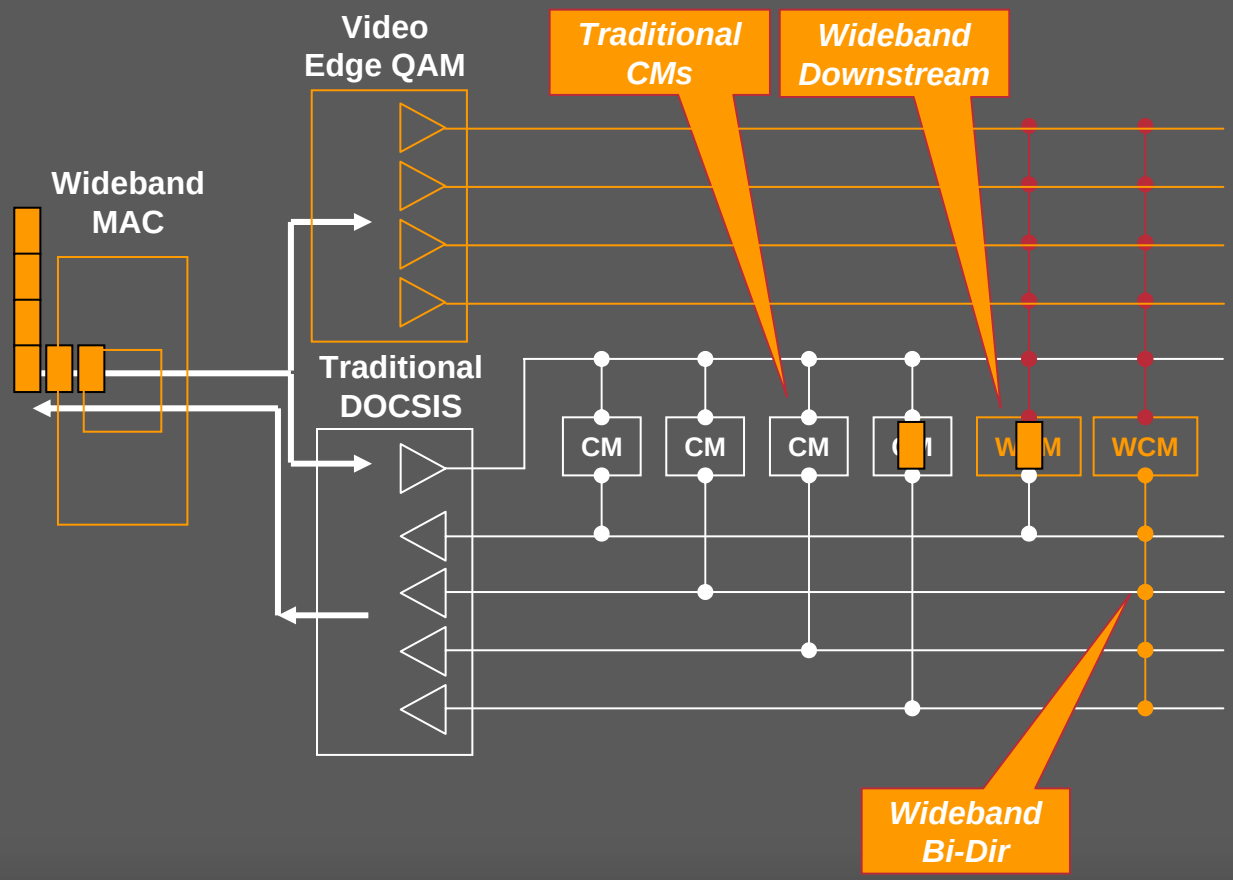
CISCO DOCSIS NETWORKS OF THE FUTURE

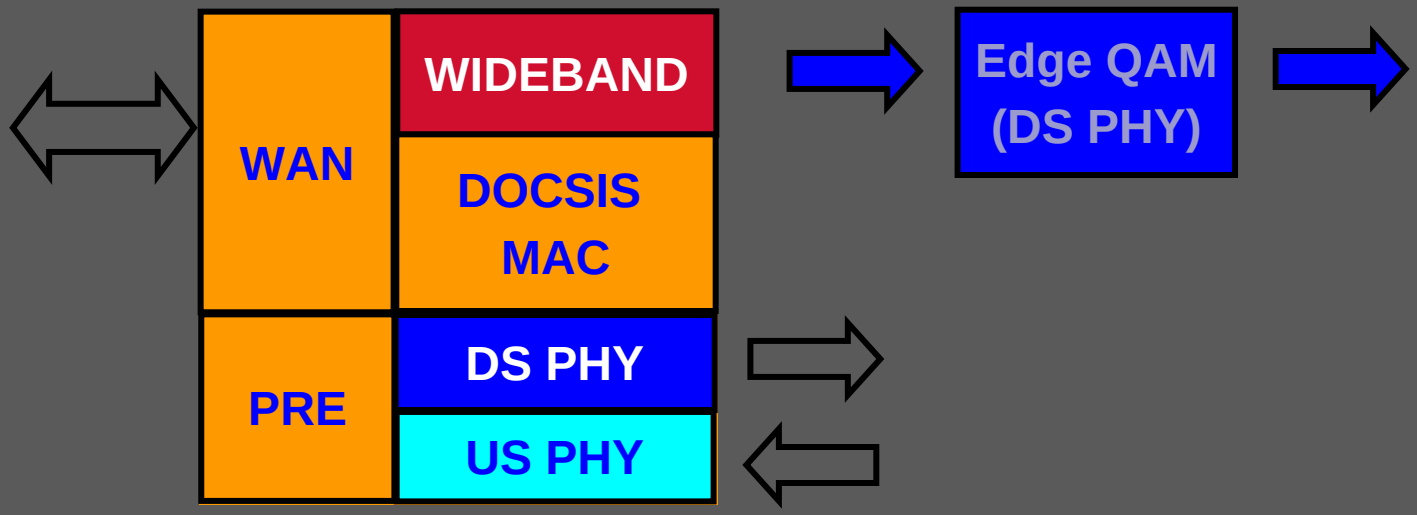
Kyle Lindsey

Jim Brown

Deploying Cisco's Wideband Architecture



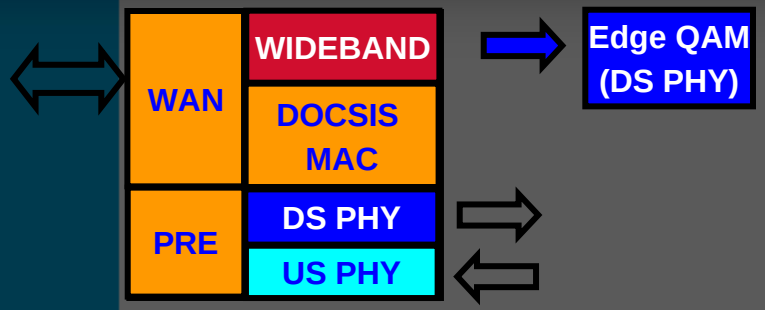
uBR Wideband Architecture



Modular CMTS and DOCSIS3.0 TECHNOLOGY IMPLEMENTATION

- Wideband SPA for DS Channel Bonding
- Standard VoD Edge QAM
- MC520&MC28U Cards for DOCSIS 1.x/2.0 & WB CMs

uBR10012 Wideband Components



WAN INTERFACE

4x HH-GE

ROUTING ENGINE

2x PRE2 @6Mpps

RP Redundancy

DOCSIS CARDS

8x MC5X20

40 DS / 160 US Ports per Chassis

WIDEBAND SPA

2x WB-SPA per Chassis

1Gbps/SPA (~24 QAMs/SPA)

Redundant GE Output (SFP)

EXTERNAL EDGE QAM

Off-the-shelf VOD QAM

Key Strengths of Cisco's Wideband Solution

CMTS Side

- Does not impact CMTS performances
- Adds Downstream Capacity to CMTS
- MODULAR Architecture
- Standard EdgeQAMs

CM Side

- Cisco design, Linksys brand, ODM manufactured
- Initial implementation scales up to 304Mbps/CM
- Doesn't require Bonded Channels to be adjacent
- Time to market solution for MSOs facing multi-100Mbps competition (ETTH, FTTH)
- Software upgradeable to DOCSIS 3.0 (DS Packet Bonding)

New CableLabs Specifications

DOCSIS 3.0


Data-Over-Cable Service Interface Specifications
DOCSIS 2.0

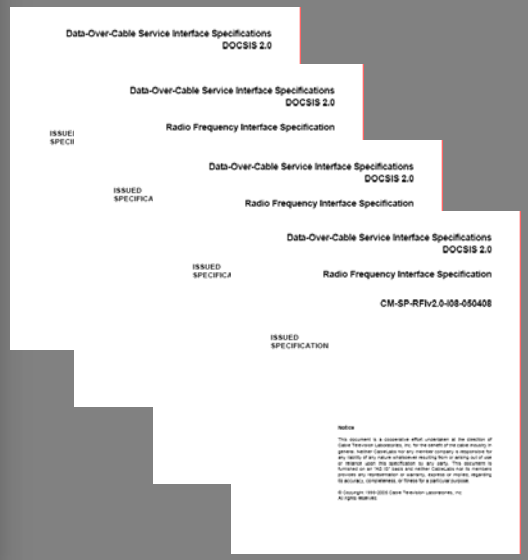
Radio Frequency Interface Specification

CM-SP-RFIv2.0-I08-050408

ISSUED SPECIFICATION

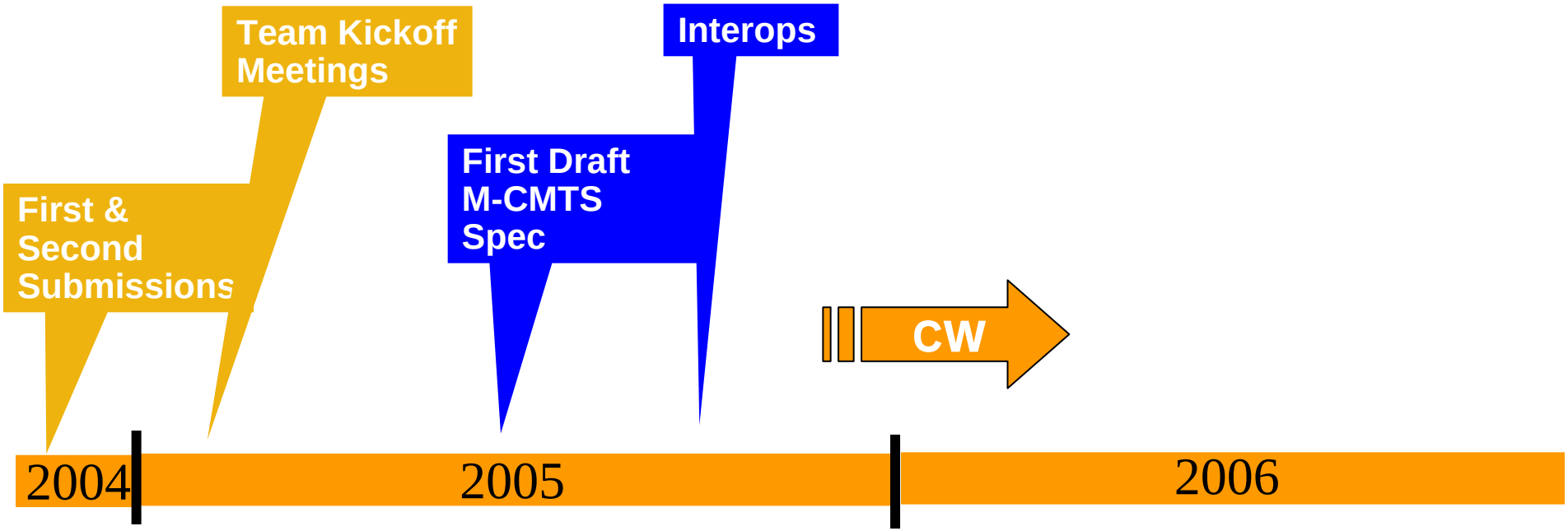
- Channel Bonding
  - DS & US
- IPv6
- Multicast Enhancements
- DOCSIS Protocol Refinements

M-CMTS



- New CMTS Architecture aimed to achieve <u>better DOCSIS economics</u>
  - Lower cost DS PHY
  - De-couple DS and US ports

CableLabs M-CMTS Specification Timeline



DOCSIS 3.x Goals

- Compatible with the M-CMTS™ architecture
- Phased release of specs.

