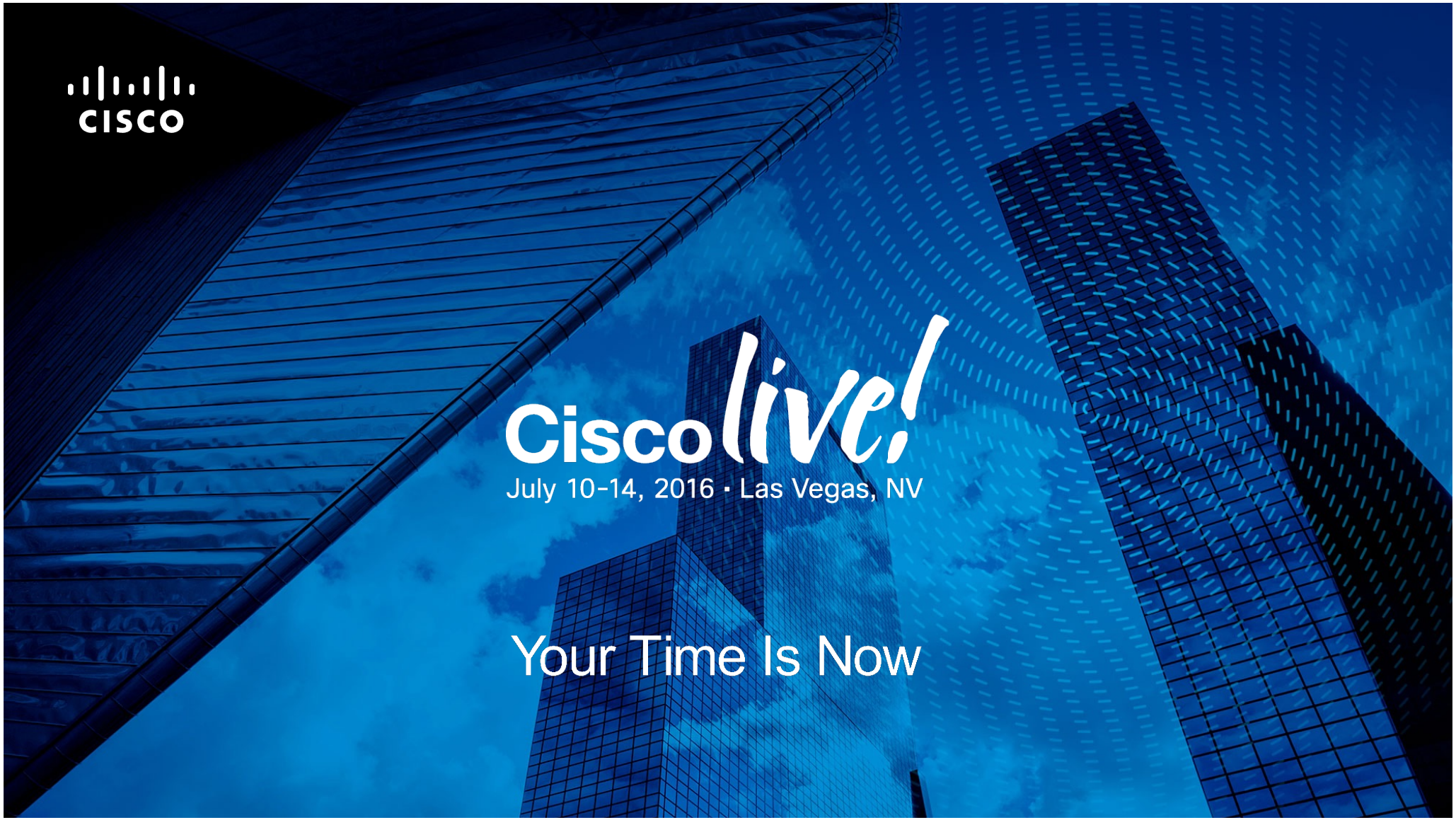
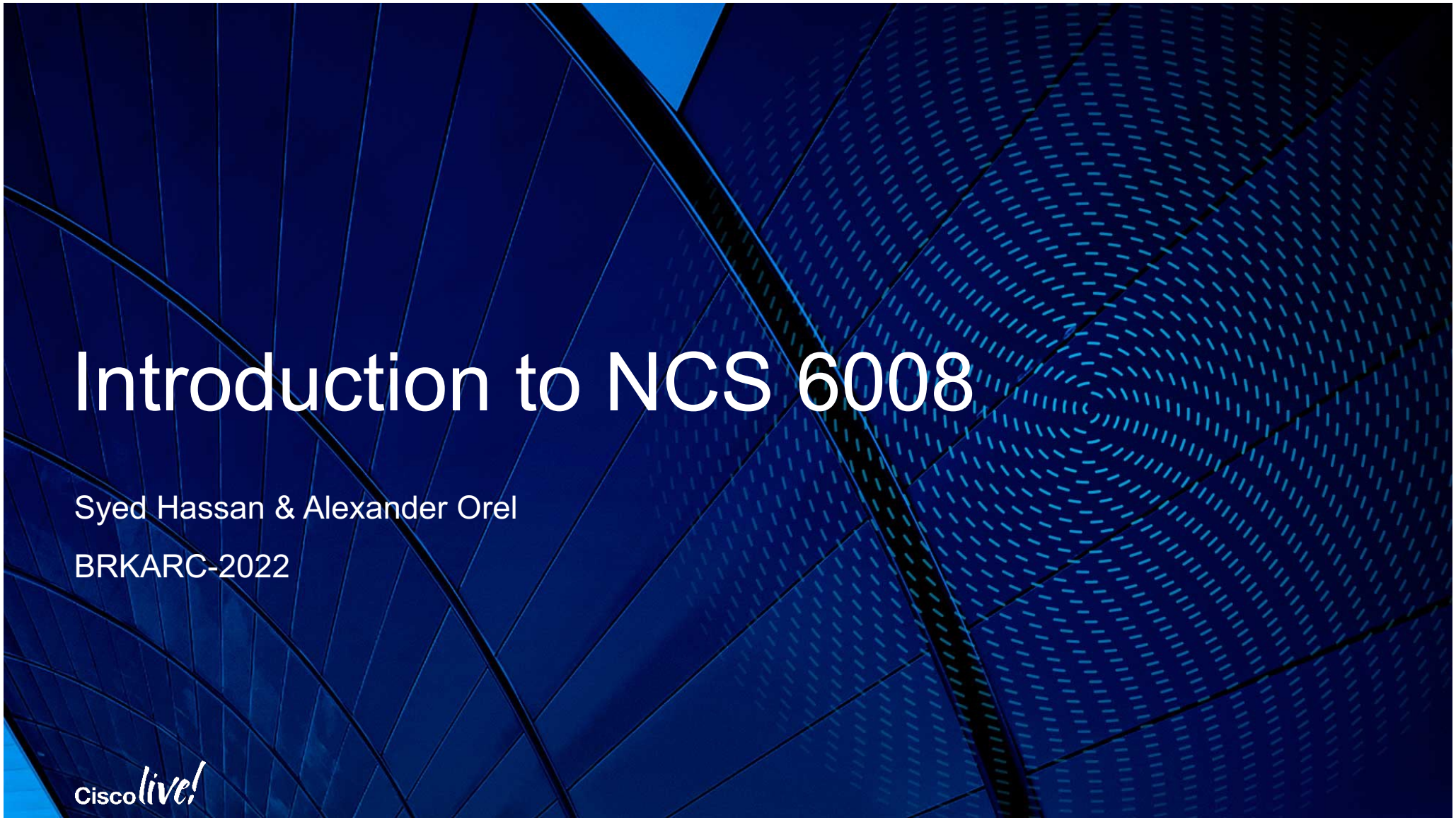

Cisco live!
July 10-14, 2016 · Las Vegas, NV
Your Time Is Now



Introduction to NCS 6008

Syed Hassan & Alexander Orel

BRKARC-2022

Cisco live!

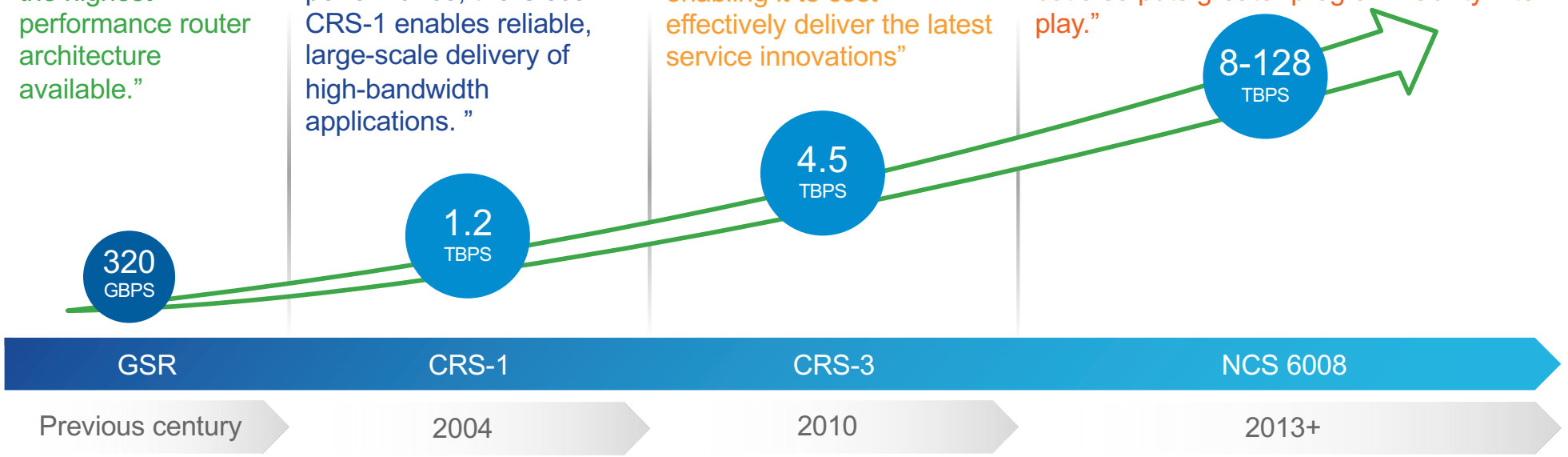
Core routing platforms evolution

"With the new 10Gbps capabilities, Cisco is providing the highest performance router architecture available."

"With its technology breakthroughs and industry-leading performance, the Cisco CRS-1 enables reliable, large-scale delivery of high-bandwidth applications. "

"Cisco CRS-3 offers unparalleled traffic capacity and network intelligence, enabling it to cost-effectively deliver the latest service innovations"

"400Gbit/s nPower X1 processor behind the NCS brings performance to handle "Internet of Things"-scale transactions, but also puts greater programmability into play."



Agenda

- What is Network Convergence System
- NCS 6008 Hardware Architecture
- Virtualized IOS XR on NCS 6008
- Packet Path and HA
- Summary

What is Network Convergence System

Family of Hardware & Software Offering
Integrated, Resilient & Scalable Architecture

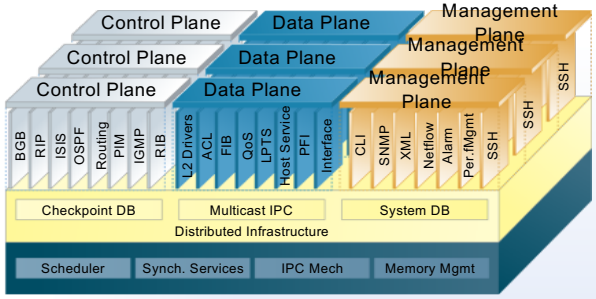
Hardware
Platforms for High Bandwidth Routing & Optical Networks
NCS 6000, NCS 4000, NCS 5000/5500

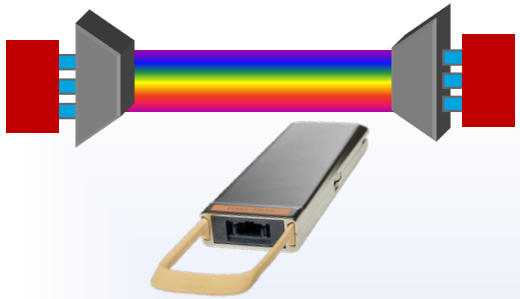
Software
Virtualized Cross-platform Operating System : Virtualized IOS-XR

