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Port Mapping the Cisco Nexus 9K Switch

Mapping 36 Port Spine Blades to a Centralized Patching Location with the HD Flex™ Fiber Cabling System

Introduction

Customers seek to leverage the Cisco* Nexus* 95xx series switches in Application Centric Infrastructure (ACI*) mode or standalone Cisco NX-OS mode to deliver software flexibility with the scalability of predictable hardware performance. Unfortunately, many customers lack the expertise to build the solid physical infrastructure foundation they need to achieve the desired performance. This is especially true regarding the logical representation of various port configurations on the 9K switch in a structured cabling paradigm.

As customers migrate to spine-leaf architectures with parallel optics transceivers, they must address the interdependencies between the logical network and physical layer infrastructure. In certain applications with NX-OS, customers desire to use the small form factor of higher speed QSFP parallel optics transceivers to break out physical fiber lanes from the transceiver and represent them as independent lower speed ports at a patch panel.

Breakout Interfaces

N9K-X9*36**-* represents a taxonomy for a family of line cards providing 36, 40GE or 100GE QSFP front panel ports. In Table 1, all the 36, 40GE ports on N9K-X9*36PQ variants support the 4 x 10GE break-out mode to operate as four individual 10GE ports. This allows the line card to provide up to 144 10GE SFP+ ports.

Table 1. Cisco Nexus 9500 I/O Module Matrix

Line Card	N9K-X9636C-R	N9K-X9636Q-R	N9K-X9736PQ	N9K-X9636PQ	N9K-X9536PQ
Interfaces	36p of 100 Gb/s, QSFP28	36p of 40 Gb/s, QSFP+	36p of 40 Gb/s, QSFP+	36p of 40 Gb/s, QSFP+	36p of 40 Gb/s, QSFP+
Supported Interface Speeds	100 Gb/s Only	40 Gb/s	40 Gb/s	40 Gb/s and 4x10 Gb/s (breakout)	40 Gb/s and 4x10 Gb/s (breakout)
OS	NX-OS Only	NX-OS Only	ACI SPINE ONLY	NX-OS Only	NX-OS Only

9K Chassis Support	8 slot/N9K-SUP-B Required	8 slot/N9K-SUP-B Required	4,8 & 16 slot	4 & 8 slot	4,8,16 slot
FET Support	TBD	TBD	N/A	Yes	Yes
Intended Use Case	Backbone & Router Interconnect	40GE Aggregation	ACI Spine	Aggregation/ Access	Aggregation/ Access

Cisco NX-OS supports breakout interfaces for the line cards indicated in Table 1. The breakout command works at the module level and splits the 40GE interface of a module into four 10GE interfaces. IT personnel reloads the module and the configuration for the interface is removed when the command is executed.

The following is an example of the command:

```
switch# configure terminal
switch(config)# interface breakout module 1
Module will be reloaded. Are you sure you want to continue(yes/no)? yes
```

When deploying a Cisco Nexus* 9K switch with 36 port blades (e.g., N9K-X9*36PQ: 40GE Gigabit Ethernet Line Card) for ACI or NX-OS applications), customers must understand:

- The physical infrastructure impact of moving from a traditional three-tier model (core, aggregation, access) to an ACI two-tier model (spine-leaf or a flat network)

- In a spine-leaf network architecture using N9K-X9736PQ line cards at the spine, every leaf switch must be connected to every spine switch, which creates high-density cabling environments (depending on network scale)

- Connections between switches are 100GE, 40GE (or 4x10GE), connections between switches and servers are generally 10GE

- Logical mapping of 40GE 9K switch ports as they are broken down through fiber harnesses and mapped to 10GE ports (36, 40GE switch ports can become 144, 10GE ports)

Without proper physical infrastructure planning, execution, and best practices customers may experience network performance issues because the physical infrastructure impacts the performance of critical business applications.

Customers should perform moves, adds, and changes (MACs) in high-density 9K implementations at the Centralized Patching Location (CPL) or cross connect. All physical fiber ports on all modular transceivers within the 9K line cards are represented ports on a front side of a patch panel located at the CPL.

