

Nexus Overview

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Systems Engineer



VMDC 2.0

Cisco Datacenter
Core Node

Cisco Datacenter
Aggregation Node

Firewall

Load-balancer

Cisco
Datacenter Services
Node

IPS

NAM

eSMT

Secondary
Data Center

Cisco Datacenter
Access Node

Cisco
SAN

NAS

SAN

EMC Unified
Storage

Cisco Unified
Compute System

ESX

Virtual
Machine

Virtual
Appliance

vBlock

FlexPod

NAS

Netapp
Storage

Network Containers

Pre-Packaged Network Services



Service Enablement Layers

Portal and Service Catalogs

- Customer facing portal
- Accounting and billing
- SLA mgmt
- Service catalog

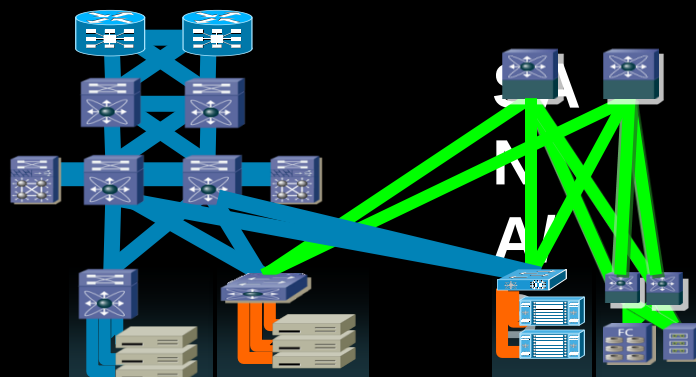


Service Orchestration

- IT admin facing
- Configuration mgmt (CMDB)
- Runbook and orchestration (RBA)
- Service desk and workflow mgmt
- Event mgmt and correlation
- Compliance and patch mgmt



Infrastructure Mgmt



vCenter



Overdrive



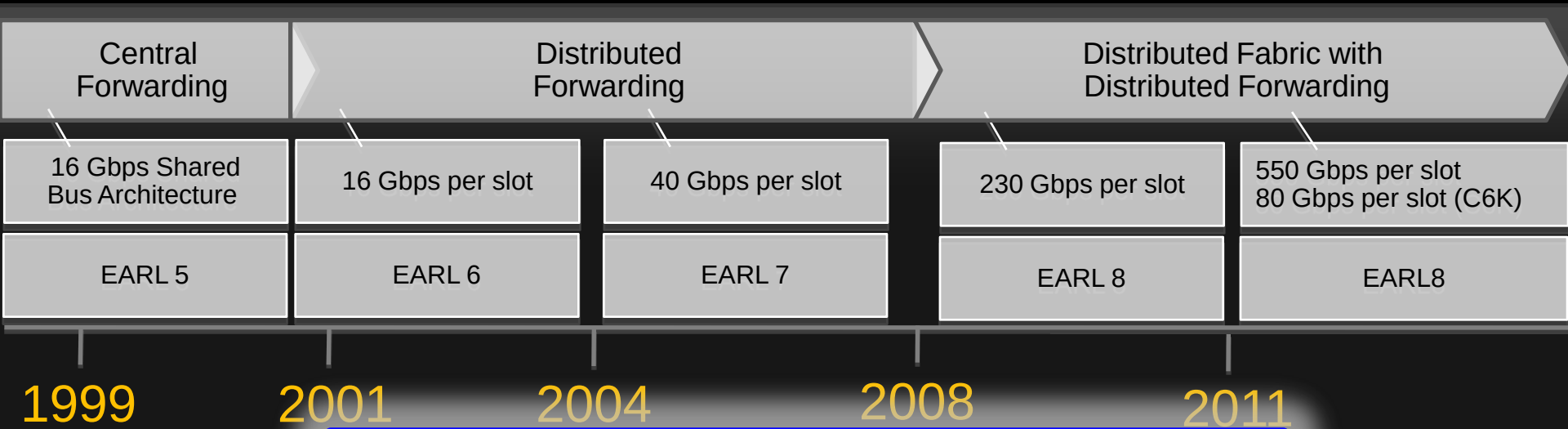
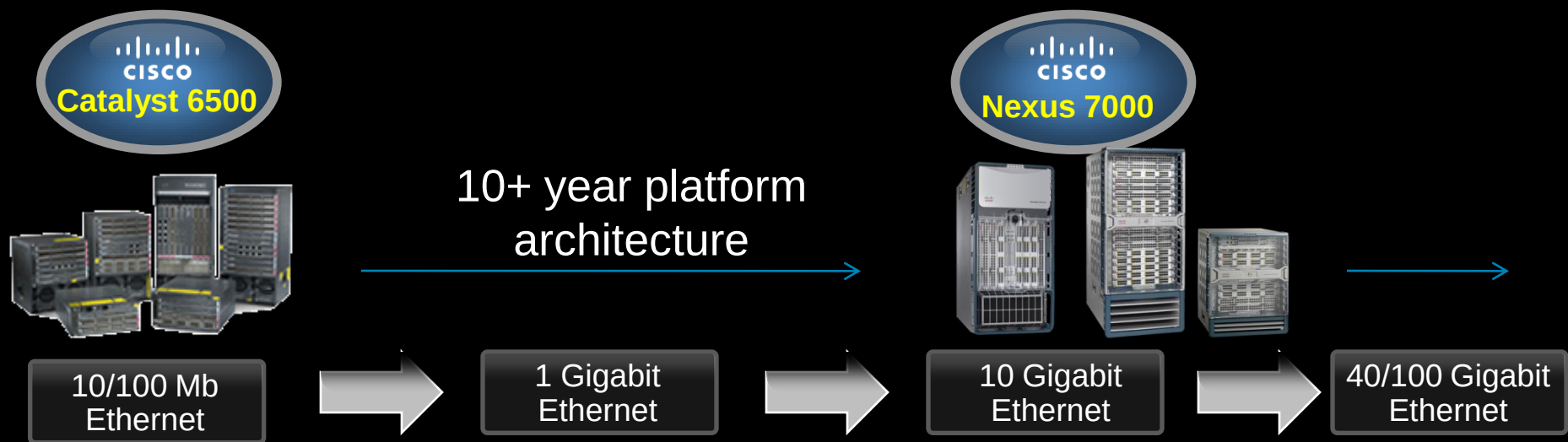
UIM



Nexus 7000

Modular Platform Investment Protection

Long lifecycle architecture



Evolution of a Proven Forwarding Architecture

Nexus 7000 Platform Overview

Next Generation Modular



Nexus 7000 and NX-OS

- 10 & 18 Slot versions
- 15+ Terabit System
- Unified Fabric Ready
- Modern, Modular OS
- Device Virtualization
- Cisco TrustSec
- Continuous Operations



Supervisor

10G Ethernet

- 32 Port SFP+ 10G
- 8 Port X2 10G - XL

1G Ethernet

- 48 Port 10/100/1000
- 48 Port 1G - XL

10G Ethernet DCB/FabricPath

- 32 Port SFP+ 10G

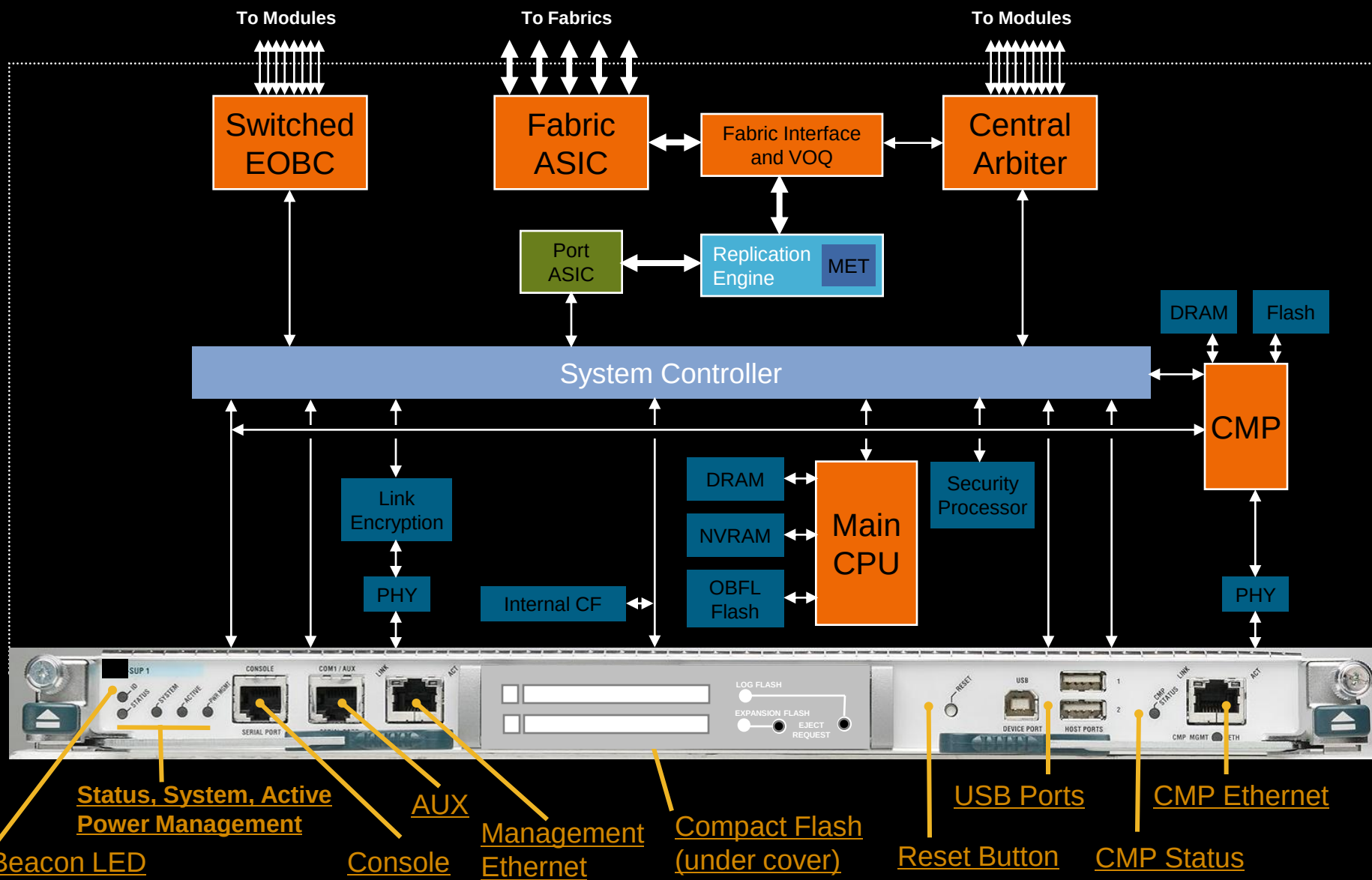
Linecard Modules



Cisco NX-OS Multi-protocol Operating System

Data Center Network Manager (DCNM)