  First phase = DOCSIS 3.0

  Downstream Bonded Channels

  Anything that has CPE HW impact
- Existing CMs work on any one of the bonded channels of a DOCSIS 3.x system/channel
- DOCSIS 3.x CMs work on an existing system/channel
- DOCSIS 1.x, 2.0 and 3.x CMs can coexist on a common channel

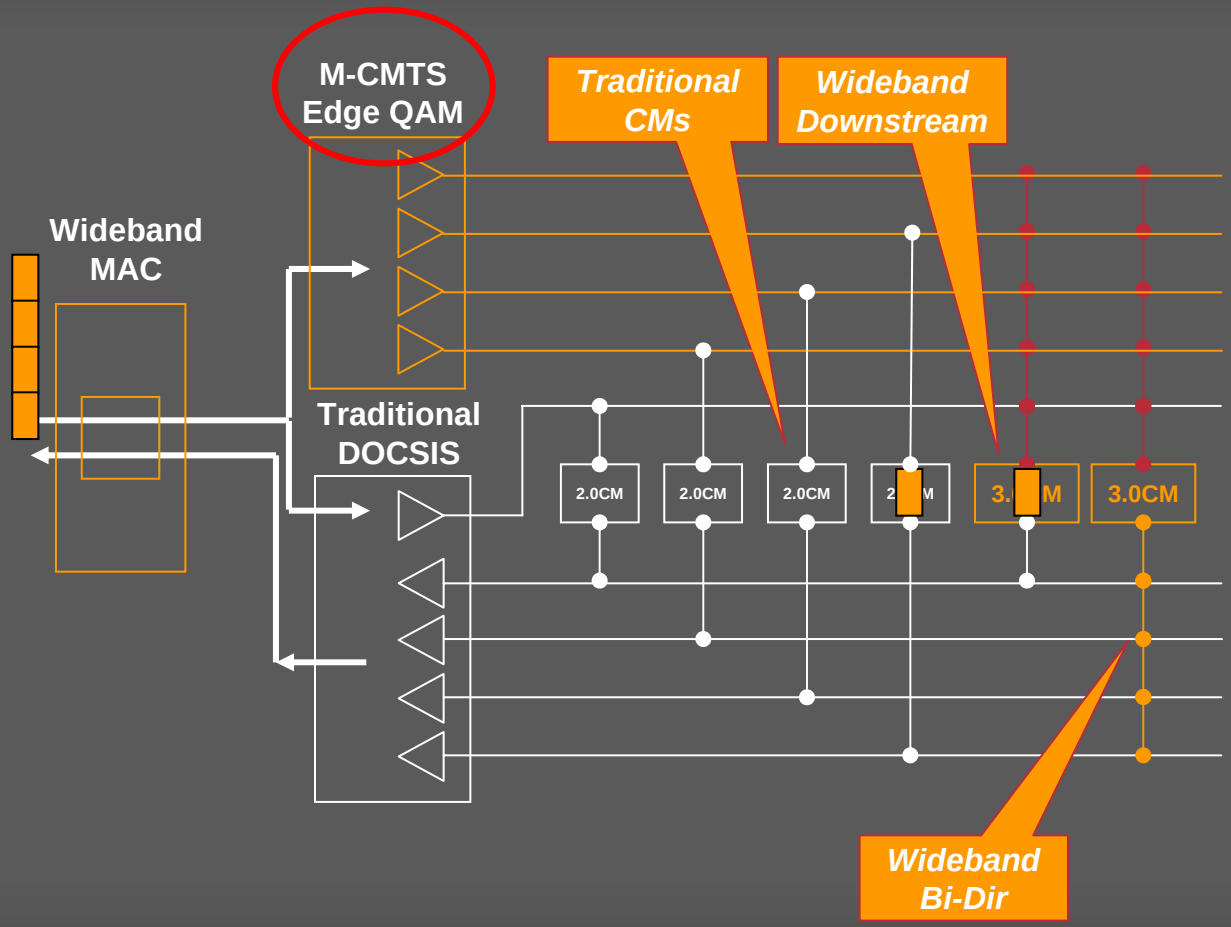
Source: CableLabs

DOCSIS 3.0 High-Level Requirements

DOCSIS Version	DOCSIS 1.0	DOCSIS 1.1	DOCSIS 2.0	DOCSIS 3.0
Services				
Broadband Internet	X	X	X	X
Tiered Services		X	X	X
VoIP		X	X	X
Video Conferencing			X	X
Commercial Services			X	X
Entertainment Video				X
Consumer Devices				
Cable Modem	X	X	X	X
VoIP Phone (MTA)		X	X	X
Residential Gateway		X	X	X
Video Phone			X	X
Mobile Devices				X
IP Set-top Box				X
Downstream Bandwidth				
Mbps/Bonding Group	40	40	40	200
Gbps/node	5	5	5	6.3
Upstream Bandwidth				
Mbps/Bonding Group	10	10	30	100
Mbps/node	80	80	170	450

Source: CableLabs

Deploying DOCSIS 3.0 Architecture



DOCSIS 3.0 Specification Status

Channel Bonding proposals:

- Downstream:
  - Merged proposal of Packet Mode Channel Bonding from Motorola, Arris, Cisco and Broadcom
  - Cisco's control plane proposal (registration, signaling, service flow management)
- Upstream:
  - Cisco's proposal of packet streaming and first-grant-back
  - Merged proposal of REQ-GNT techniques from Broadcom, Cisco and Motorola.

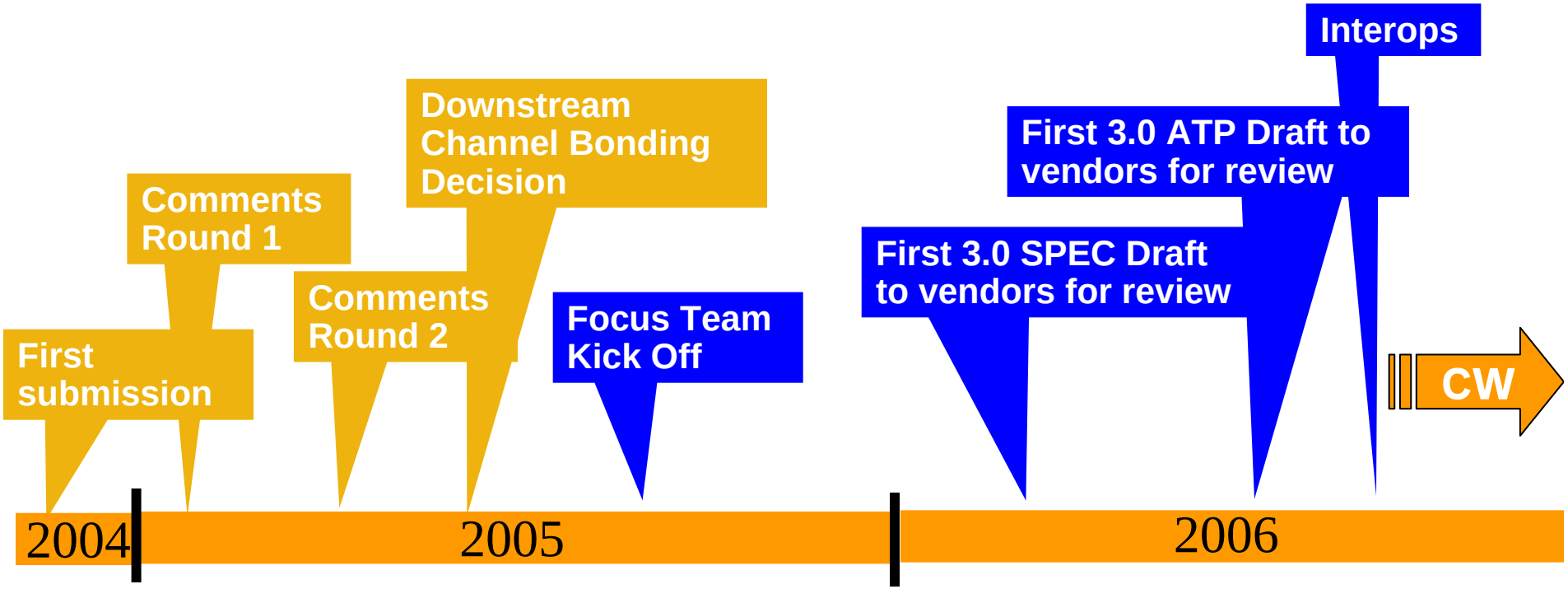
IPv6:

- Cisco was the only vendor submitting a baseline document

Multicast

- Cisco was the only vendor submitting a baseline document

CableLabs DOCSIS 3.0 Specification Timeline



Source: CableLabs

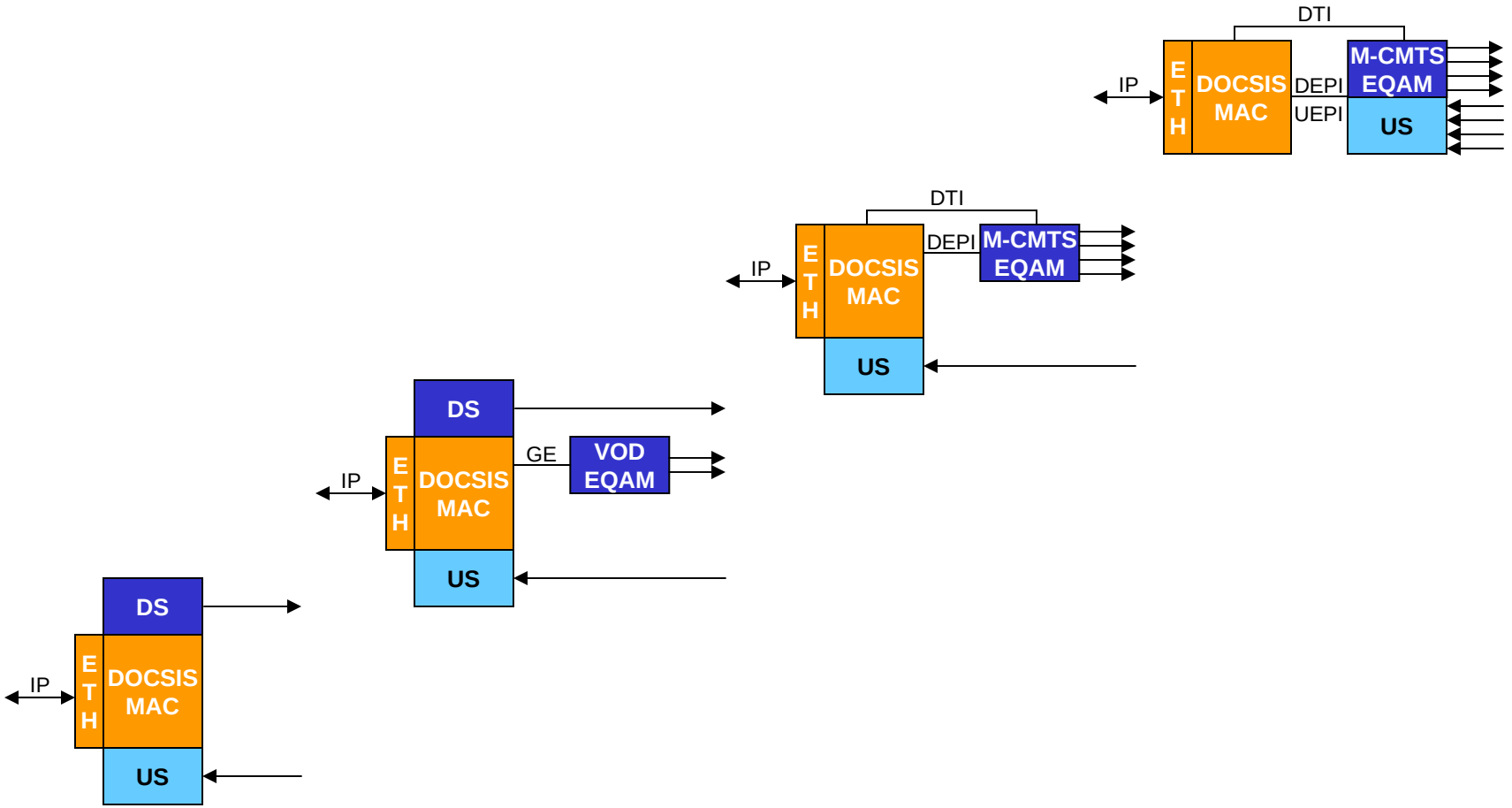
Cisco 3G-CMTS

"Traditional CMTS" Architecture

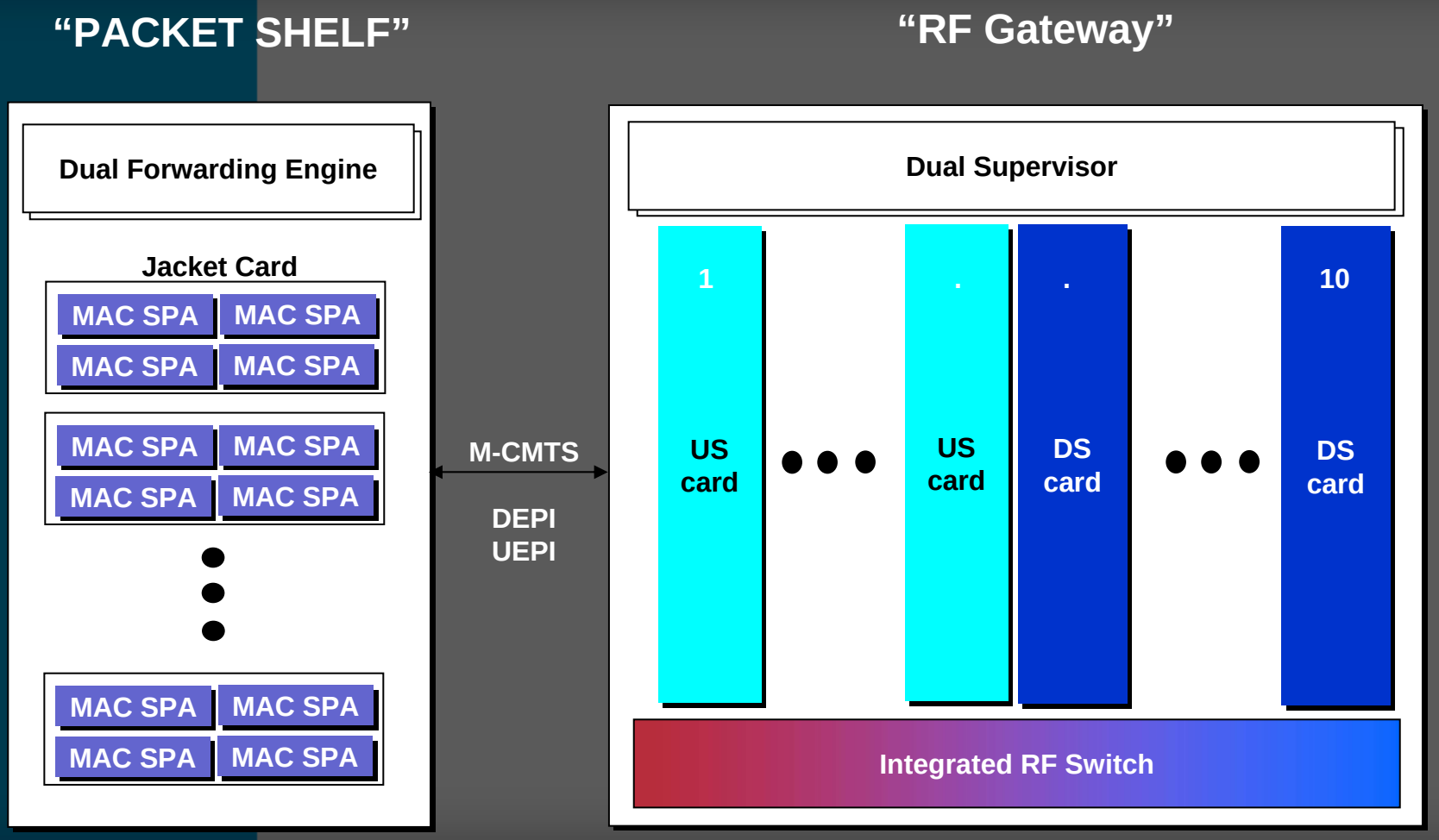
Cisco Wideband™ Architecture

CableLabs® M-CMTS™ Architecture

Cisco 3G-CMTS Architecture



3G-CMTS Solution Overview

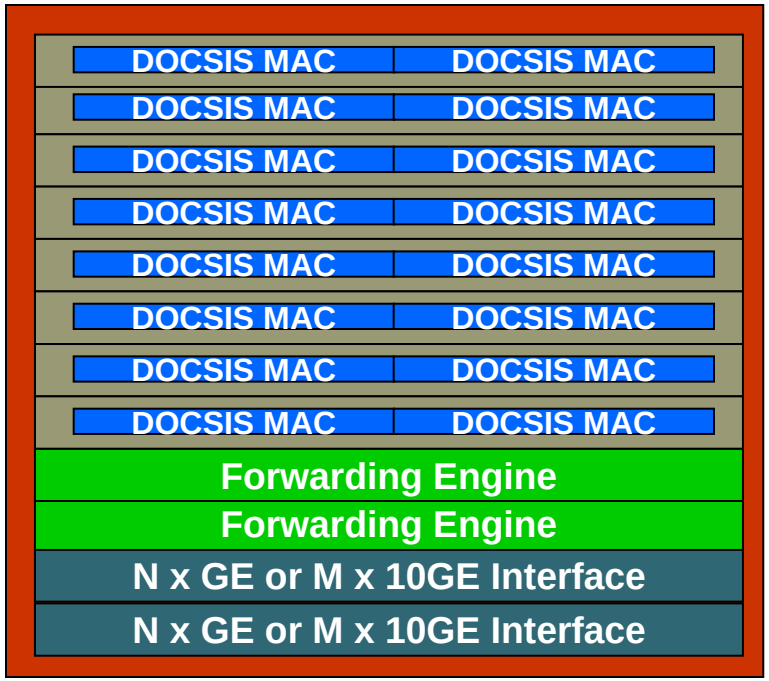


Packet Shelf Summary

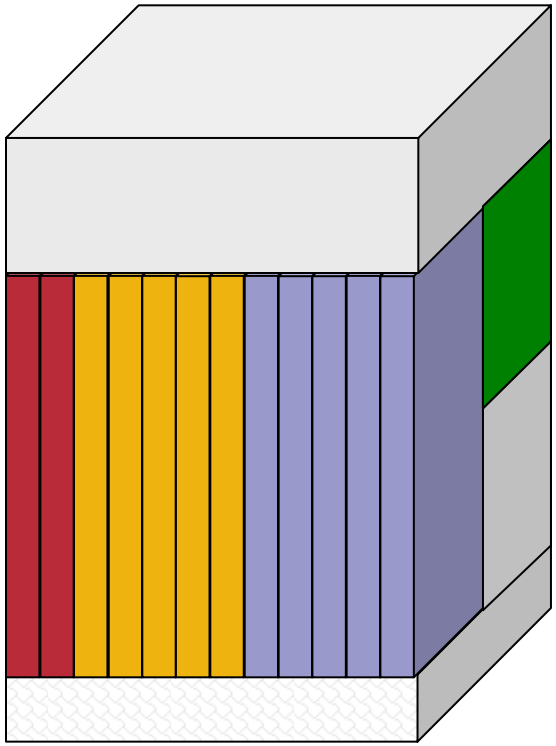
- Very high packet performance
- High density Ethernet connectivity
- Flexible optical connectivity options
- Universal DOCSIS MAC SPA

  US,DS,NB,WB
- Full Redundancy
- Full suite software features

  MPLS, L2TPv3, L2 switching, routing.
- DOCSIS 3.0 & M-CMTS Qualified



RFGW Summary

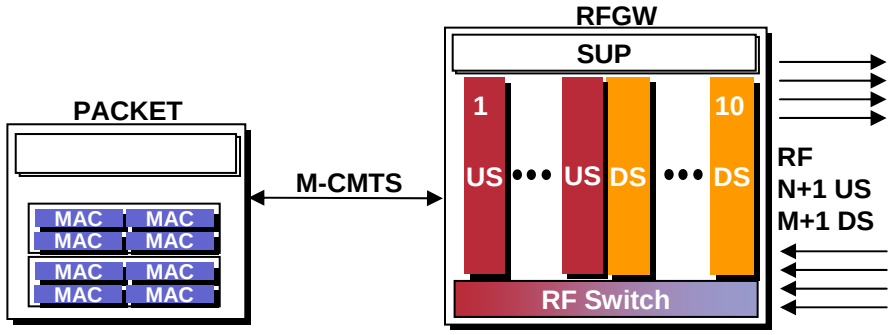


- Specifications
  - 10 RF slots, 2 Supervisor slots
  - 2 power supplies, 2 clocking cards
  - Multi 10GE or 1GE backhauls
  - Front-to-back airflow
  - Integrated RF switch (US&DS)
  - Cable Once, Dense connectors
  - DOCSIS 3.0 Qualified
- Downstream PHY card
  - M-CMTS compliant
- Upstream PHY card with virtual cabling
  - UEPI compliant
- Extensive software and hardware HA
- Evolve to multiple form factors