Network Convergence System

Cisco Routing Technology

Key Innovation Investments





Cisco NPU
Custom Silicon Family

Virtualized IOS-XR

Optics

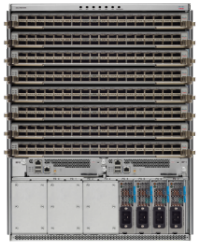
NCS Family of Platforms

NCS 6000

IP Transport Router

Up to 5T/slot

1.2 Pbps MC Systems



NCS 5500

Ultra Dense 100GE router

3.6T/slot

288 100GE ports per chassis

NCS 5000

Small form-factor 10/25/40/100GE Dense System

Up to 32 100GE in 1RU

NCS 4000

Converged Packet Optical Solution

OTN + WDM + SONET +Ethernet

Up to 500G/slot

NCS 2000/NCS1000

Next Gen ROADM

Aggregation of QSFP28/QSFP+

200G/250G DWDM muxponders

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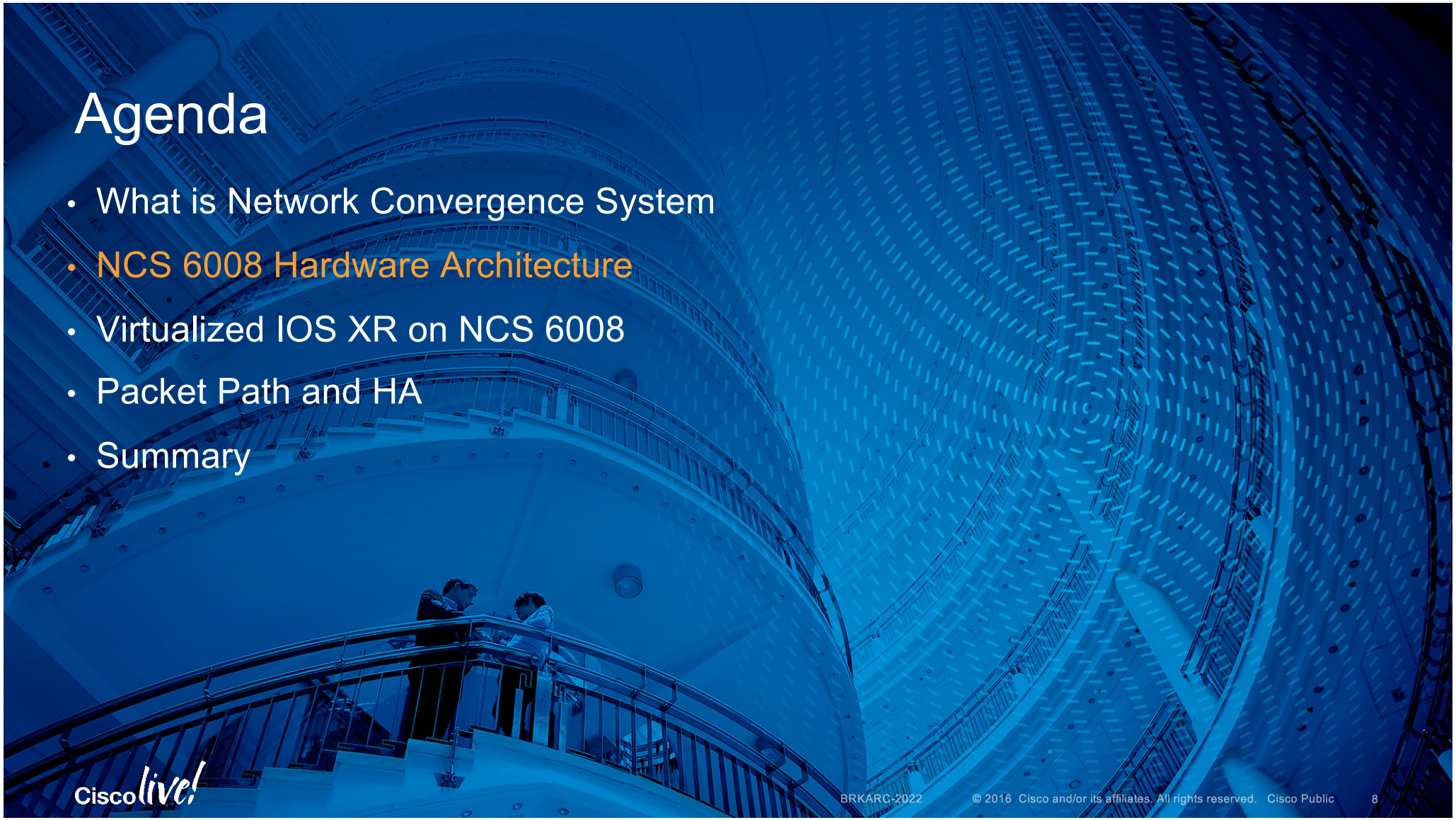
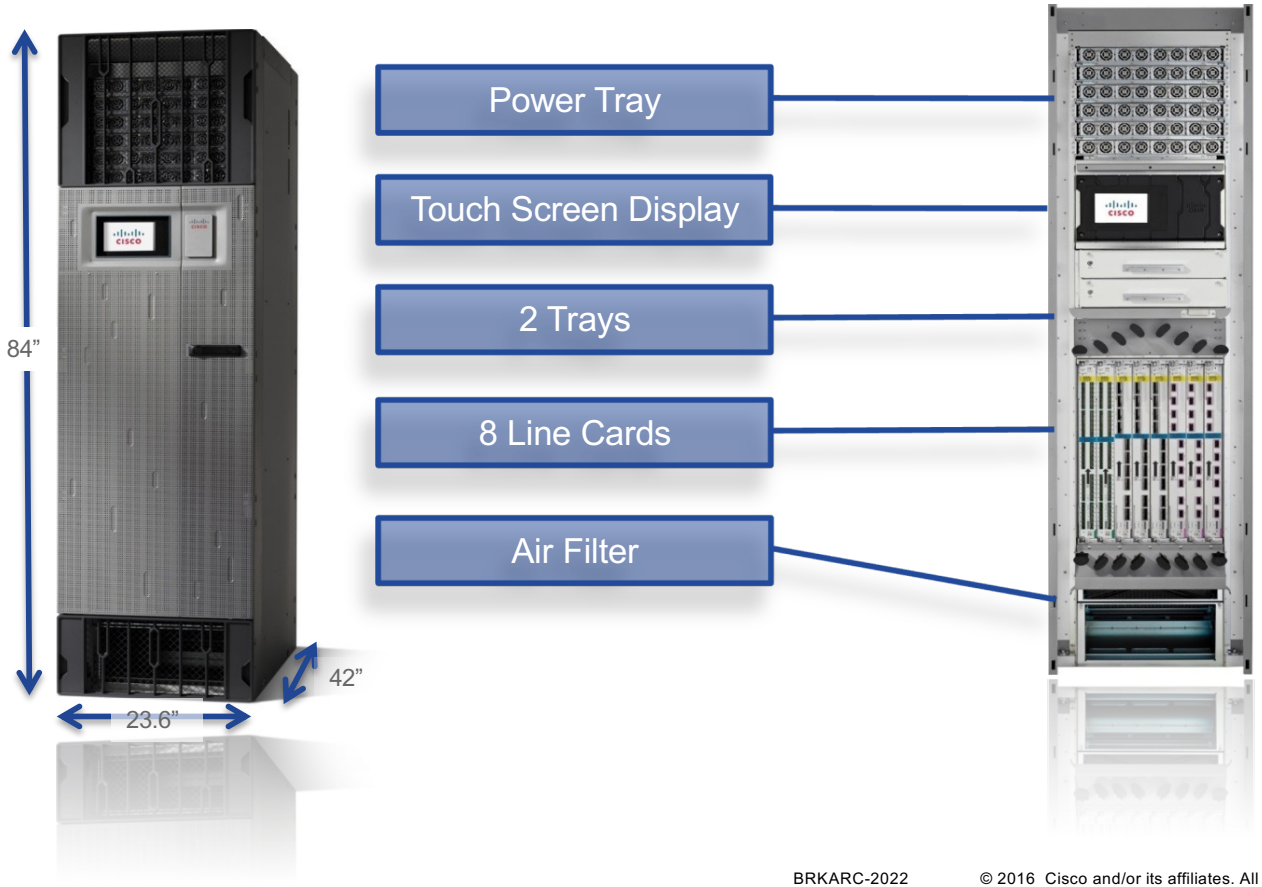


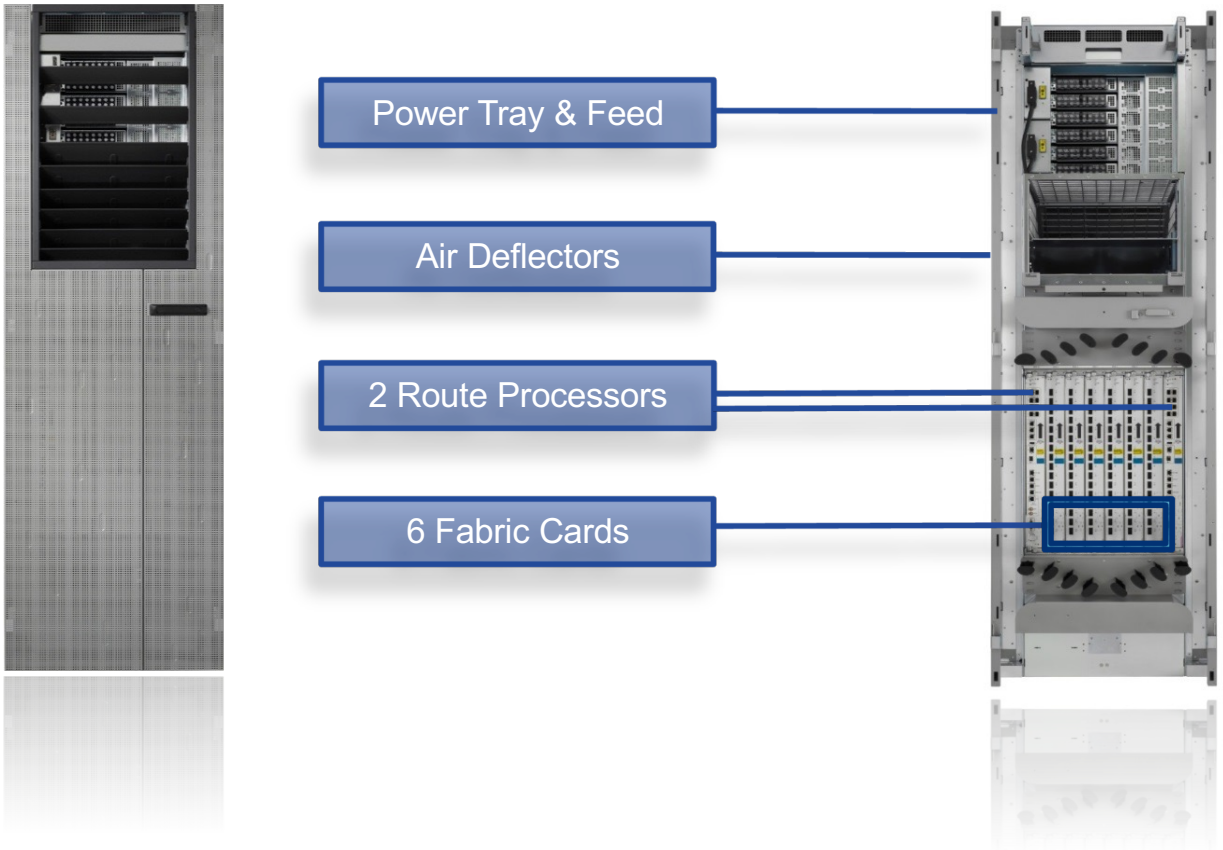
NCS 6008 Line Card Chassis

- 8x 1Tbps Line Cards
  - Custom purpose-built NPUs
  - High scale forwarding & services
- High-speed Switch Fabric
  - Fully redundant
  - 3 Variations
    - SC/B2B/MC
- Redundant Route Processors

NCS 6008 – Chassis Overview

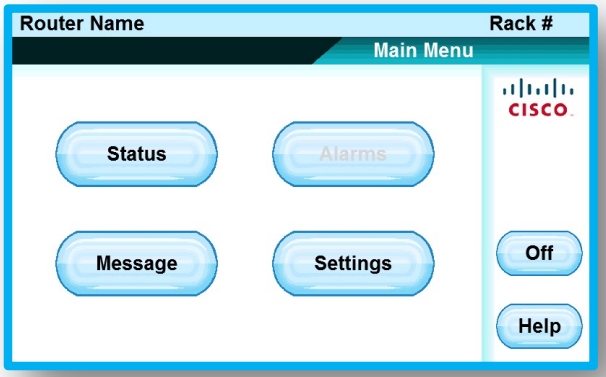


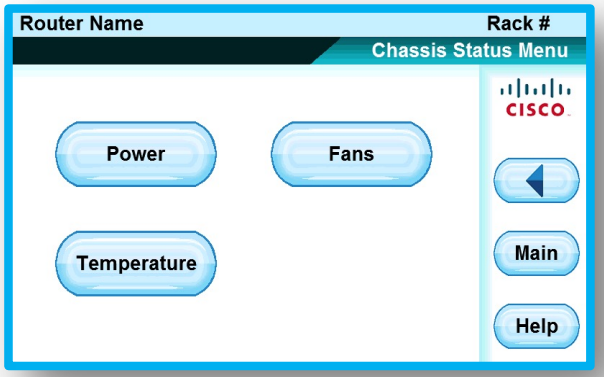
NCS 6008 – Chassis Overview

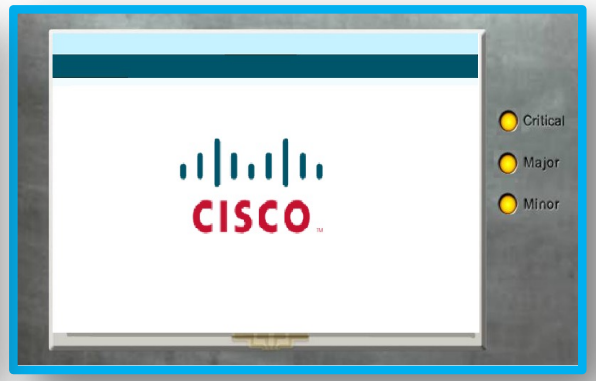


NCS 6008 – Touch Screen Display

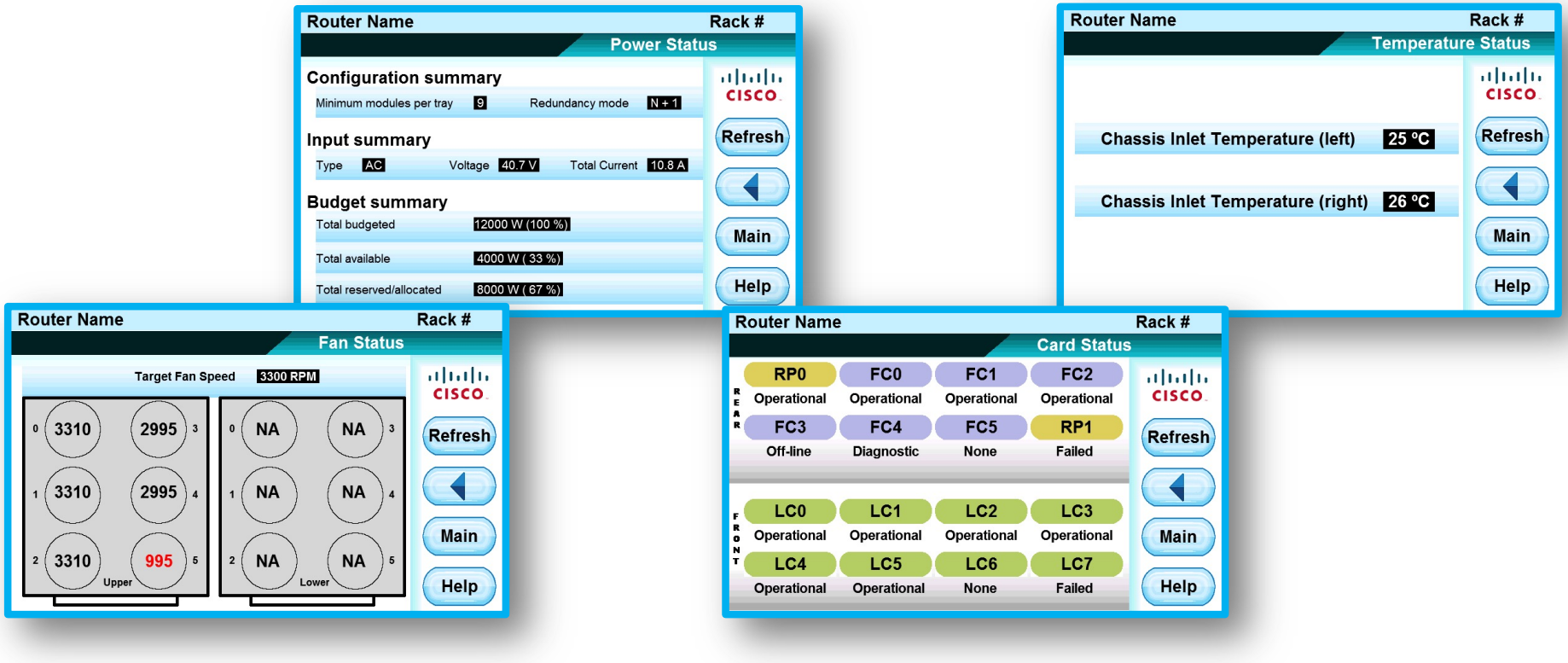
- 7” Touch Screen Read-Only Display
- System Status and Alarm Monitoring