Supervisor Engine 1 Architecture

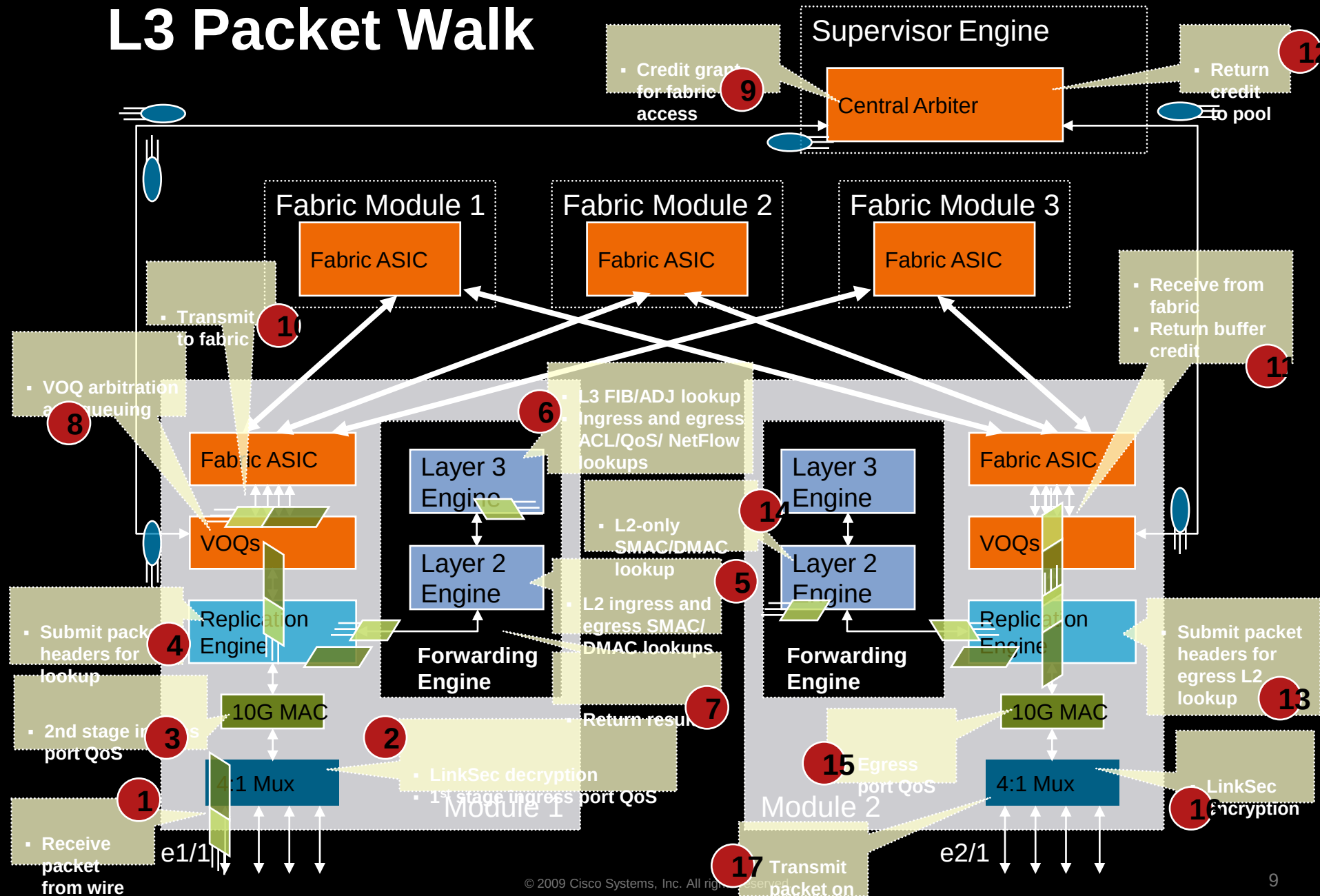


HDR = Packet Headers

DATA = Packet Data

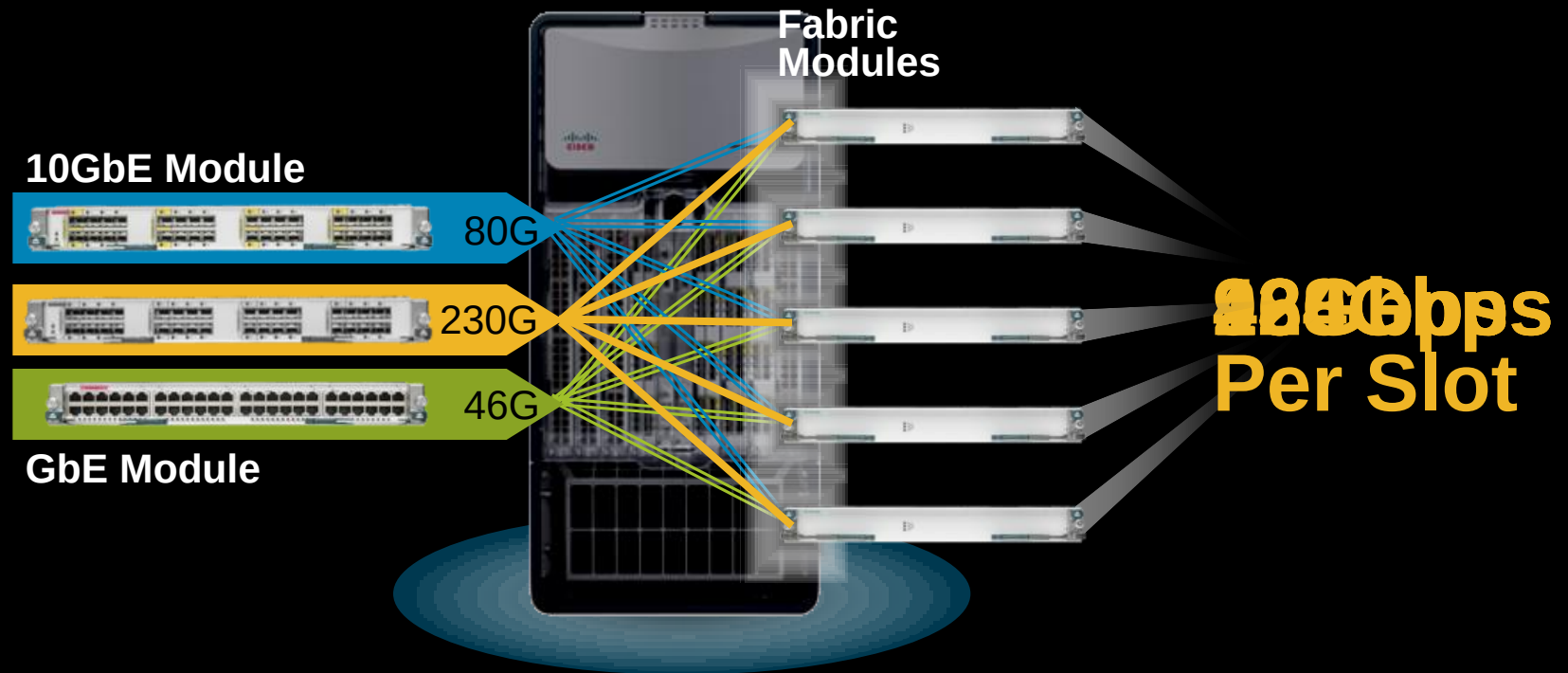
CTRL = Internal Signalling

L3 Packet Walk



15Tb+ System Performance

Bandwidth Scales with Each Fabric Module



Investment Protection and Unified Fabric

Nexus 7000 I/O Module Portfolio

Services Rich Platform (M Series Modules)



“XL” Version
in NX-OS 5.1

32-Port 10GbE Module

SFP+ SR, LR, and ER

Integrated L2 / L3 Forwarding Engine

128K FIB TCAM

80 Gbps per slot

Fabric Extender Support, 802.1aeLink-Sec

4:1 over-sub or 1:1 line rate mode



“XL” Capable

8-Port 10GbE Module

X2 Optics – SR, LR, ZR, xWDM

Integrated L2 / L3 Forwarding Engine

Up to 1 Million Prefix

80 Gbps per slot, 120 MPPS



“XL” Version
in Cairo Maint.