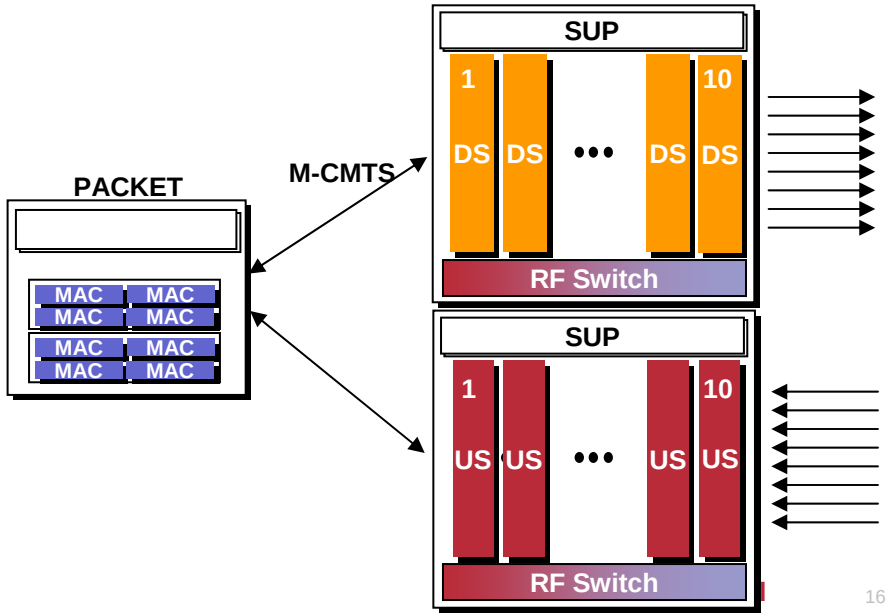
Deployment Scenarios

multiple dimensions of flexibility (location, application, US/DS)

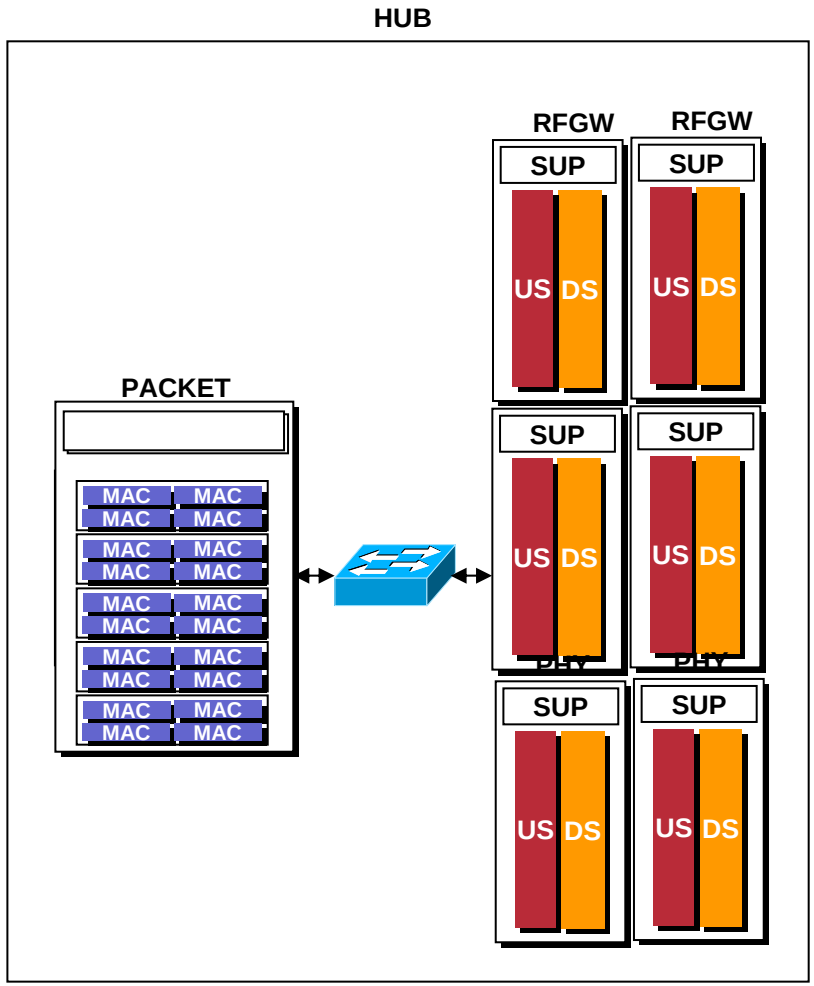
HA CMTS
Combined DOCSIS DS & US



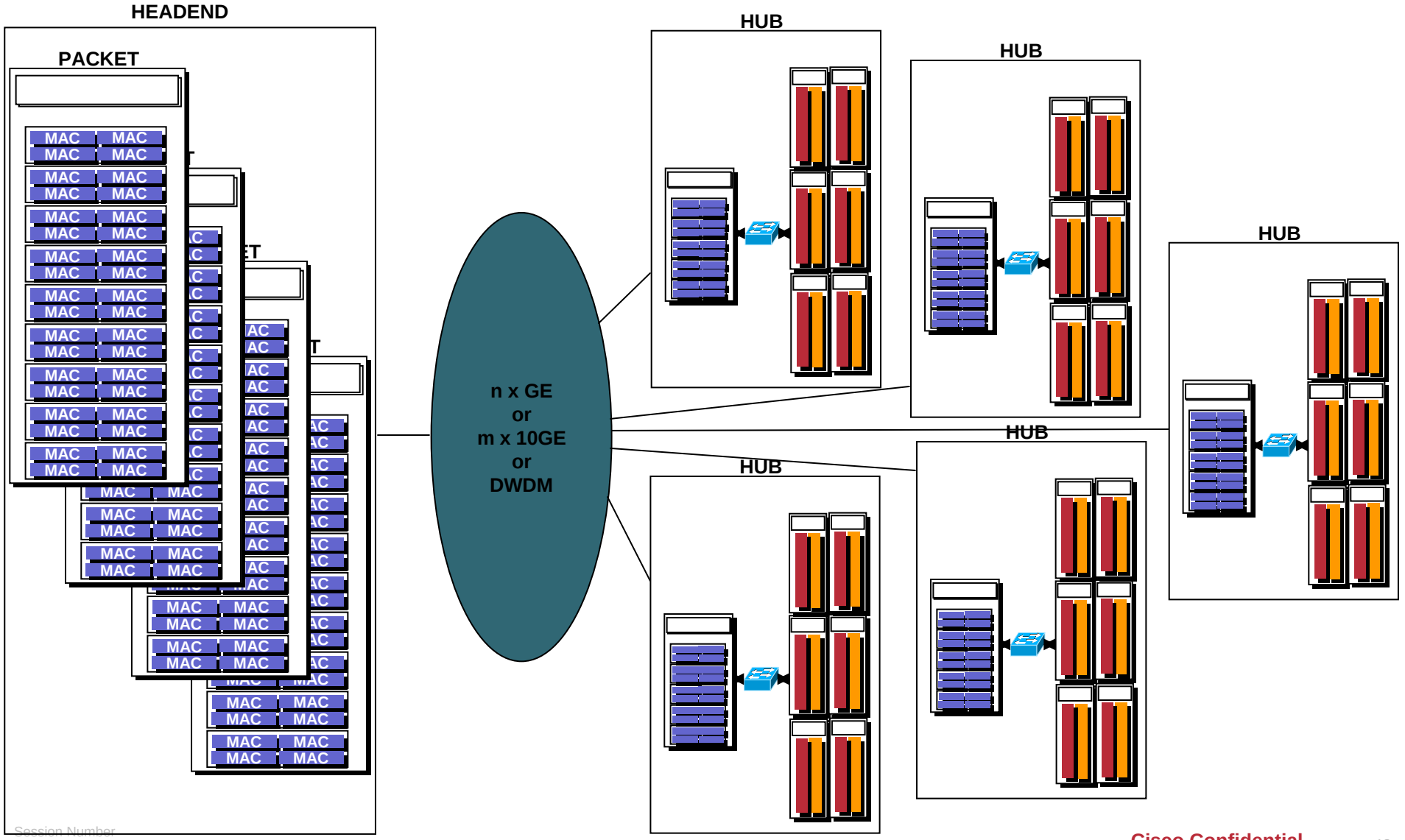
HA CMTS
Separate DS & US



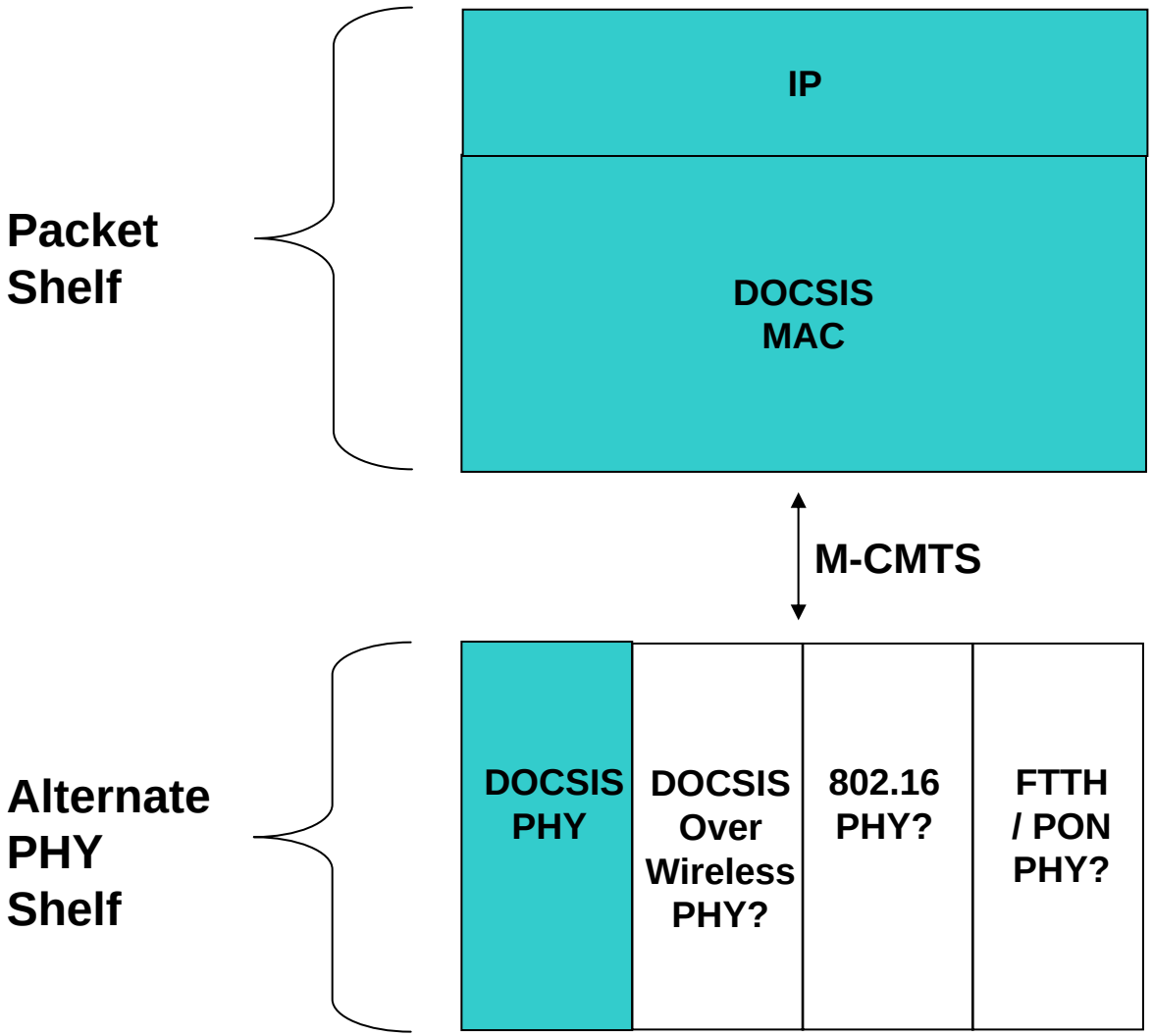
Deployment Scenarios



Deployment Scenarios



3G-CMTS Split Pkt/PHY Evolution



Leverage features in DOCSIS;