When additional 9K chassis or line cards are added to the network they are connected via appropriate fiber assemblies to a new/existing patch panel located at the CPL facility. The switch-to-switch and switch device connections occur using short jumpers at the CPL to structured cabling reaching out into the data center.

Structured Cabling Approach with HD Flex™ Fiber Cabling System

The Panduit® HD Flex Fiber Cabling System (Figure 1) enables data center technicians to quickly and safely complete MACs while simultaneously providing the scalability for increasing density as business demands evolve.

This complete, integrated fiber system accommodates high-performance data centers, delivering serviceability, network reliability, and ease of deployment in critical high-density applications such as port mapping high-speed ports from Cisco 9K line cards to a CPL.

For the 9K port mapping application (Figure 2), components within the HD Flex fiber cabling system facilitate logically structured cabling elements to present switch ports in the CPL.

Figure 1. HD Flex Fiber Cabling System.

For the QSFP native interfaces on the line card (MPO for 100GE/40GE parallel optics), small form factor MPO cabling and MPO patch panels present mapped MPO port interfaces at the cross connect. For bi-directional (BiDi) and parallel breakout use cases, MPO cabling and purpose-built modular cassettes present mapped LC port interfaces at the cross connect.
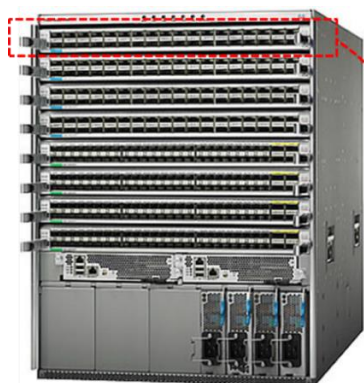
Cisco N9K-X9636PQ: 36 port 40 Gigabit Ethernet Line Card "Slot 1", 36 40G ports

Figure 2. Port Mapping the N9K-C9508 with the N9K-X9636PQ: 40 Gigabit Ethernet line card.

Native 40GE MPO

Delivering the ports to a CPL in a logical and organized fashion can be done by using short MPO to MPO interconnect cordage and the deployment of MPO coupler panels in the HD Flex enclosure/patch panel using the arrangement in Figure 3.
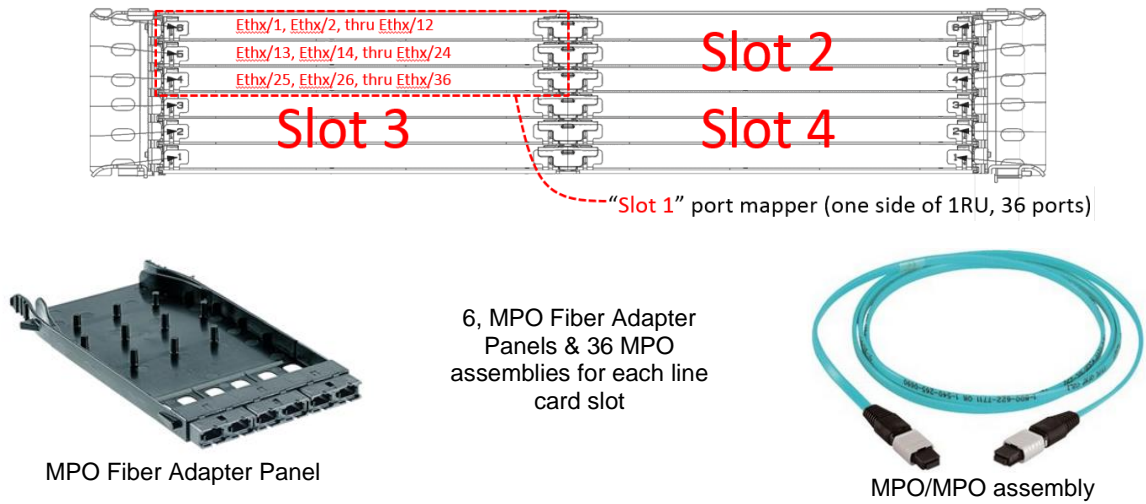

Ethx/1, Ethx/2, thru Ethx/12
Ethx/13, Ethx/14, thru Ethx/24
Ethx/25, Ethx/26, thru Ethx/36
Slot 2
Slot 3
Slot 4
"Slot 1" port mapper (one side of 1RU, 36 ports)

MPO Fiber Adapter Panel

6, MPO Fiber Adapter Panels & 36 MPO assemblies for each line card slot

MPO/MPO assembly

Figure 3. Native 40GE MPO cabling elements.