48-port 10/100/1000

RJ-45 Copper

Integrated L2 / L3 Forwarding Engine

128K FIB TCAM

46 Gbps per slot



“XL” Version
Available

48-port 1 Gigabit SFP Module

SX, LX, ZX, T and xWDM

Integrated L2 / L3 Forwarding Engine

128K - 1M Prefix

46 Gbps per slot

Nexus 7000 F-Series Module

High Performance 10GbE supporting Unified Fabrics

- **Scalable** 512 ports per system,
- **High-performance** 320 Gbps switching capacity
- **Low Latency** 5μs port to port latency
- **Standards Based** TRILL and DCB support
- **Flexible** 1G and 10G autosensing
- **Energy Efficient** ~10W per 10GbE port



32-Port 1/10 GbE for
server access and
aggregation

“The F-Series modules on the Cisco Nexus 7000 series are currently deployed in LLNL’s high performance computing infrastructure, offering us a high density 10GE and low latency networking solution. This technology has enabled LLNL to build large storage network fabrics to support the world class supercomputing systems vital to the laboratory's national security research and development missions”

Matt Leininger, Deputy for Advanced Technology
Projects at Lawrence Livermore National Laboratory



Nexus 7000 Linecard Options

Feature comparison of M-Series and F-Series

	M1 Series (Service Rich)	F1 Series (Performance)
Performance (bps)	80Gbps	320Gbps Local, 230Gbps Fabric
Line Rate 10GbE Ports (18 slot)	128	512
L3 (IPv4, IPv6)	Yes (Up to 128K or up to 1M routes - XL)	No
L2 Table	128K	16K
Netflow	Yes	No
ACL	Up to 64K or up to 128K (XL)	2K
Per Line Rate 10G Port Ingress / Egress Buffer	100MB / 112MB	1.53MB / 0.7MB
FCoE	No	Yes
FabricPath (TRILL)	No	Yes
Latency	~ 20 μ s	~ 5 μ s
Power per Line Rate 10GbE Port	~ 80 watts per port	~ 10 watts per port
List Price	\$70K - 32 ports 4-1 \$44K – 8 ports 1-1	\$35K – 32 ports

M1 and F1 modules are complementary

Core

All M1 Series

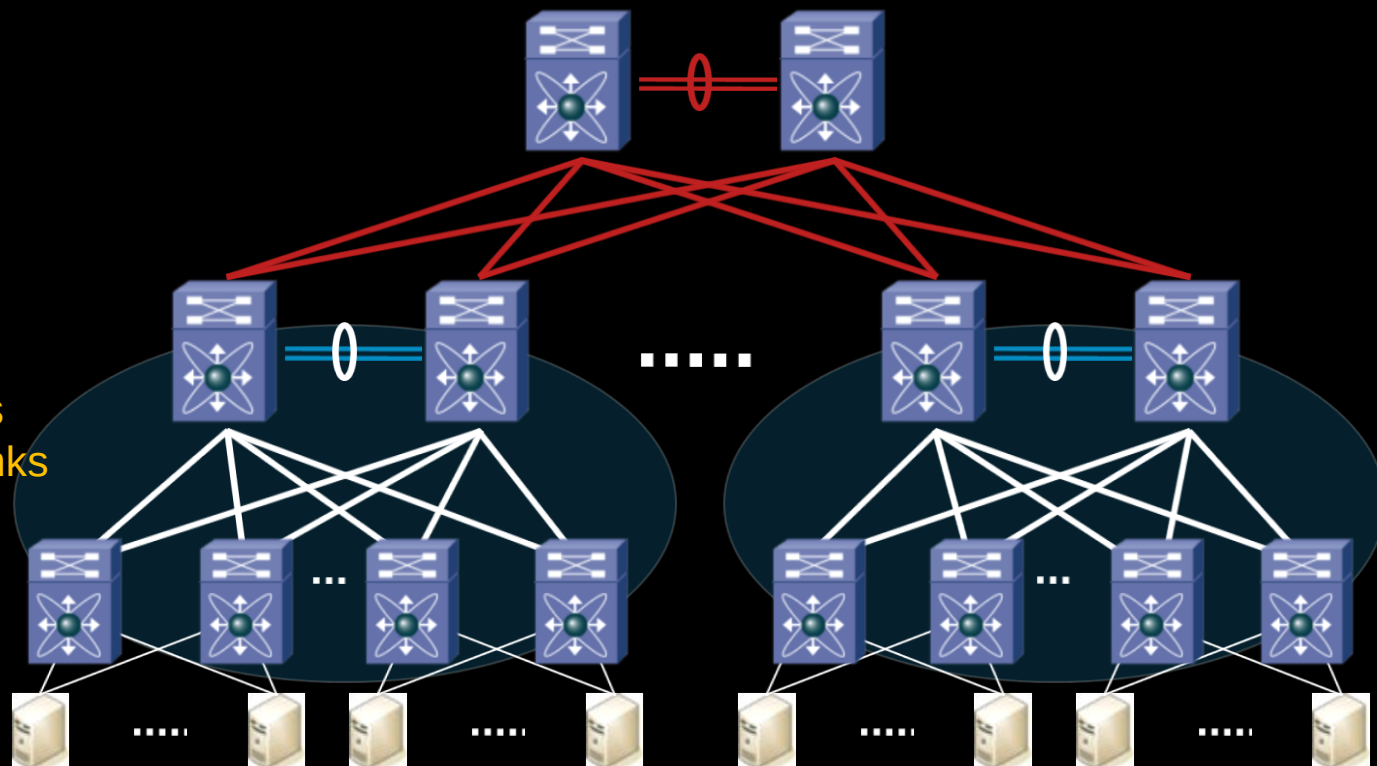
Aggregation

M1 Series Up Links

F1 Series Down Links

Access –

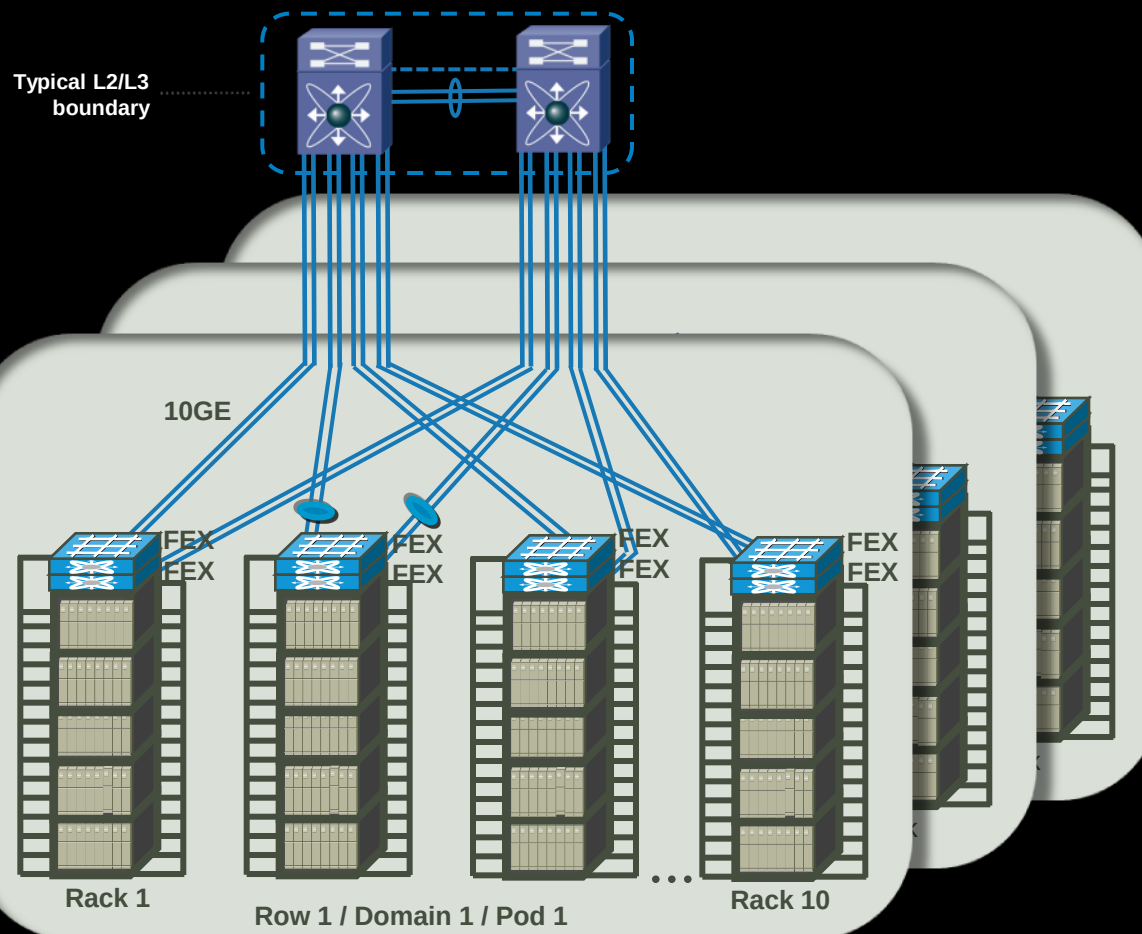
All F1 Series



- Requirements analysis will dictate where M1/F1 will be most advantageous
- Mixed chassis possible and supported
- M1 modules can provide L3 proxy functionality for F1 modules