-Provisioning model
-Network management model
-Billing model
-QoS architecture
-Voice, Video, Data integration
-Proven technology
-Industry recognised specifications

Possibly develop in-house or outsource development

Cisco
Market
Leadership

More Bandwidth

+

Features to enable higher ARPU Services

+

Lower Cost

+

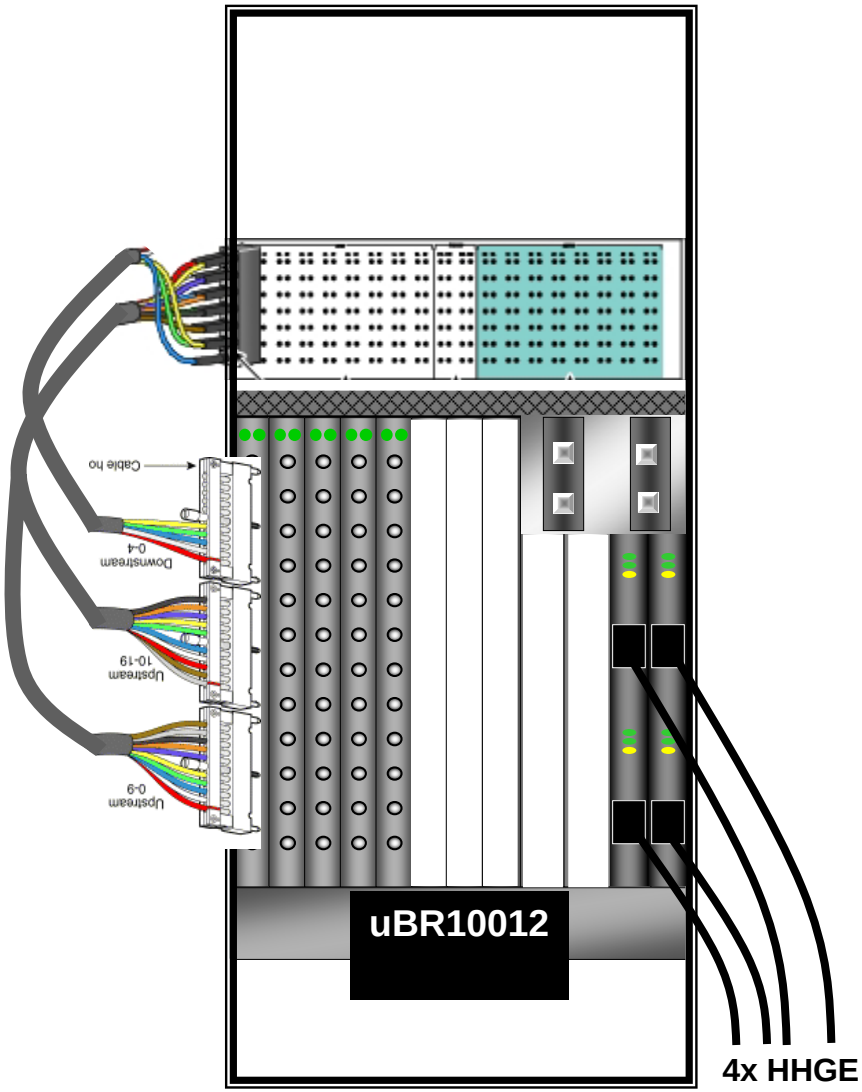
Investment Protection

=

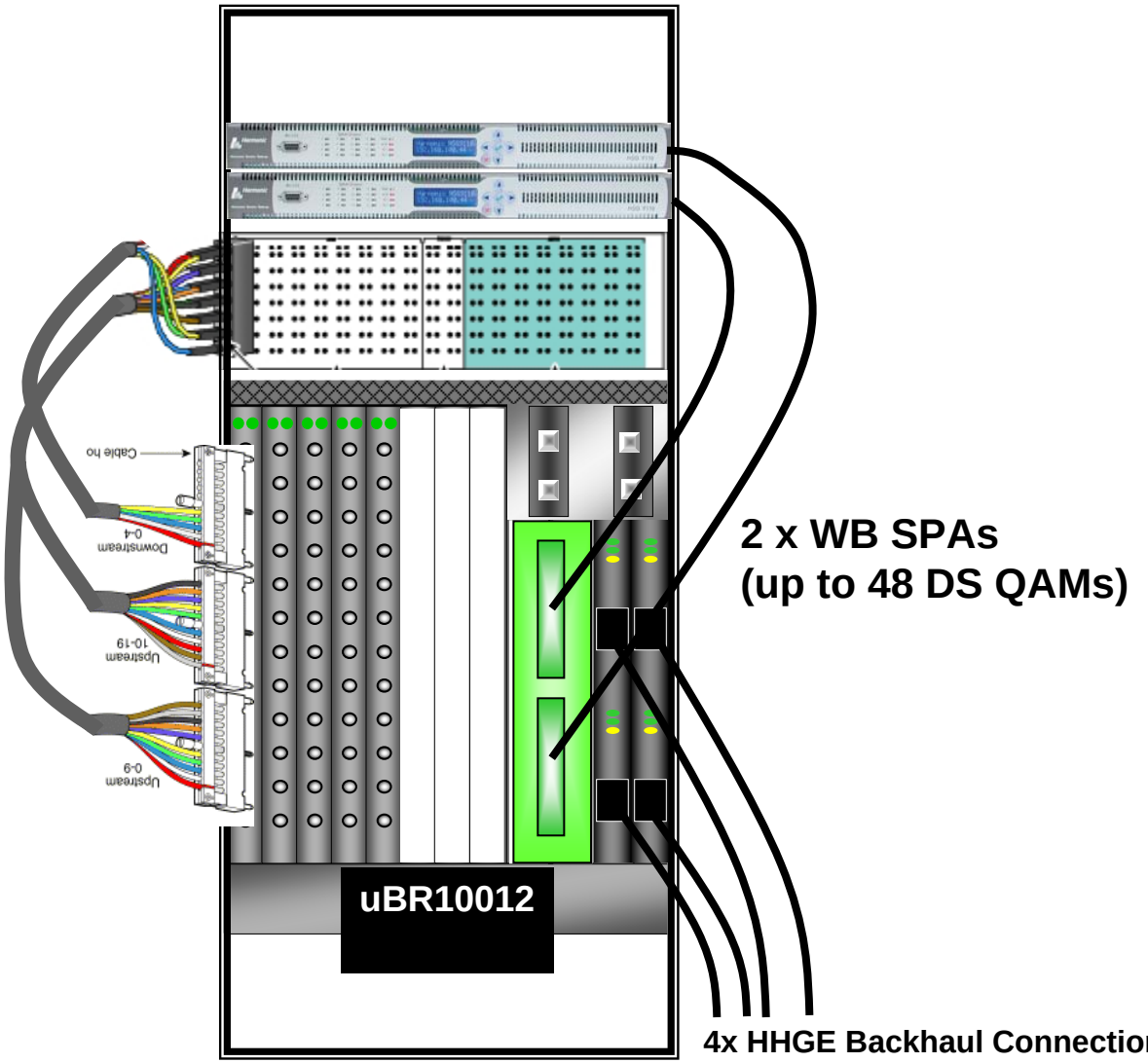
Cisco 3G-CMTS Solution

“Fiber Speeds, Cable Feeds.”

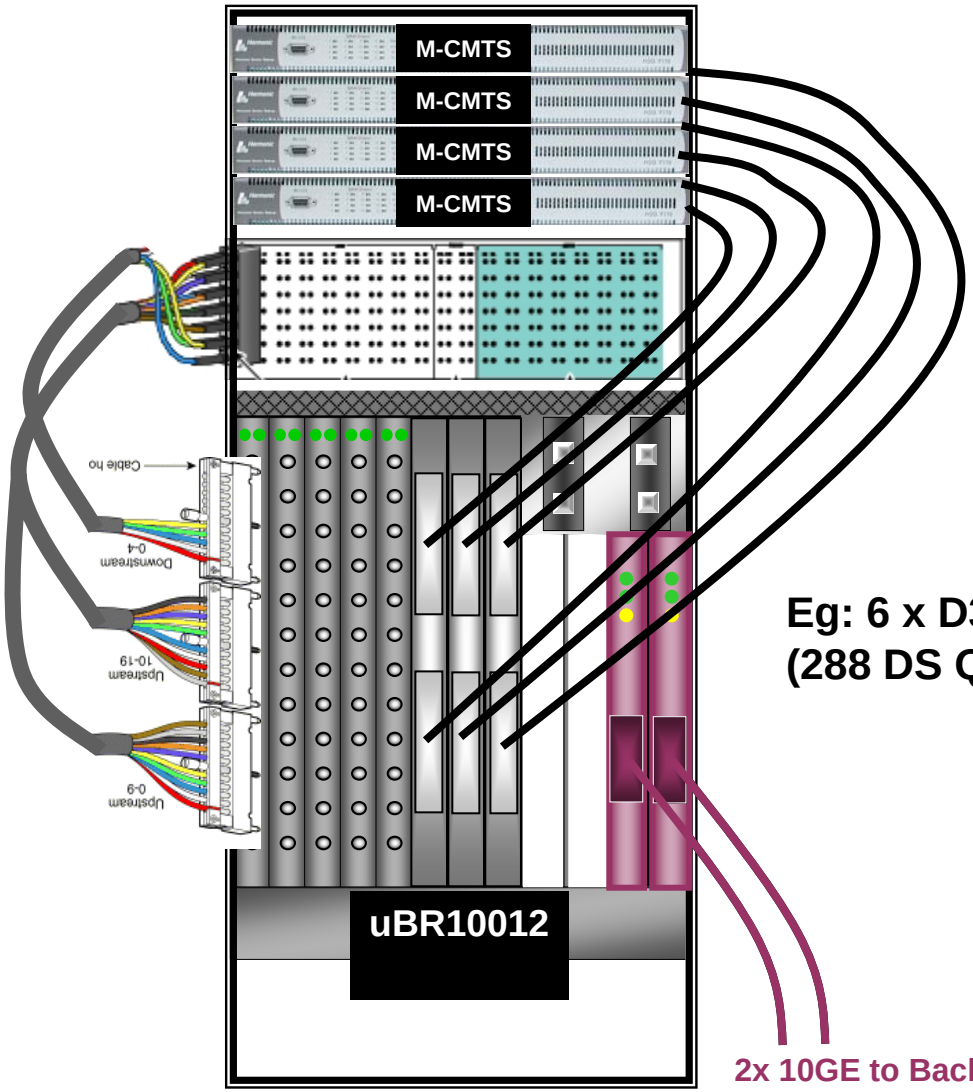
Phase Today – uBR10K with MC5x20 4+1 Redundancy