With this system, operators bring the ports off the switch and map and manage them in the CPL. The deployment of two of the HD Flex enclosure patch panel fiber distribution systems exactly maps a 9K Nexus switch populated with eight, 36 port 40Gb/s blades (Figure 4).
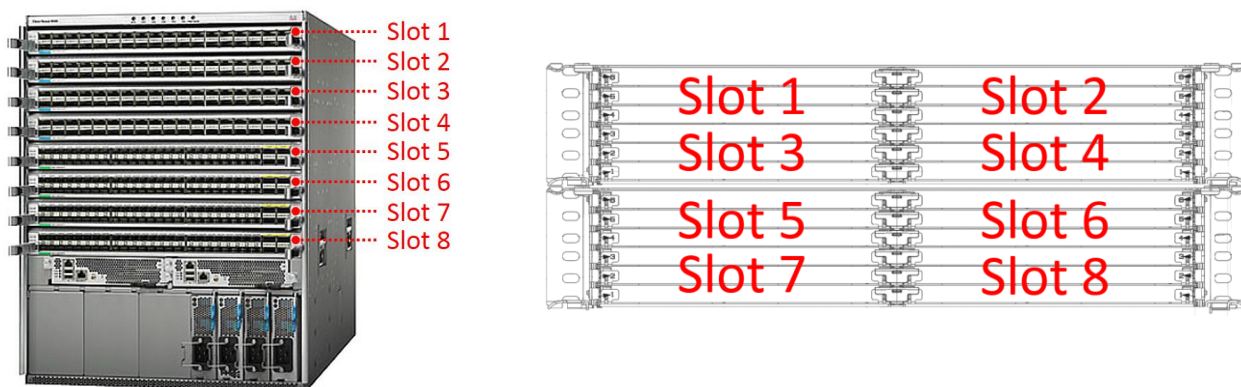

Slot 1
Slot 2
Slot 3
Slot 4
Slot 5
Slot 6
Slot 7
Slot 8

Slot 1   Slot 2
Slot 3   Slot 4
Slot 5   Slot 6
Slot 7   Slot 8

Figure 4. Port mapping native 40GE QSFP modules.

40GE MPO to 4x10GE Breakout Mode

Delivering the ports to a CPL in a logical and organized fashion can be done by using short MPO to MPO interconnect cordage and the deployment of 4x1 breakout cassettes in the HD Flex enclosure/patch panel using the arrangement shown in Figure 5.
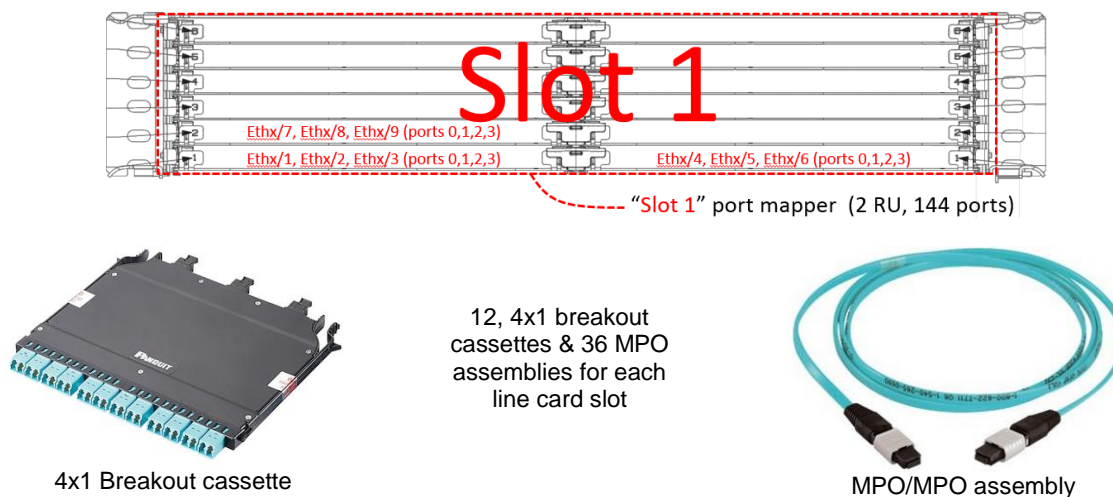