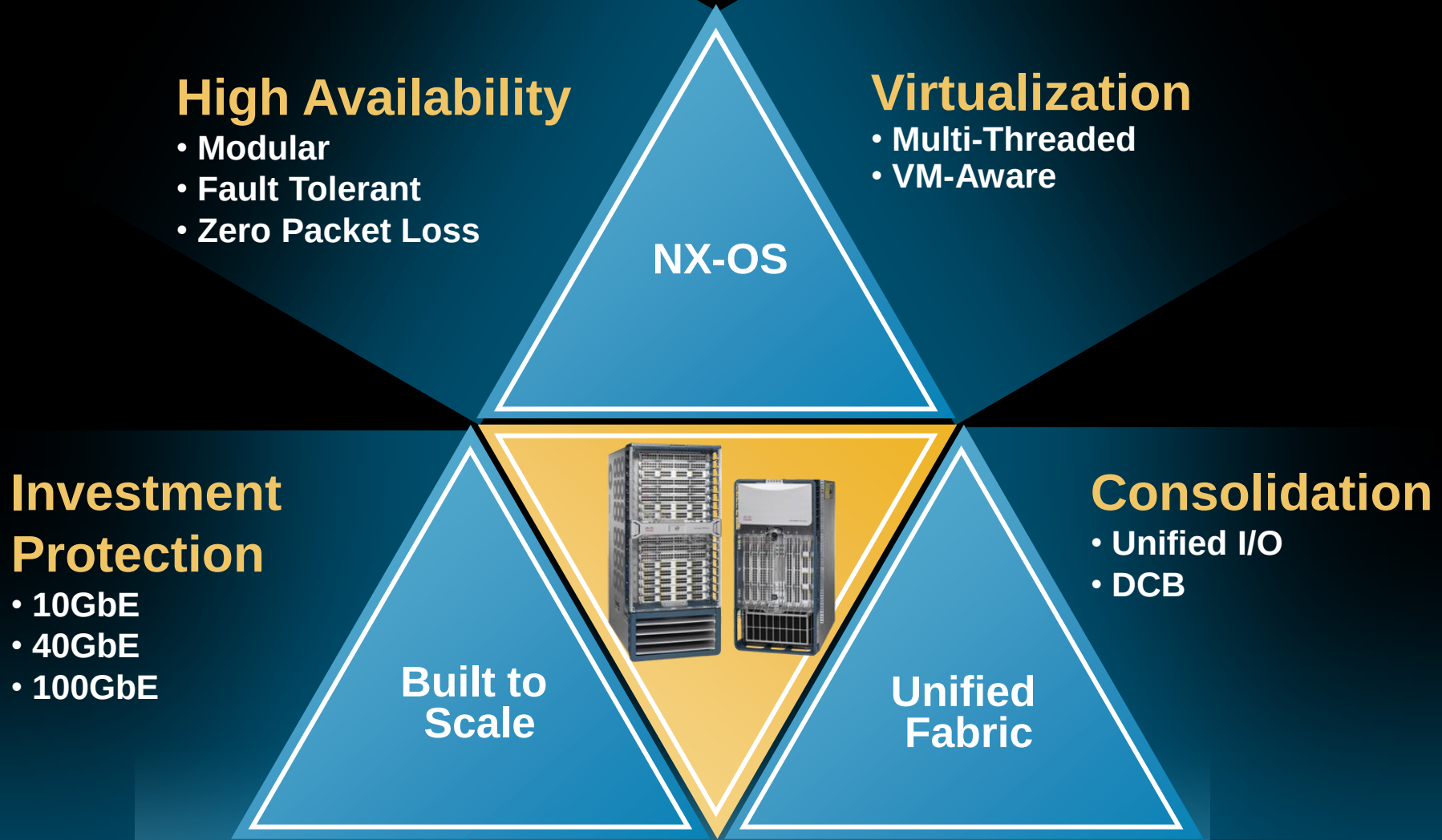
Support for Virtualized Access Layer (FEX)

Deployment Scenario: Nexus 2000 + Nexus 7000



- Nexus 2000 Fabric Extenders can be connected directly to Nexus 7000
- Simplifying management domain – 1000+ ports managed centrally (up to 32 Nexus 2248TP supported)
- Nexus 2248TP supported in NX-OS 5.1
- Benefits of ToR Cabling with Modular Chassis Features
- Software update only on Nexus 7000
 - Supported on N7K-M132XP12(L)

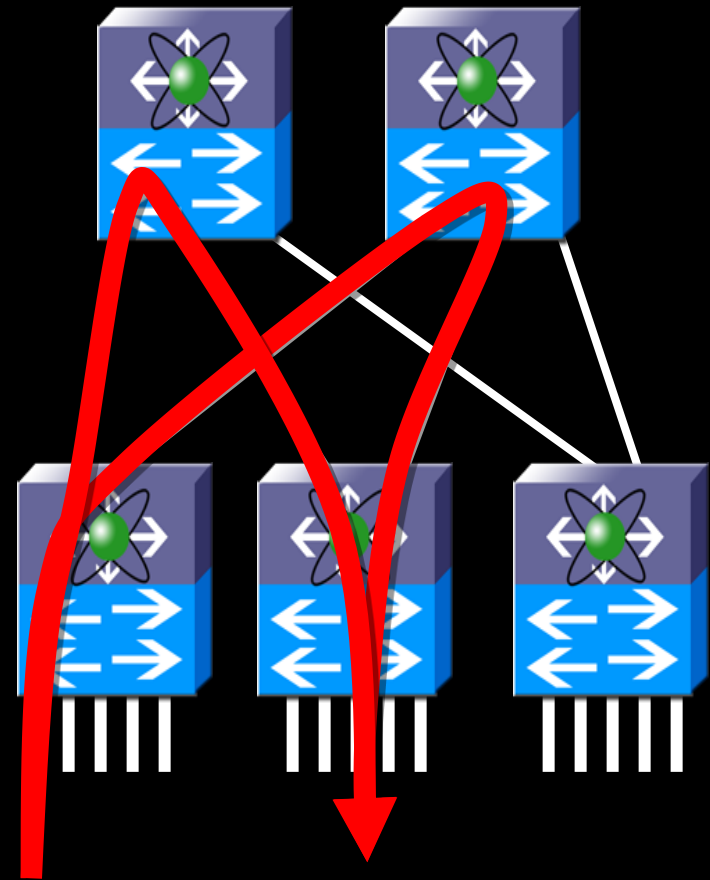
Nexus 7000 – Modular Software and Hardware



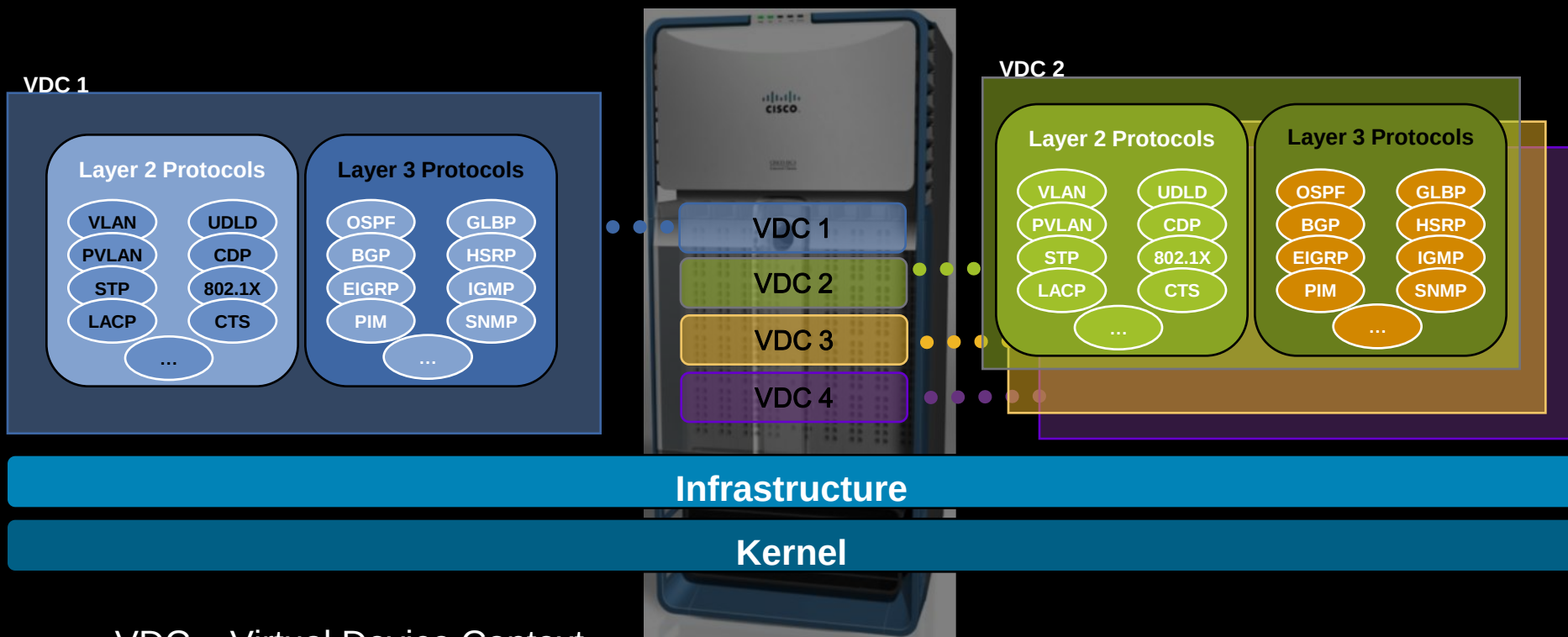
Fabricpath

Layer 2 Multipathing

- Increase bandwidth of L2 networks via multiple active links
- Finally removes Spanning Tree Protocol from the network after several evolutionary intermediate steps (STP+, VSS, vPC)
- L3 multipathing is common in IP networks, similar principles and protocols applied to L2
- Cisco FabricPath - available for Nexus 7000, planned for Nexus 5500 (2HCY2011)
- Transparent Interconnection of Lots of Links (TRILL)
- Extensions to well-known protocols (IS-IS)
- Simple configuration