Phase 0 – Cisco Wideband Solution



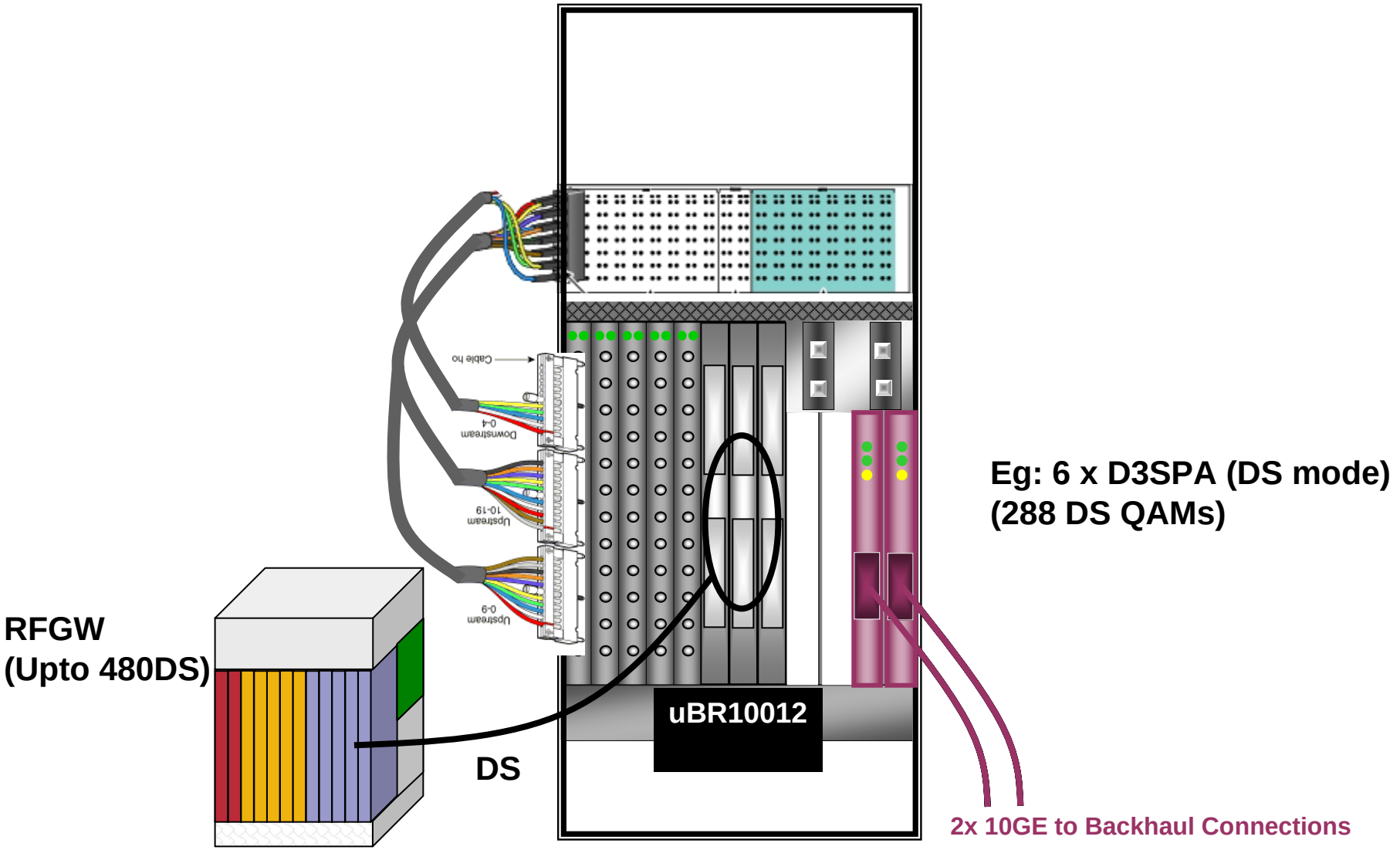
Phase 1 – DOCSIS 3.0 DS + M-CMTS EQAM Pizza Box



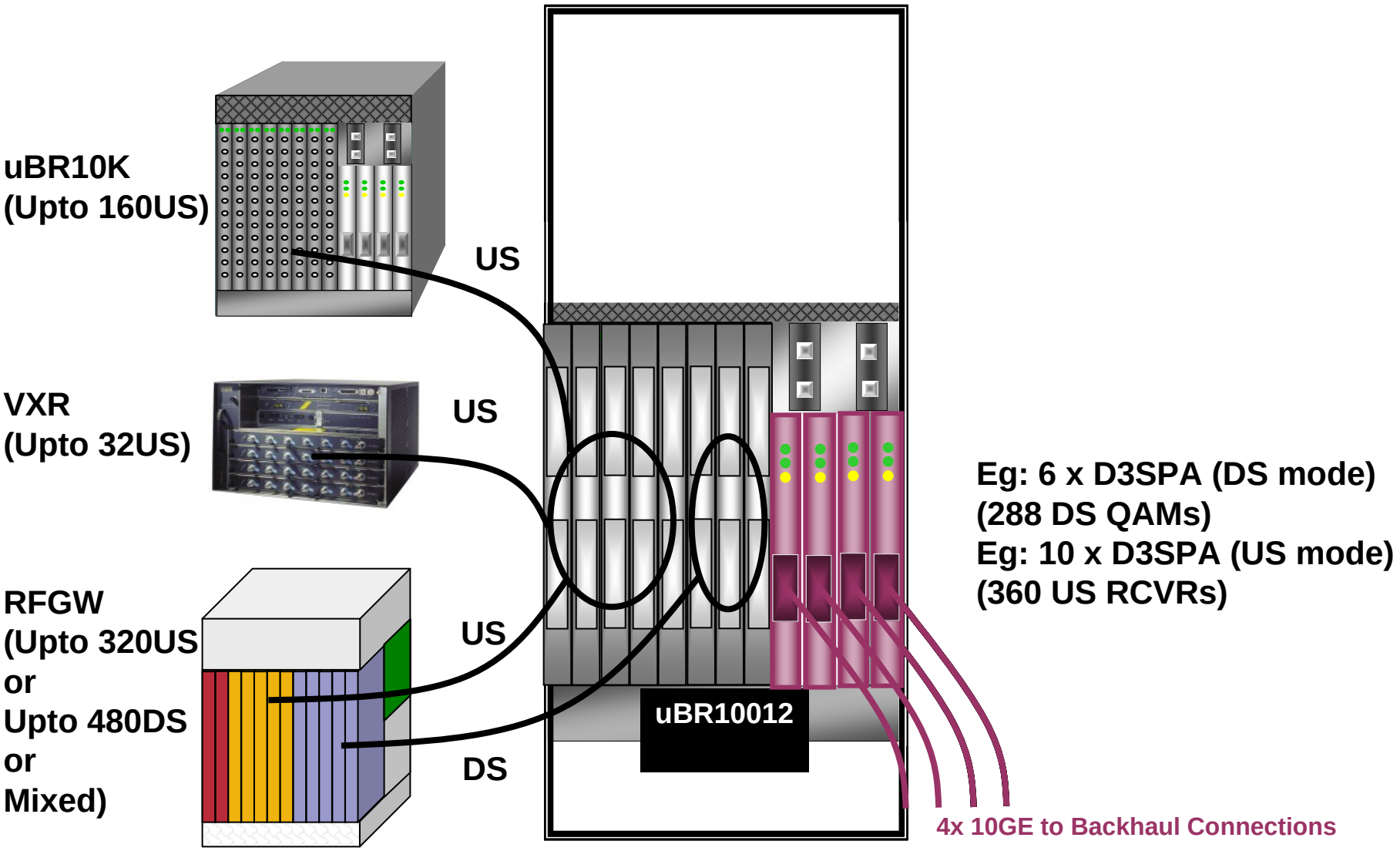
Eg: 6 x D3SPA (DS mode)
(288 DS QAMs)

2x 10GE to Backhaul Connections

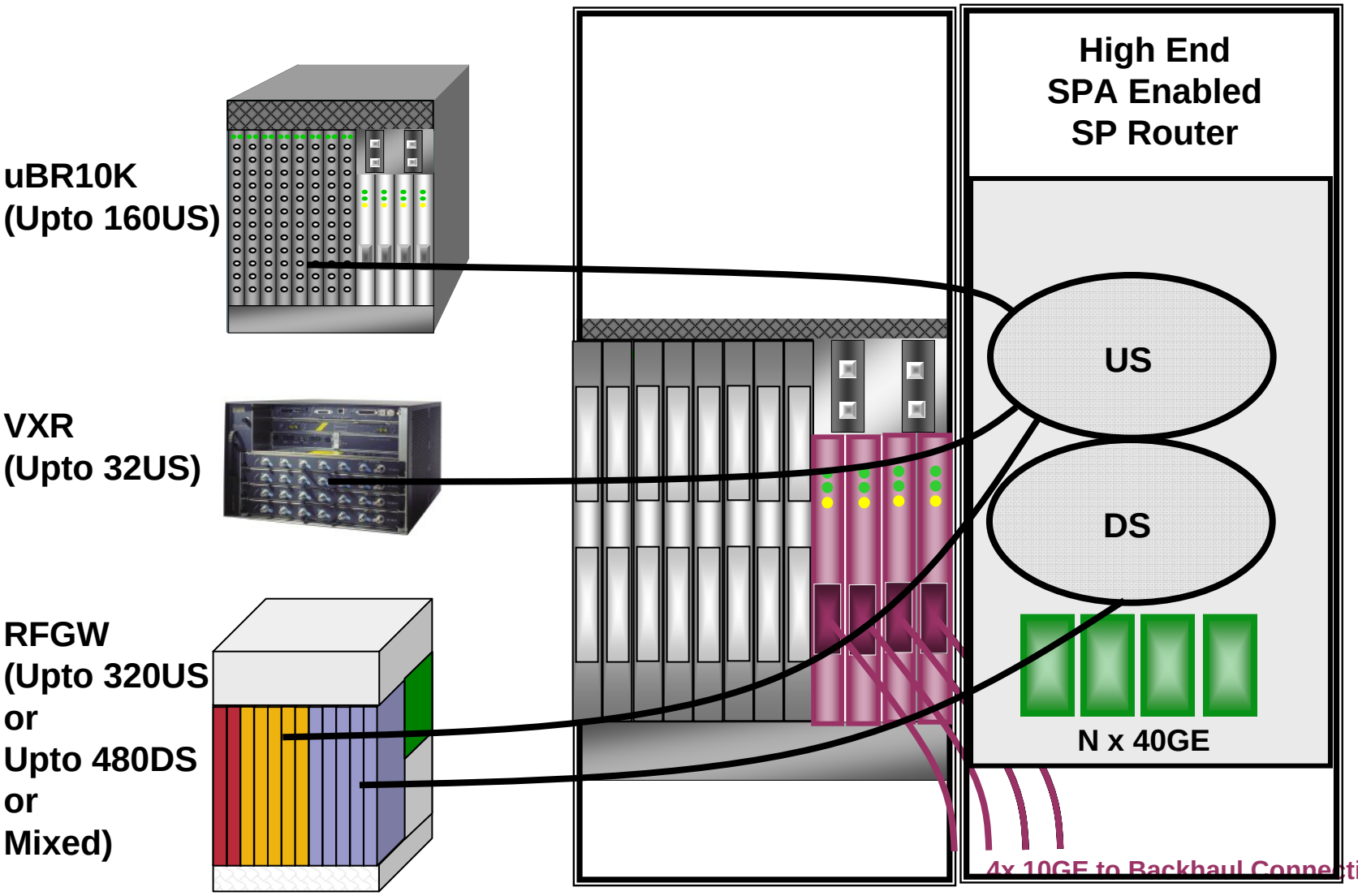
Phase 1 – DOCSIS 3.0 DS + M-CMTS EQAM RFGW



