Nexus 5500 and 6000

Max Ardica
Technical Leader
Cisco’s Data Center Portfolio
Leading with Innovation

Unified Fabric

Nexus 5K
Nexus 2K
Nexus 6K
Nexus 3K
Nexus 1K
Blade Offerings
MDS 9000
Nexus 7K

Financial
Low Latency
MSDC/Cloud
Scalability
Service Provider
Agile Service Delivery
Enterprise
Private Cloud Automation
Cisco Nexus 5500 and 2000 Update
Cisco Nexus 5500
Offering Choice and Flexibility for Varied Deployments

NEXUS 5500 Platform
Nexus 5548UP 1RU Switch (Unified Ports)
Nexus 5596UP 2RU Switch (Unified Ports)

Nexux 5548 Layer 3 Daughter Card
New Version Now Available

Nexus 5596 Layer 3 Expansion Module
New Version Now Available

Nexus 5500 Unified Ports Expansion Module
Industry First for FCoE over 10G BASE-T

Cisco Nexus 5500
Nexus 5596T

Nexus 5596T Switch

Flexible
- 10GBASE-T Ecosystem (Intel, Panduit, Commscope)
- Support existing Fiber GEM and new Copper GEM

Scalable
- 96 Access Ports for Direct Server Attach
- Up to 68 1/10GBase-T Ports per chassis
- FP+ Ports supporting FEX Technology

Functionality
- Hardware (1/10GBASE-T Ports)
- Supports FCoE
- Software leverages NX-OS L2/L3 feature set
Cisco Nexus 5500
4p QSFP+ GEM

- Supported on all Nexus 5500 Series Chassis
- Only 4x10G mode supported
FEX Architecture
Simplified Operations and Lower cost

- Simultaneous support of EoR, MoR and ToR
- Reduction in the number of management points for ToR architectures
- Support for Rack and Blade server connectivity

Managing up to 1152 Server ports with 1RU switch
Cisco Nexus 2000 Series
Simplified Operations with Revolutionary Scale

2013

100M/1G FEX
N2K-C2232TM-E-10GE
RJ45 downlinks

N2K-C2248TP-E-1GE
Expanded Memory FEX

1/10G FEX
N2K-C2248PQ
48 port 1/10G FEX SFP+
4xQSFP

2012

N2K-C2248TP-1GE
100M/1G FEX

N2K-C2232TM-10GE
RJ45 downlinks

2011

N2K-C2248TP-1GE
100M/1G FEX

N2K-C2232TM-10GE
RJ45 downlinks

2010

N2K-C2232PP-10GE
SFP+ downlinks

B22 HP FEX
1/10G FEX for HP Blade servers

2009

B22 Dell FEX
1/10G FEX for Dell Blade servers

B22F FEX
10G FEX for Fujitsu Blade servers

Indicates Lead Product
Nexus 2000 Series Fabric Extenders
Nexus 2248PQ-10GE

48 ports 10/1G Fabric Extender
• 48x 1/10GE SFP+ host interfaces
• 4x QSFP+ (16x 10GE) on network interfaces
• Front-to-back airflow and back-to-front airflow
• N5500 and N6000 parent switch at FCS
• Feature parity with Nexus 2232PP
• Additional uplink buffers (2x16MB)
• FCoE supported

Design Scenario
• High Density 10GE SFP+ ToR
• Connectivity Flexibility
• Virtualized Environments
• Storage consolidation
• Predictable low latency
A newer and better 10GBASE-T PHY than 2232TM (40nm):
- Better BER characteristics than 2232TM: Supports FCoE
- Reduction in power consumption

<table>
<thead>
<tr>
<th>Technology</th>
<th>BER</th>
<th>Distance</th>
<th>PHY Power (each side)</th>
<th>Transceiver Latency</th>
</tr>
</thead>
<tbody>
<tr>
<td>SFP+ CU Copper</td>
<td>$\sim 10^{-18}$</td>
<td>10m</td>
<td>$\sim 0.1$W</td>
<td>$\sim 0.25$us</td>
</tr>
<tr>
<td>SFP+ SR short reach</td>
<td>$\sim 10^{-18}$</td>
<td>300m</td>
<td>1W</td>
<td>$\sim 0.1$us</td>
</tr>
<tr>
<td>SFP+ LR long reach</td>
<td>$\sim 10^{-18}$</td>
<td>10km</td>
<td>1W</td>
<td>$\sim 0.1$us</td>
</tr>
<tr>
<td>10GBASE-T – 40nm</td>
<td>$\sim 10^{-15}$</td>
<td>100m</td>
<td>$\sim 3.5$W</td>
<td>$\sim 2.5$-3us</td>
</tr>
</tbody>
</table>

