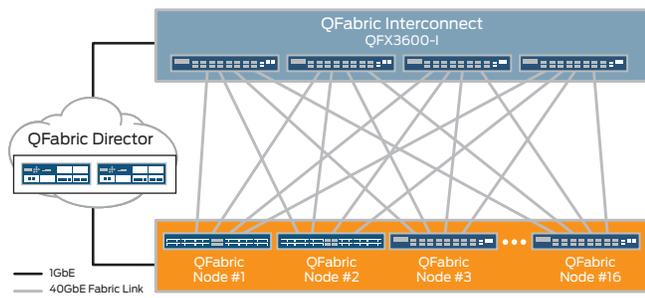


Figure 3: QFX3000-M System with four QFX3600-I QFabric Interconnects and mix of QFX3500 and QFX3600 QFabric Nodes

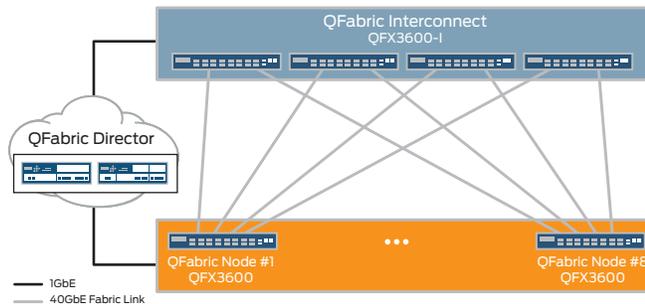


Figure 4: Wire-speed configuration of QFX3000-M System with eight QFX3600 QFabric Nodes

### QFX3600 in a QFX3000-G System

The QFX3000-G is a large-scale QFabric System that scales to 128 QFabric Nodes using the modular QFX3008-I QFabric Interconnect. Both QFX3500 and QFX3600 switches can be used as QFabric Nodes in a QFX3000-G system.

When configured exclusively with 64 QFX3600 Nodes, the QFX3000-G is the industry's only switch that can scale to support 2,048 wire-speed 10GbE ports in a single switch.

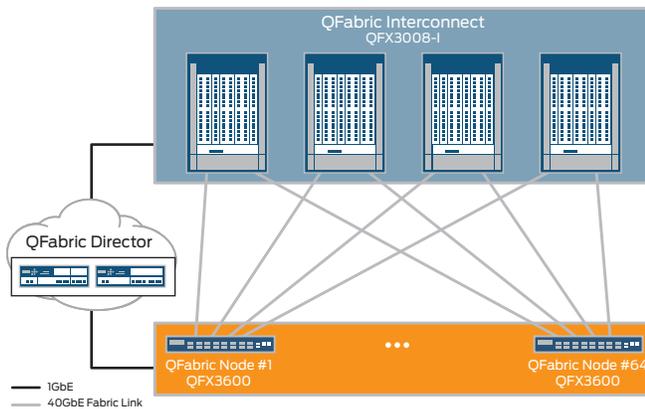


Figure 5: Wire-speed configuration of QFX3000-G System with 64 QFX3600 QFabric Nodes

### Virtual Chassis Technology

The QFX3600 supports Juniper Networks' unique Virtual Chassis technology, which enables up to 10 interconnected switches to be managed and operated as a single, logical device with a single IP address. Virtual Chassis technology enables enterprises to separate physical topology from logical groupings of endpoints and, as a result, provides efficient resource utilization. All QFX3600 switches can participate in the same Virtual Chassis configuration with any combination of EX4300, QFX3500 and QFX5100 Ethernet switches, delivering highly flexible and scalable configuration options for data center deployments.

### QFX3600 in a Virtual Chassis Fabric Architecture

Existing Virtual Chassis technology is further scaled and enhanced to support a spine-and-leaf topology that is ideal for high-performance, low-latency data center deployments. In its first instance, this topology, called Virtual Chassis Fabric, enables up to 20 QFX Series or EX Series switches to be deployed in a spine-and-leaf configuration, with two to four QFX5100s in the spine and up to 18 QFX3600, QFX3500, QFX5100 or EX4300 switches as leaf nodes. This architecture provides any rack-to-any rack deterministic throughput and low latency while simplifying network operations through a single point of management.