Phase 2 – DOCSIS 3.0 DS+US



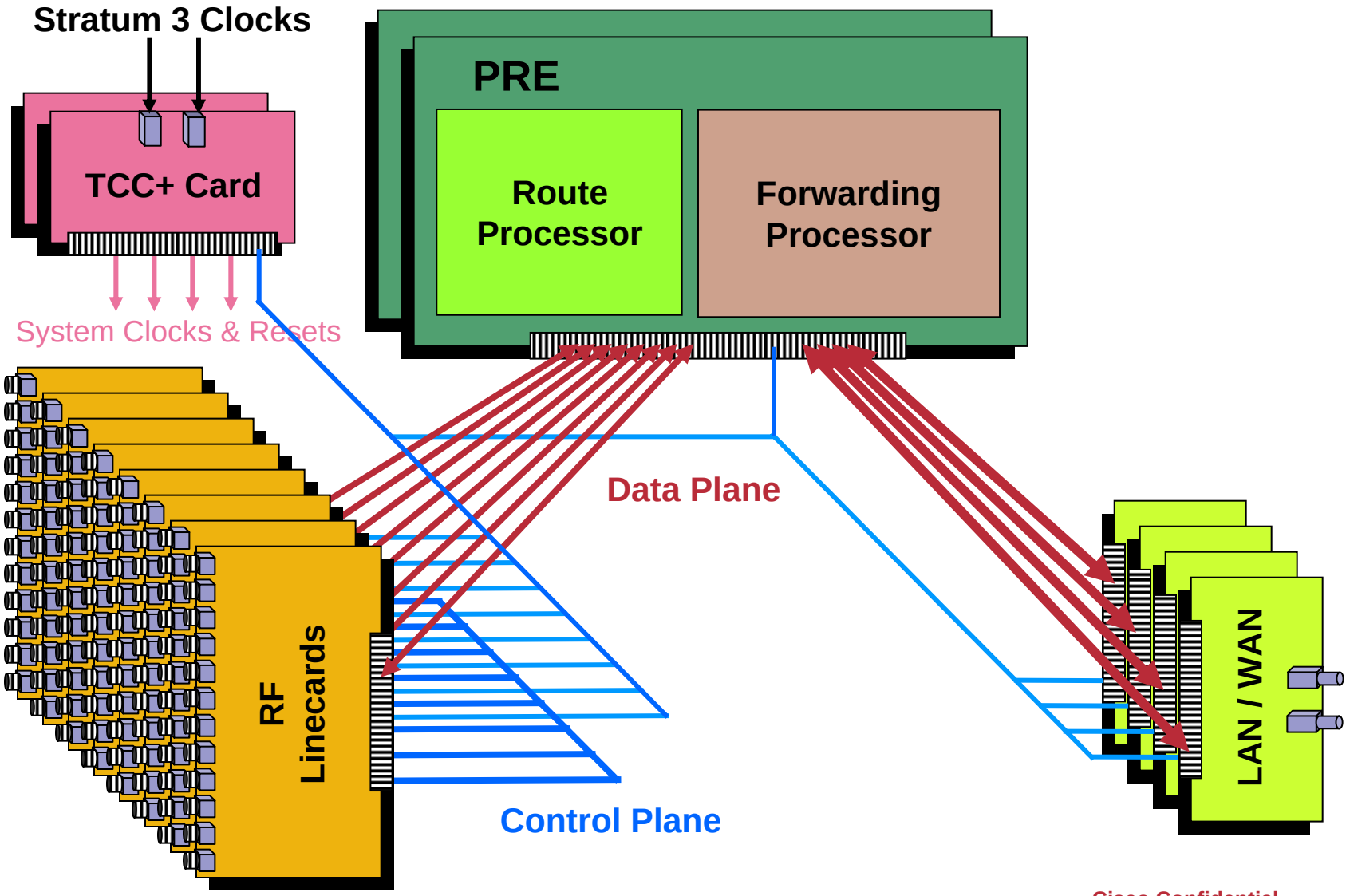
Phase 3 – Huge Scale Packet Shelf



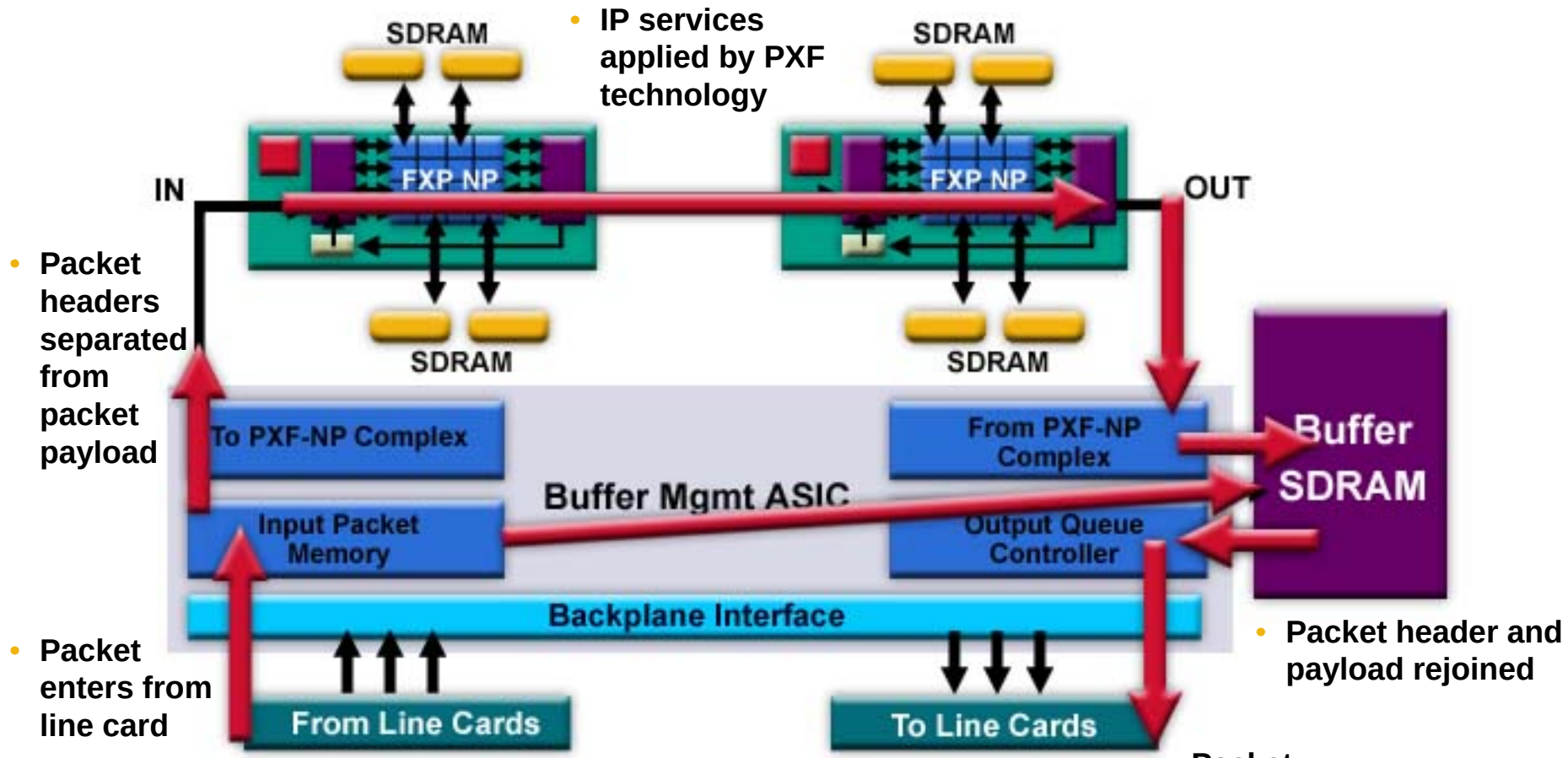

Cisco Systems


THE GOOD NEWS IS — WE'VE SOLVED YOUR BANDWIDTH PROBLEM...

