Welcome

Technical Services
Virtual Boot Camp
Session 13

Technical Services India Team
Recap - Telepresence

Technology

- Product Portfolio - TC codec series
- Camera details
- Cables & Connectors
- How to capture logs
- Troubleshooting
- Lab

Q&A
Session 13 - Nexus

Technology

- Nexus Overview
- Software Architecture
- Hardware Architecture
- IOS vs NX-OS
- Nexus Release Train Info

Q&A
Cisco NX-OS Highlights
Designed to Meet the Operational Needs of the Data Center

- **Feature Rich Operating System**
  Comprehensive L2 and L3 feature set

- **Modular, Multi-Threaded/Processor**
  Highly scalable unprecedented uptime

- **Intelligent IOS-Like CLI**
  Little or no retraining required

- **Zero Service Disruption**
  Maintenance ≠ Downtime

- **Virtualization Support**
  Industry first virtualized network OS, VM-FEX

- **Layer 2 and Layer 3 Multipathing**
  Resilient scalable Layer 2 and Layer 3 domains

- **Storage and Ethernet Convergence**
  FCoE, iSCSI, HPC

- **Advanced Management Infrastructure**
  XML and Web Services
NX-Os Feature/Service Granularity

- Highly granular implementations
- Each service is an individual memory protected process
  - Including multiple instances of particular service
- Effective fault isolation between services
- Individually Monitored & Managed
NX-OS: Infrastructure Services

- System Manager (sysMgr)
- MTS
- PSS
- Feature Manager
- Interface Manager ➔ EthPM / FCPM / PCM
- Platform Management ➔ Platform Manager, Xbar Manager, Module Manager
- Forwarding Plane ➔ Dist/Centralized forwarding, traffic replication, L3 Control Software
Interface Manager - EthPM

**EthPM** handles all following Interface Types:

- Physical Interfaces
- Port-Channel Interfaces
- Sub-Interfaces
- Loopback/Null Interfaces
- Management Interfaces
- Supervisor Inband Interfaces
Port Index Manager (PIXM)

- PIXM is the supervisor component that is responsible for the generation of port indices.
- EthPM interacts with PIXM to generate and release hardware indices for all physical ports in a module (during OIR).
- On receiving the indices, EthPM programs it in the PortASIC (via port client process)
- EthPM interacts with PIXM to perform CBL programming also.
MTS used for inter-process communication – has built-in HA support

MTS offers SAPs (Service Access Points) to allow services to exchange messages, which are opcode based.

MTS is also a key component in the synchronization of state between active and standby services.

New MTS node is created for every VDC (so that same SAP can be used) and specified in all MTS messages.
ELTM - Requirement

- EARL8 is designed to support features based on port only, vlan only and (port, vlan) pair.
- This increases the Logical Interface (LIF) count to 128K and above.
- Now we need a software process to program all LIF related tables in the EARL ASICs.
- The software process responsible for programming is ELTM !!
Debug/ Crash info

- show cores [ vdc X ] ➔ not persistent across reload
- show process log vdc-all ➔ persistent across reload

Files from:
- logflash:/core/
- logflash:/debug/
- logflash:/log/
- logflash:/generic/
- logflash:/eem_logs/
NX-OS runs on the Linecard

- Microcode version of NX-OS powers the linecards
- Runs on linecard control-plane CPU
- Service processes on the linecards are for hardware and functional support
- Reinforces highly distributed architecture
- In Service Upgrade capabilities
NX-OS Stateful Process Restart

- NX-OS services checkpoint their runtime state to the PSS for recovery in the event of a failure.