NCS 6008 – Touch Screen Display

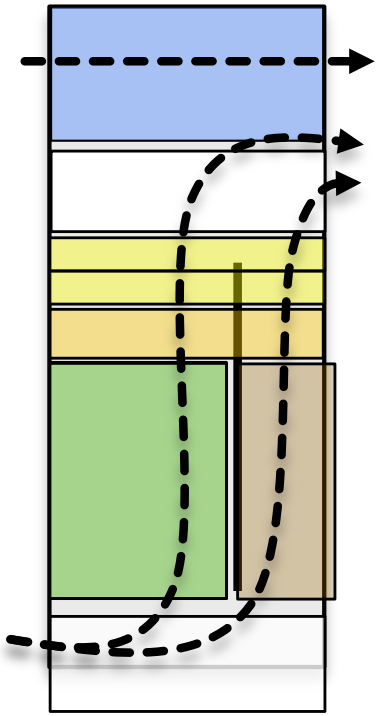


NCS 6008 – Fan Trays

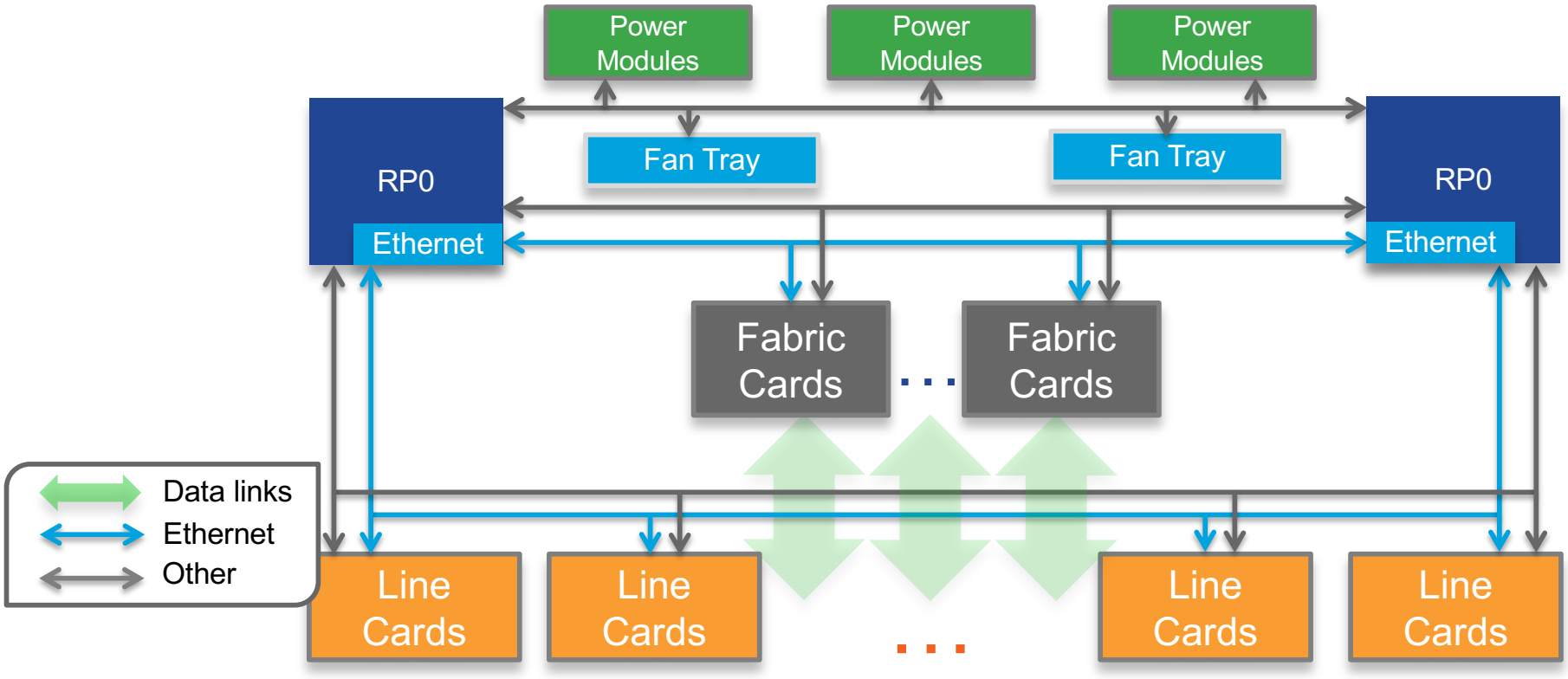
- Redundant Fan Trays
- 6 Fans per tray

NCS 6008 – Fan Trays

- Air Flow

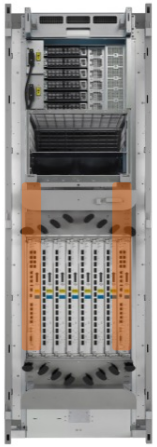


NCS 6008 Architecture at a glance



NCS 6008 – Route Processor

- 2 RP per system
  - Inserted in both side slots in rear
- 8-Core x86 CPU @ 1.8 GHz
- 3 Console Ports
- 2 Management Ports
  - RJ45 – 1G
  - SFP+ - 10G
- 48GB DRAM (3x16)
- 32GB (System) & 200GB (Data) SSD
- USB 2.0



NCS 6008 – Route Processor

Ports & Connections

Expansion Ethernet for Multi-chassis

Console Ports

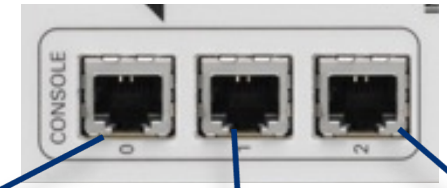
Management Ethernet

Future – Interface Shelf

USB Port

Timing and Synchronization

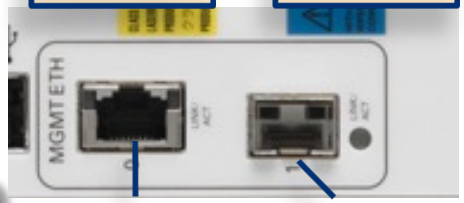
Alarm



Admin Console

XR (SDR) Console

Unused



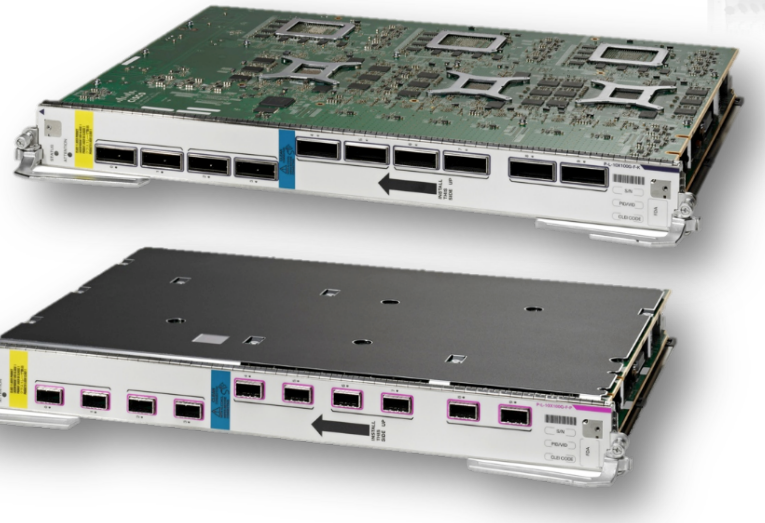
Admin Mgmt. Port

XR Mgmt. Port

10G-SFP-SR
10G-SFP-L
SFP-GE-S
SFP-GE-L
SFP-GE-T
10G-SFP-SR-X
10G-SFP-LR-X

NCS 6008 – Line Cards

- 8 LineCard slots
  - Up to 1Tb/Slot in 1st Generation cards
- Powered by Cisco nPower X1 & nPower X1e Network Processor
- Various flavors based on
  - Scale and feature capabilities
  - Port Speed
  - Optic types



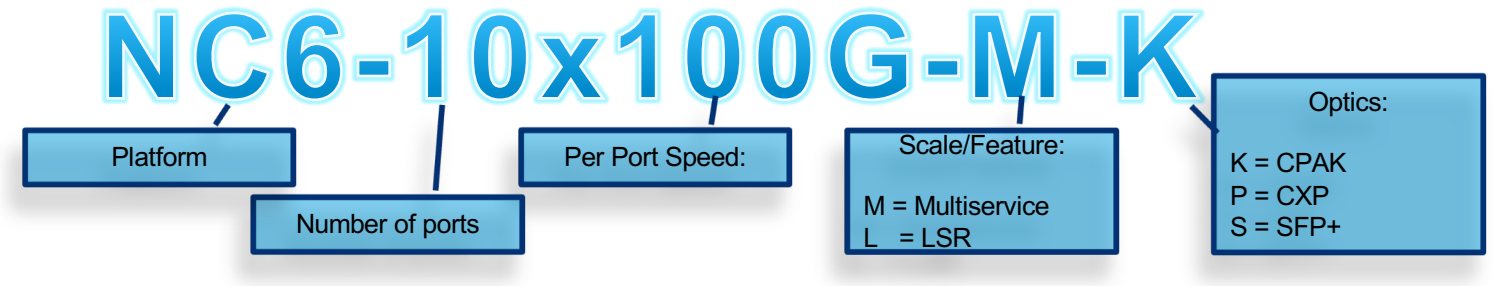
NC6-60X10G-M-K
NC6-60X10G-M-P

NCS 6008 – Line Cards

Two flavors

- LSR – Lean Core applications
  - Limited CEF and L3 Scale
- MSC – Full IP/MPLS support
  - Edge Features (L3/L2 VPN support)
  - Higher L3 interface support
  - Higher TE mid point scale, Netwflow scale etc.

	LSR	MSC
Hierarchical Policy	No	Yes
Vlan QoS	No	Yes
L2/L3 vpn	No	Yes
Max Routes	64K	4M



NCS 6008 – 100G Line Cards

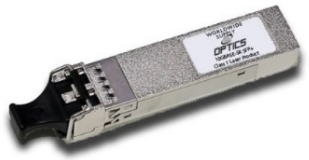
- 10x100G CXP
  - 100G and 10G port capacity
  - CXP Short Range Optics (SR10)
  - Powered by nPowerX1 Network Processing Unit (NPU)

- 10x100G CPAK
  - Anyport Technology: 100G, 10G and 40G port capacity
    - 10 x 10G interfaces per port
    - 1 x 100G interface per port
    - 2 x 40G interfaces per port
  - CPAK Short Range (SR10) and Long Range (LR4/LR10) Optics
  - Powered by nPowerX1 NPU

NCS 6008 – 10G Line Cards

- 60x10G SFP+
  - SR, LR, ZR SFP+ Options
  - WANPHY and OTU-2 Support
  - Tune-able DWDM 10G (future)
  - Powered by nPowerX1e NPU

Product	Distance	Wavelength	10GE Mode
SFP-10G-SR	Up to 400m	850nm	LAN
SFP-10G-SR-X	Up to 400m	850nm	LAN/WAN/OTU
SFP-10G-LR	10Km	1310nm	LAN
SFP-10G-LR-X	10Km	1310nm	LAN/WAN/OTU
SFP-10G-ER	40Km	1550nm	LAN
SFP-10G-ZR	80Km	1550nm	LAN/WAN/OTU



NCS 6008 – 100G PAYG Line Cards

- PAYG Line cards
  - 10 Physical ports ; with 2 or 4 usable port
- Add more ports through software license
  - License with granularity of 2 ports

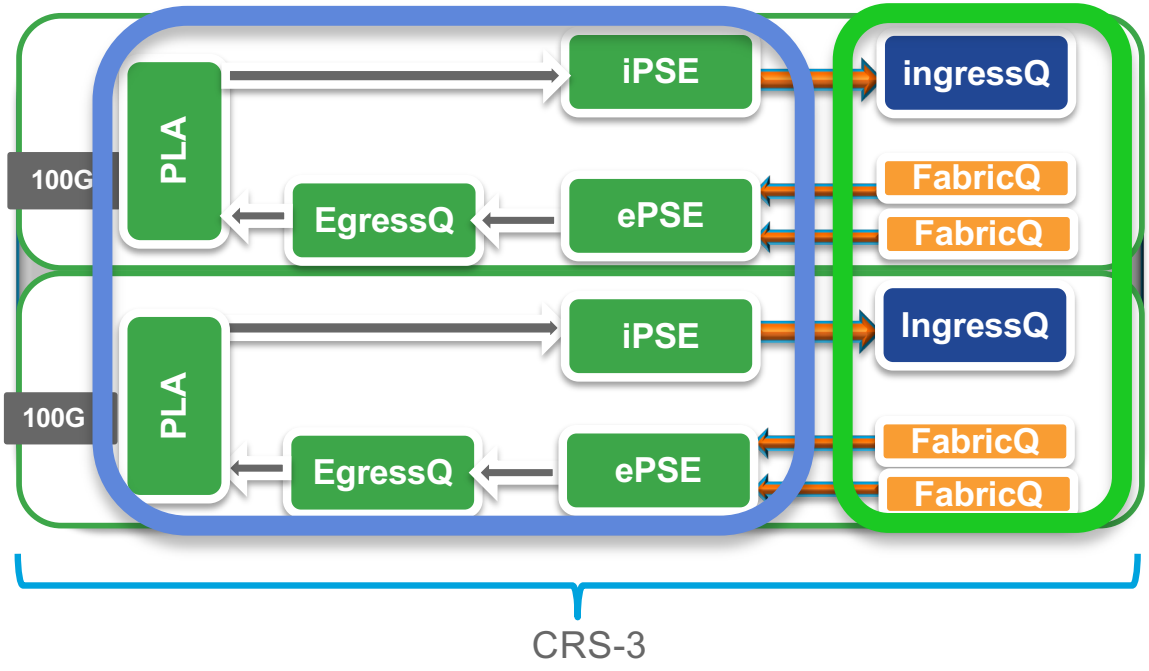
NCS 6008 – Line Cards

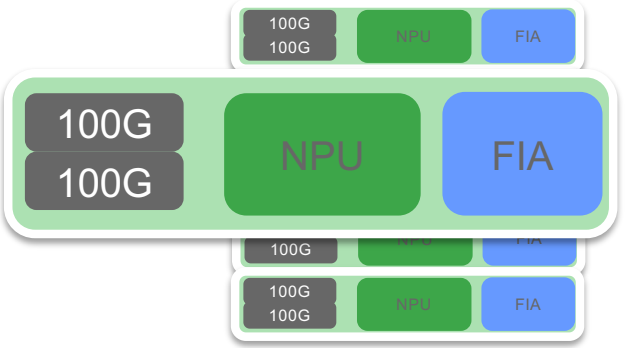
Slices

- "Slice" based architecture
  - 200Gbps capable bi-directional
  - Independent packet processing for slices
  - 10x100G
    - 5 Slices
    - 2 Interfaces per slice
  - 60x10G
    - 4 Slices
    - 15 Interfaces per slices
- HA on slice granularity
  - Single failure will take down only slice

