Cisco Remote Phy Solution

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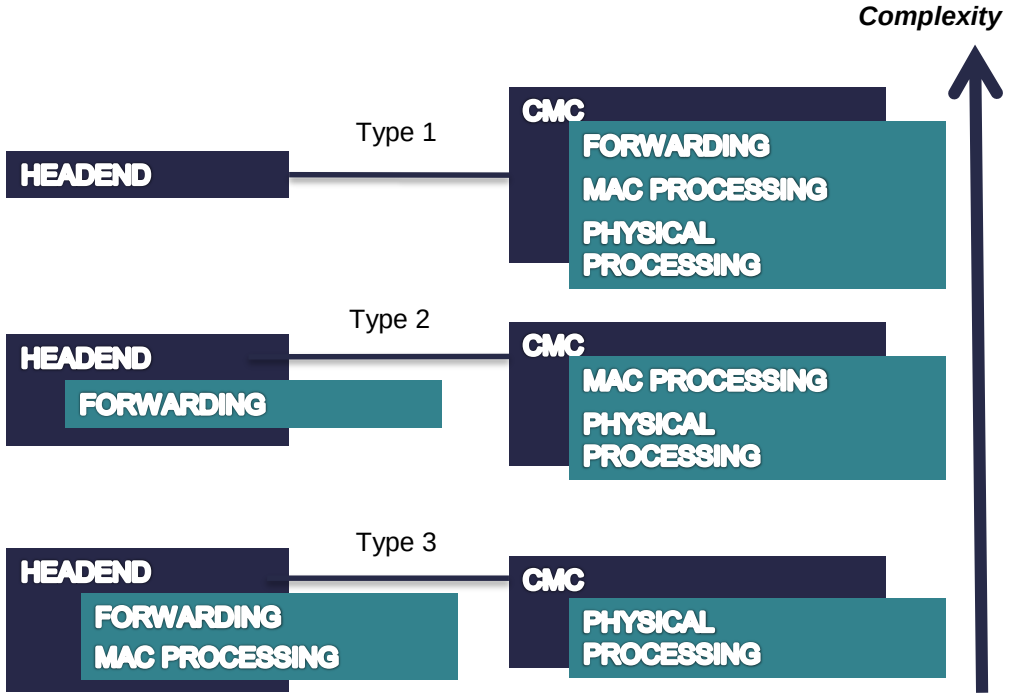
Standards update

Three different architectures in C-DOCSIS

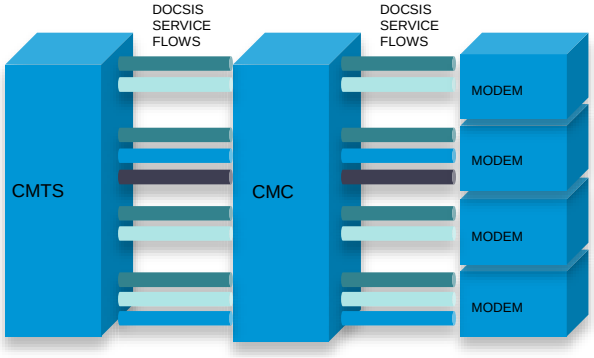
- Key difference are the degree of complexity in the Cable Media Converter (CMC)
- C-DOCSIS type I – miniCMTS
  - CMC is a self-contained layer 2 CMTS
  - or remote system control, classification, forwarding, MAC and PHY
  - EPON mandated, max ~ 200 modems
- C-DOCSIS type 2 – remote MAC
  - CMC has MAC and PHY functionality
  - EPON mandated, max ~ 200 modems
  - EPON OLT with system control, classification and forwarding capability
- C-DOCSIS type 3 – remote PHY
  - CMC contains PHY only – Cisco contribution
  - Head end system control, Mac, classification and forwarding capability
  - IP connection headend controller to CMC



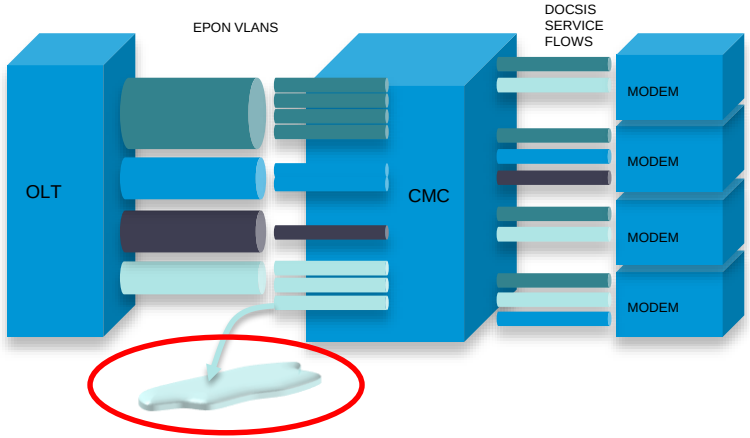
CableLabs draft C-DOCSIS specification included all 3 architectures and most of the major CMTS vendors have endorsed Type 3 – Remote PHY