Industry First for FCoE over 10G BASE-T

- Supports 1/10GBASE-T on all host ports
- Supports 10GBASE-T standard (cabling to 100m)
- Consistent FEX architecture benefits
Cisco Nexus 6004/6001 Overview
Introducing Cisco Nexus 6004

### High Performance
- Line rate L2 and L3 with all ports and all features and all frame sizes
- 1-microsecond port-to-port latency with all frame sizes
- 40-Gbps flow
- 40-Gbps FCoE
- Cut-through switching for 40 and 10 GE
- 25-MB buffer per three QSFP interfaces

### High Scalability
- 96 x 40G in 4RU
- 384x10 GE in 4RU
- Up to 256,000 MAC (115k L2 / 64k L3 at FCS)
- Up to 128,000 ARP (64k at FCS)
- 32,000 LPM (24k at FCS)
- 16,000 bridge domains
- 31 Bidirectional SPAN sessions (16 at FCS)

### Feature-Rich
- L2 and L3 features
- FEXlink
- vPC FabricPath TRILL
- FabricPath with segment ID
- Adapter-FEX/VM-FEX

### Visibility and Analytics
- Line-rate SPAN
- Sampled NetFlow*
- Micro-burst and buffer monitoring*
- Latency monitoring*
- Conditional SPAN-SPAN on drop-SPAN on higher latency*

* Some features in this slide are not supported by software at FCS
Nexus 6004 Chassis
Port-Side View

- Chassis depth: 30 in.
- Chassis width: 17.5 in.

48 Fixed QSFP Interfaces
12 QSFP ports Expansion Module

30 in.
4RU
The chassis has six power supply slots; a minimum of three is required. They support both 3 + 1 and 3 + 3 redundancy.

Each power supply is rated 1100W, 90—240 VAC.

The chassis has four fan trays. A minimum of three is required.
Nexus 6004 Chassis
Twelve QSFP Line-Card Expansion Modules

- Provide 12 QSFP interfaces
- Support 40, 10GE, FCoE
- Offer same performance, features, and scalability as fixed ports
- Support OIR
Introducing Cisco Nexus 6001

**High Performance**
- Line rate L2 and L3 with all ports and all features and all frame sizes
- 1-microsecond port-to-port latency with all frame sizes
- 40-Gbps flow
- 40-Gbps FCoE
- Cut-through switching for 40 and 10 GE
- 25-MB buffer per three QSFP interfaces

**High Scalability**
- 48x10 GE + 4x40 GE in 1RU
- Up to 256,000 MAC (115k L2 / 64k L3 at FCS)
- Up to 128,000 ARP (64k at FCS)
- 32,000 LPM (24k at FCS)
- 16,000 bridge domains
- 31 Bidirectional SPAN sessions (16 at FCS)

**Feature-Rich**
- L2 and L3 features
- FEXlink
- vPC FabricPath TRILL
- FabricPath with segment ID
- Vinci leaf, spine, and border node
- Adapter-FEX/VM-FEX

**Visibility and Analytics**
- Line-rate SPAN
- Sampled NetFlow*
- Micro-burst and buffer monitoring*
- Latency monitoring*
- Conditional SPAN-SPAN on drop-SPAN on higher latency*

* Some features in this slide are not supported by software at FCS
Nexus 6001 Chassis
Port-Side View

- Chassis depth: 30 in.
- Chassis width: 17.3 in.
Nexus 6001 Chassis
Power Supply and Fans

Power Supply 1+1 redundancy

Fan Module 2+1 redundancy

Console Mgmt0 USB
Nexus 6000

Key Forwarding Tables

- Host table: 256,000 entry hashing table; actual capacity is slightly less than 256,000
- Host table: Shared between MAC, ARP, and ND and /32 host route

- Host table FCS carving: 128,000 MAC, 128,000 IP host
- LPM table: 32,000 entries. Also known as summary routes
- Mroute table: 64,000 entries

* Hardware table size. Please check configuration limit for software scaling
Nexus 6000
FEX Scalability

- 24 FEX per Cisco Nexus® 6004 in L2 and L3 at FCS (32 planned at Harbord+)
- Support for all different types of FEX including HP FEX and Fujitsu FEX for blade servers (except first model Cisco Nexus 2148)
- Dell FEX support with Harbord Maintenance release (Q2CY13)
Cisco Nexus 6000 Internal Architecture
Nexus 6004 Internal Architecture