The QFX3600, along with the EX4300, QFX3500 and QFX5100 switches, can act as leaf nodes in a Virtual Chassis Fabric deployment, providing support for data centers with mixed 1GbE, 10GbE and 40GbE servers, as well as environments transitioning from 1GbE to 10GbE or 40GbE servers.

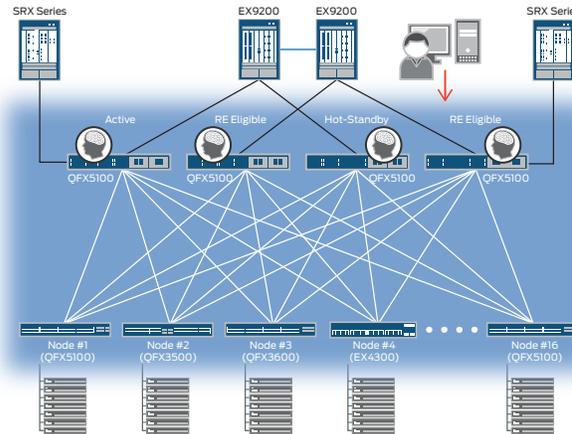


Figure 6: Virtual Chassis Fabric data center deployment with a mix of 1GbE and 10GbE

### 40GbE Aggregation Switch in a Two-Tier Switching Infrastructure

The QFX3600 switch is also designed for use in two-tier data center designs. The QFX3600 can be used in Layer 3 access deployments using equal-cost multipath (ECMP) with any standardized L3 routing protocols or Juniper multichassis link aggregation (MC-LAG) technology. Using ECMP, each switch can aggregate up to 64 access switches over 10GbE, or 16 access

switches over 40GbE. Using MC-LAG technology, the QFX3600 can be used in either access or aggregation modes, dual-homing the 10GbE/40GbE servers or dual-homing the access switches when used in aggregation.

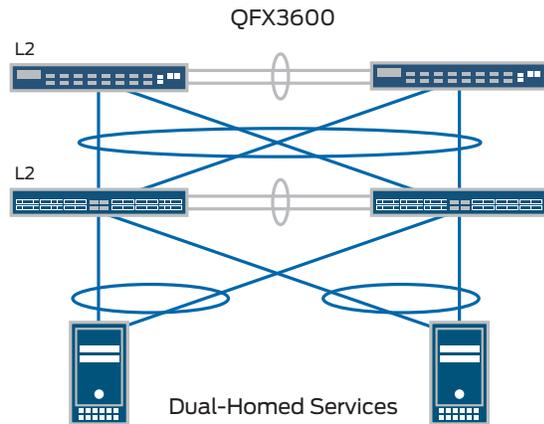


Figure 7: QFX3600 in a two-tier MC-LAG design

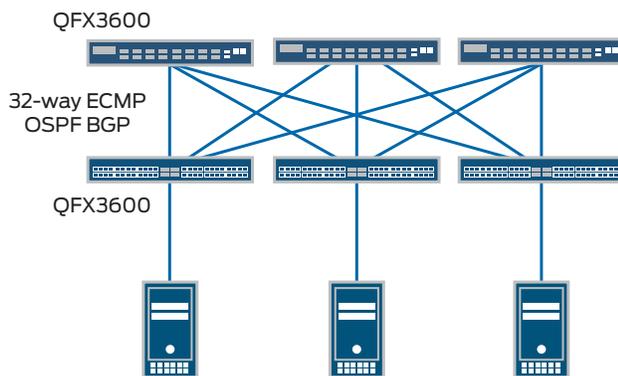


Figure 8: QFX3600 in a two-tier ECMP design

## High-Performance Ethernet Access L2 and L3 Deployments

With its compact, 1 U form factor, high-density 40GbE/10GbE ports, front-to-back and back-to-front airflow, and rear port design, the QFX3600 is the ideal platform for top-of-rack deployments in high-performance, highly demanding data centers. Featuring 1.28 Tbps throughput, 960 Mpps forwarding capacity, low power consumption, and a form factor that makes it ideal for use in containerized data centers, the QFX3600 offers a highly efficient solution for aggregating high-performance servers in the data center while providing a path to 40GbE. The QFX3600 can operate in both cut-through and store-and-forward modes, and the switch delivers sustained wire-speed switching with sub-second latency and low jitter for any packet size (including jumbo frames) in either mode.