Type 3 QoS versus Type 1 and 2 QoS

TYPE 3



TYPE 1 and 2

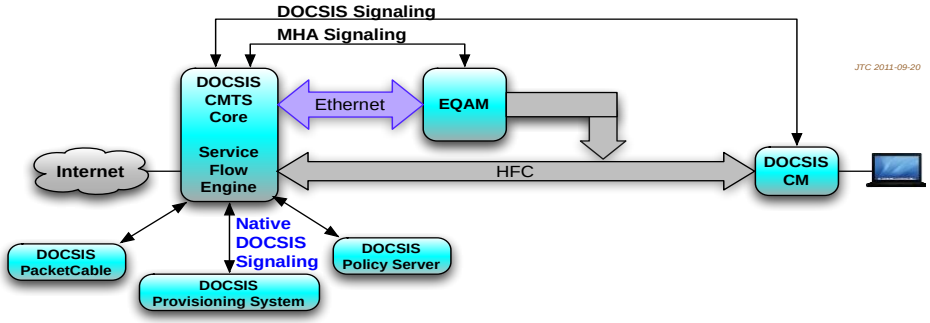


- The bandwidth from the CMTS/OLT to the CMC is likely to be restricted especially if GPON or EPON CMC backhaul is used

  Example: 100Mbps PON split supporting a 800Mbps capable CMC
- Type 3 will handle this gracefully using DOCSIS QoS
- Type 1 and 2 translate DOCSIS QoS to xPON VLANs. Each VLAN with a bit rate and max delay setting
- Type 1 and 2 will drop packets regardless of VLAN configured capacity

What is MHAv2?

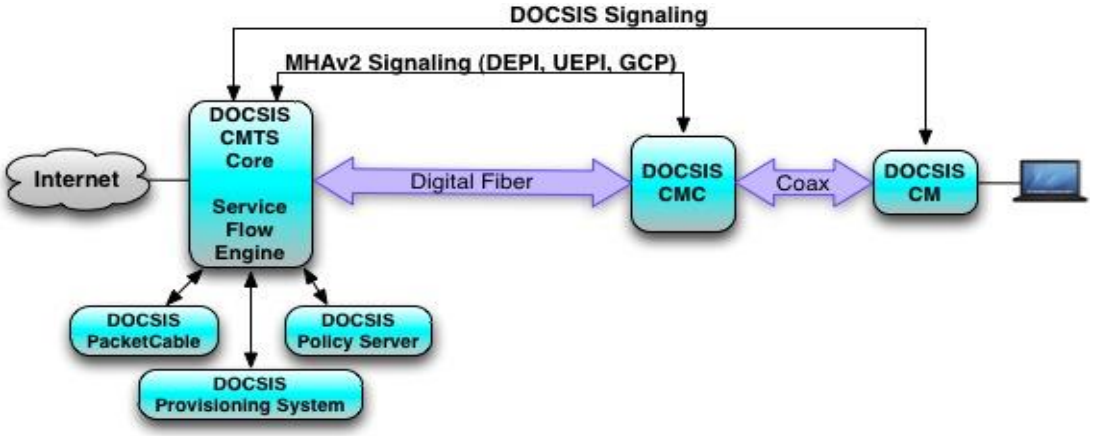
- MHA Modular Headend Architecture abbreviated. MHA contains a series of CableLabs officially published standards.



- MHAv1 allows the CMTS downstream physical layer (downstream edge QAMs) to be placed in a separate chassis.
  - ie M-CMTS in the current Cisco form
- MHAv1 first proposed and defined by Cisco in 2005 (all major CMTS and chip manufacturers were involved).The standard been has issued and related products been have tested at large-scale for many years of deployment.

What is MHAv2?

- MHAv2 is a set of open protocols standard recommendations specifically designed for C-DOCSIS