If a fault occurs in a process...
- HA manager determines best recovery action (restart process, switchover to redundant supervisor).
- Process restarts with no impact on data plane.
- Total recovery time: ~10s ms.
- State is recovered, operation resumes.
In-Service Software Upgrade

```
N7K# install all kickstart bootdisk:5.0-kickstart system bootdisk:5.0-system
N7K#
```

Release 5.0

1. Upgrade standby supervisor
2. Reload standby supervisor
3. Initiate SSO
4. Upgrade standby supervisor
5. Reload standby supervisor
6. Upgrade LCs in series *

* Parallel upgrade of the I/O modules supported on the Nexus 7000 from 5.2
Nexus 7000 Series Switches

Nexus 7000 Series: Broad Range of Deployment Options

<table>
<thead>
<tr>
<th></th>
<th>Nexus 7004</th>
<th>Nexus 7009</th>
<th>Nexus 7010</th>
<th>Nexus 7018</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Slots</strong></td>
<td>2 I/O + 2 Sup</td>
<td>7 I/O + 2 sup</td>
<td>8 I/O + 2 sup</td>
<td>16 I/O + 2 sup</td>
</tr>
<tr>
<td><strong>Height</strong></td>
<td>7 RU</td>
<td>14 RU</td>
<td>21 RU</td>
<td>25 RU</td>
</tr>
<tr>
<td><strong>BW / Slot</strong></td>
<td>440 Gig/Slot</td>
<td>550 Gig / Slot</td>
<td>230/550 Gig / slot</td>
<td>230/550 Gig / slot</td>
</tr>
<tr>
<td><strong>10G Density</strong></td>
<td>96 10GbE Ports</td>
<td>336 10GbE Ports</td>
<td>384 10GbE Ports</td>
<td>768 10GbE Ports</td>
</tr>
</tbody>
</table>
Nexus 7010 Chassis

- **7010**: The 7010 chassis is a cutting edge core chassis designed for high bandwidth, low-latency, next-generation network topologies. Every attempt has been made to make this a future proof chassis for evolving technologies and physical layer exchange of data.
- 10-Slots: 1-4 and 7-10 are line card slots, 5-6 are supervisory slots
- Supports 256 10Gbps, and/or 384 1Gbps ports
- 1.2 Tb/s system bandwidth, future proof to 15+ Tb/s
- 80 Gbps, 60Mpps per slot
- Air flow is front to back, bottom to top
- Up to 5 Crossbar Fabric Modules
- Up to 3 power supplies
Nexus 7010 Chassis

- System status LEDs
- Front-to-back airflow
- Air exhaust
- Fan trays
- Two chassis per 7' rack
- Crossbar fabric modules
- Power supplies
- Optional front door
- Integrated cable management with cover
- Supervisor slots (5-6)
- I/O module slots (1-4, 7-10)
- Air intake with optional filter
Nexus 7018 Chassis

- The 7018 chassis is a larger version of the 7010. An additional 8 line cards are supported with an even larger crossbar fabric backplane. Like the 7010, this chassis is designed for high bandwidth, low-latency, next-generation network topologies. Every attempt has been made to make this a future proof chassis for evolving technologies and physical layer exchange of data.
- 18-Slots: 1-8 and 11-18 are line card slots, 9-10 are supervisory slots
- Supports 512 10Gbps, 768 1Gbps, and 128 non-blocking 10Gbps ports
- 7.8 Tbps system bandwidth, future proof to 17.6 Tbps
- 256 Gbps, 192 Mpps per slot
- Air flow is side to side
- Up to 5 Crossbar Fabric Modules
- Up to 4 power supplies
Nexus 7018 Chassis

- Integrated cable management
- Optional front door
- Locking ejector levers
- Supervisor slots (9-10)
- Payload slots (1-8, 11-18)
- Power supply air intake
- System status LEDs
- ID LEDs on all FRUs
- Side-to-side airflow
- Common equipment removes from rear
- Power supplies (2 - 4)
- Crossbar fabric modules
- System fan trays
Nexus 7004/7700 Chassis

Key Features:
- Inbuilt fabric
- Only Sup2 Support

Key Features:
- Cross Bow
- Half-Width Sup
Nexus Supervisor Engine 1

- N7K-SUP1 (Supervisor Engine 1): This is the first generation supervisory card for the Nexus 7000 series. Cisco’s recommendation is to run with two of these per chassis in an active/standby configuration.
- Dual-core 1.66Ghz Intel Xeon processors with 4GB DRAM
- 2MB NVRAM, 2GB internal bootdisk, 2 external compact flash slots 10/100/1000bps management port
- Console and Auxiliary serial ports
- USB file transfer port
- Connectivity Management Processor (CMP) with separate 10/100/1000 Ethernet access that will support 802.1ae LinkSec encryption in the future.
- Supervisory modules run in Active/Standby mode for continuous operation
## Nexus Supervisor Engine 2