## Junos Operating System

The QFX3600 switch runs the same reliable and high-performance Juniper Networks Junos® operating system that is used by Juniper Networks EX Series Ethernet Switches, Juniper routers, and Juniper Networks SRX Series Services Gateways. By utilizing a common operating system, Juniper delivers a consistent implementation and operation of control plane features across products. To maintain that consistency, Junos OS adheres to a highly disciplined development process, follows a single release track, and employs a highly available modular architecture that prevents isolated failures from bringing down an entire system. These attributes are fundamental to the core value of the software, enabling Junos OS-powered products to be updated simultaneously with the same software release. Features are fully regression tested, making each new release a superset of the previous version. Customers can deploy the software with confidence that existing capabilities will be maintained and operate consistently.

## Management Features

The following system management capabilities are available for the QFX3600 switch.

- The standard Junos OS command-line interface (CLI) and SNMP module offers the same granular management capabilities and scripting parameters found in any router or switch powered by Junos OS.
- QFX3600 fault, performance, and configuration data can also be exported to leading third-party management systems such as HP OpenView, IBM Tivoli, and Computer Associates Unicenter software, providing a complete, consolidated view of network operations.
- The QFX3600 is supported by Juniper Networks Junos Space, an open, programmable application platform for hosting a comprehensive suite of network operational application tools that provide an open approach for automating the deployment and operation of a Juniper infrastructure. Explicitly designed to allow partners and customers to build and deploy smart, simple, and easy to use applications, Junos Space provides multiple management and infrastructure applications for managing Juniper resources and assets such as inventory management, device and interface configuration, automated software management and deployment, and event-driven fault management. These Junos Space applications offer predefined automation schemes and best practice templates to enable rapid and accurate deployments.
- The QFX3600 also supports the Junos XML management protocol and Junos XML management protocol automation tools. Junos XML management protocol facilitates the quick and easy development of custom applications and scripts using the XML programming language. Junos XML management protocol automation tools provide early detection and automatic resolution of potential problems related to the operating system.

## Features and Benefits

The QFX3600 switch includes the following key features and benefits:

- **Performance:** The QFX3600 delivers 1.28 Tbps of throughput and 960 Mpps of switching capacity to sustain wire-speed switching with low latency and low jitter. All ports can run at full wire-speed capacity with full performance in both Layer 2 and Layer 3 mode, with the option to operate in either cut-through or store-and-forward mode. BFD support for routing protocols ensures fast convergence and provides failure detection on any kind of path between switches, including direct and indirect Layer 3 links.
- **Rich QoS:** The QFX3600 is designed for general-purpose 10GbE as well as iSCSI, NAS, and FCoE deployments. The QFX3600 supports rich QoS functionality in hardware, including multiple dedicated hardware queues for unicast and multicast traffic, a sophisticated two-tier scheduler, and rich QoS functionality delivered via Junos software, which includes classification, marking, policing and shaping functionality. A dynamic buffer (9MB) allocation scheme with both dedicated and pooled buffer spaces allows the switch to react to congestion and short periods of microbursts across ports and priorities while supporting fairness lossless forwarding.
- **Reliability:** The QFX3600 is designed with robust high availability features that include redundant AC and DC power supplies and fan modules to ensure hardware availability. Control plane and data plane separation, combined with the Junos OS high availability design, ensures maximum system-level availability.
- **Server Virtualization:** The QFX3600 switch supports a large media access control (MAC) address table that enables large-scale server virtualization deployment. The QFX3600 is also supported by Junos Space Virtual Control, which unifies physical and virtual infrastructures to provide network operators with a comprehensive view into the complete end-to-end network. In addition, the QFX3600 switch supports the IEEE 802.1Qbg standard, hairpin forwarding, to enable Virtual Ethernet Port Aggregator (VEPA) deployment.
- **Automation:** The QFX3600 switches support a number of features for network automation and plug-and-play operations. Features include zero-touch provisioning, operations and event scripts, and atomic rollback. The switch also offers support for integration with VMware vCenter, Puppet, and OpenStack.
- **Intelligent Buffer Management:** The QFX3600 switches have a total of 8MB 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 QFX3600 effectively absorbs traffic bursts while providing deterministic performance, significantly increasing performance over static allocation.
- **Insight Technology for Analytics:** The QFX3600 provides dynamic buffer utilization monitoring and reporting with an interval of 8 microseconds to provide microburst and latency insight. It calculates both queue depth and latency, and logs messages when configured thresholds are crossed. Interface traffic statistics for both unicast and multicast traffic can be monitored at one-second granularity. The data can be viewed via CLI, system log, or streamed to external servers for more analysis. Supported reporting formats include Java Script Object Notification (JSON), CSV and TSV. These files can be consumed by orchestration systems, SDN controllers, or network management applications (such as Juniper Networks Junos Space Network Director) to make better network design decisions and identify network hotspots.
- **MPLS:** QFX3600 switches support a broad set of MPLS features, including L3 VPN, IPv6 provider edge router (6PE), RSVP traffic engineering, and LDP to allow standards-based network segmentation and virtualization. The QFX3600 can be deployed as a low-latency MPLS label-switching router (LSR) or MPLS PE router in smaller scale environments.
- **FCoE:** As a Fibre Channel over Ethernet (FCoE) transit switch, the QFX3600 provides an IEEE data center bridging (DCB) converged network between FCoE-enabled servers and an FCoE-enabled Fibre Channel storage area network (SAN). The QFX3600 offers a full-featured DCB implementation that provides strong monitoring capabilities on the top-of-rack switch for SAN and LAN administration teams to maintain clear separation of management. In addition, FCoE Initiation Protocol (FIP) snooping provides perimeter protection, ensuring that the presence of an Ethernet layer does not impact existing SAN security policies. FCoE link aggregation group (LAG) active/active support is available to achieve resilient (dual-rail) FCoE connectivity.  
  
The FCoE transit switch functionality, including priority-based flow control (PFC), Enhanced Transmission Selection (ETS), and Data Center Bridging Capability Exchange (DCBX), are included as part of the default software.
- **Energy Efficiency and Environmental Friendliness:** The QFX3600 is an environmentally conscious green solution that lowers operational expenses. The switch consumes less than 4 watts per 10GbE port, while variable speed fans dynamically adjust their speed based on ambient temperature to optimize operating power. With maximum power consumption of 345 W and nominal power of 255 W, the QFX3600 is certified for Silver PSU Efficiency at 85%.  
  
The QFX3600 is also certified for environmentally responsible compliance with labels such as Reduction of Hazardous Substances (ROHS); Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH); and Waste Electronics and Electrical Equipment (WEEE).

## Specifications

### Hardware

#### System

- Switching capacity: 1.28 Tbps and 960 Mpps switching capacity
- Switching mode: Cut-through and store-and-forward
- Weight: 30.8 lb (14 kg) with dual power supplies and fan modules
- Front-to-back and back-to-front airflow
- Rear port connections

#### Interface Options

- 16 QSFP+ ports
- Dual management ports (copper or fiber)
- USB port
- Console port

#### Supported Transceiver and Direct Attach Cable

- QSFP+ DAC cables: 1/3 m twinax copper
- QSFP+ to 4X10 SFP+ breakout DAC cables: 1/3 m twinax copper
- QSFP+ 40GbE SR4 optic

#### Dimension

- Height: 1.74 in (4.4 cm), 1 U
- Width: 17 in (43.2 cm)
- Depth: 19.4 in (49.3 cm)

#### Rack Installation Kit

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

#### Display and Ports

- LCD panel for system monitoring

#### Airflow

- Front-to-back cooling
- Back-to-front cooling
- Redundant variable-speed fans to reduce power draw