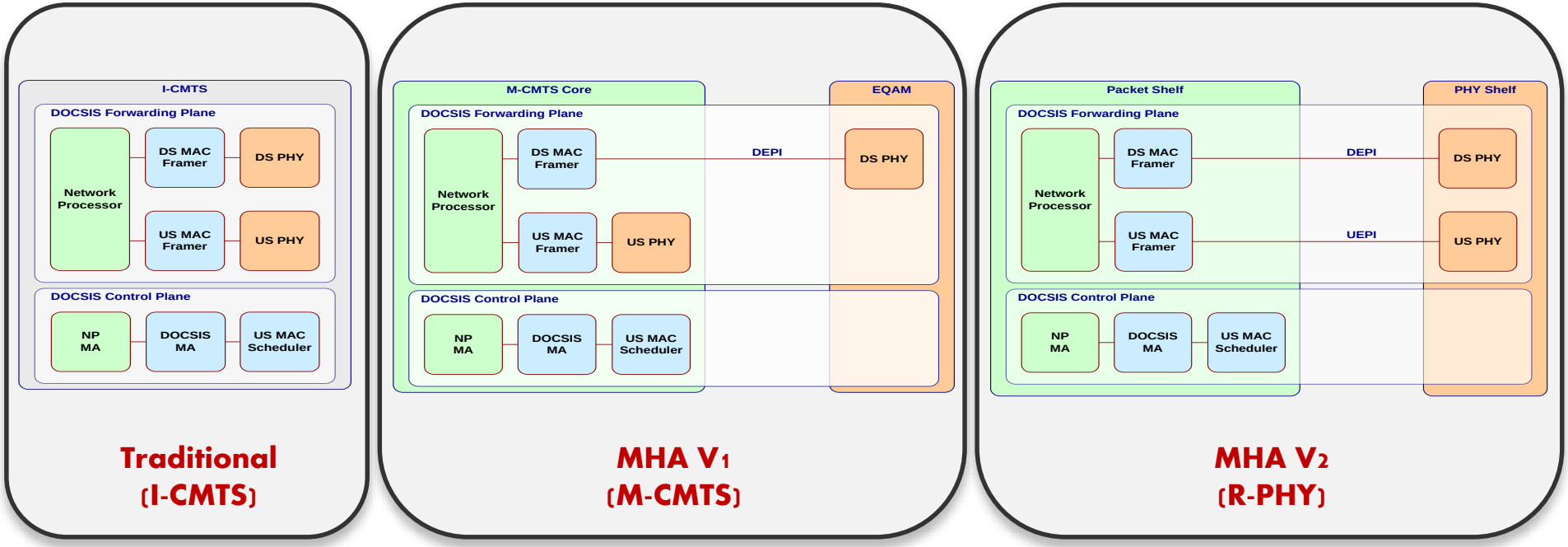
- GCP: General control plane protocol used to start and run / configure the CMC
- DEPI: based on L2TPv3 is the downstream link between MAC and remote PHY inherited and is inherited from MHAv1 - contains the control plane and forwarding plane protocol
- UEPI: Based on the the L2TPv3 is the upstream link between MAC and upstream PHY also providing support for a range of other protocols, such as 802.1 x, DHCP, TFTP, PTP

Key Advantages Of Remote-PHY

- Based on mature protocols
  - *DEPI, UEPI, GCP are commonly used in current CMTS technology*
  - *L2TP v3 based Pseudowire， no reliance on transmission technology*
- Backward compatibility & Futureproof
  - *Support DOCSIS1.1 to 3.0 CM and DOCSIS3.1, PCMM 1.5*
  - *Support downstream and upstream channel bonding, AES/DES encryption, logical channel, PHS etc*
- Leverage current provisioning system
  - *Leverage current CMTS provisioning system and configuration system*
  - *One CMTS manages hundreds of CMC*
  - *One CMC is capable of supporting more than thousand of CM, minimize the operational cost*

Introducing Cisco's remote PHY C-DOCSIS system

DOCSIS Remote PHY
A logical next step



Remote Phy Whitepaper:
http://www.cisco.com/c/en/us/solutions/collateral/service-provider/converged-cable-access-platform-ccap-solution/white-paper-c11-732260.pdf

Cisco remote PHY CMC Controller – *UBR-MC3GX60-RPHY*

- uBR10012 chassis with PRE5 / PRE4 route processor
- De-stuffed of MC3GX60V
- CMC Controller card

  3x gigE links per card linked to the ip network connection to the CMC's

  60x CMC supported per controller with 4x US active per CMC

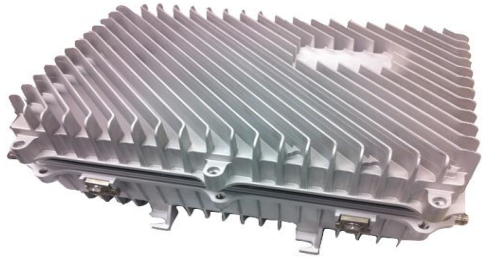
  240x CMC supported per controller with 1x US active per CMC
- 15 Mac Domain per Line Card
- Uses the mac processing chips of the MC3GX60V line card
- Leverage most current 10k software and features
- Removes the requirement to run RF cable TO / FROM the chassis
- Coexist with existing RF line cards
- Software license support like MC3GX60V