Nexus 7000 Virtualization with VDCs



VDC – Virtual Device Context

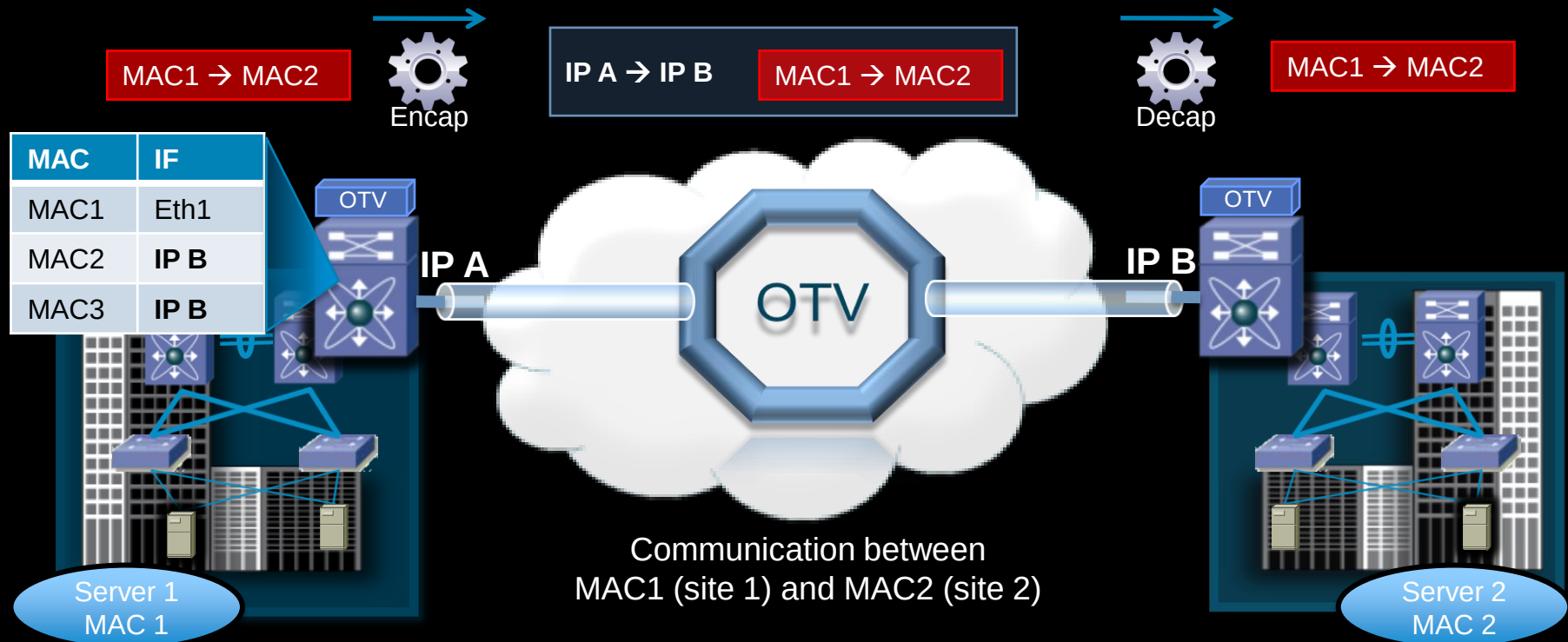
- Flexible separation/distribution of hardware resources and software components
- Complete isolation
- Complete isolation
- Secure
- Forwarding engine scalability with appropriate interface allocation

3rd Party N7K PCI Certification

Solving L2 DCI challenges

Overlay Transport Virtualization (OTV)

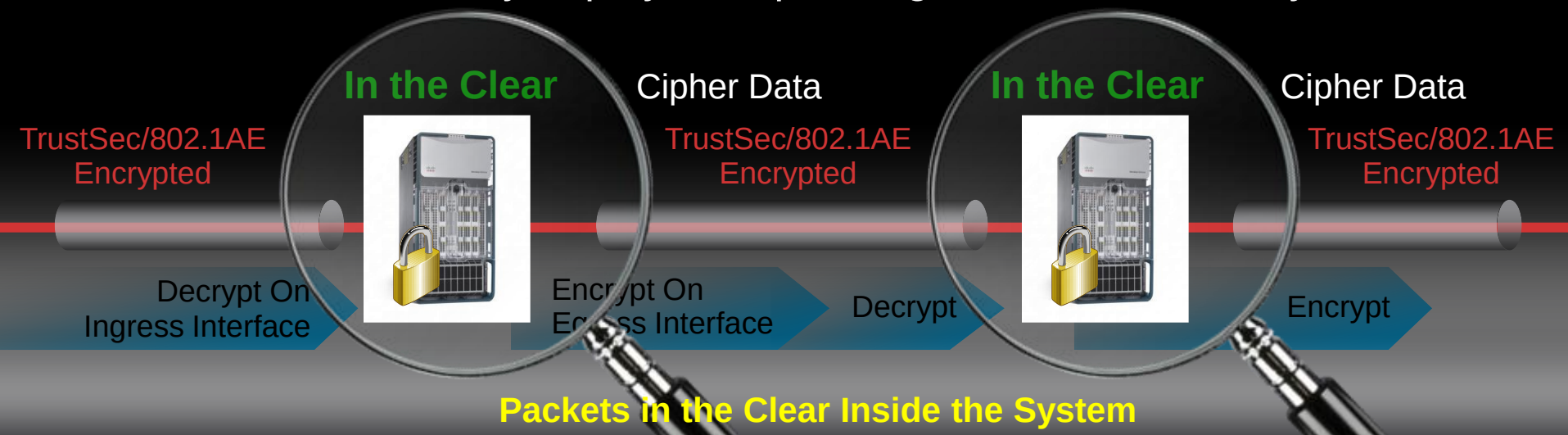
- Ethernet traffic between sites is encapsulated in IP: “MAC in IP”
- Dynamic encapsulation based on MAC routing table
- No Pseudo-Wire or Tunnel state maintained



Cisco TrustSec Integrity & Confidentiality

Line Rate Link Layer Encryption for Nexus 7000

- Hop-by-Hop packet confidentiality and integrity via IEEE 802.1AE
- “Bump-in-the-wire” model
 - ✓Packets are encrypted on egress
 - ✓Packets are decrypted on ingress
 - ✓Packets are in the clear in the device
- Allows the network to continue to perform all the packet inspection features currently used
- Can be incrementally deployed depending on link vulnerability