#### Power Supply and Fan Modules

- Dual redundant (1+1) and hot-pluggable power supplies
- 110–240 V single phase AC power or DC power
- Redundant and hot-pluggable fan modules

#### Heat Dissipation

- Maximum: 1,177 BTU
- Nominal: 870 BTU

#### Operational Mean Time Between Failures (MTBF)

- 87 Khrs

#### Performance Scale

- MAC addresses per system: 120,000
- VLAN IDs: 4,095 active, 4,089 configurable
- Number of link aggregation groups (LAGs): 48
- Number of ports per LAG: 32
- Firewall filters: 1,500
- IPv4 unicast routes: 16,000 prefixes; 8,000 host routes
- Multicast groups: 3,500

- Jumbo frame: 9,216 bytes
- Spanning Tree Protocol (STP)
  - Multiple Spanning Tree Protocol (MSTP) instances: 64
  - VLAN Spanning Tree Protocol (VSTP) instances: 253
- Traffic mirroring
  - Mirroring destination ports per switch: 4
  - Maximum number of mirroring sessions: 4
  - Mirroring destination VLANs per switch: 4

#### 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
- MAC address filtering
- 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)
- IEEE 802.1AB Link Layer Discovery Protocol (LLDP)
- Jumbo frame (9,216 bytes)

#### Link Aggregation

- 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
  - FCoE packet: Source ID (SID), Destination ID (DID), Originator exchange ID (OXID), source port

#### Layer 3 Features (IPv4)

- Static routing
- Routing policy
- Routing protocols (OSPF, BGP)
- Virtual Router Redundancy Protocol (VRRP)
- Dynamic Host Configuration Protocol (DHCP) relay

#### Multicast Features

- Internet Group Management Protocol (IGMP) v1/2/3
- IGMP snooping v1/2/3
- L3 multicast routing protocols PIM sparse mode, PIM source-specific multicast
- Multicast Source Directory Protocol (MSDP)
- Anycast RP
- Static RP
- Protocol Independent Multicast bootstrap router (PIM BSR)

## Security and Filters

- Secure interface login and password
- RADIUS
- TACACS+
- Ingress and egress filters: Allow and deny, port filters, VLAN filters, routed filters
- Filter actions: Logging, system logging, reject, mirror to an interface, counters, assign forwarding class, permit, drop, police, mark
- SSH v1, v2
- Static Address Resolution Protocol (ARP) support
- Storm control, port error disable, and autorecovery
- Control plane denial-of-service (DoS) protection

## Quality of Service (QoS)

- L2 QoS: Classification, rewrite, queuing
- L3 QoS
- Rate limiting:
  - Ingress policing: 1 rate 2 color, 2 rate 3 color
  - Egress policer, policer mark down action
  - Egress shaping: Per queue, per port
- 12 hardware queues per port (8 unicast and 4 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/DSCP (ingress)
- Remarking of bridged packets

## Data Center Bridging (DCB)

- Priority-based Flow Control (PFC)—IEEE 802.1Qbb
- Enhanced Transmission Selection (ETS)—IEEE 802.1Qaz
- Data Center Bridging Exchange Protocol (DCBX)—part of the ETS standard
- Ethernet Congestion Management (QCN)—IEEE 802.1Qau\*

## Fibre Channel over Ethernet (FCoE)

- FCoE transit switch (FIP snooping)

## Server Virtualization Management

- Junos Space Virtual Control
- IEEE 802.1Qbg\*

## Virtual Chassis

- 40GbE and 10GbE as Virtual Chassis ports
- Virtual Chassis RE election
- Virtual Chassis pre-provisioning (plug-and-play)
- Auto-LAG formation of Virtual Chassis ports
- FCoE transit across Virtual Chassis members
- QoS on Virtual Chassis ports
- Local Designated Forwarding\*
- NSSU