Cisco Remote PHY CMC Spec

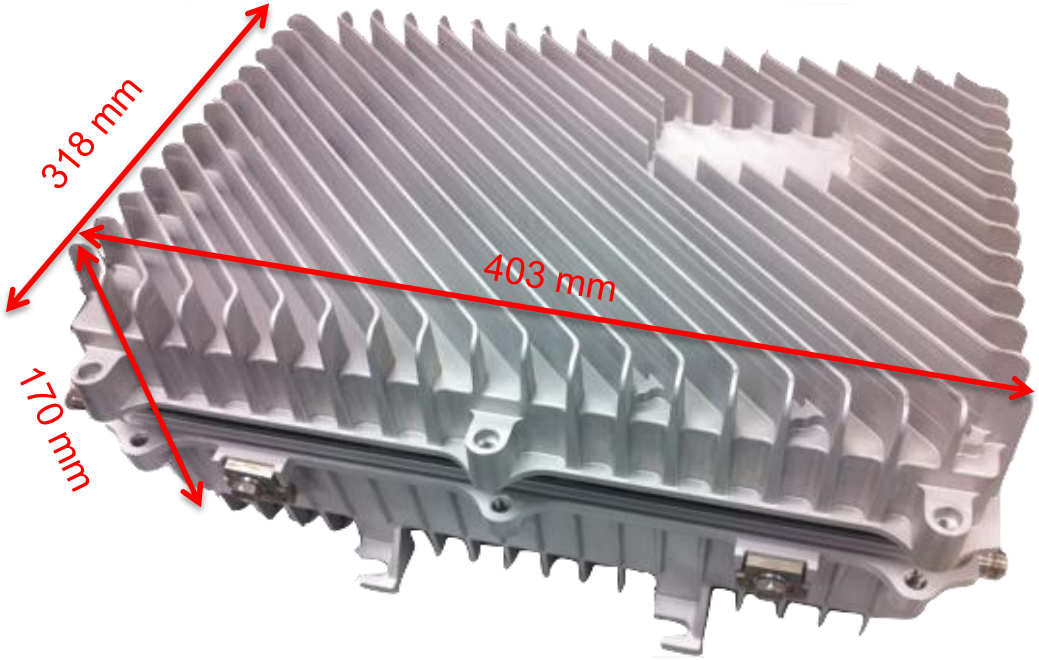
- 16 Downstream channels + 4 Upstream channels
- DOCSIS3.0 and Euro-DOCSIS3.0 compliant
- Power: 60V AC/220V AC
- FRX (one way fiber node), 1G ONU,10G ONU (post FCS) are customer selectable
- Input: 1x RF in, 1+1 RJ45 ports (external ONU), 1x Fiber input (FRX), 1+1 SFP IP
- Output:

  4x RF out, QAM RF output =45dBmV (16 channels), CATV output =50dBmV

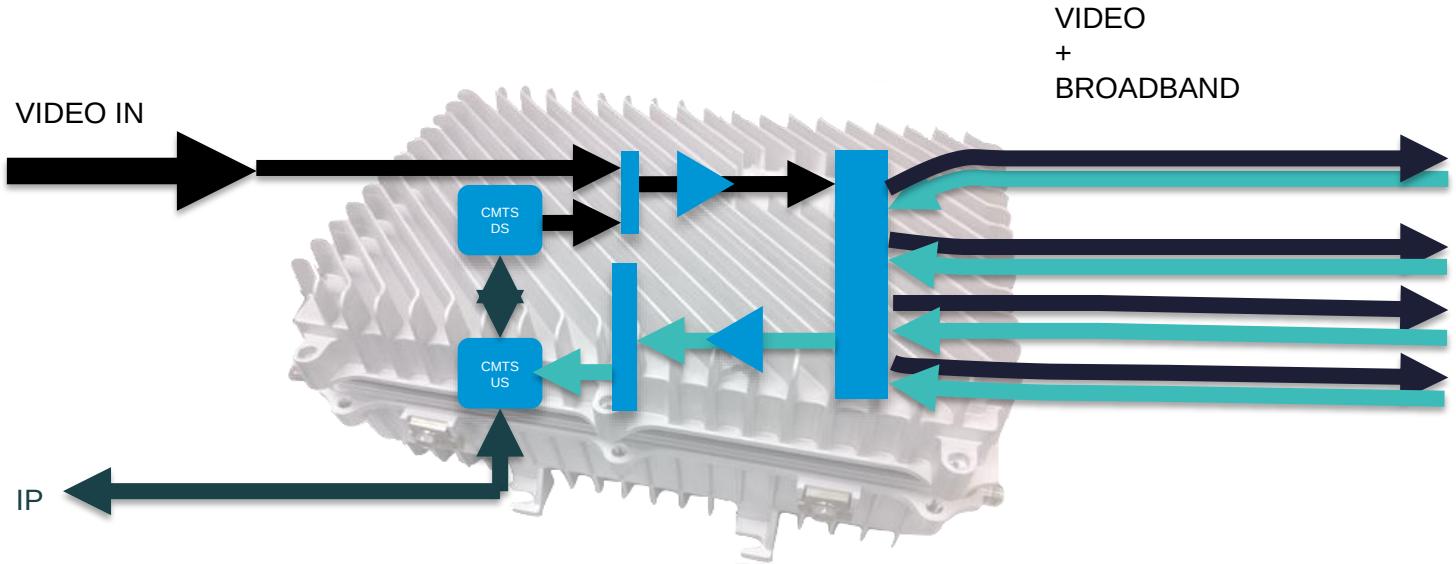
  2x RF out, QAM RF output =49dBmV (16 channels), CATV output =54dBmV
- 42/54 and 65/87MHZ split is customer selectable
- Operating temperature: -40°C~60°C
- Waterproof: IP67
- Accessories: Adapters, F connector, EQ, Pads, console cable etc