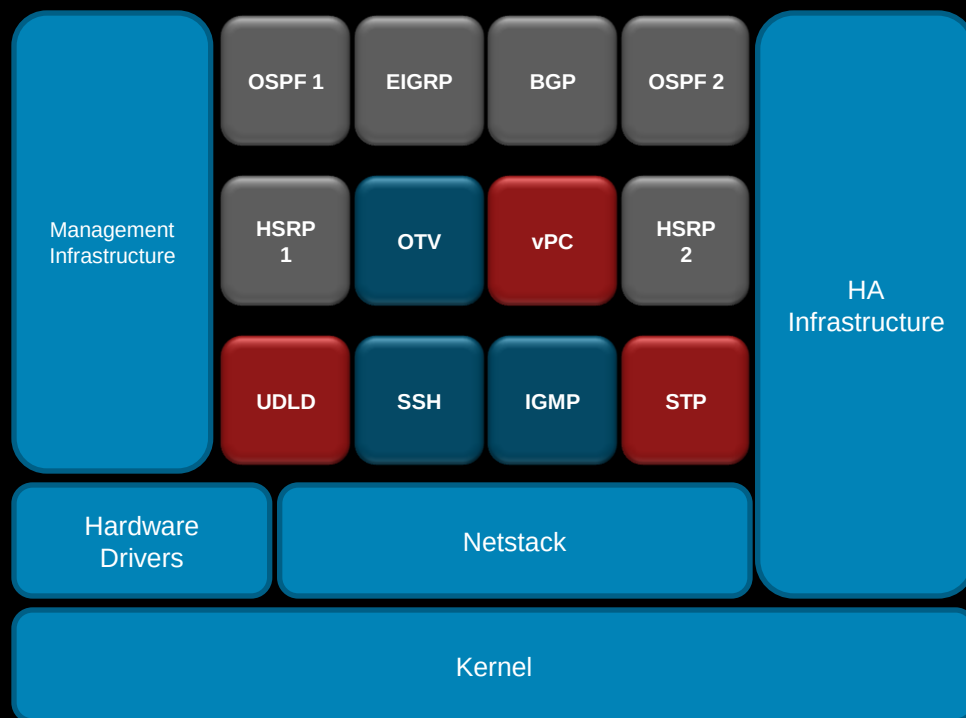


License Model Summary

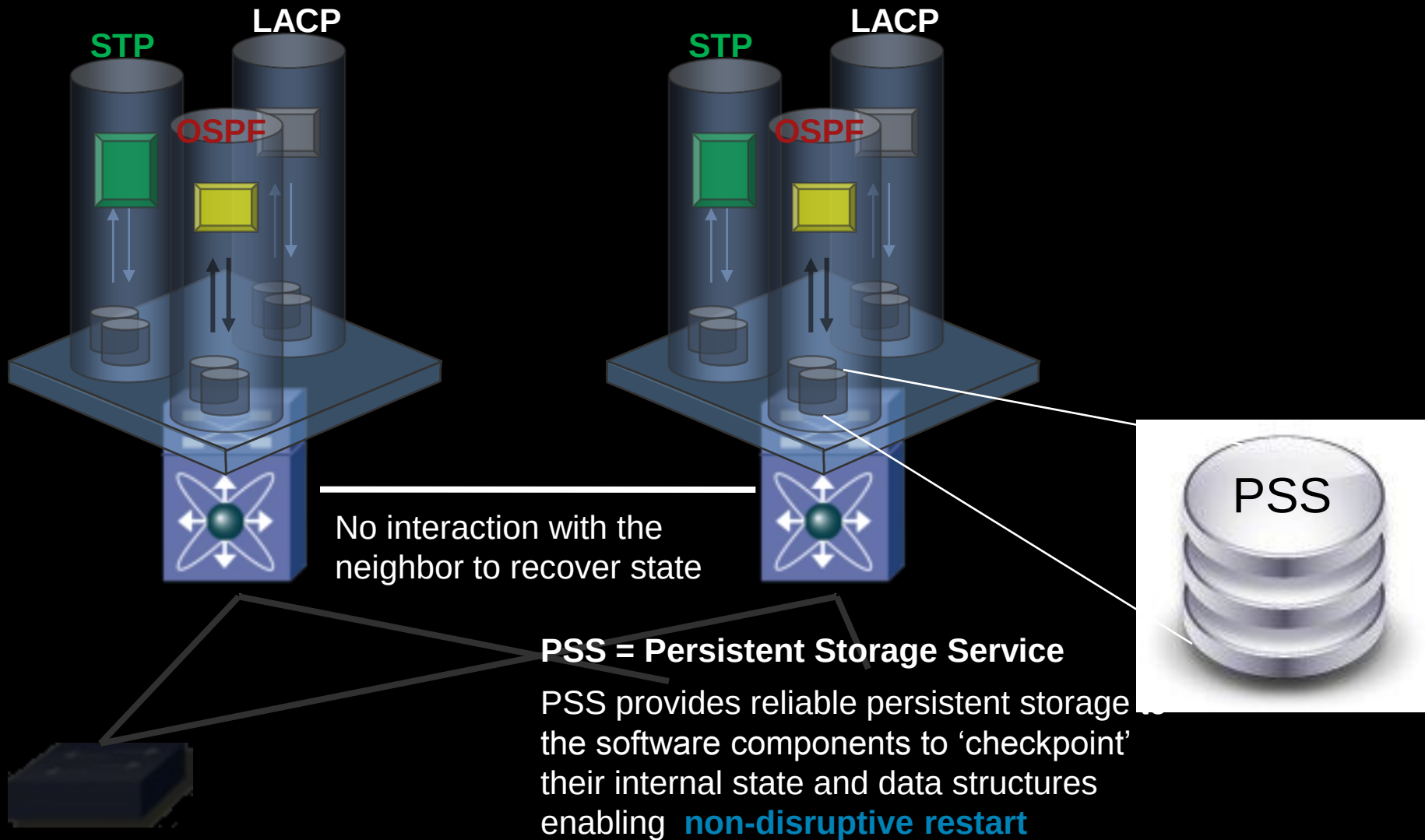
Feature License	Features
Enterprise Services Package	BGP (Multi-Protocol) EIGRP GRE (IP Tunnels) ISIS MSDP OSPF PBR PIM
Advanced Services Package	Cisco Trustsec (Encryption) VDC
Transport Services Package	OTV 5.0(2a)
Scalable Feature Package	XL Modules 5.0(2a)
Enhanced Layer 2 Package	Cisco Fabric Path 5.1(1)

NX-OS Feature/Service Granularity

- Minimized failure domain
- Streamlined deployment
- Reduced attack surface
- Improved bug triage



NX-OS Stateful Process Restart

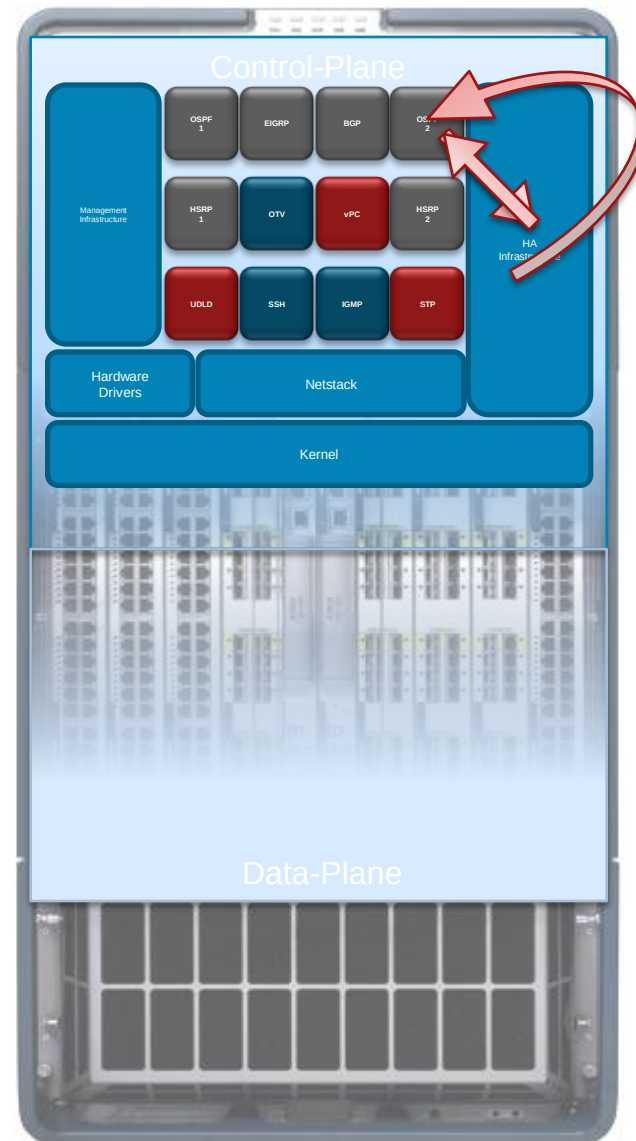


NX-OS Stateful Process Restart (cont.)

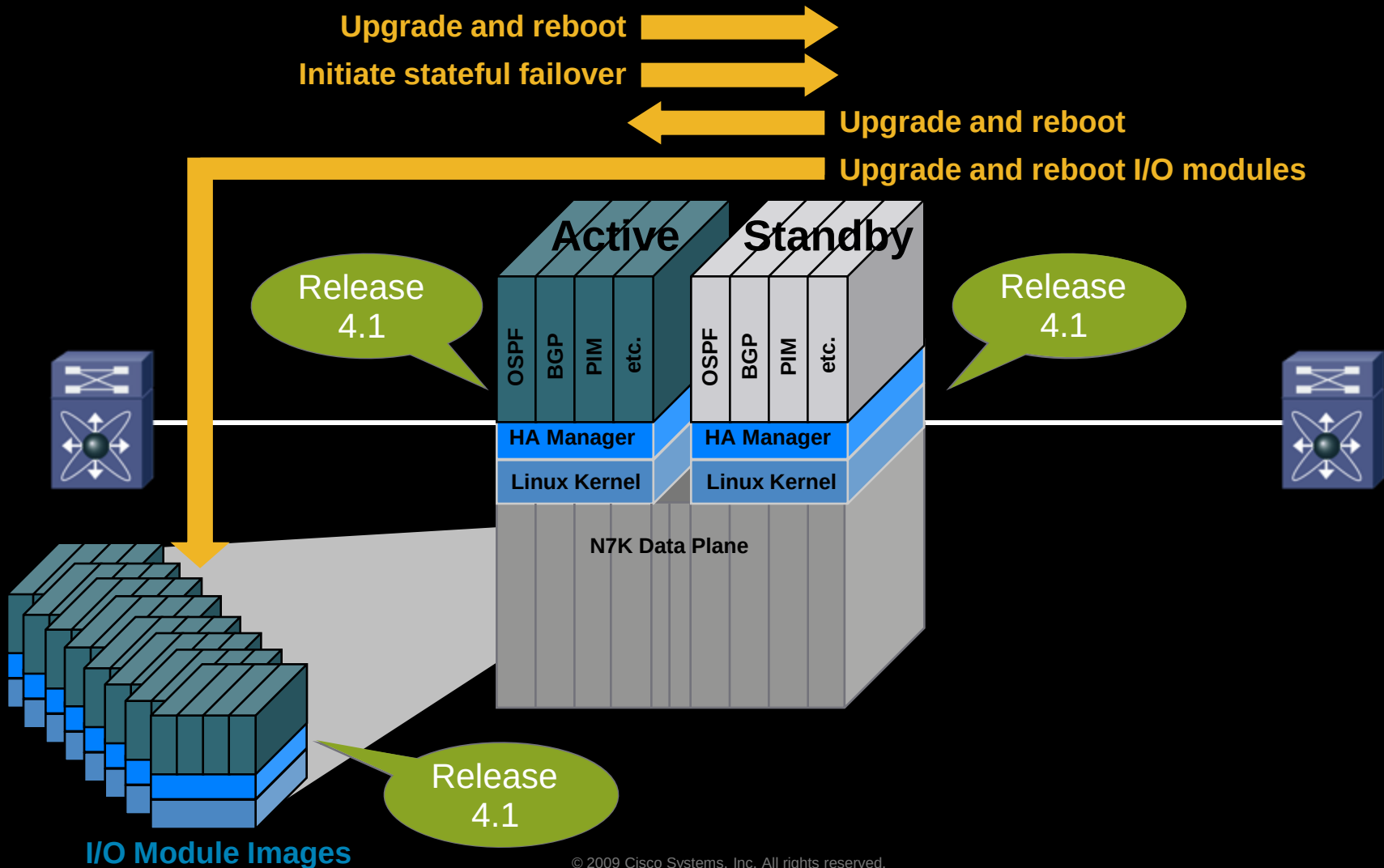
- NX-OS services checkpoint their runtime state to the PSS for recovery in the event of a failure

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: ~80ms
- State is recovered, operation resumes



True In-Service Software Upgrade on Nexus 7000



High Availability – Independently Verified Zero Packet Loss

- ✓ Zero Packet Loss when Upgrading and Downgrading the software image - ISSU
- ✓ Zero Packet Loss when removing Fabric Cards
- ✓ Zero Packet Loss when killing and restarting OSPF
- ✓ Zero Packet Loss when failing over Supervisors