NCS 6008 – Line Cards

Slice Details





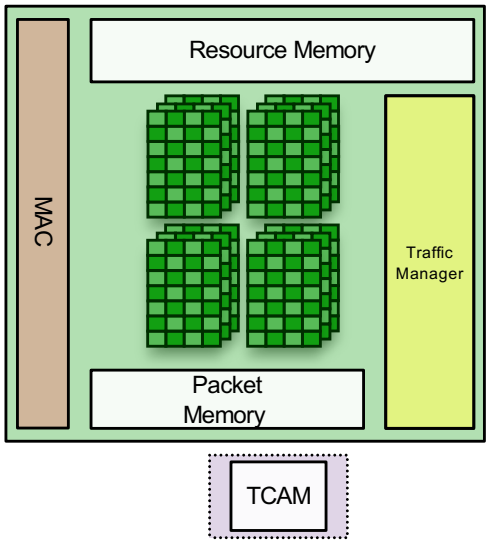
Ingress PLA + PPE + Egress Q

FabricQ + Ingress Q

NPUs

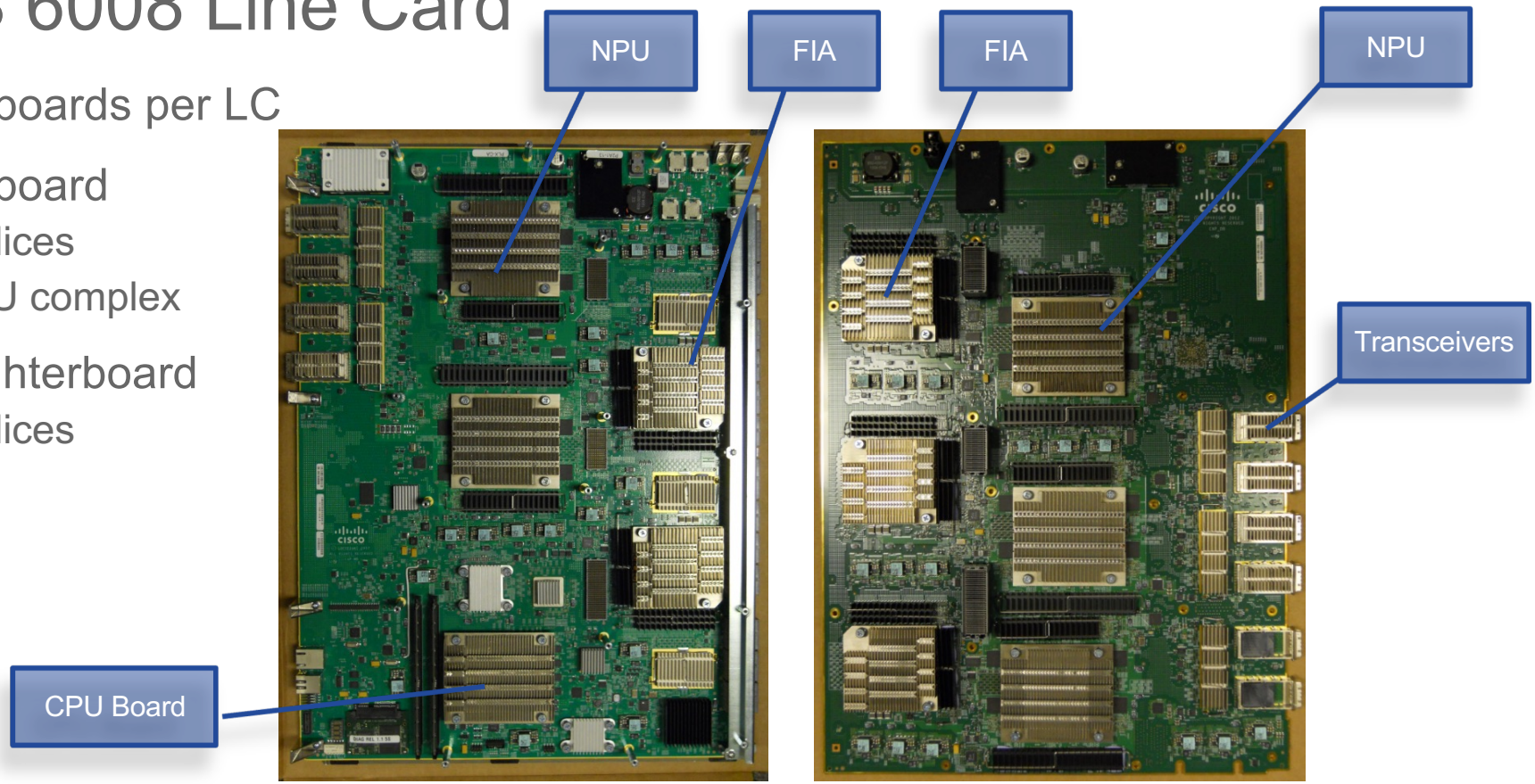
nPowerX1 & nPowerX1e

- 336 packet processor engines (PPE) @ 800MHz
  - Two threads per PPE
- 130 Mpps ; 200 Gbps Full Duplex
- Integrated MAC
  - 15x10G , 5x40GE, 2x100GE
- nPowerX1:
  - On-chip TCAM
- nPowerX1e:
  - Off-chip TCAM



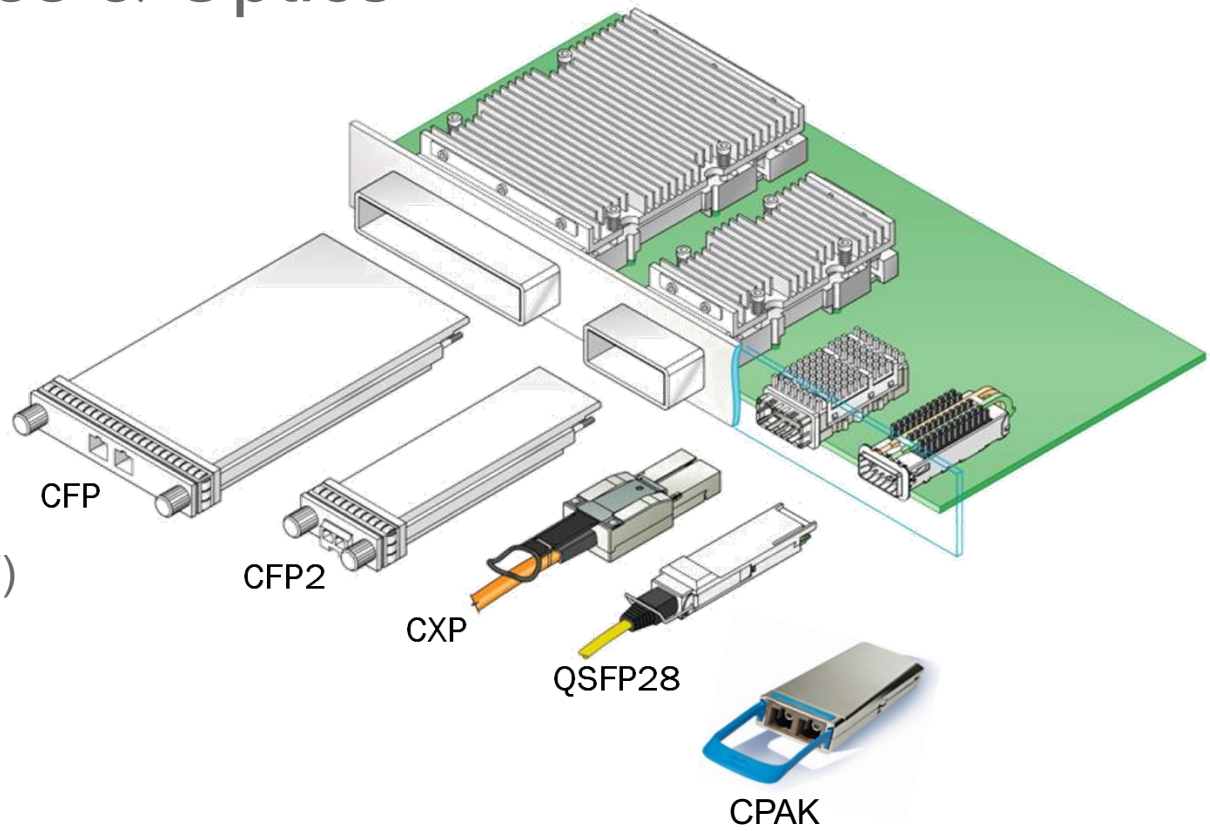
NCS 6008 Line Card

- Two boards per LC
- Mainboard
  - 2 Slices
  - CPU complex
- Daughterboard
  - 3 Slices



NCS 6008 – Interfaces & Optics

- CFP
  - Density: 1-2 per line card
  - ~24W per CFP
  - (<8W for CFP2)
- CXP Short Reach
  - ~3.5W power consumption
- CPAK Short/Long Reach
  - 70% less power than CFP (~7W)
  - 70% smaller than CFP



NCS 6008 – Interfaces & Optics

Available Optics Options

CPAK

100G – SR10
100G – LR10

MPO Connector

CXP

100G – SR10

MPO Connector

CPAK

100G – LR4

SC Connector

SFP+

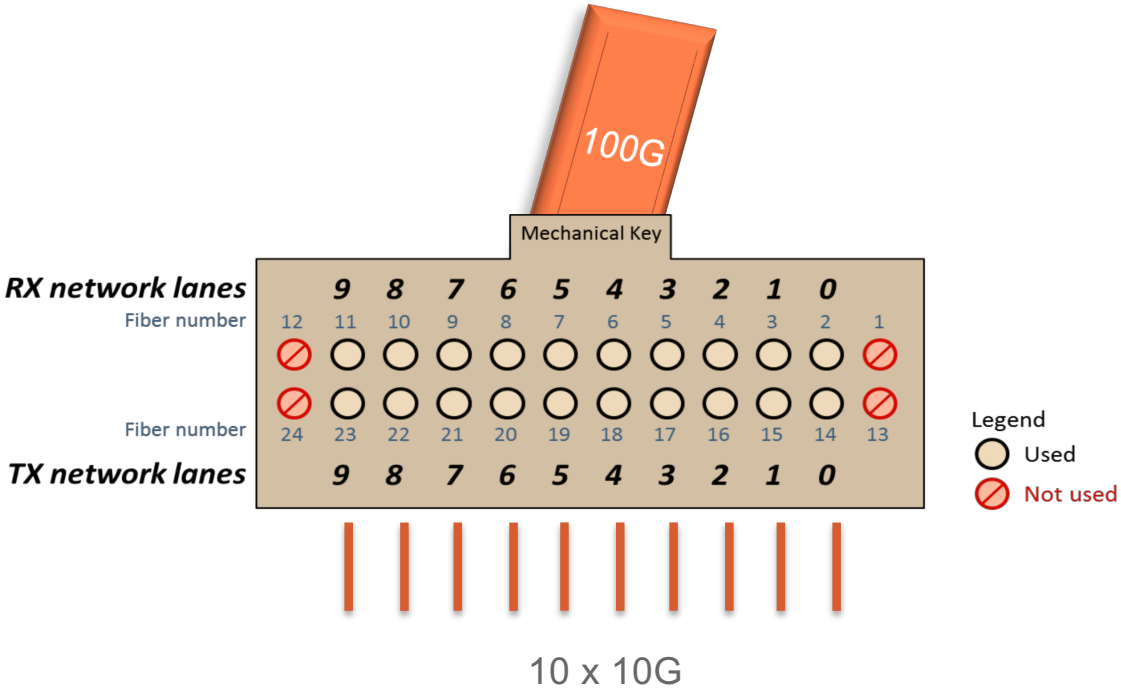
10 G
SR, LR, ER, ZR,
SR-X, LR-X

LC Connector

NCS 6008 – Interfaces & Optics

Breakout Mode – SR10 & LR10

- CLI Configurable
- Each Slice configured independently
- Converts all interfaces in the slice



10 x 10G

NCS 6008 – Interfaces & Optics

Breakout Mode – Cable Management

- Passive Patch Panel
- 3RU Rack Mountable
- 10 MPO (100G) Connectors → 100G LC (10G) Connectors

NCS-PP-100X10-SR

NCS 6008 – Power System

- Fully redundant power system
- Six Power Trays
  - Grouped into two Shelves (Shared switch)
  - Individually replaceable
- AC and DC Power Tray options
- DC:
  - -40V -- -72V Input @ 60A Max
- AC:
  - 200V – 240V Input @ 16A Max