Remote Phy CMC dimensions

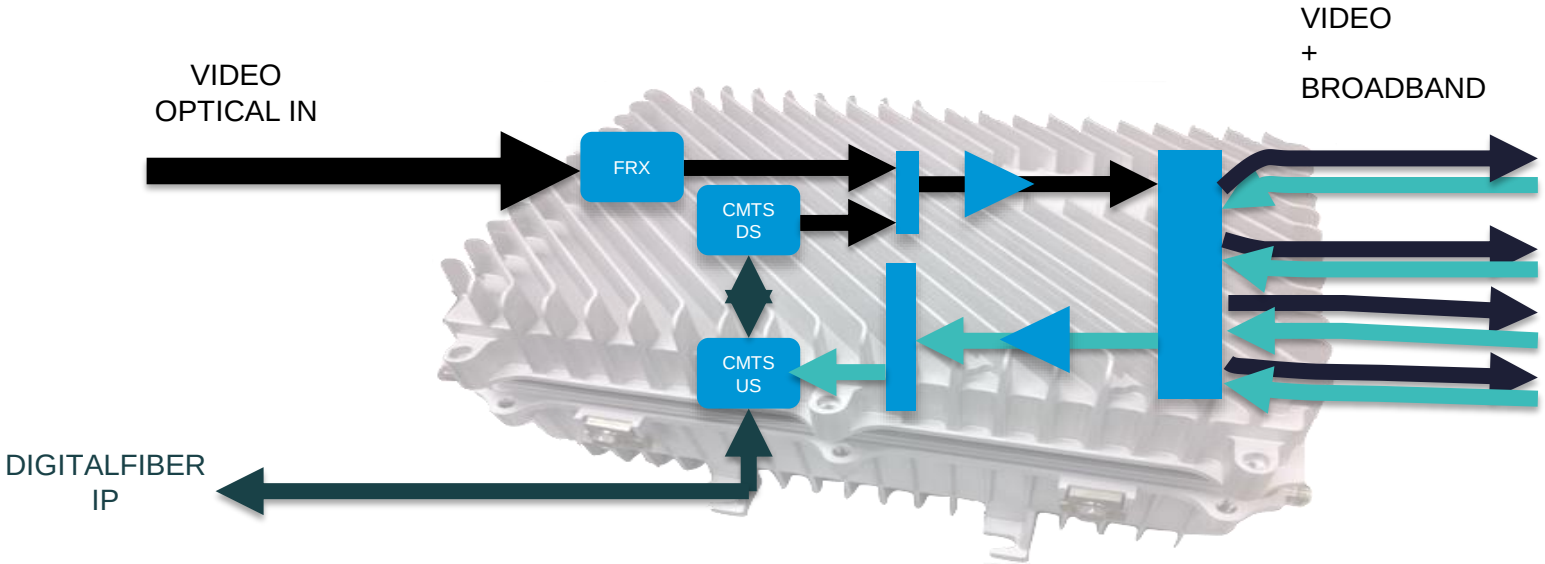


Cisco remote PHY CMC Simplified block diagram



- Note: Reverse path is blocked at the CMC

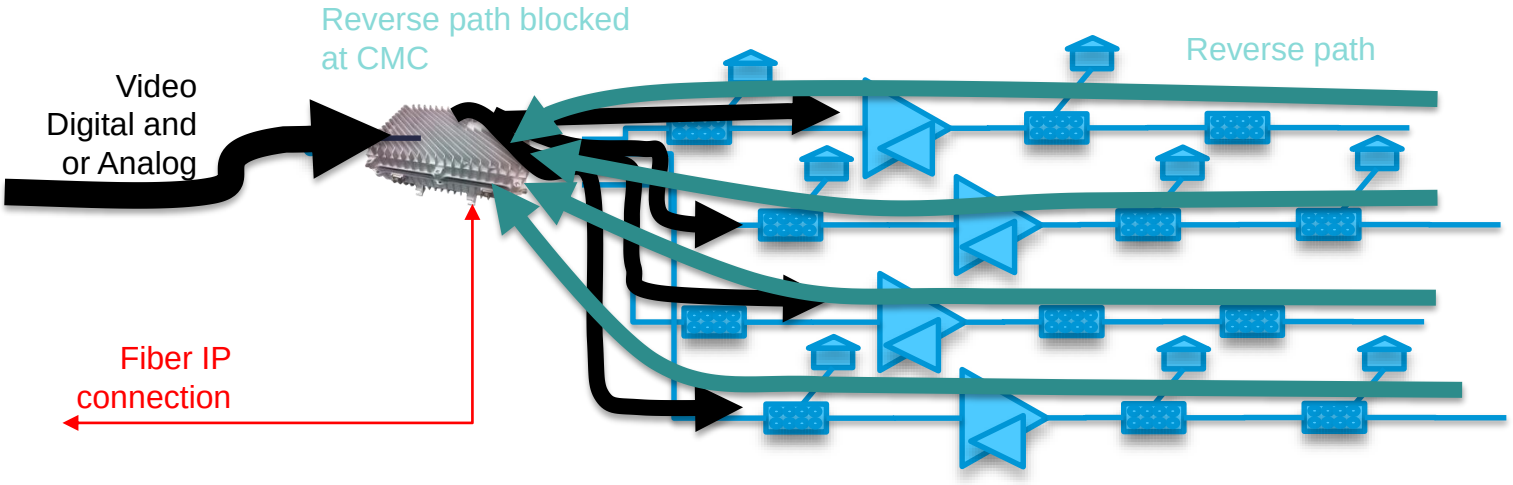
Cisco remote PHY CMC with FRX Simplified block diagram