Ethx/7, Ethx/8, Ethx/9 (ports 0,1,2,3)
Ethx/1, Ethx/2, Ethx/3 (ports 0,1,2,3)   Ethx/4, Ethx/5, Ethx/6 (ports 0,1,2,3)
"Slot 1" port mapper (2 RU, 144 ports)

12, 4x1 breakout cassettes & 36 MPO assemblies for each line card slot

4x1 Breakout cassette

MPO/MPO assembly

Figure 5. Port mapping 10GE cabling elements.

Figure 6 shows the replication of eight of the 2RU port map systems shown in Figure 5.

With this system, the 40GE ports are off the switch with an MPO fiber assembly connected to the 4x1 breakout cassette in the CPL. The LC ports are in three, four-port groups on the front of the cassette to be mapped as logical 10GE ports from the 40GE QSFP module in the line card.

The deployment of eight of the 2RU HD Flex enclosure or patch panel fiber distribution systems exactly maps a 9K Nexus switch populated with eight, 36 port 40Gb/s blades in 10GE breakout mode. Alternatively, the deployment of four of the 4RU HD Flex enclosure or patch panel fiber distribution systems exactly maps the 9K Nexus switch with slightly less modularity.

The addition of these ports brought off the 9K switch and mimicked in the CPL allows for efficient cross connection with LC duplex jumpers to a 10GE serial duplex structured cabling system downstream.
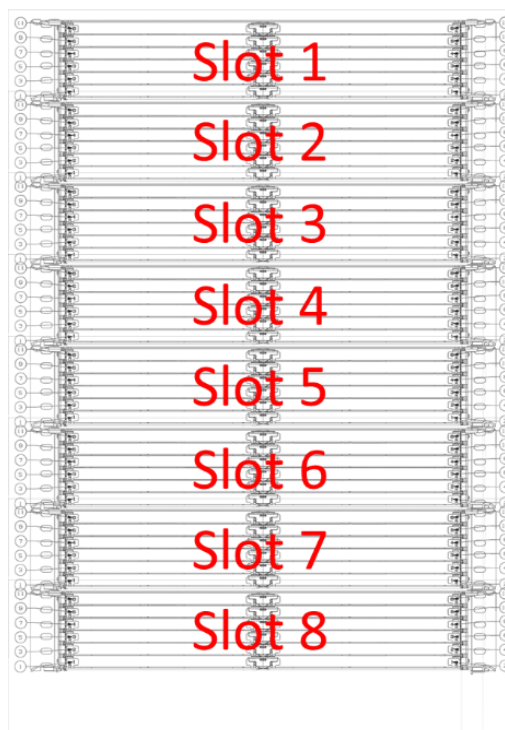

Figure 6. Port mapping 10GE from native 40GE QSFP modules.