NCS 6008 – Power System

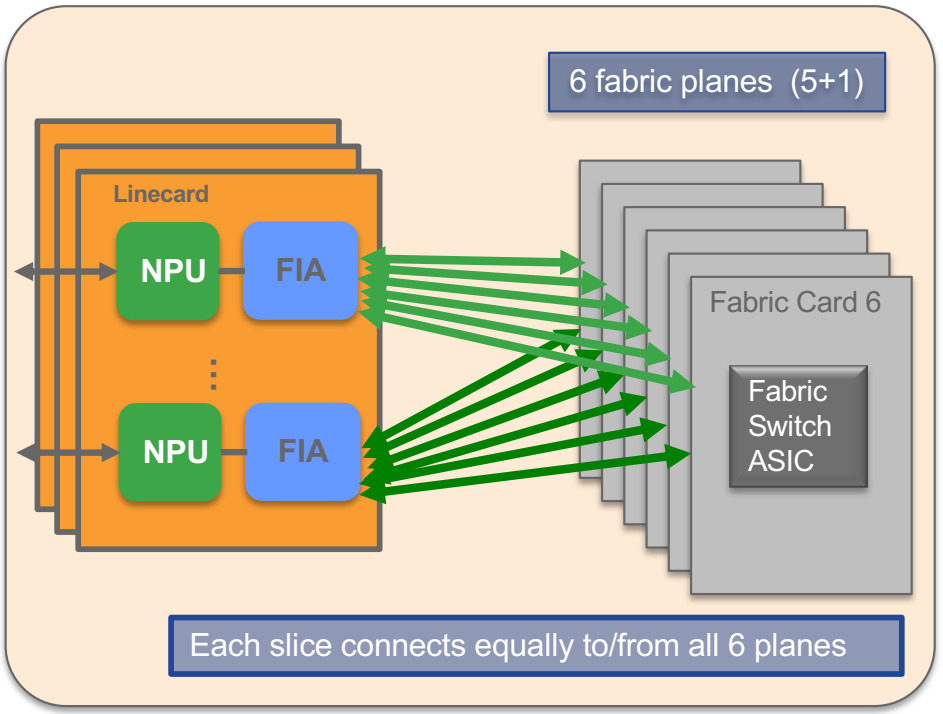
- Individual Power Module (PM)
- Field replaceable
- Provides power to common power bus
- 1 Power Feed per PM
- No placement restriction
  - Minimum 4 PM required
- 4 DC Power Module per Tray
  - 24 PM per chassis (12+12 redundancy)
- 3 AC Power Module per Tray
  - 18 PM per chassis (9+9 redundancy)

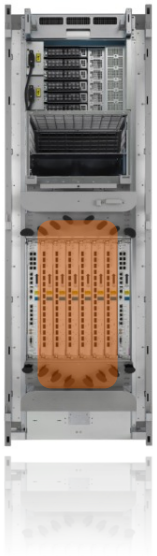
AC 3000W

DC 2100W

NCS 6008 – Switch Fabric

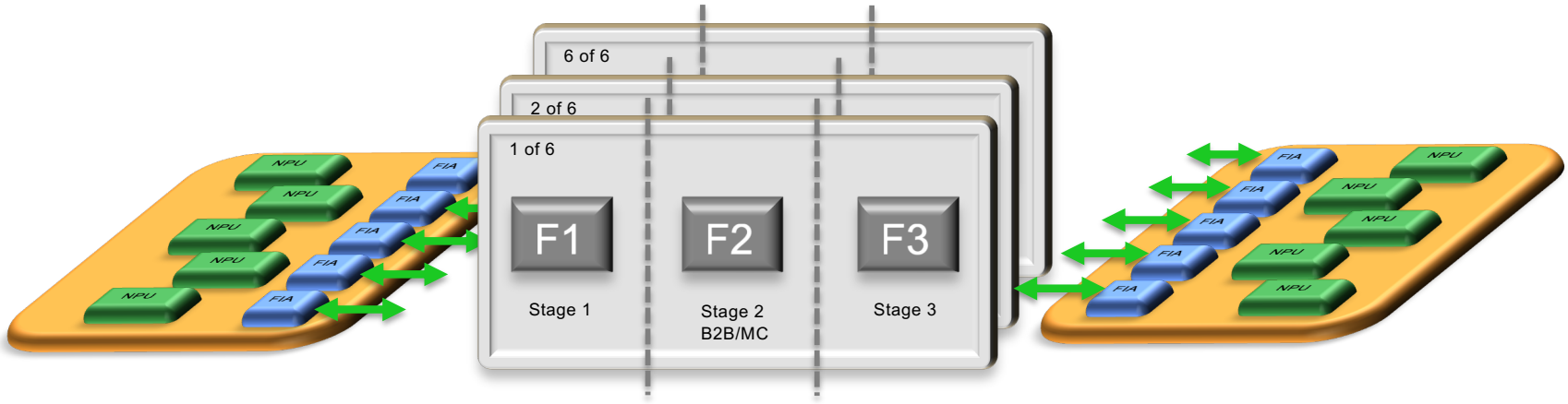
- Three fabric types:
  - NC6-FC for standalone,
  - NC6-MC (Multi-chassis)
- Six fabric cards
  - 5+1 planes (one plane/card)
- Non blocking three stage fabric
- VOQ Based
  - Distributed credit scheduler
  - 64-256B Variable size packets
- Each “slice” connects to all planes



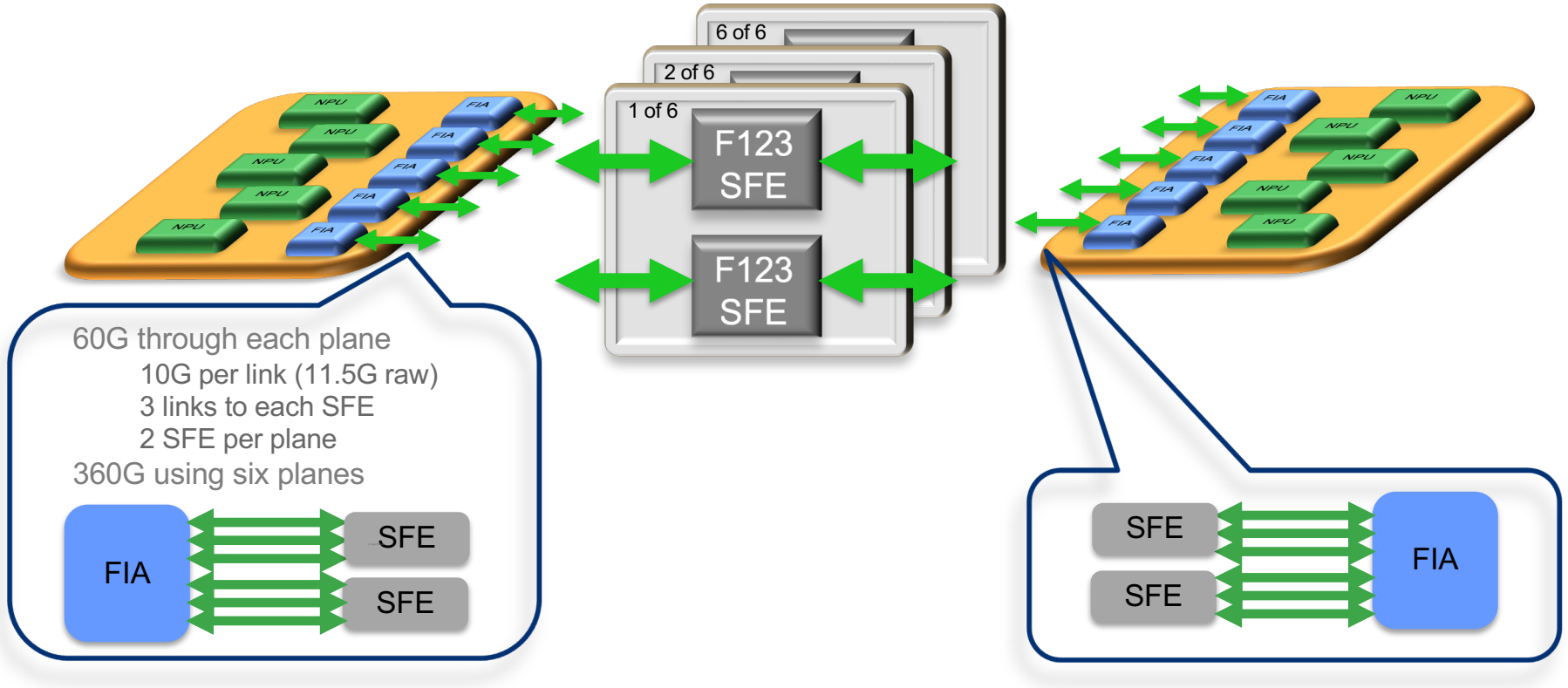


NCS 6008 – Three Stage Switch Fabric

- F1,F2,F3 for Back-to-Back and Multichassis
- Collapsed F123 for Single Chassis



Single Chassis Fabric Card connections



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Virtualization ….

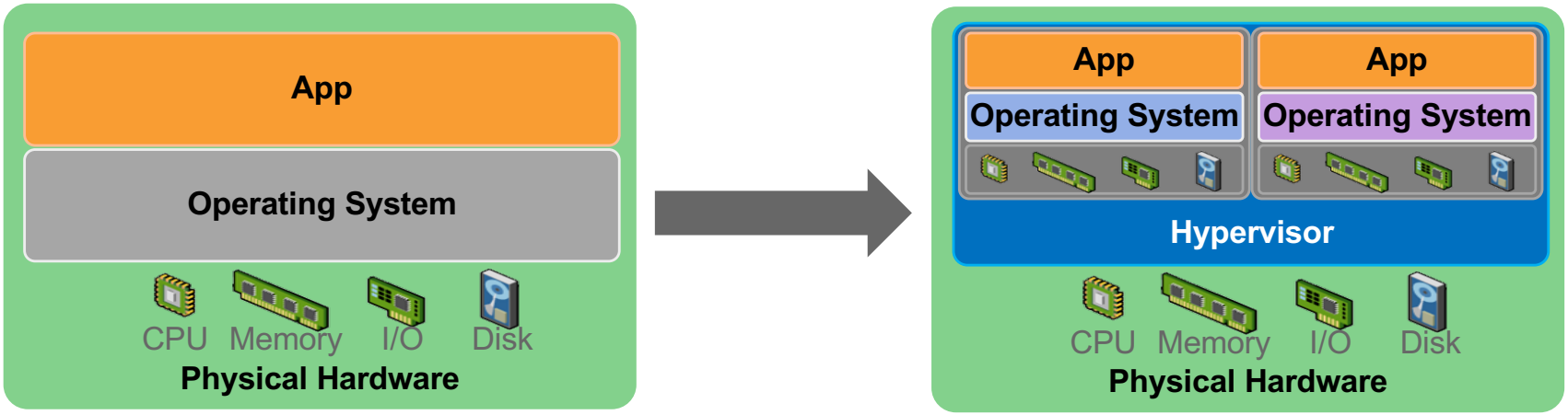
… ability to run multiple operating systems on top of a single physical platform by providing an abstract view to each.

The software layer providing virtualization is called a “virtual machine monitor” or “Hypervisor”.

The operating system instances are called “virtual machines (VM)” or “guest OS”

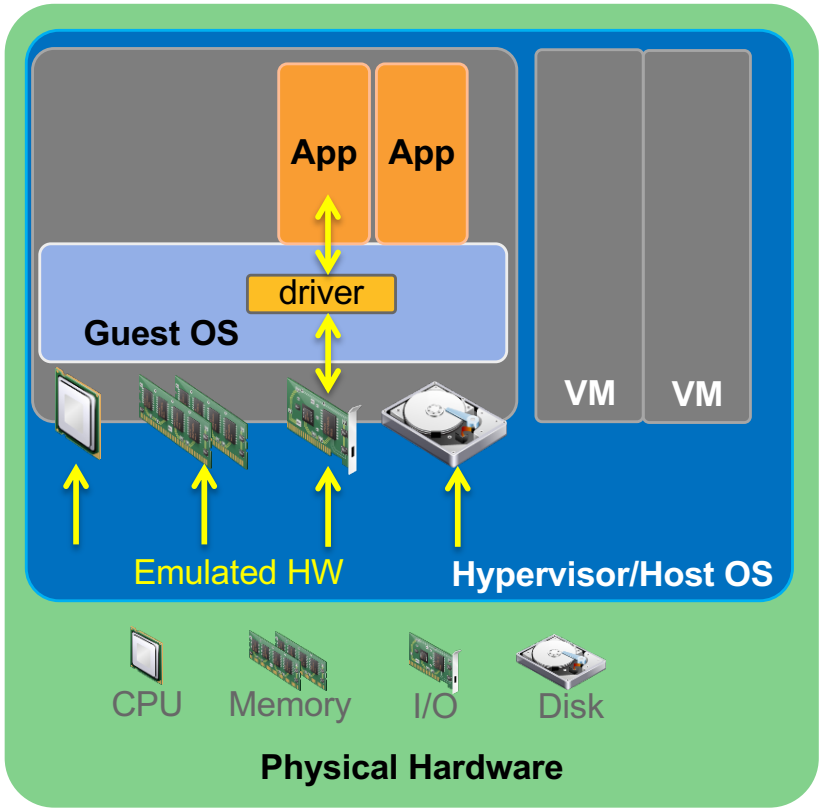
Virtualization…

- Effective resource utilization by splitting across multiple Operating Systems
  - Hypervisor is the Virtualization abstraction layer
  - Hypervisor runs on bare metal or inside Host OS



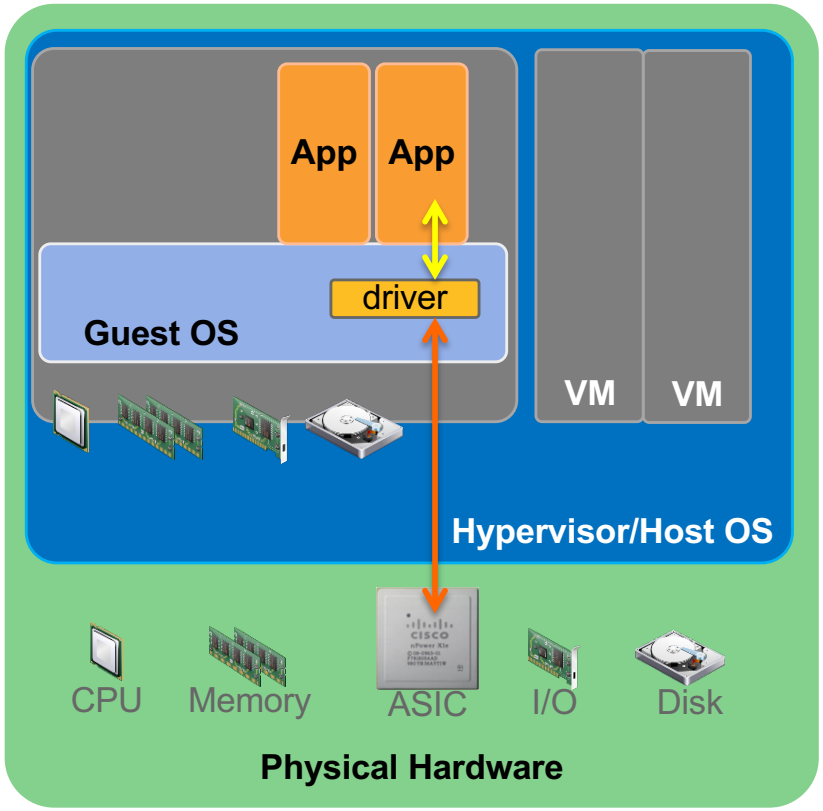
Virtualization…

- Passthrough
  - Common devices emulated by hypervisor
  - Guest OS driver interacts with emulated devices