- Note: Reverse path is blocked at the CMC
- FRX – Forward path receiver

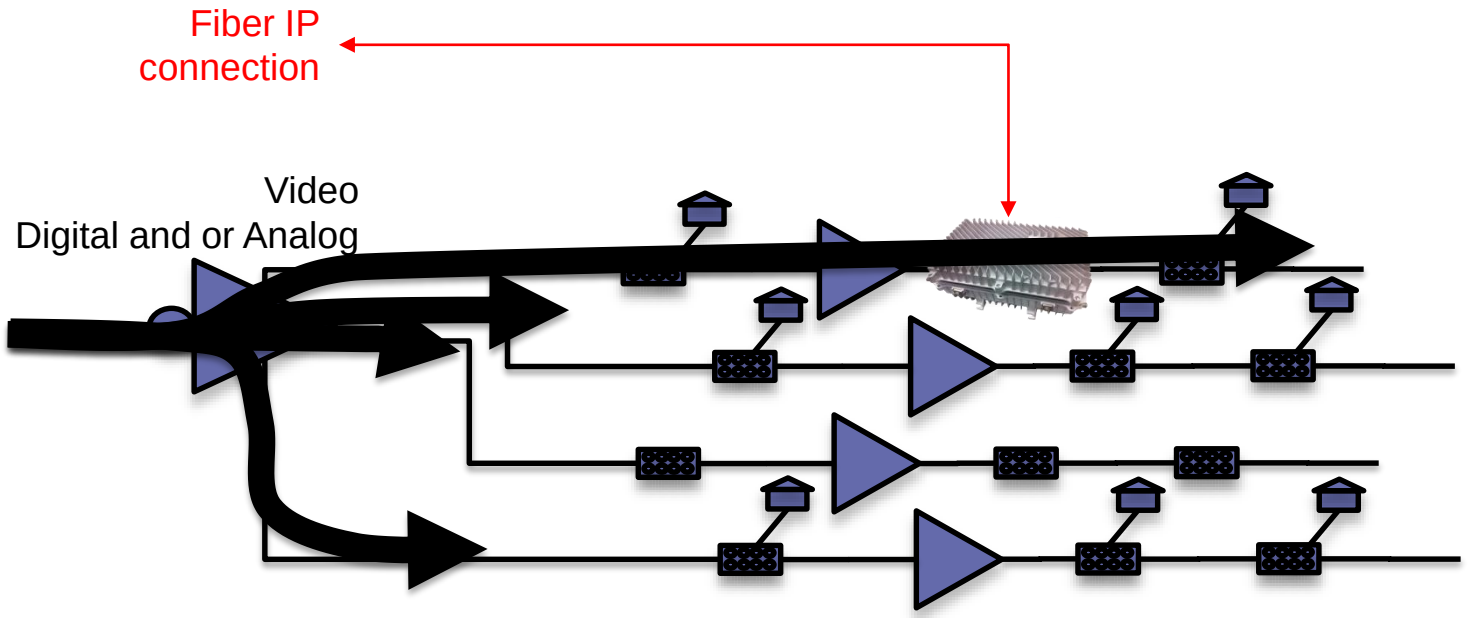
Use Cases & Roadmap

Insert CMC into node service area
Reverse path terminates at CMC



- Cut Coaxial cable from node / new connectors
- Terminate unused node outputs
- Activate reverse path in active components after node
- Align CMC video output / reverse input
- Add IP backhaul