40GE BiDi (or FET) Application

Delivering the 40GE (BiDi) or 10GE Fabric Extender Transceiver* (FET) ports to a CPL in a logical and organized fashion can be done by using short Duplex LC to MPO harnesses and the deployment of standard 6 port cassette modules in the HD Flex enclosure/patch panel using the arrangement shown in Figure 7.
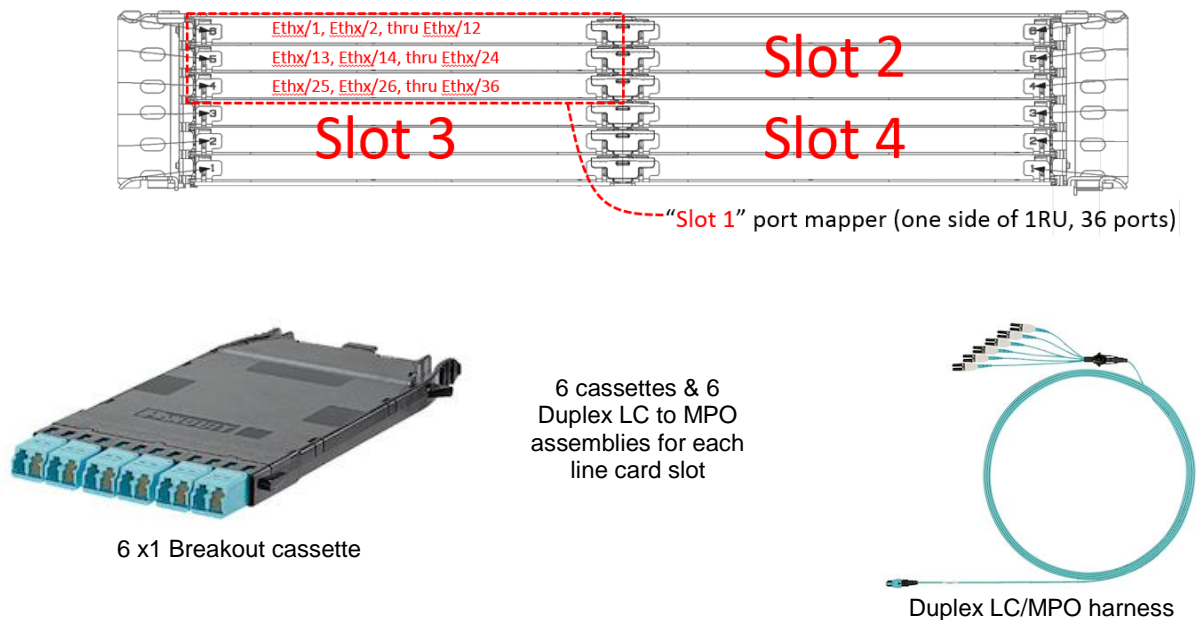

6 x1 Breakout cassette

6 cassettes & 6 Duplex LC to MPO assemblies for each line card slot

Duplex LC/MPO harness

Figure 7. 40GE BiDi (or FET) cabling elements.

Figure 8 shows the replication of two of the 2RU port map systems shown in Figure 7. With this system, the 40GE BiDi or 10GE FET ports are brought off the switch with an LC/MPO harness assembly and connected to the 6-port cassette in the CPL. The LC ports are presented in six, 6-port groups on the front of the cassette to be mapped as logical 40GE (BiDi) or 10GE FET ports from the module in the line card.
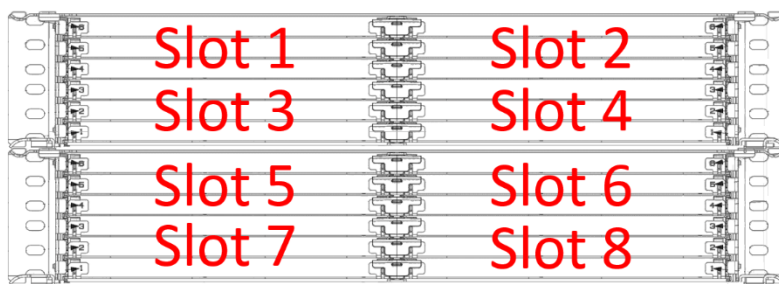

Figure 8. Port mapping BiDi or FET modules.

The deployment of two of the 2RU HD Flex enclosure or patch panel fiber distribution systems exactly maps a 9K Nexus switch populated with eight, 36 port BiDi or FET equipped blades. Alternatively, the deployment of a single 4RU HD Flex enclosure or patch panel fiber distribution system exactly maps the 9K Nexus switch with slightly less modularity. The addition of these ports brought off the 9K and mimicked in the CPL allows for efficient cross connection with LC duplex jumpers to a 10GE serial duplex structured cabling system downstream.

Visit our fiber optic systems product page for connectivity accessories and ordering information for HD Flex™ fiber enclosures, fiber assemblies, and cable management accessories.