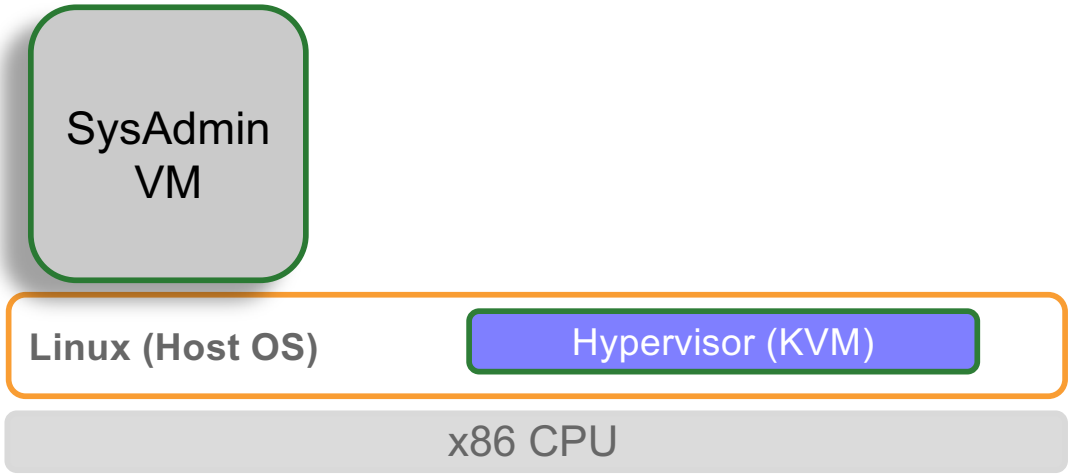
Virtualization…

- Passthrough
  - Custom ASICs may require direct access from VM
  - Hypervisor allows direct interaction between driver inside a VM and real hardware



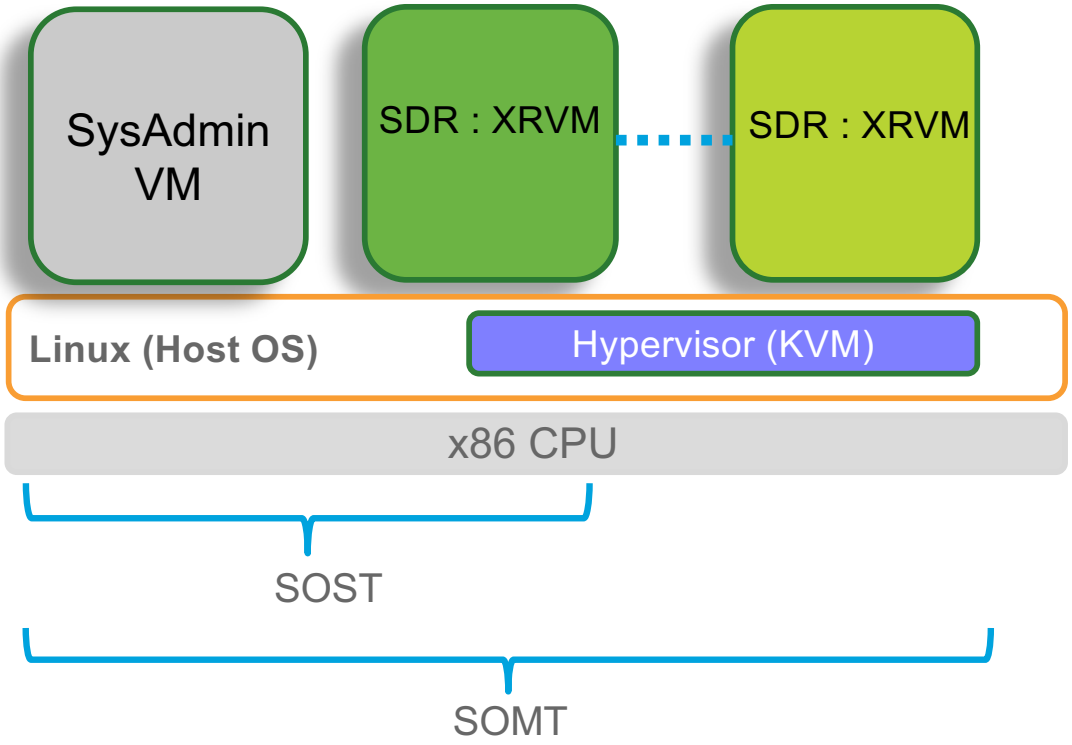
NCS 6008 – Software Concepts

- Host :
  - 64 bit architecture
  - Linux Kernel
  - Runs on x86 CPU on RP and LC
  - Hosts the Qemu/KVM Hypervisor
- Admin VM :
  - Allows network slicing
  - Detect hardware insertion, inventory etc
  - SDR management (creation/deletion)
  - Common software functionality (fan/alarms etc.)
  - Active on all RP and LC – service based redundancy



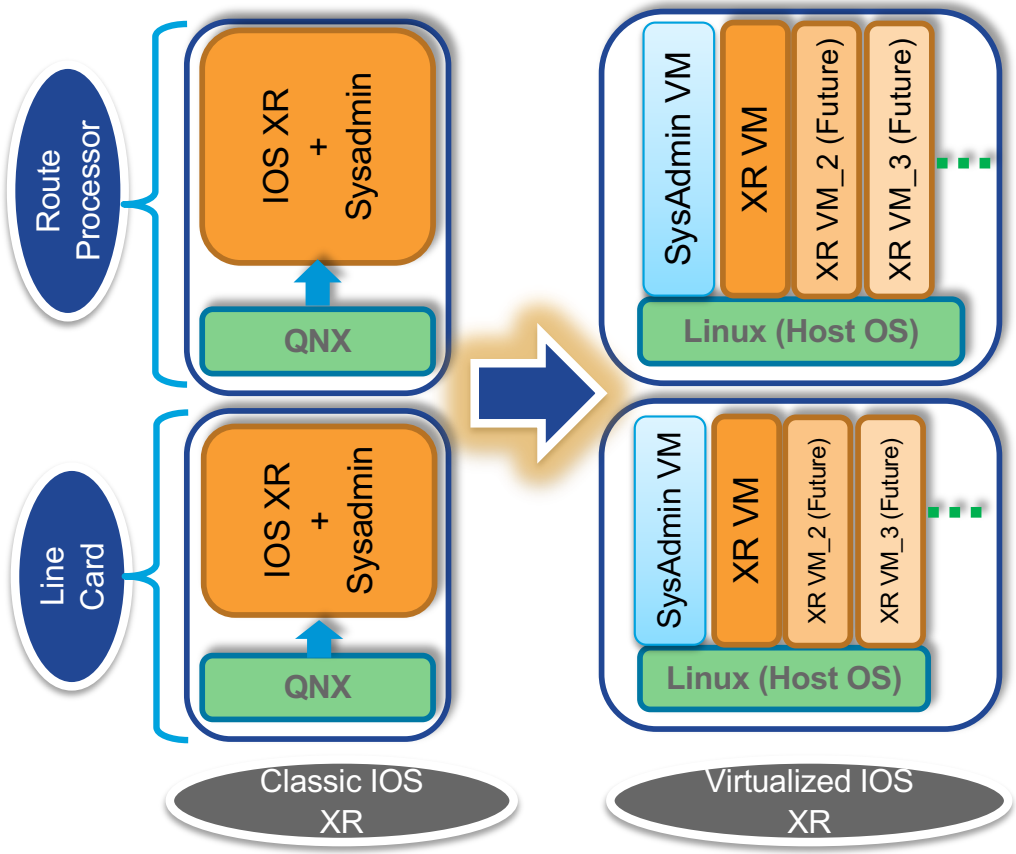
NCS 6008 – Software Concepts

- SDR / XRVM
  - L1/L2/L3/DWDM services
  - Will interact with LC VMs through XR IPC
  - Runs control plane of interfaces
  - Multiple Instances can be spawned
    - SOST
    - SOMT
    - ISSU



NCS 6008 – Software Concepts

Virtualized IOS XRv Evaluation



- Independent Admin/XR
  - Fault isolation
  - XR Scalability for multiple tenants
- Admin VM:
  - System management and monitoring
- XR VM:
  - Routing application and management
  - Consistent IOS-XR user interface

Benefits of Virtualization

Service Integration	In-Service Software Upgrade (ISSU)	Reliability	Control Plane Expansion
• Multiple, highly secure and isolated app containers • Co-existence of multiple XR versions	• Zero topology and packet loss upgrade	• Improved system reliability with separate admin and application virtual machines (VMs)	• Flexible XR/service VM placement on dedicated compute device

Hypervisor

Benefits of Virtualized Cisco® IOS-XR

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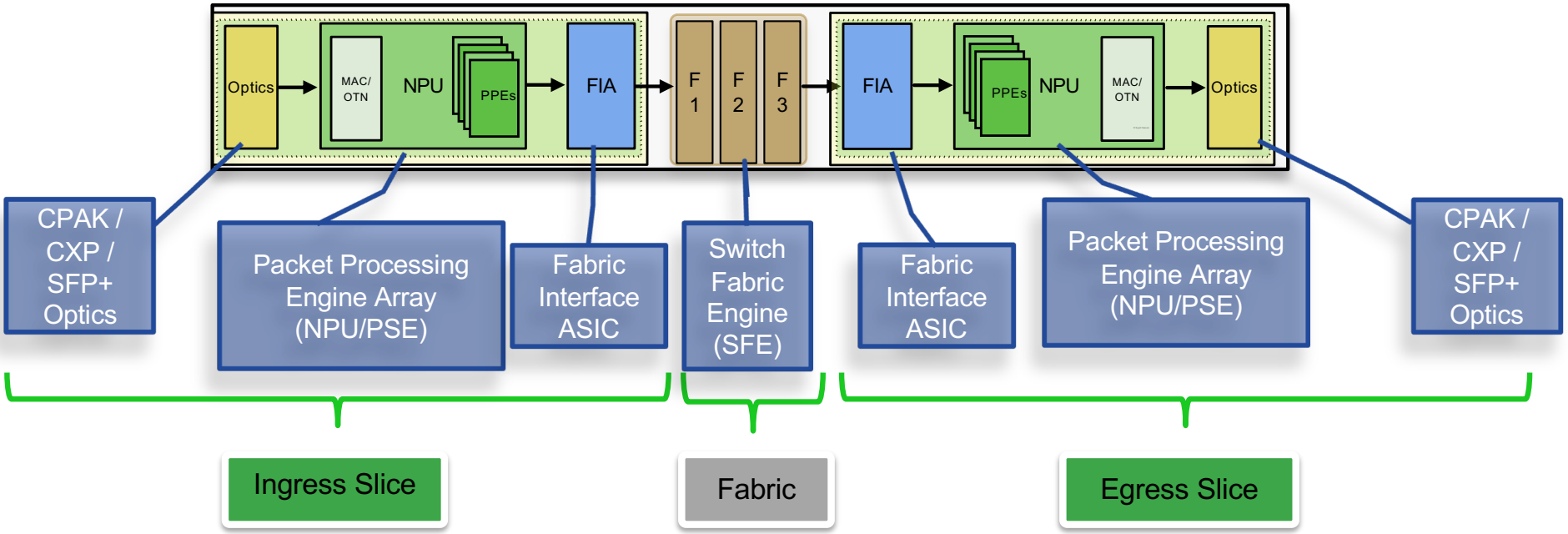
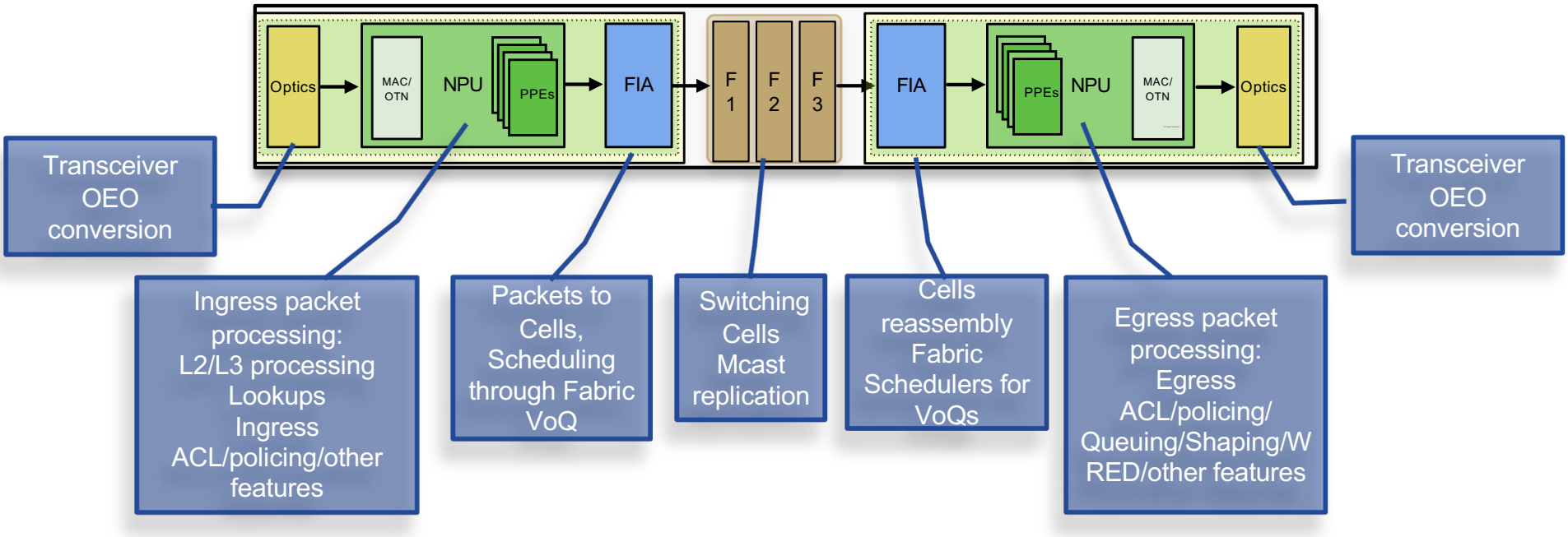
- Summary