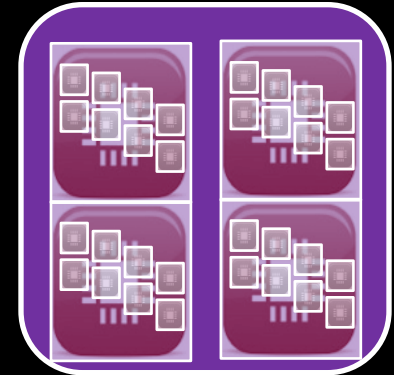
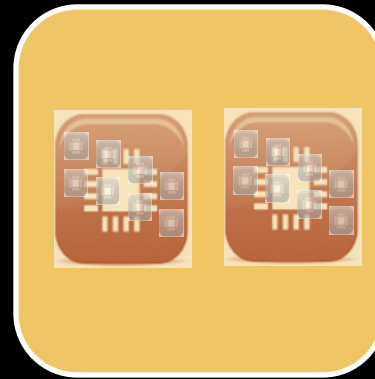
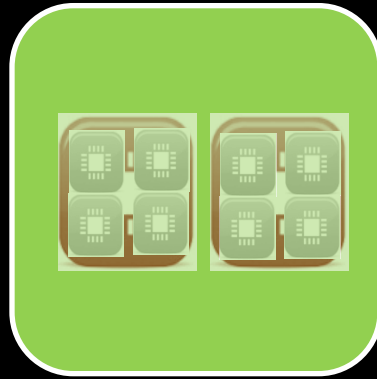


Test Conditions: Nexus 7000 I/O modules load balance all of the traffic across all 5 Fabric Cards. The test was performed with 51,200 OSPF routes, 256 OSPF neighbors (one on each 10GbE port), every packet going through a security ACL of 7000 lines, every packet being rewritten using a 500 line QOS ACL, each line cards was doing 48 Mpps lookup, and Cisco Netflow to track up to 512,000 flows.

Virtual Machine Proliferation

Future network must accommodate high-density of Virtual Machines

Cisco UCS C460



**Dual Socket –
Single Core**

4 VMs per Core

**8 VMs per
Physical Server**

**Dual Socket –
Quad Core**

4 VMs per Core

**32 VMs per
Physical Server**

**Dual Socket –
Eight Core**

4 VMs per Core

**64 VMs Per
Physical Server**

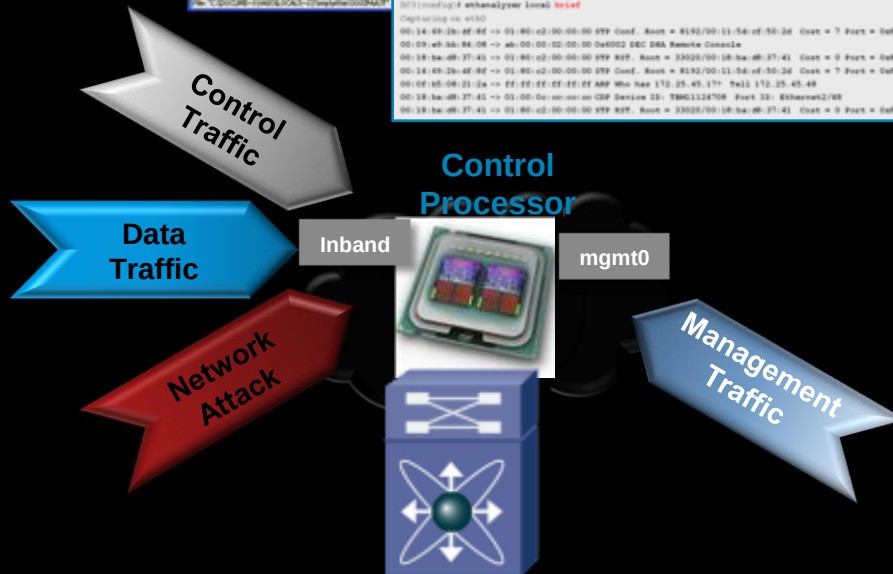
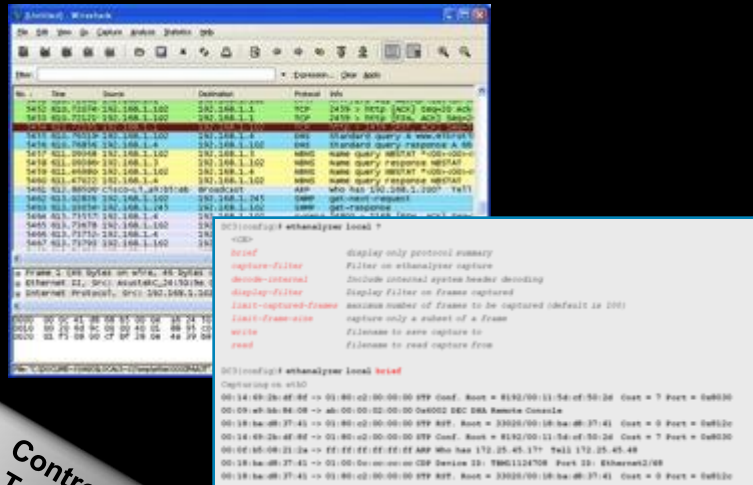
**Quad Socket –
Eight Core**

4 VMs per Core

**128 VMs Per
Physical Server**

Growth in VMs requires large table sizes in aggregation layer
VM density growing with Moore's Law

Control Plane Traffic Monitoring Embedded WireShark Analyzer



- Monitor traffic from inband and mgmt0 interfaces to the Control Processor
- Extensive capture and display options, including to file (.pcap)
- Capture rules/filters

Real-time embedded protocol analyzer provides ultimate visibility into traffic flows within the box



Nexus 5000

Cisco Nexus 5010/5020

1st generation of Nexus 5xxx family

Industry's First I/O Consolidation Virtualization Fabric for Enterprise Data Center

Nexus 5000 Switch Family



Nexus 5010 - 28-Port L2 Switch

- 20 Ports 10GE/FCoE/DCB, fixed
- 1 Expansion Module



Nexus 5020 - 56-Port L2 Switch

- 40 Ports 10GE/FCoE/DCB, fixed
- 2 Expansion Modules

Expansion Modules



Fibre Channel

- 8 Ports 1/2/4G FC



Fibre Channel

- 6 Ports 2/4/8G FC



FC + Ethernet

- 4 Ports 10GbE/FCoE/DCB
- 4 Ports 1/2/4G FC



Ethernet

- 6 Ports 10GE/FCoE/DCB



2x10GE/DCB/FCoE



SW FCoE/DCB + 2x10GE



2x10GE

OS

Cisco NX-OS

Mgmt

Cisco Fabric Manager and Cisco Data Center Network Manager

Cisco Nexus 5548P/5548UP/5596UP

2nd generation of Nexus 5xxx family

Evolution of Nexus 5000 family to provide increased functionality and scalability

Nexus 5500 Switch Family



Nexus 5548P and Nexus 5548UP

- 32 fixed 1/10GE/FCoE/DCB or unified ports
- L3 capable (daughter card)
- 1 Expansion Module