<table>
<thead>
<tr>
<th>Item</th>
<th>Sup2</th>
<th>Sup2E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor</td>
<td>Xeon</td>
<td>Xeon</td>
</tr>
<tr>
<td>Number of cores</td>
<td>Quad core</td>
<td>2 quad cores</td>
</tr>
<tr>
<td>Speed</td>
<td>2.13 GHz</td>
<td>2.13 GHz</td>
</tr>
<tr>
<td>Kernel</td>
<td>64-bit</td>
<td>64-bit</td>
</tr>
<tr>
<td>Cisco NX-OS version</td>
<td>Cisco NX-OS Software Release 6.1</td>
<td>Cisco NX-OS Software Release 6.1</td>
</tr>
<tr>
<td>Memory</td>
<td>12 GB (DDR3)</td>
<td>32 GB (DDR3)</td>
</tr>
<tr>
<td></td>
<td>NVRAM 2-MB battery backup</td>
<td>NVRAM 2-MB battery backup</td>
</tr>
<tr>
<td>Control and monitoring processor (CMP)</td>
<td>Not supported</td>
<td>Not supported</td>
</tr>
<tr>
<td>Flash memory</td>
<td>USB flash memory</td>
<td>USB flash memory</td>
</tr>
<tr>
<td>Removable storage</td>
<td>2 external USB memory slots:</td>
<td>2 external USB memory slots:</td>
</tr>
<tr>
<td></td>
<td>• Log (8 GB)</td>
<td>• Log (8 GB)</td>
</tr>
<tr>
<td></td>
<td>• Expansion (2 GB)</td>
<td>• Expansion (2 GB)</td>
</tr>
<tr>
<td>Power</td>
<td>Typical: 109W</td>
<td>Typical: 147W</td>
</tr>
<tr>
<td></td>
<td>Maximum: 300W</td>
<td>Maximum: 300W</td>
</tr>
<tr>
<td>Dimensions</td>
<td>• H x W x D: 1.18 x 15.35 x 21.85 in. (3.0 x 38.9 x 55.6 cm)</td>
<td>• H x W x D: 1.18 x 15.35 x 21.85 in. (3.0 x 38.9 x 55.6 cm)</td>
</tr>
<tr>
<td></td>
<td>• Weight 10.34 lb (4.7 kg)</td>
<td>• Weight 11.55 lb (5.25 kg)</td>
</tr>
</tbody>
</table>
Nexus 7000 I/O Module Families – M1 and F1

- **M family** – L2/L3/L4 with large forwarding tables and rich feature set

- **F family** – Low-cost, high performance, low latency, low power and streamlined feature set
8-Port 10GE M1 I/O Module (N7K-M108X2-12L)

- Supported in NX-OS release 5.0(2a) and later
- 8-port 10G with X2 transceivers
- 80G full-duplex fabric connectivity
- Two integrated forwarding engines (120Mpps) Support for “XL” forwarding tables (licensed feature)
- Distributed L3 multicast replication
- 802.1AE LinkSec
32-Port 10GE M1 I/O Modules (N7K-M132XP-12/L)

- N7K-M132XP-12 – Supported in all releases
- N7K-M132XP-12L – Supported in NX-OS release 5.1(1) and later
- 32-port 10G with SFP+ transceivers
- 80G full-duplex fabric connectivity
- Integrated 60Mpps forwarding engineXL forwarding engine on “L” version
- Oversubscription option for higher density (up to 4:1)
- Supports Nexus 2000 (FEX) connections
- Distributed L3 multicast replication
- 802.1AE LinkSec
Shared vs. Dedicated Mode

**Shared mode**
- Four interfaces in port group share 10G bandwidth
- "Port group"—group of contiguous even or odd ports that share 10G of bandwidth (e.g., ports 1,3,5,7)