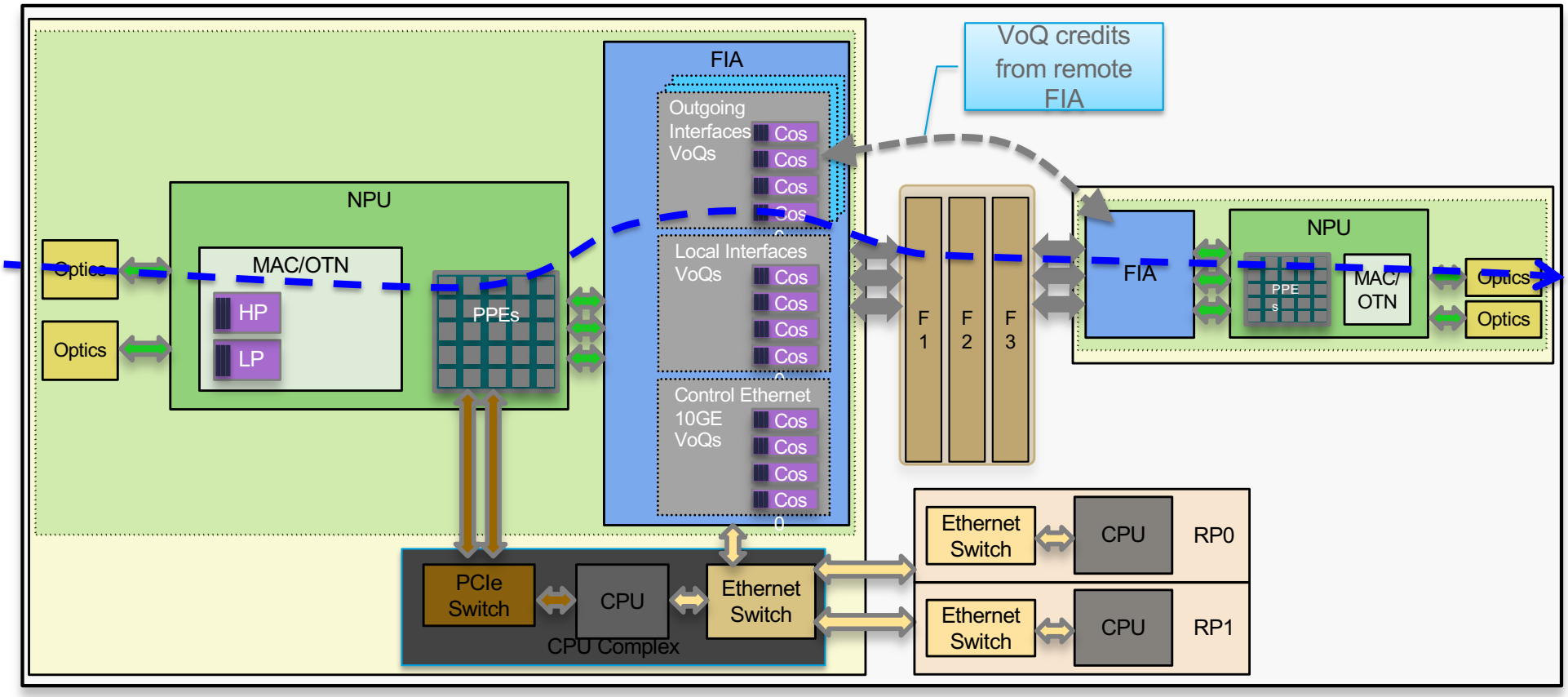
NCS 6008 Data Path



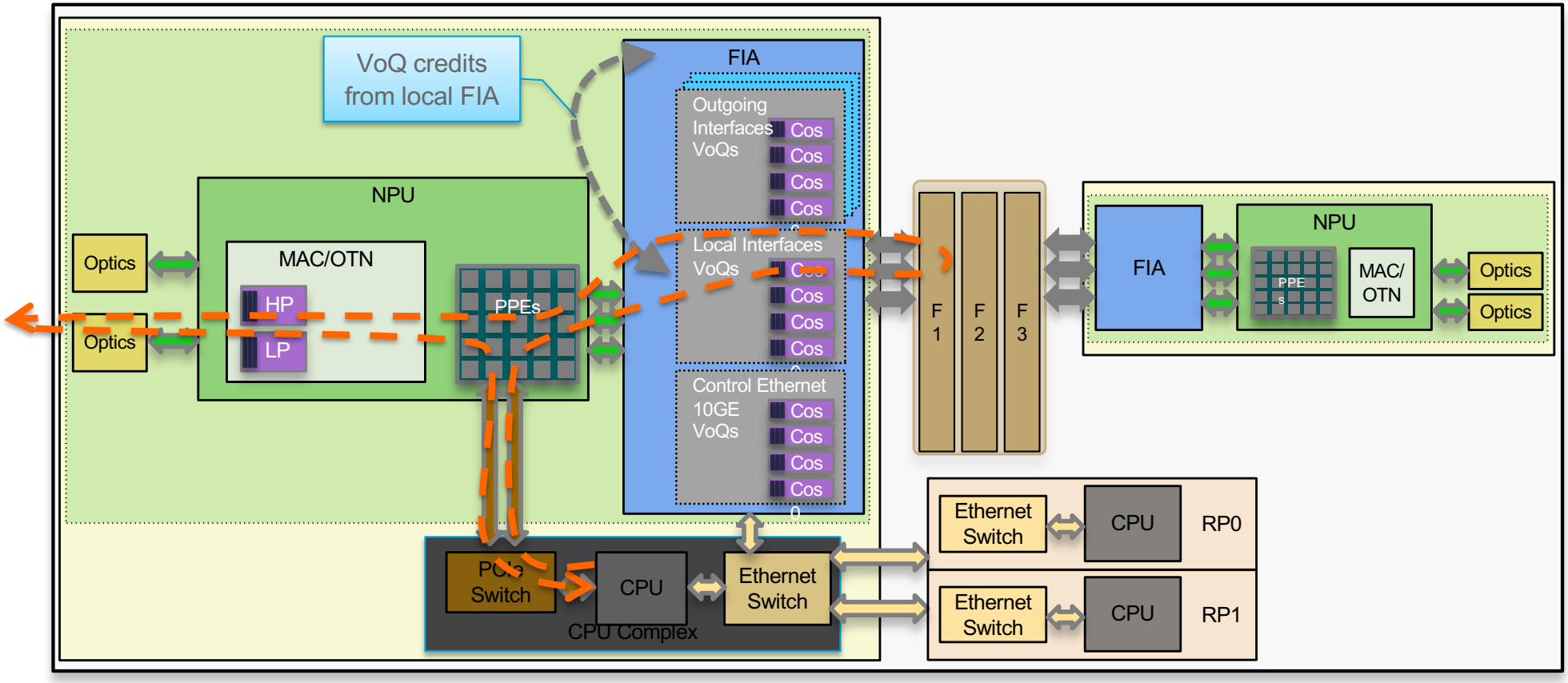
NCS 6008 Data Path



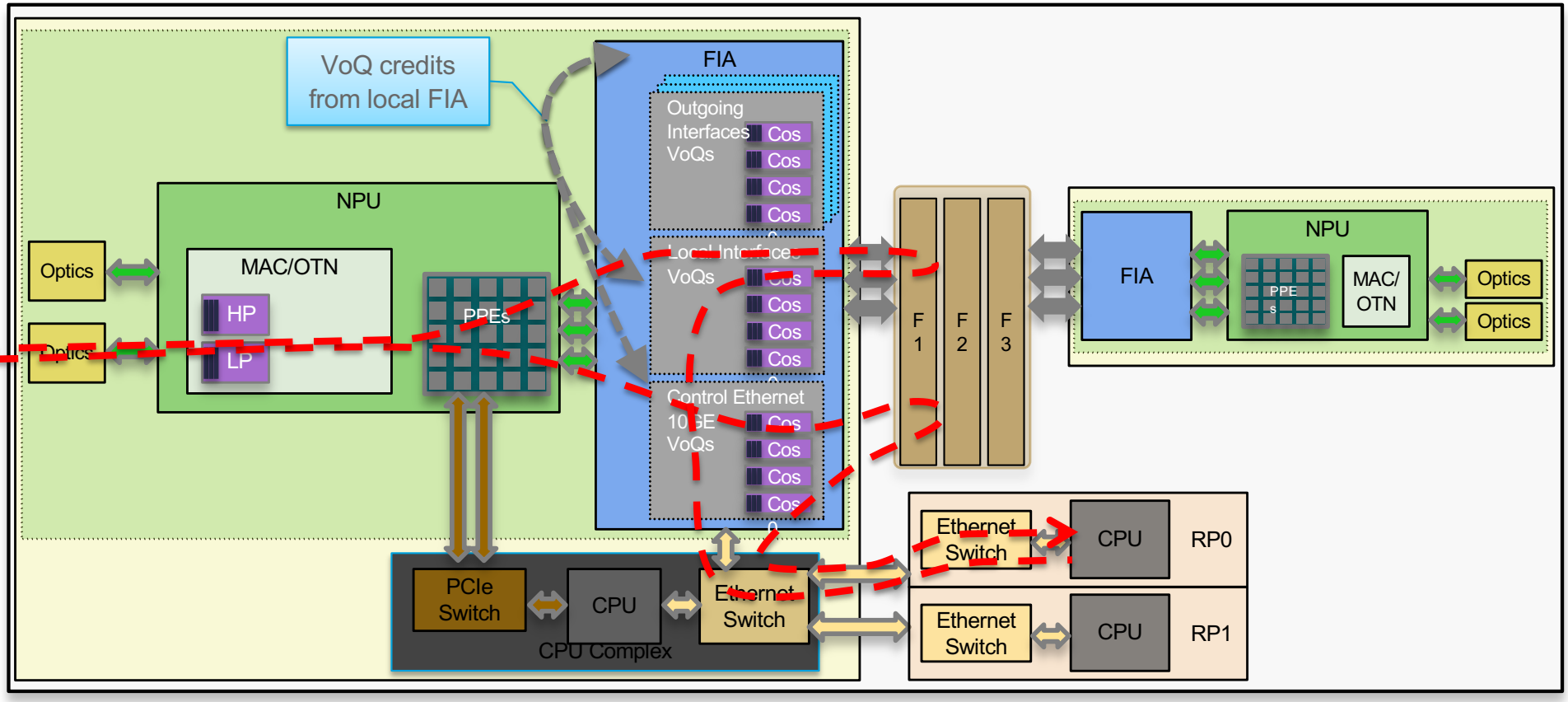
Life of a Packet Overview - Transit



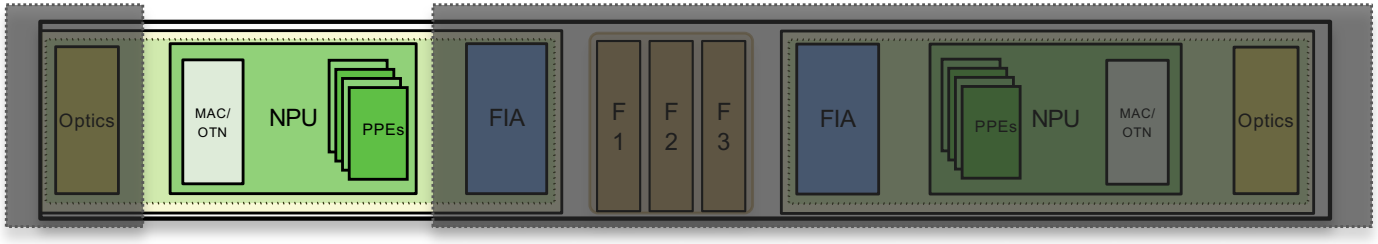
Life of a Packet Overview – LC Punt



Life of a Packet Overview – RP Punt

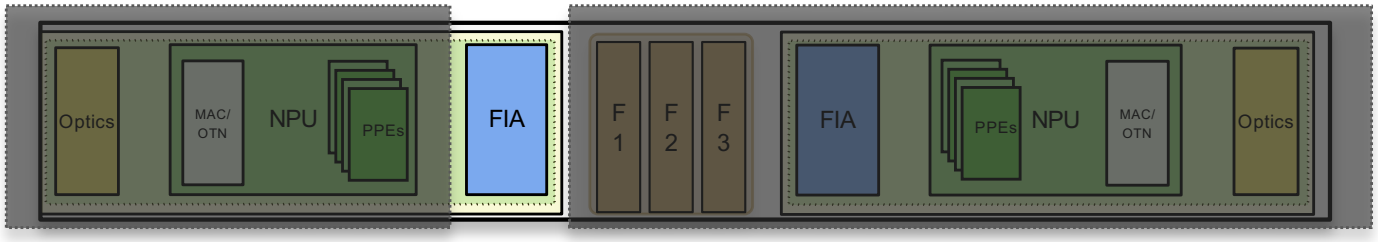


NCS 6008 Data Packet Path



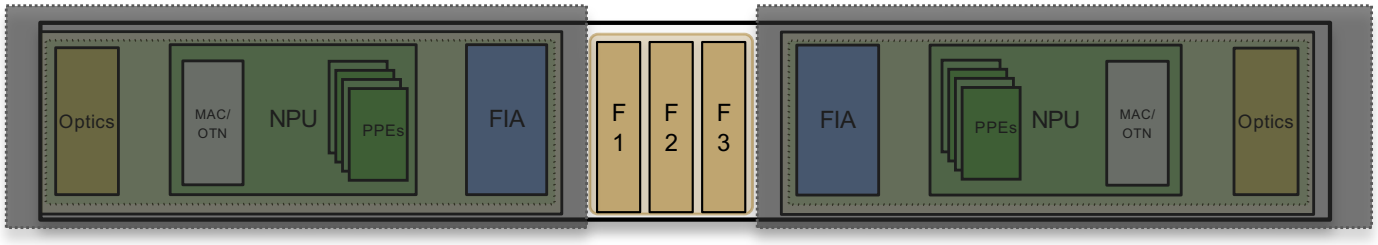
- NPU processing
  - MAC/OTN layer implementation
  - ACL filtering
  - QoS features:
    - Classification, Policing, Setting
  - Forwarding functions:
    - CEF, FIB lookups, VOQ selection, uRPF checks
  - Netflow