Switch Fabric

Fabric 1
Fabric 2
Fabric 3
Fabric 4

UPC 1
UPC 2
UPC 16
UPC 17
UPC 32

48xQSFP (Fixed interfaces)
48xQSFP (with 4 expansion modules)

Supervisor
UPC-0
CPU
Nexus 6001 Internal Architecture
Unified Port Controller (UPC)
UPC ASIC

- Multimode MAC; built-in PHY for 1, 10, and 40 GE
- Packet parsing and rewriting
- Lookup engine and access control: L2, L3, FabricPath, TRILL, ACL, FCoE, and policing
- Buffering and queuing: Buffer management, PFC for lossless traffic, queuing (Strict Priority Queuing and DWRR), and packet replication (SPAN and multicast)
- Extra fabric bandwidth for SPAN and multidestination traffic
Cisco Nexus 6000 Transceivers and Cables
Interface Speed Mode

- By default port is in 40 GE mode.
- Port speed can be changed at a group of three QSFP ports.
- The group of 12 QSFP ports needs to be reset after port mode change.
- The fixed 48 x QSFP is named in the same way as the ports on the expansion module.
Unified Port Controller (UPC)
Converting 40GE Interface to Four 10 GE Interfaces

Convert the QSFP Interfaces to Four 10 GE Interfaces When Connecting to a SFP+ Port or to the QSFP Interfaces That Operate in Four 10 GE Mode, such as the QSFP Uplink of N2248PQ-10G or the Cisco Nexus® 5500 QSFP GEM.

1. Apply global CLI to change interface types to 10 GE.
   - Every three contiguous QSFP interfaces resides on one UPC ASIC.
   - The port range specified in the CLI has to include all ports on the ASIC.

2. Power off the affected modules.
   - Every group of 12 QSFP interfaces is managed as one module, even for the fixed interfaces.

3. Power on the affected modules.

N6004(config)# interface breakout slot 1 port 1-6 map 10g-4x
N6004(config)# poweroff module 1
N6004(config)# no poweroff module 1
N6004(config)#
QSFP-40G-SR4

**Key Specs**

<table>
<thead>
<tr>
<th></th>
<th>40GBASE-SR4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical interface</td>
<td>Four 10 GE</td>
</tr>
<tr>
<td>Media type</td>
<td>Multimode ribbon fiber</td>
</tr>
<tr>
<td>Optical technology</td>
<td>850-nm VCSEL technology/array</td>
</tr>
<tr>
<td>Reach</td>
<td>100m with OM3 MMF</td>
</tr>
<tr>
<td></td>
<td>150m with OM4 MMF</td>
</tr>
<tr>
<td>Optical interface</td>
<td>12 fiber MPO/MTP</td>
</tr>
<tr>
<td>Power consumption</td>
<td>&lt;1.5W</td>
</tr>
</tbody>
</table>
### QSFP-40G-CSR4

**FEATURES**
- IEEE 10 GE-SR compliance
- Configurable to run in 40 GE mode
  - (Cisco to Cisco connectivity)
- Supported Connectivity
  - Between QSFP-40G-CSR4
  - Between QSFP-40G-CSR4 and 10GE-SR
- Up to 300m reach on MMF OM3
  - Up to 400 m reach on MMF OM4

### Key Specs

<table>
<thead>
<tr>
<th>Host Card</th>
<th>4x ROSA</th>
<th>4x TOSA</th>
<th>MPO-12</th>
<th>12-Fiber MPO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>Four 10GBASE-SR</td>
<td>MPO-12</td>
<td>OM3: ≤ 300m</td>
<td>OM4: ≤ 400m</td>
</tr>
<tr>
<td>Connector</td>
<td>Multimode ribbon</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reach</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fiber</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td></td>
<td></td>
<td></td>
<td>1.5W</td>
</tr>
</tbody>
</table>
Multimode Ribbon Fiber
40 GE

For QSFP-40G-SR4 and QSFP-40G-CSR4

12-Fiber MPO Connector

- MPO/MTP connector with 12 pins
- Use 4 fiber pairs
  - 4 TX and 4 RX allows for 40 GE
  - 4 unused fibers in the center
Bit Spray Over QSFP-40G