Nexus 5596UP

- 48 fixed unified ports
- L3 capable (modules)
- 3 Expansion Modules

Expansion Modules



10GE/FCOE/DCB

- 16 ports
- 1/10 GE



Unified ports

- 16 Ports
- 1/10 GE, 1/2/4/8G FC



FC + Ethernet

- 8 Ports 1/10GE
- 8 Ports 1/2/4/8G FC

Partners



2x10GE/DCB/FCoE



SW FCoE/DCB + 2x10GE



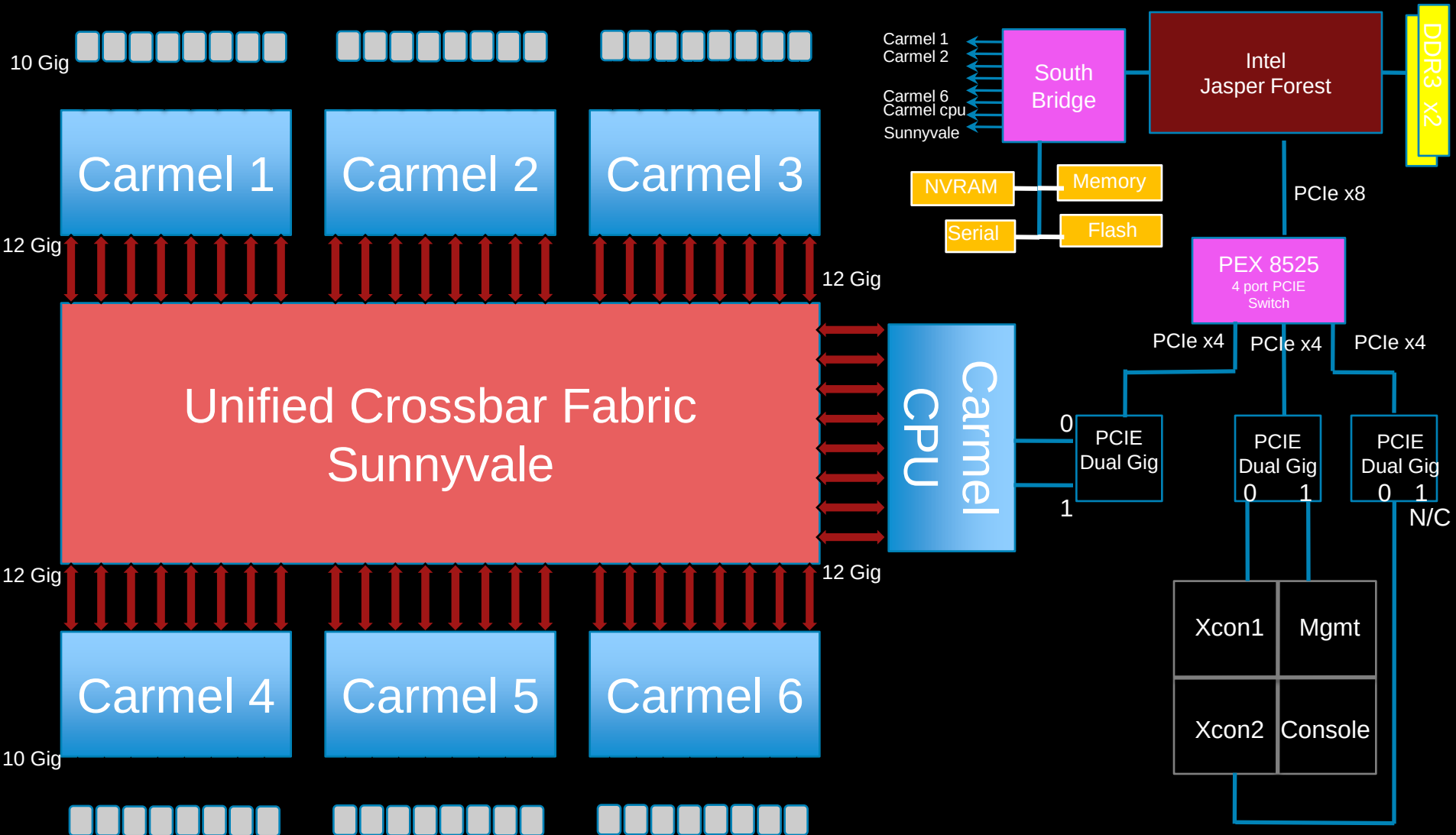
2x10GE

Cisco NX-OS

Mgmt

Cisco Fabric Manager and Cisco Data Center Network Manager

Nexus 5548 Hardware Diagram



Nexus 5500 Hardware Highlights (1)

- 1/10GE classical Ethernet / DCB / FCoE switch
- 1/2/4/8G Fibre Channel switch, T11 FCoE
- 4096 VLANs (some are reserved by NXOS in SW)
- 32k MAC addresses
 - Consider 4k for mcast and 25k for unicast – remaining is for hashing collision space
- 4k multicast groups
- 96 ports of line-rate 10GE

Nexus 5500 Hardware Highlights (2)

- **HW support for Cisco L2MP, IETF TRILL (together they are referred to as Fabricpath)**
- **QoS and Multicast enhancements (DSCP marking, more multicast queues...)**
- **SPAN enhancements**
- **LIF scaling (4K every 8 ports) for FEX/NIV use**
- **Support for IEEE 1588 (Precision Time Protocol – μ s timestamp)**

Unified ports

Overview

- Ports on Nexus 5548UP & Nexus 5596UP and Unified ports GEM can be configured to be in Ethernet or FC mode.

- CLI :

```
n5k(config)# slot <slot-num>
```

```
n5k(config-slot)# port <port-range> type <fc | ethernet>
```

- Configuration example

```
n5k(config)# slot 1
```

```
n5k(config-slot)# port 41-48 type fc
```

```
n5k(config-slot)# port 1-40 type ethernet
```

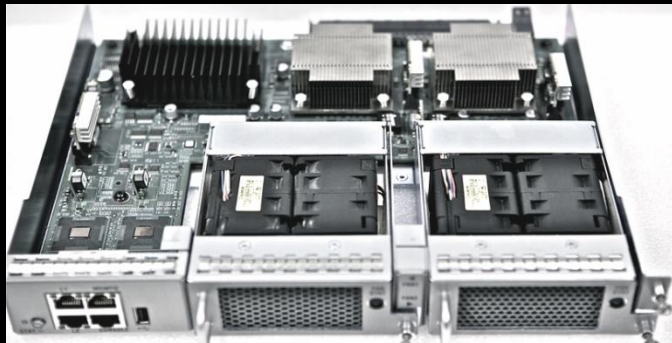
- Supported HW

- ✓ Nexus 5548UP & Nexus 5596UP baseboard ports
- ✓ Unified GEM Ports

Nexus 5500 L3 capabilities

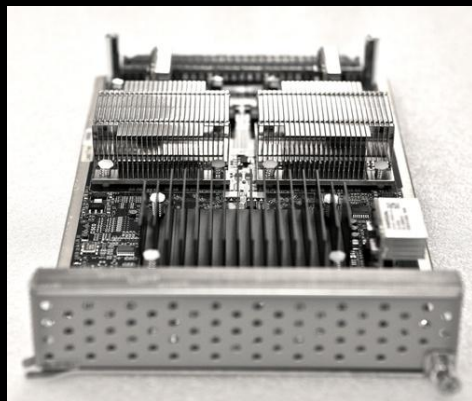
Enabling new deployment scenarios

Orderable
Now!



N55-D160L3

- Daughter-card for Nexus 5548P/UP
- Field replaceable
- In-rack upgradeable for deployed units
- Enables Layer 3 on all 48 10GE ports
- 160Gbps (240Mpps) of Layer 3 processing
- Additional 100W power consumption



N55-M160L3

- Expansion module for Nexus 5596UP
- No front-panel ports
- Enables Layer 3 on all ports of 5596UP
- 160Gbps (240Mpps) of Layer 3 processing
- Expandable to 480Gbps of processing*
- Functions as 48 port Linerate router*
- Not compatible with 5548P/UP
- Additional 100W power consumption per module

* Enabled in future with software upgrade

Layer 3 Feature Details at FCS

Feature	Details
L3 interface	• L3 interface (non-FEX ports) • L3 sub-interface • SVI (FEX ports could be members of VLANs) • Port channels
VRF	• VRF-lite • VRF aware Unicast -BGP/OSPF/RIP • VRF Aware Multicast
BGP	• Peer templates • Neighbor Authentication • Route Reflectors • BGP Confederations • Route Aggregation • BGP Dampening • Route Refresh Capability • Graceful Restart • ECMP • Route Redistribution • Route Filtering • VRF aware BGP

Layer 3 Feature Details at FCS

Feature	Details
OSPF	• Supports all type of OSPF Area • Authentication • Area Filter-list • Virtual Link • Graceful Restart • ECMP • Route Redistribution • Route Filtering – Prefix-list, Filter-list • LSA & SPF Throttling • VRF Aware OSPF
RIP	• MD5 Authentication • Route Redistribution • Route filtering • VRF Aware
EIGRP	• Authentication • Route Summarization • Route Redistribution • Route filtering
Static route	

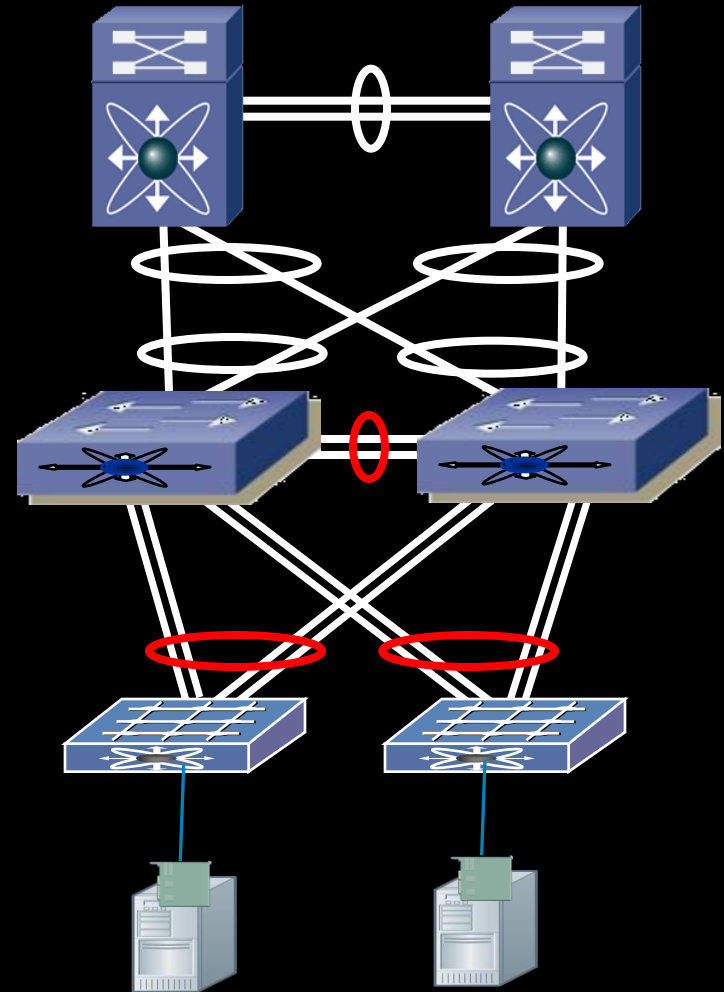
Layer 3 Feature Details at FCS

Feature	Details
Multicast	• PIM-SM • MSDP • RP Selection – Static, Auto , Any cast, BSR • SSM • VRF Aware PIM-SM/IGMP
IGMP	• Version 2, 3
uRPF	Strict and Loose mode, uRPF with ACL
ACL	Router ACL with L3 & L4 options to match
HSRP/VRRP	Object Tracking, Preemption, MD5 Authentication, VRF Aware
Other	SPAN, ECMP (16)

Data Center Access Architecture

Virtual Port Channel – Design Considerations

- Two independent vPC configurations **are** supported on the same N5K
- vPC upstream to the N7K is independent of the downstream vPC connecting the N2K
- Independent hashing decisions for the upstream and downstream traffic flows



Thank you.