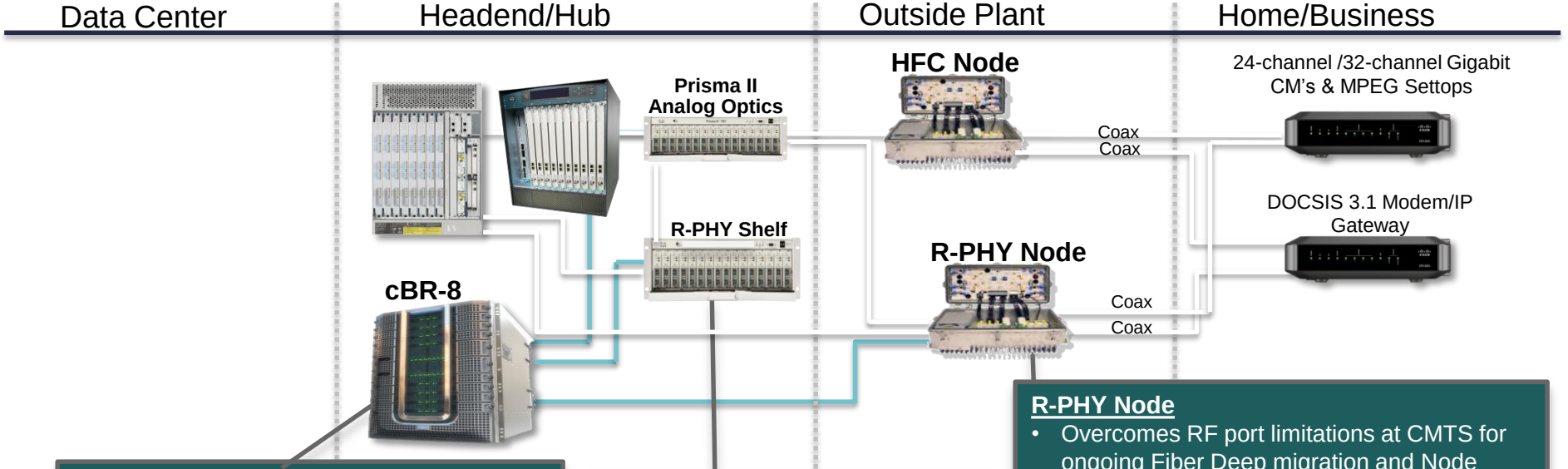
Insert CMC into node service area (one way plant)



Cisco cBR: At a Glance

- 13RU, 10-slot mid-plane chassis with integrated N+1 RF Switch
- Service Groups per Chassis:
  - 64 SG's (I-CMTS)
  - Up to 256 SG's (R-PHY)
- Up to 6,144 DS/QAM per chassis
- 8x16 RF Linecards
- 4 Gbps DS capacity per SG
- 8x10 GE WAN ports; 160+ Gbps forwarding (at FCS)
- Backplane scalable to 1+ Tbps