- Cisco Nexus 6004 and all its components are designed to carry 40-Gbps flow.
- Each packet is sent over four fibers. No packet hash algorithm is involved.
- Each packet is stripped to 64-bit blocks first; then it encodes to a 66-bit block.
- All the 66-bit blocks are sent over the four fibers in the round-robin fashion.
- The bit spray depicted here applies to QSFP interfaces running at 40 GE mode. When the QSFP interface is configured as four 10 GE interfaces, each fiber and copper cable will carry the packet for one 10 GE interface.
Physical Connection Choices

- FCS support: QSFP-SR4 (100m over OM3); copper 40 GE–40 GE cable and copper breakout cable
- FCS stretch: QSFP-CSR4 (300m over OM3); post FCS: QSFP-LR4 (10 KM over SMF)
# QSFP-40G-LR4

## Key Specs

<table>
<thead>
<tr>
<th>Media type</th>
<th>Standard single-mode fiber</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optical technology</td>
<td>1300-nm built-in CWDM laser technology (1271-, 1291-, 1311-, and 1331-nm grid) Integrated optical multiplexer/de-multiplexer</td>
</tr>
<tr>
<td>Reach</td>
<td>10-km single mode</td>
</tr>
<tr>
<td>Optical interface</td>
<td>LC duplex connector</td>
</tr>
<tr>
<td>Power consumption</td>
<td>3.5W</td>
</tr>
</tbody>
</table>

Cisco Will Also Support OTN Data Rate
FET-40G
Planned for Q3CY13

- Low-cost QSFP optical transceiver connecting FEX to Cisco Nexus® 6004
- Supported on Cisco Nexus 6004 and Nexus 2248PQ-10G
- Interoperable with FET-10G
- Support for 100m distance with OM3
Cisco Nexus
6000
Quality of Service
Eight classes of service: 2 reserved for control traffic, 6 for data traffic

Traffic classification
  DSCP, CoS, and ACL

Strict Priority Queuing and DWRR
  DCBX 802.1Qaz

Packet marking
  DSCP, CoS, and ECN

Ingress and egress policing
  4096 policers per ASIC

No drop system class

Flexible buffer management
Ingress UPC

25-MB packet buffer is shared by every three 40 GE ports or twelve 10 GE ports.

Buffer is 16 MB at ingress and 9 MB at egress.

Unicast packet can be buffered at both ingress and egress.

Multicast is buffered at egress.

Increased Packet Buffer

- 25-MB packet buffer is shared by every three 40 GE ports or twelve 10 GE ports.
- Buffer is 16 MB at ingress and 9 MB at egress.
- Unicast packet can be buffered at both ingress and egress.
- Multicast is buffered at egress.
Flexible Buffer Management

Ingress Buffer

Shared buffer is good for burst absorption.

Dedicated buffer is good for predictable performance for each port.

Buffer management is flexible: Dedicated plus shared.

Long-distance FCoE, video editing (i.e., AVID), Big Data, and distributed storage
Flexible Buffer Management

Egress Buffer

9-MB packet buffer at egress
UPC is shared among three 40 GE or twelve 10 GE.
By default majority of egress buffer is allocated for multicast traffic

CLI is provided to allocate buffer between unicast and multicast (future).

Unicast traffic can be buffered at egress and ingress.
Multicast is buffered at egress in case of interface oversubscription.
Efficient Multicast Replication

- Optimized multicast replication throughout the system
- Fabric replication and egress replication; one copy is replicated to egress UPC, where there is a receiver—minimizing the traffic load on the switch fabric and eliminating the switch fabric congestion
- Line-rate multicast replication at fabric and egress UPC for all frame sizes
N6004 implements flow based hashing for multi-destination traffic and it supports multicast load sharing over PortChannel with 5-tuple packet header.

Traffic is replicated to all egress UPC where the PortChannel member resides.

Egress UPC runs hash calculation and one egress port is chosen to send out multicast packets. The UPC ASIC that is not supposed to send out packet will drop the packet (Egress UPC 1 in the example).
Cisco Nexus 6000 SPAN
Nexus 6000 SPAN Differentiators

**Large number of active SPAN sessions**

- 31 bidirectional active SPAN sessions supported by hardware
- 16 bidirectional active SPAN sessions supported at FCS

**Line-rate SPAN**

- Line-rate SPAN for multiple 40 GE ports
- Built-in extra capacity in fabric to accommodate SPAN traffic

**Intelligent SPAN**

- Prioritize data over SPAN in case of fabric link oversubscription due to SPAN traffic
- Conditional SPAN
For More Information

For more information about Nexus 6001/6004 collateral please visit

http://www.cisco.com/go/nexus6000
Thank you.