NCS 6008 Data Packet Path



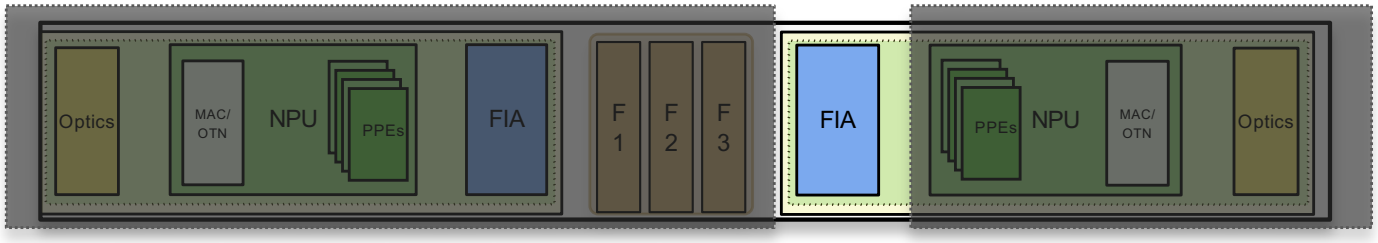
- FIA Processing
  - Performs CRC operations
  - Segments packet to 64-256B cells
  - Sends cells towards fabric
  - Load-Balanced over all links
- VOQs may de-queue based on credits
  - Credits granted by credit scheduler on egress FIA

NCS 6008 Data Packet Path



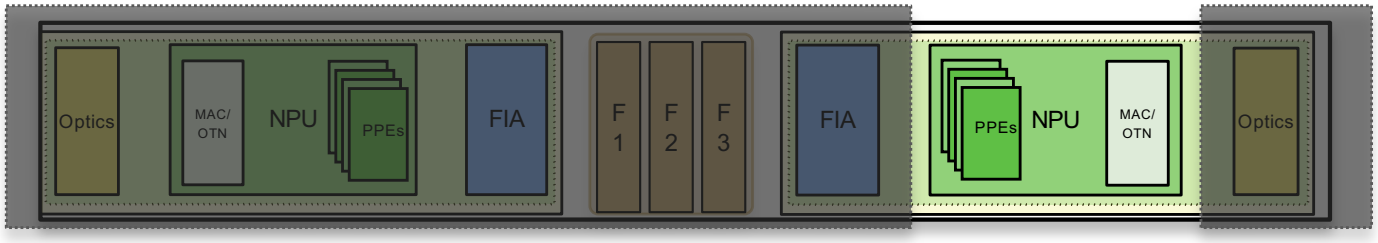
- Routes cells to destination FIA
- Replicates multicast packets to FIAs
  - When more than one destination FIAs

NCS 6008 Data Packet Path



- Receives cells
  - CRC checks on received cells
- Reassembles into packets
  - CRC check on packets

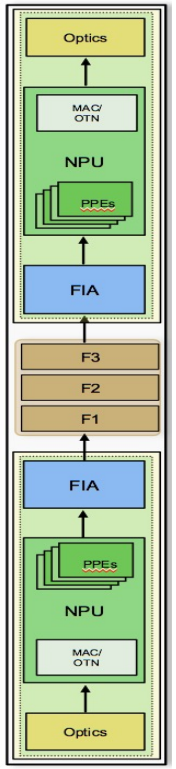
NCS 6008 Data Packet Path



- NPU processing
  - MAC/OTN layer implementation
  - Forwarding functions:
    - L2 rewrite based on adjacency table
  - ACL filtering
  - QoS features:
    - Classification, Policing, Setting
  - Netflow

NCS 6008 Data Packet Path

CLI Reference for Monitoring & Troubleshooting



show interface <type> <interface#>
show controllers <type> <interface#> stats
show controllers plim asic statistics interface <type> <interface#>
show controllers plim asic statistics summary location <r/s/m>

show controllers pse statistics summary instance <#> location <r/s/m>

show controller fia statistics instance <#> location <r/s/m>

(admin) show controller fabric plane all statistics detail

show controller fia statistics instance <#> location <r/s/m>

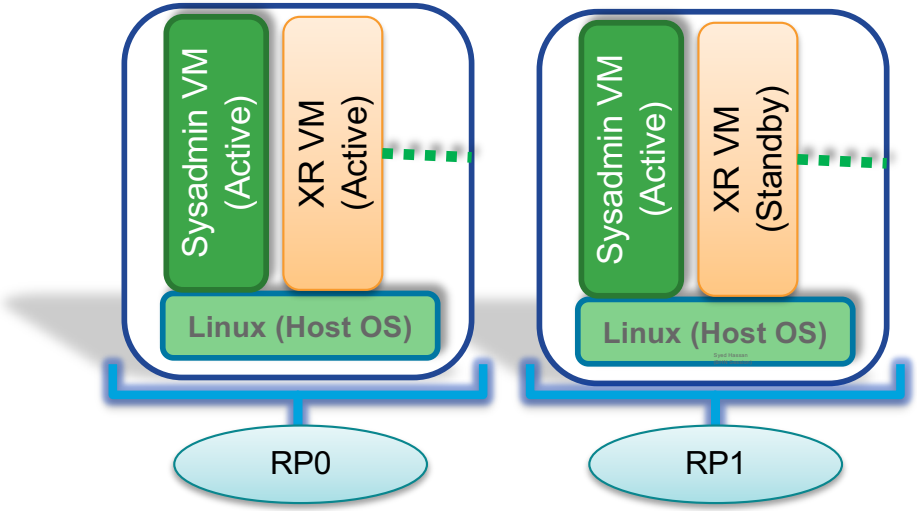
show controllers pse statistics summary instance <#> location <r/s/m>

show interface <type> <interface#>
show controllers <type> <interface#> stats
show controllers plim asic statistics interface <type> <interface#>
show controllers plim asic statistics summary location <r/s/m>

System High Availability

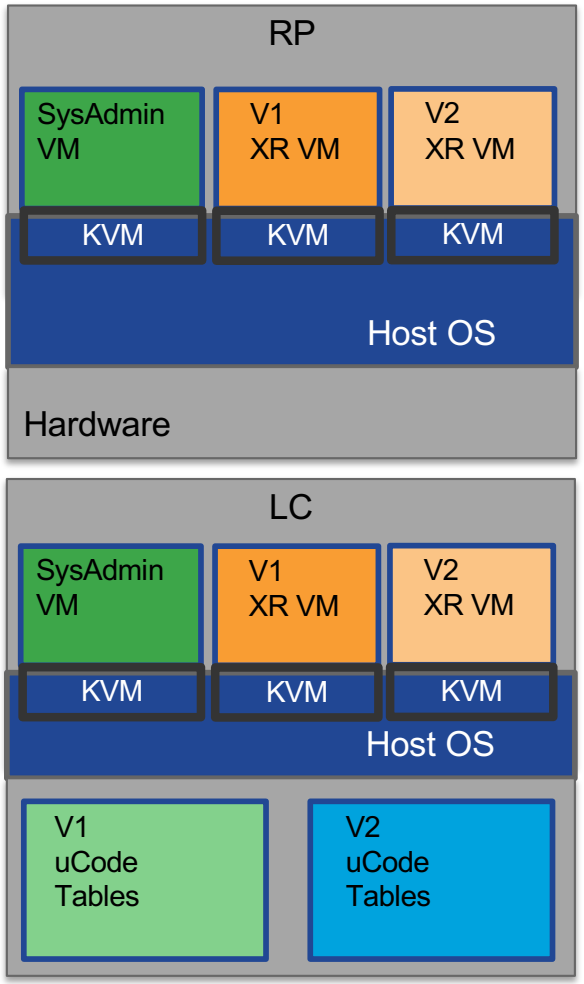
Hardware and Software redundancy

- RP Hardware is redundant by design
- XR-VM and SysAdmin-VM run on both RP's
  - XR-VM takes "active" and "standby" role like classic-XR
  - Admin-VM is "active" on both RPs, redundancy is at service level



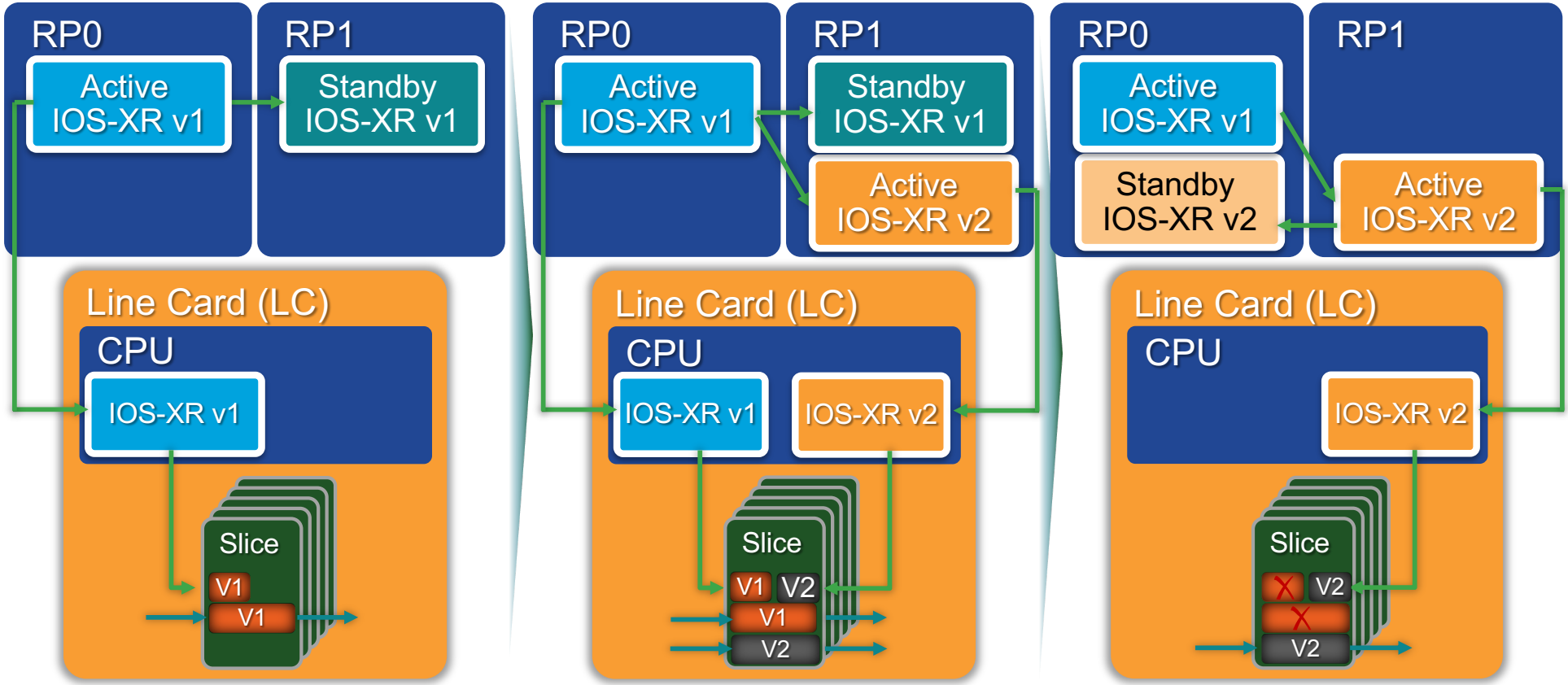
ZPL/ZTL ISSU concepts

- Multiple, highly secure and isolated application containers
- Co-existence of multiple versions of XR
- Synchronization between versions using NSR mechanisms
- Dedicated CPU, Memory and NPU resources to support ZPL/ZTL ISSU

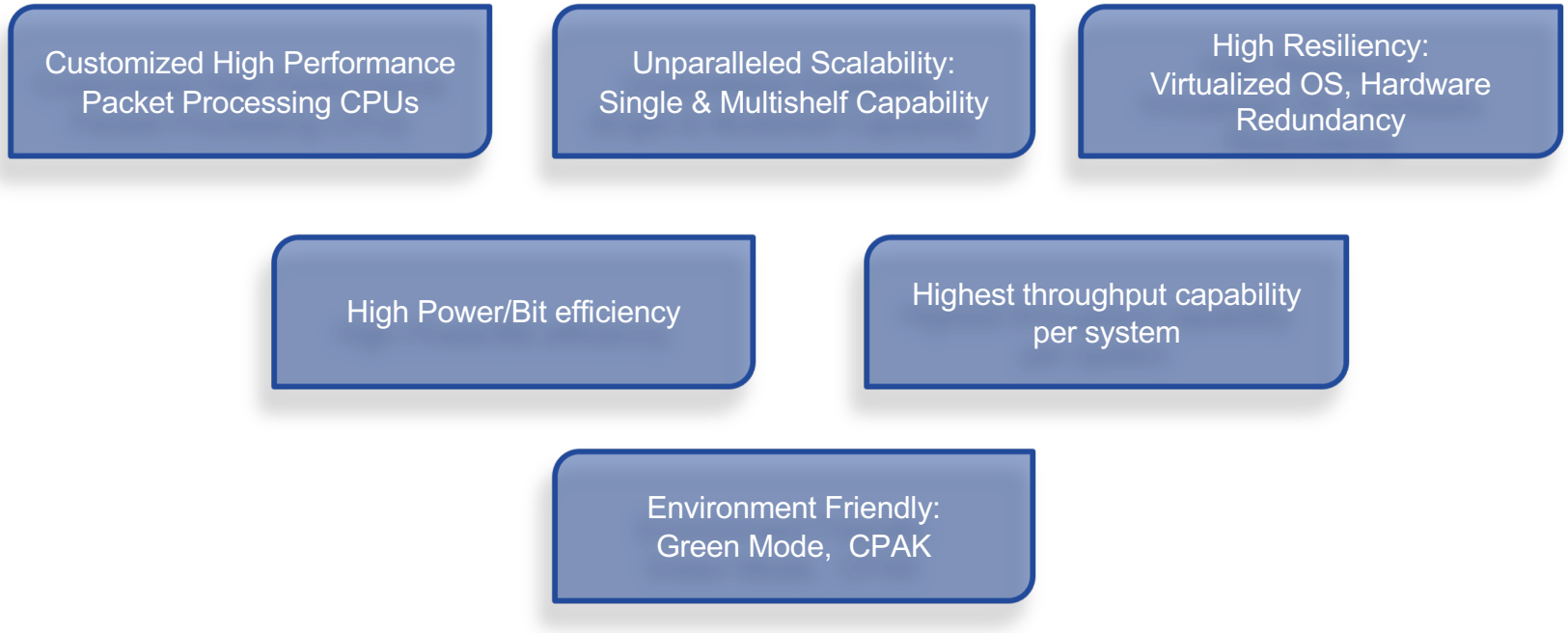


ISSU with Virtualized IOS-XR

ISSU Operation: Normal ➔ Load/Run ➔ Switch/Commit



NCS 6008 Recap



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