- Graceful Restart (GRES)
- Non-stop Routing (NSR)\*
- Non-stop Bridging (NSB)\*

## MPLS

- Static LSPs
- RSVP-based signaling of LSPs
- LDP-based signaling of LSPs
- LDP Tunneling (LDP over RSVP)
- MPLS CoS
- MPLS ACL/Policers
- MPLS LSR Support
- IPv6 Tunneling (6PE) (via IPv4 MPLS backbone)
- MPLS OAM - LSP ping
- IPv4 L3 VPN (RFC 2547, 4364)

## Management and Operations

- Role-based CLI management and access
- CLI via console, telnet, or SSH
- Show and debug commands, statistics
- Extended ping and traceroute
- Junos OS configuration rescue and rollback
- Image rollback
- SNMP v1/v2/v3
- Junos XML management protocol
- Zero Touch Provisioning (ZTP)
- OpenStack Neutron Plug-in
- Puppet

## 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 802.3ad
- IEEE 802.1AB
- IEEE 802.3x
- IEEE 802.1Qbb
- IEEE 802.1Qaz
- IEEE 802.1Qau\*
- IEEE 802.1Qbg\*

\* Roadmap

## T11 Standards

- INCITS T11 FC-BB-5

## Supported RFC

- 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 Reverse Address Resolution Protocol (RARP)
- RFC 906 TFTP Bootstrap
- RFC 951, RFC 1542 BootP
- RFC 1122 Host requirements
- RFC 1256 IPv4 ICMP Router Discovery (IRDP)
- RFC 1492 TACACS+
- RFC 1519 Classless Interdomain Routing (CIDR)
- RFC 1812 Requirements for IP Version 4 routers
- RFC 2030 SNTP, Simple Network Time Protocol
- RFC 2068 HTTP server
- RFC 2138 RADIUS Authentication
- RFC 2139 RADIUS Accounting
- RFC 2267 Network ingress filtering
- RFC 5176 Dynamic Authorization Extensions to RADIUS

## Supported MIBs

- RFC 1155 SMI
- RFC 1157 SNMPv1
- RFC 1212, RFC 1213, RFC 1215 MIB-II, Ethernet-Like MIB and TRAPs
- RFC 1901 Introduction to Community-based SNMPv2
- RFC 2011 SNMPv2 for Internet protocol using SMIv2
- RFC 2012 SNMPv2 for transmission control protocol using SMIv2
- RFC 2013 SNMPv2 for 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 2790 Host Resources MIB
- RFC 2819 RMON MIB
- RFC 2863 Interface Group 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)—(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. 60950-1 (2007) Information Technology Equipment - Safety
- UL 60950-1 (2nd Ed.) Information Technology Equipment—Safety
- EN 60950-1 (2006) Information Technology Equipment—Safety
- IEC 60950-1 (2005) Information Technology Equipment—Safety (All country deviations): CB Scheme report.
- EN 60825-1 +A1+A2 (1994) Safety of Laser Products - Part 1: Equipment Classification

### EMC

- FCC 47CFR, Part 15 Class A (2009) USA Radiated Emissions
- EN 55022 Class A (2006)+ A1 2007 European Radiated Emissions
- VCCI Class A (2007) Japanese Radiated Emissions
- AS/NZS CISPR22:2009
- EN 300 386 V1.5.1 Telecom Network Equipment
- EN 55024:1998/A2:2003 Information Technology Equipment Immunity Characteristics

## NEBs Compliance

- GR-63-Core (2006) Network Equipment, Building Systems (NEBS) Physical Protection
- GR-1089-Core Issues 3 (2011) EMC and Electrical Safety for Network Telecommunications Equipment
- SR-3580 (1995) NEBS Criteria Levels (Level 3)

## 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 2,000
- Relative humidity operating: 5% to 90% (non-condensing)
- Relative humidity non-operating: 0% to 95% (non-condensing)

## Juniper Networks Services and Support

Juniper Networks leads the market in performance-enabling services designed to accelerate, extend, and optimize your high-performance QFabric System. 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 QFabric performance, designed and delivered by the world's leading professional QFabric service experts.

For more information, please visit [www.juniper.net/us/en/products-services](http://www.juniper.net/us/en/products-services).