**Dedicated mode**
- First interface in port group gets 10G bandwidth
- Other three interfaces in port group disabled
48-Port 1G M1 I/O Modules

- Integrated 60Mpps forwarding engine
- 46G full duplex fabric connectivityLine rate on 48-ports with some local switching
- Distributed L3 multicast replication
- 802.1AE LinkSec
32-Port 1G/10GE F1 I/O Module (N7K-F132XP-15)

- Supported in NX-OS release 5.1(1) and later
- 32-port 1G/10G with SFP/SFP+ transceivers
- 230G full-duplex fabric connectivity (320G local switching)
- System-on-chip (SoC)† forwarding engine design
  16 independent SoC ASICs
- Layer 2 forwarding with L3/L4 services (ACL/QoS)
- Multi-protocol – Classic Ethernet, FabricPath, DCB, FCoE
### F2 48-Port 1 and 10 Gb Module
(N7K-F248XP-25/N7K-F248XT-25E)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Cisco NX-OS Software Release 6.0</th>
<th>Cisco NX-OS Software Release 6.1.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ports</td>
<td>48 ports of 1 and 10 Gigabit Ethernet (SFP or SFP+ pluggable optic modules)</td>
<td>48 ports of 1 and 10GBASE-T with RJ-45 cabling</td>
</tr>
<tr>
<td>Forwarding Capacity</td>
<td>720-mpps Layer 2 and Layer 3 forwarding capacity for both IPv4 and IPv6 packets</td>
<td>720-mpps Layer 2 and Layer 3 forwarding capacity for both IPv4 and IPv6 packets</td>
</tr>
<tr>
<td>VLAN Allocation</td>
<td>16,384 per SoC, and up to 196,608 per module (depending on VLAN allocation)</td>
<td>16,384 per SoC, and up to 196,608 per module (depending on VLAN allocation)</td>
</tr>
<tr>
<td>Bandwidth Capacity</td>
<td>550 Gbps in each direction (1.1 Tbps full duplex) distributed across up to five fabric modules</td>
<td>550 Gbps in each direction (1.1 Tbps full duplex) distributed across up to five fabric modules</td>
</tr>
</tbody>
</table>
F3-Series 6-Port 100 Gb

- Cisco NX-OS Software Release 6.2(8)
- 6 ports of 100 Gigabit Ethernet (Cisco CPAK)
- 900mpps of Layer 2 and Layer 3 forwarding capacity for both IPv4 and IPv6 packets
- High-density, low-latency, scalable data center architecture
7700 F3 Modules

7700 F3-Series 24-Port 40 Gigabit Ethernet Module (N77-F324FQ-25)

- Supported in all Cisco Nexus 7700 chassis
- 24 ports of 40 Gigabit Ethernet (QSFP+)
- 1.44 bpps of Layer 2 and Layer 3 forwarding capacity for both IPv4 and IPv6 packets

7700 F3-Series 48-Port Fiber 1 and 10 Gigabit Ethernet Module (N77-F348XP-23)

- Supported in all Cisco Nexus 7700 chassis
- 48 ports of 1 and 10 Gigabit Ethernet (SFP and SFP+)
- 720 mpps of Layer 2 and Layer 3 forwarding capacity for both IPv4 and IPv6 packets
M2-Series 6-Port 40 Gb Module (N7K-M206FQ-23L)

- Supported in all Cisco Nexus 7000 Series chassis
- Supported Fabric-1 or Fabric-2 fabric modules
- Supported SUP1, SUP2 or SUP2E Supervisor modules
- Cisco NX-OS Software Release 6.1 or later (minimum requirement)
- 6 ports of 40 Gigabit Ethernet (Quad Small Form-Factor Pluggable Plus [QSFP+] optics modules
- 120 Mpps Layer 2 and Layer 3 IPv4 unicast and 60 Mpps IPv6 unicast
- 550 Gbps in each direction (1.1 Tbps full duplex) distributed across up to five Fabric-2 modules
- 230 Gbps in each direction (460 Gbps full duplex) distributed across up to five Fabric-1 modules
M2-Series 24-Port 10 Gb Module(N7K-M224XP-23L)