cBR-8: Full CCAP with Unmatched Scaling

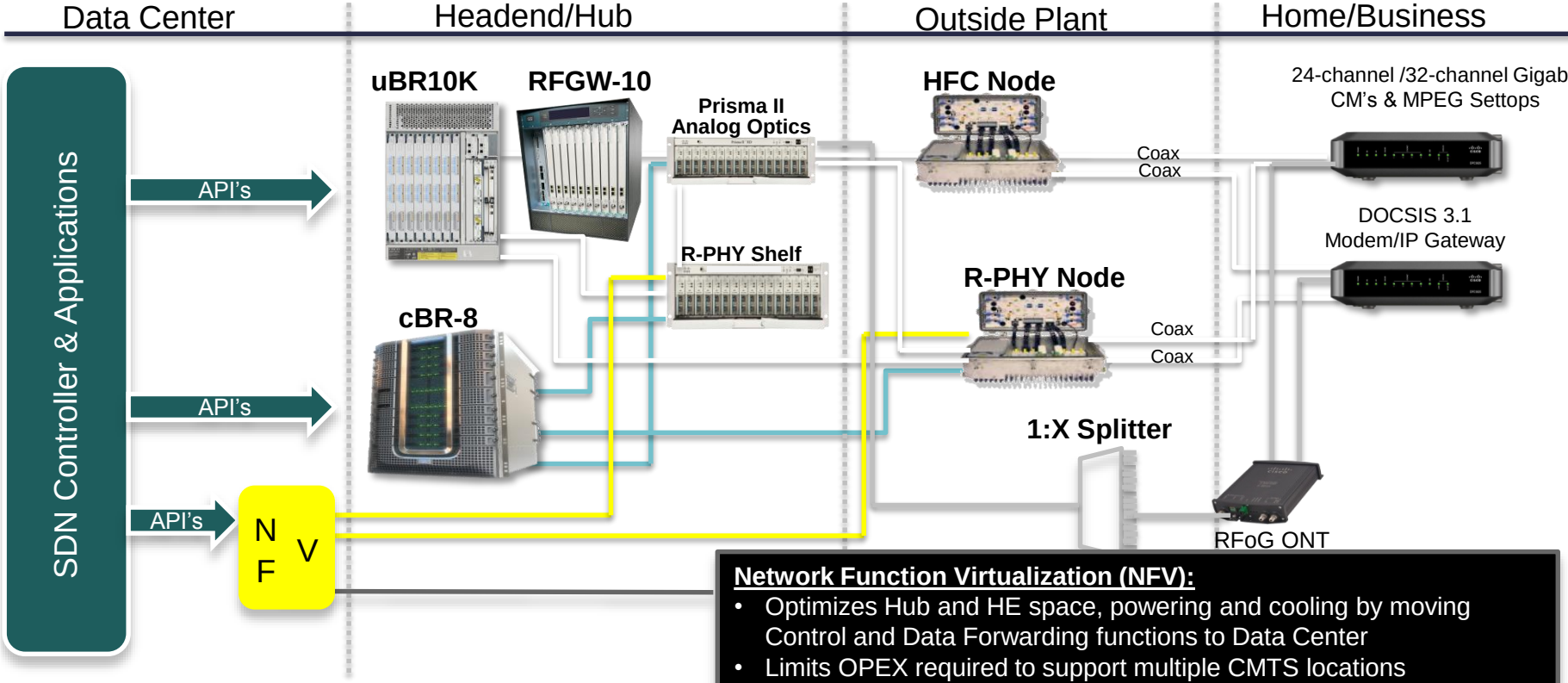


cBR-8:
- Unmatched density and speeds
  - 64 SG's at 4 Gigabit (I-CMTS)
  - 192SG's at 1 Gigabit (R-PHY)
- Converged Video & Data in 13RU
- D3.1 DS capable hardware
- D3.1 US support via module upgrade
- Note: pluggable Optics provide option to eliminate Prisma II Optics shelf

R-PHY Shelf:
- Optimizes CAPEX and OPEX by consolidating multiple small hubs into a single CMTS (up to 256 SG's to one 13RU cBR8)
- Provides N:1 redundancy

R-PHY Node
- Overcomes RF port limitations at CMTS for ongoing Fiber Deep migration and Node splits (up to 192SG's to one 13RU cBR-8)
- Digital Fiber provides improved CNR performance for higher modulation (4K QAM)
- Digital fiber provides networking functionality all the way to the Node
- Creates launch point for Ethernet & PON based services

SDN For Service Velocity & Network Mgmt



Network Function Virtualization (NFV):

- Optimizes Hub and HE space, powering and cooling by moving Control and Data Forwarding functions to Data Center
- Limits OPEX required to support multiple CMTS locations
- Ultimate agility to change services simply adding a new instance of a virtual CMTS in a new Virtual Machine (VM).

Conclusion

Advantages of using Remote PHY (C-DOCSIS III) for Executing your digital optics (deep fiber strategy) in your DOCSIS networks

Low Incremental Cost Less Risk	• Maximum leverage existing DOCSIS infrastructure and investment with field proven products and technologies • Incremental pay-as-you grow deployment strategy
Simplicity Lower OPEX	• Minimal change, keeping your existing DOCSIS provisioning, backend systems and CPEs • Centralized management functions with simple PHY at the node
Faster Time to Market	• Full support of all DOCSIS functions • Faster time to market and feature velocity • Support in our uBR10K and cBR-8 platform
Superior Performance and Architecture	• Increase scalability beyond CMTS for future growth • More bits/Hz: Support higher modulation (4096QAM with DOCSIS 3.1) • Better end-to-end QoS assurance and Higher Availability with simplicity at the node and centralized function at a secure control environments • Migration from FTTN to FTTH (ME4600 ETH & PON)

Thank you.