## Ordering Information

The QFX3600 switch is a build-to-order system. When ordering, customers must choose from the following options:

- Airflow direction (AFI or AFO)
- Type of power supply (AC or DC)
- If power supply type is AC, power cable must be chosen based on the destination country
- Transceivers (QSFP+) and direct-attached copper
- Maintenance services

Model Number	Description
<b>Base Hardware</b>	
QFX3600-16Q-AFI	QFX3600 16-port QSFP+ switch with three fans and field-replaceable unit (FRU) side to port side air flow. Power supplies (2 required) and power cables (2 required) not included.
QFX3600-16Q-AFO	QFX3600 16-port QSFP switch with three fans and port side to FRU side air flow. Power supplies (2 required) and power cables (2 required) not included.
QFX3600-16Q-ACR	QFX3600 16-port QSFP+ switch with three fans, FRU side to port side air flow and redundant AC power supplies
QFX3600-16Q-ACRB	QFX3600 16-port QSFP+ switch with three fans, port side to FRU side air flow and redundant AC power supplies
<b>Spares</b>	
JPSU-650W-AC-AFI	Juniper 650 W AC power supply for EX4550, QFX3500, and QFX3600 (PSU side airflow intake)
JPSU-650W-AC-AFO	Juniper 650 W AC power supply for EX4550, QFX3500, and QFX3600 (PSU side airflow exhaust)
JPSU-650W-DC-AFI	Juniper 650 W DC power supply for EX4550, QFX3500, and QFX3600 (PSU side airflow intake)
JPSU-650W-DC-AFO	Juniper 650 W DC power supply for EX4550, QFX3500, and QFX3600 (PSU side airflow exhaust)
CBL-EX-PWR-C13-AR	AC power cable—Argentina (10 A/250 V, 2.5 m)
CBL-EX-PWR-C13-AU	AC power cable—Australia (10 A/250 V, 2.5 m)
CBL-EX-PWR-C13-BR	AC power cable—Brazil (10 A/250 V, 2.5 m)
CBL-EX-PWR-C13-C14	AC power cable, patch cord (10 A/250 V, 2.5 m) for EU only
CBL-EX-PWR-C13-CH	AC power cable—China (10 A/250 V, 2.5 m)
CBL-EX-PWR-C13-EU	AC power cable—Europe (10 A/250 V, 2.5 m)
CBL-EX-PWR-C13-IL	AC power cable—Israel (10 A/250 V, 2.5 m)
CBL-EX-PWR-C13-IN	AC power cable—India (6 A/250 V, 2.5 m)
CBL-EX-PWR-C13-IT	AC power cable—Italy (10 A/250 V, 2.5 m)
CBL-EX-PWR-C13-JP	AC power cable—Japan (12 A/125 V, 2.5 m)
CBL-EX-PWR-C13-KR	AC power cable—Korea (10 A/250 V, 2.5 m)
CBL-EX-PWR-C13-SA	AC power cable—South Africa (10 A/250 V, 2.5 m)
CBL-EX-PWR-C13-SZ	AC power cable—Switzerland (10 A/250 V, 2.5 m)
CBL-EX-PWR-C13-TW	AC power cable—Taiwan (10 A/125 V, 2.5 m)
CBL-EX-PWR-C13-UK	AC power cable—UK (10 A/250 V, 2.5 m)
CBL-EX-PWR-C13-US	AC power cable—US (13 A/125 V, 2.5 m)