- Supported in all Cisco Nexus 7000 Series chassis
- Supported Fabric-1 or Fabric-2 fabric modules
- Supported SUP1, SUP2 or SUP2E Supervisor modules
- Cisco NX-OS Software Release 6.1 or later (minimum requirement)
- 24 ports of 10 Gigabit Ethernet (Small Form-Factor Pluggable Plus [SFP+] optics modules)
- 550 Gbps in each direction (1.1 Tbps full duplex) distributed across up to five Fabric-2 modules
- 230 Gbps in each direction (460 Gbps full duplex) distributed across up to five Fabric-1 modules
I/O Module Design Principles

M I/O modules:
- Multi-chipset design
- Feature-rich
- Large forwarding tables and deep buffers in external memory

F I/O modules:
- Integrated SoC design
- Streamlined feature set
- On-chip forwarding tables and buffering (no external memory interfaces)
Crossbar Switch Fabric Module FAB-1

- Each fabric module provides 46Gbps per I/O module slot. Up to 230Gbps per slot with 5 fabric modules.
- Different I/O modules leverage different amount of fabric bandwidth: 80G per slot with 10G M1 modules, 230G per slot with 10G F1 modules.
- Access to fabric controlled using QoS-aware central arbitration with VOQ.

N7K-C7010-FAB-1
Crossbar Switch Fabric Module FAB-2

- 110 Gbps per slot per fabric
- Cisco NX-OS Software Release 5.2 (minimum requirement) on 7009 Chassis
- Cisco NX-OS Software Release 6.0 (minimum requirement) on 7010 and 7018 chassis
Fabric Module Capacity (Ex: FAB-1)

2 x 23G channels per I/O module slot
1 x 23G channel per supervisor slot

230Gbps per slot bandwidth

FAB-2 is 550Gbps per slot bandwidth
M1 I/O Module Capacity

1G modules
- Require 1 fabric for full bandwidth
- Require 2 fabrics for N+1 redundancy

230Gbps
per slot bandwidth
- 4th and 5th fabric modules provide additional redundancy and future-proofing

10G modules
- Require 2 fabrics for full bandwidth
- Require 3 fabrics for N+1 redundancy
F1 I/O Module Capacity

F1 SFP+ module
- Operates with any number of fabrics
- Requires 5 fabrics for maximum bandwidth
- Redundancy model is graceful bandwidth derating

230Gbps
per slot bandwidth
Nexus 7000 Architecture Summary

- I/O Modules: Variety of front-panel interface and transceiver types with LinkSec, VOQ, and other advanced hardware features.
- Chassis: Future-proofed chassis designs with density and airflow options.
- Supervisor Engines: Control plane protocols, system and network management.
- Fabrics: Lossless-capable fabric with 230G/slot bandwidth to interconnect I/O modules and provide investment protection.
- Forwarding Engines: Hardware services, including unicast/multicast, bridging/routing, ACL/QoS classification, and NetFlow statistics.
FEX-Link: Extending the Fabric

- Nexus 7000/5x00 + FEX is like a “Virtual Chassis”
- Nexus 2000 FEX is a “Virtual Line Card” to its “parents”
- No Spanning Tree between the FEX and its “parent”
- No local switching on the FEX
- NX-OS Linecard code runs on the 2148/2248/2232
Nexus 2000 with Nexus 7000

- Combines benefits of Top of Rack (ToR) and End of Row (EoR) network architectures
- Reduces cable runs
- Reduce management points in the network
- Ensures feature consistency across hundreds or thousands of server ports
Important Cisco NX-OS and Cisco IOS Software Differences

- Direct EXEC mode
- By default, the admin user has network-admin rights that allow full read/write access. Additional users can be created with very granular rights to permit or deny specific CLI commands. (Roles network/vdc-admin/operator)
- The Cisco NX-OS has a Setup Utility that allows a user to specify the system defaults, perform basic configuration, and apply a pre-defined Control Plane Policing (CoPP) security policy.
- The Cisco NX-OS uses a feature based license model. An Enterprise Services, Advanced Services, Transport Services, Scalable Feature and Enhanced Layer 2 license is required depending on the features required. Additional licenses may be required in the future.
- The Cisco NX-OS has the ability to enable and disable features such as OSPF, BGP, etc… using the feature configuration command. Configuration and verification commands are not available until you enable the specific feature.
- Interfaces are labeled in the configuration as Ethernet. There aren’t any speed designations.
- The Cisco NX-OS has two preconfigured VRF instances by default (management, default).
Important Cisco NX-OS and Cisco IOS Software Differences

- SSHv2 server/client functionality is enabled by default. TELNET server functionality is disabled by default. (The TELNET client is enabled by default and cannot be disabled.)
- VTY and Auxiliary port configurations do not show up in the default configuration unless a parameter is modified (The Console port is included in the default configuration). The VTY port supports 32 simultaneous sessions and the timeout is disabled by default for all three port types.
- The Console and VTY ports always prompt the user for a username/password pair for authentication before granting access to the CLI. The Cisco IOS applies the login command to the Console and VTY ports by default to enable password authentication (If the no login command is applied, a user can gain access without a password.).
- A user can execute show commands in configuration mode without using the do command as in Cisco IOS Software.
- When executing a show command, a user has several more options when using the pipe (|) option such as grep for parsing the output, perl for activating a script, and xml to format the output for network management applications.

http://docwiki.cisco.com/wiki/Cisco_Nexus_7000_NX-OS/IOS_Comparison_Tech_Notes
NX-OS Release Trains

- 4.2(1), 4.2(2), 4.2(2a), 4.2(3), 4.2(4), 4.2(6), 4.2(8)
- 5.0(2a), 5.0(3), 5.0(5)
- 5.1(1), 5.1(1a), 5.1(2), 5.1(3), 5.1(4), 5.1(5), 5.1(6)
- 5.2(1), 5.2(3)a, 5.2(4), 5.2(5), 5.2(7), 5.2(9)
- 6.0(1), 6.0(2), 6.0(3), 6.0(4)
- 6.2.2, 6.2(2a), 6.2.6, 6.2.6a, 6.2.8

Also keep track of Nexus EPLD/CMP Images
L2 Packet Flow

1. Receive packet from wire
2. LinkSec decryption
3. 1st stage ingress port QoS
4. Submit packet headers for lookup
5. L2 SMAC/DMAC lookups
6. ACL/QoS/NetFlow lookup
7. Return result
8. VOQ arbitration and queuing
9. Credit grant for fabric access
10. Transmit to fabric
11. Receive from fabric
12. Return credit to pool
13. Submit packet headers for egress L2 lookup
14. Egress port QoS
15. 10G MAC
16. LinkSec encryption
17. Transmit packet on wire
Technical Services Virtual Boot Camp Series

- Session 1: LAN Switching - Technical Services Virtual Boot Camp
- Session 2: LAN Switching - Technical Services Virtual Boot Camp
- Session 3: Security - Technical Services Virtual Boot Camp
- Session 4: Security - Technical Services Virtual Boot Camp
- Session 5: Voice - Technical Services Virtual Boot Camp
- Session 6: Voice - Technical Services Virtual Boot Camp

Session 1: LAN Switching - Technical Services Virtual Boot Camp
- Session Presentation - Troubleshooting and Upgradation on Cisco LAN switches.pptx
- Video - Troubleshooting and Upgradation on Cisco LAN switches
- Q&A from Troubleshooting and Upgradation on Cisco LAN switches Session 1
- Cisco Technical Assistance Center (TAC) Support Model - Technical Services Virtual Boot Camp Series

Session 2: LAN Switching - Technical Services Virtual Boot Camp
- Session Presentation - Understanding LAN Switching Features – STP, QOS and Stacking.pptx
- Video - Understanding LAN Switching Features – STP, QOS, and Stacking

https://supportforums.cisco.com/docs/DOC-37994 ...PPT
https://supportforums.cisco.com/videos/7517 ....Video
https://supportforums.cisco.com/docs/DOC-37851 ...Q&A
Technology

- VPC and VDC Concept
- Common issue noticed
- How to capture right set of logs
- Troubleshooting
- Live Demo

Q&A