Model Number	Description
<b>Optics and Transceivers</b>	
QFX-QSFP-40G-SR4	QSFP+ 40GBASE-SR4 40 gigabit optics, 850 nm for up to 150 m transmission on multimode fiber-optic (MMF)
QFX-QSFP-40G-ESR4	QSFP+ 40GBASE-ESR4 40 gigabit optics, 300m(400m) with OM3(OM4) MMF
QFX-QSFP-DAC-1M	QSFP+ to QSFP+ Ethernet direct attach copper (twinax copper cable), 1 m passive
QFX-QSFP-DAC-3M	QSFP+ to QSFP+ Ethernet direct attach copper (twinax copper cable), 3 m passive
QFX-QSFP-DACBO-1M	QSFP+ to SFP+ 10GbE direct attach break-out copper (twinax copper cable), 1 m
QFX-QSFP-DACBO-3M	QSFP+ to SFP+ 10GbE direct attach breakout copper (twinax copper cable), 3 m
<b>Services</b>	
SVC-COR-QFX3600-16Q	Juniper Care Core Support for QFX3600 16-port QSFP+ switch with three fans; power supplies and cables not included
SVC-CP-QFX3600-16Q	Juniper Care Core Plus Support for QFX3600 16-port QSFP+ switch with three fans; power supplies and cables not included
SVC-NDCE-QFX3600-16Q	Juniper Care Next Day Onsite Support for QFX3600 16-port QSFP+ switch with three fans; power supplies and cables not included
SVC-ND-QFX3600-16Q	Juniper Care Next Day Support for QFX3600 16-port QSFP+ switch with three fans; power supplies and cables not included
SVC-NDS-QFX3600-16Q	Juniper Care Next Day Ship Support for QFX3600 16-port QSFP+ switch with three fans; power supplies and cables not included
SVC-SDCE-QFX3600-16Q	Juniper Care Same Day Onsite Support for QFX3600 16-port QSFP+ switch with three fans; power supplies and cables not included
SVC-SD-QFX3600-16Q	Juniper Care Same Day Support for QFX3600 16-port QSFP+ switch with three fans; power supplies and cables not included

Model Number	Description
PAR-AR5-QFX3600-16Q	Operate Specialist AR5 Support for QFX3600 16-port QSFP+ switch with three fans; power supplies and cables not included
PAR-NDCE-QFX3600-16Q	Operate Specialist Next Day Onsite Support for QFX3600 16-port QSFP+ switch with three fans; power supplies and cables not included
PAR-ND-QFX3600-16Q	Operate Specialist Next Day Support for QFX3600 16-port QSFP+ switch with three fans; power supplies and cables not included
PAR-NDS-QFX3600-16Q	Operate Specialist Next Day Ship Support for QFX3600 16-port QSFP+ switch with three fans; power supplies and cables not included
PAR-RTF-QFX3600-16Q	Operate Specialist RTF Support for QFX3600 16-port QSFP+ switch with three fans; power supplies and cables not included
PAR-SDCE-QFX3600-16Q	Operate Specialist Same Day Onsite Support for QFX3600 16-port QSFP+ switch with three fans; power supplies and cables not included
PAR-SD-QFX3600-16Q	Operate Specialist Same Day Support for QFX3600 16-port QSFP+ switch with three fans; power supplies and cables not included
PAR-SUP-QFX3600-16Q	Operate Specialist Basic Support for QFX3600 16-port QSFP+ switch with three fans; power supplies and cables not included
PAR-SUP-QFX3600-16Q	Operate Specialist Basic Support for QFX3600 16-port QSFP+ switch with three fans; power supplies and cables not included

## 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](http://www.juniper.net).

Corporate and Sales Headquarters  
 Juniper Networks, Inc.  
 1133 Innovation Way  
 Sunnyvale, CA 94089 USA  
 Phone: 888.JUNIPER (888.586.4737)  
 or +1.408.745.2000  
 Fax: +1.408.745.2100  
[www.juniper.net](http://www.juniper.net)

APAC and EMEA Headquarters  
 Juniper Networks International B.V.  
 Boeing Avenue 240  
 1119 PZ Schiphol-Rijk  
 Amsterdam, The Netherlands  
 Phone: +31.0.207.125.700  
 Fax: +31.0.207.125.701

Copyright 2015 Juniper Networks, Inc. All rights reserved. Juniper Networks, the Juniper Networks logo, Junos and QFabric are registered trademarks of Juniper Networks, Inc. in the United States and other countries. All other trademarks, service marks, registered marks, or registered service marks are the property of their respective owners. Juniper Networks assumes no responsibility for any inaccuracies in this document. Juniper Networks reserves the right to change, modify, transfer, or otherwise revise this publication without notice.

**JUNIPER**  
 NETWORKS