uBR10012 Architecture

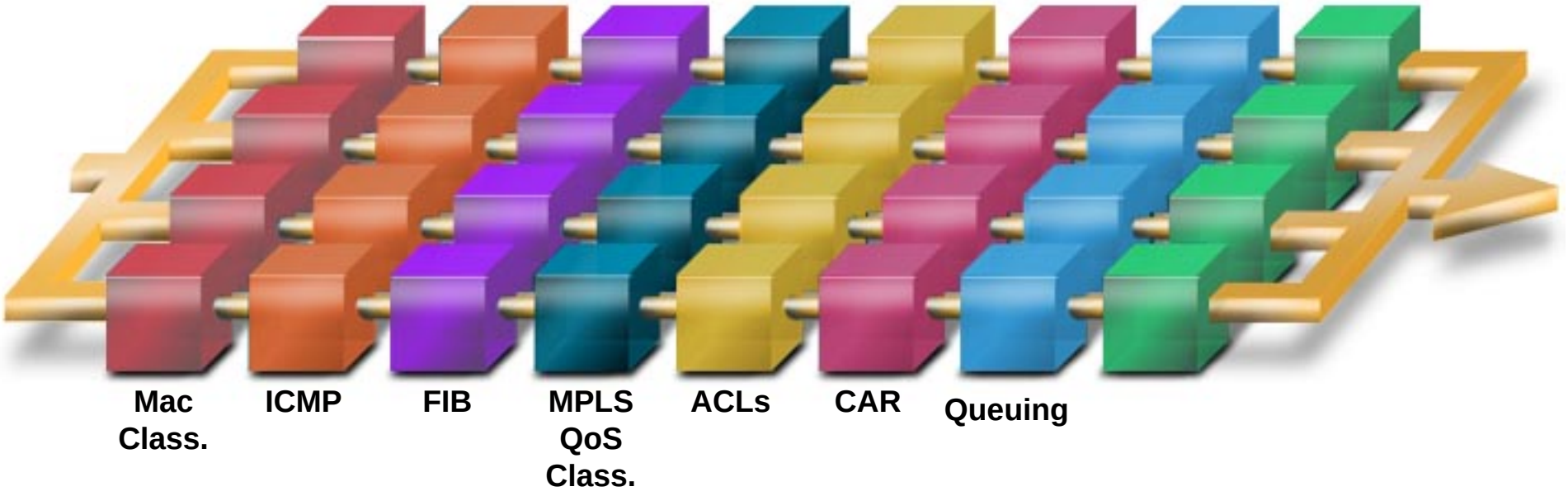


Day in the Life of a Packet



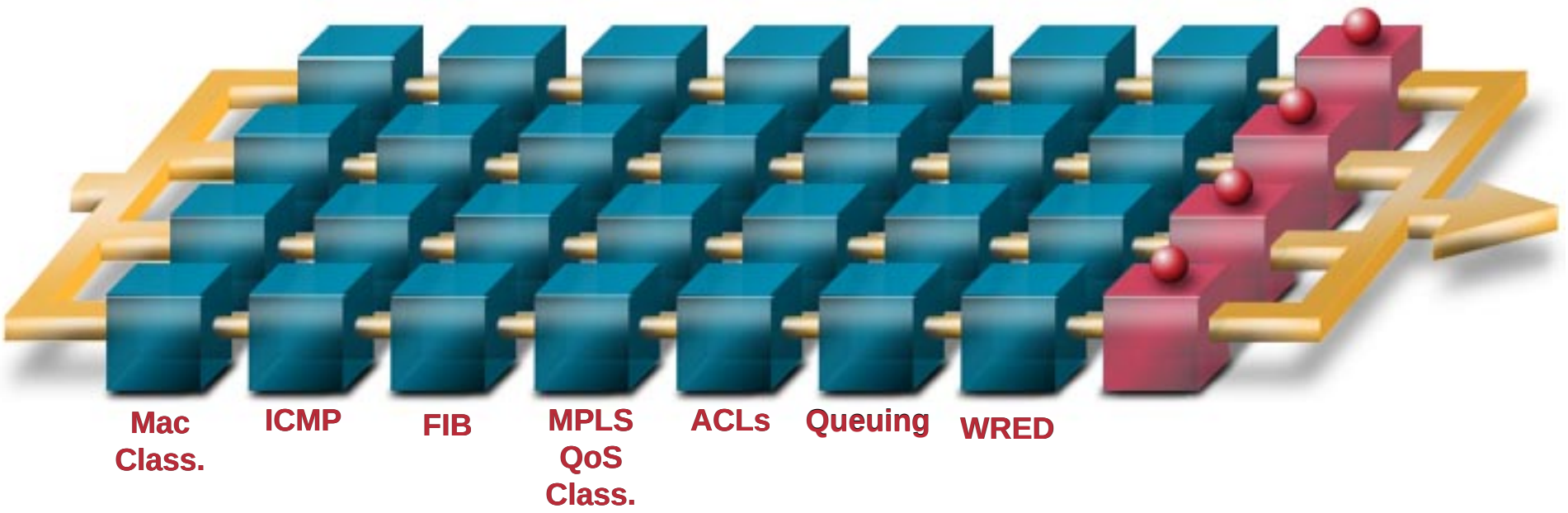
- IP services applied by PXF technology
- Packet headers separated from packet payload
- Packet enters from line card
- Packet header and payload rejoined
- Packet exits to line card

Dedicated Hardware for High Performance



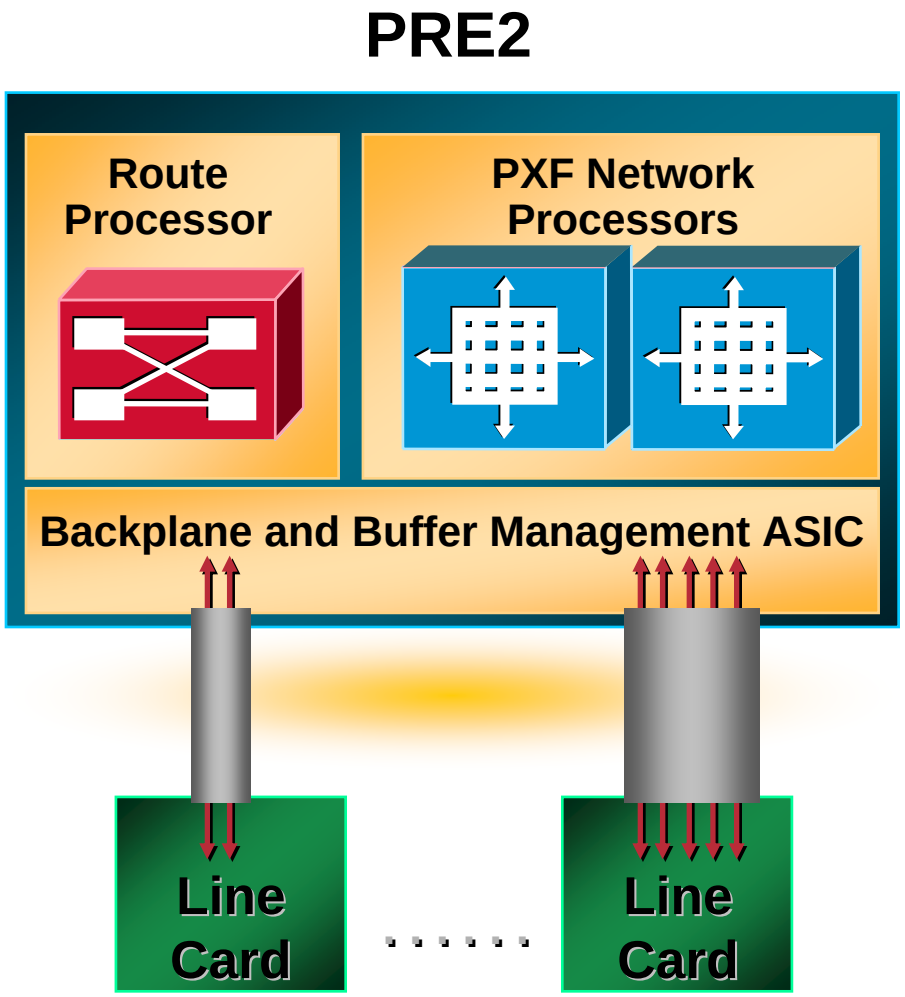
- PXF has 64 sub-processors

Dedicated Hardware for High Performance



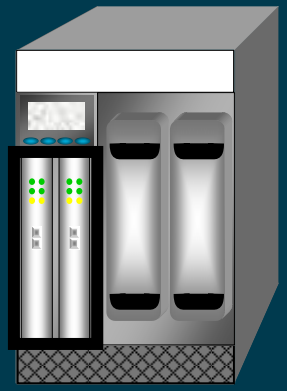
- PXF's assembly line technology guarantees every packet will have every IP service applied

Performance Routing Engine (PRE2)



UBR10012 Product Evolution

Routing Engines



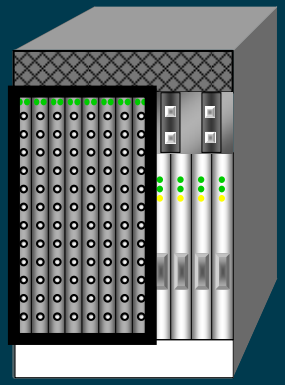
Performance Routing Engine Evolution

PRE1: 2Mpps

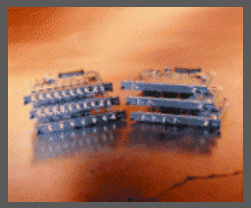
s

PRE3: 10Mpps

UBR10012 Product Evolution
DOCSIS Interface



Industry-leading DOCSIS Technology



MC16x/28C

MC520S

MC520U

MC520T

Wideband SPA

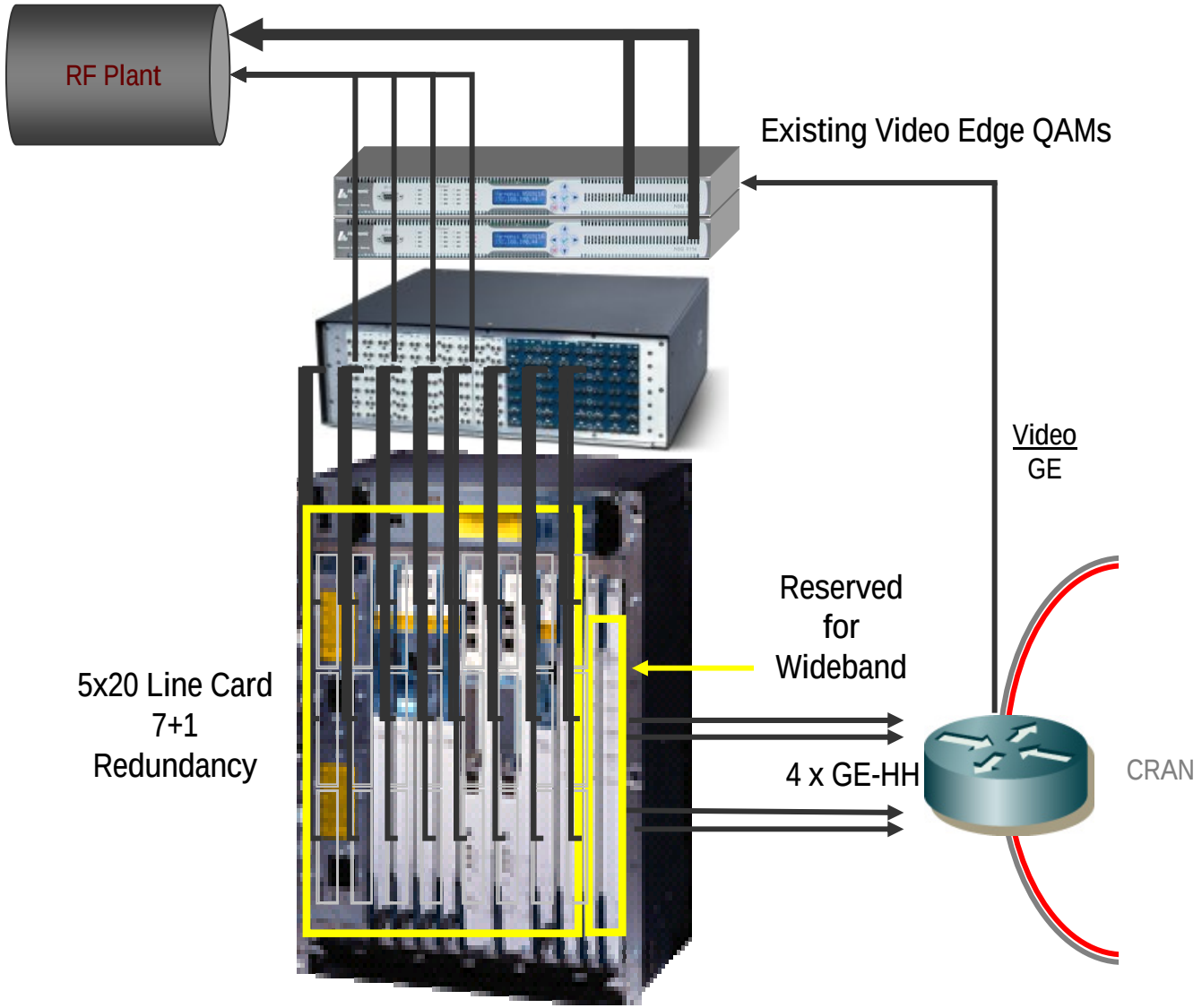
D3 SPA


CISCO SYSTEMS

Cisco Intelligent Edge Architecture Deployment Overview

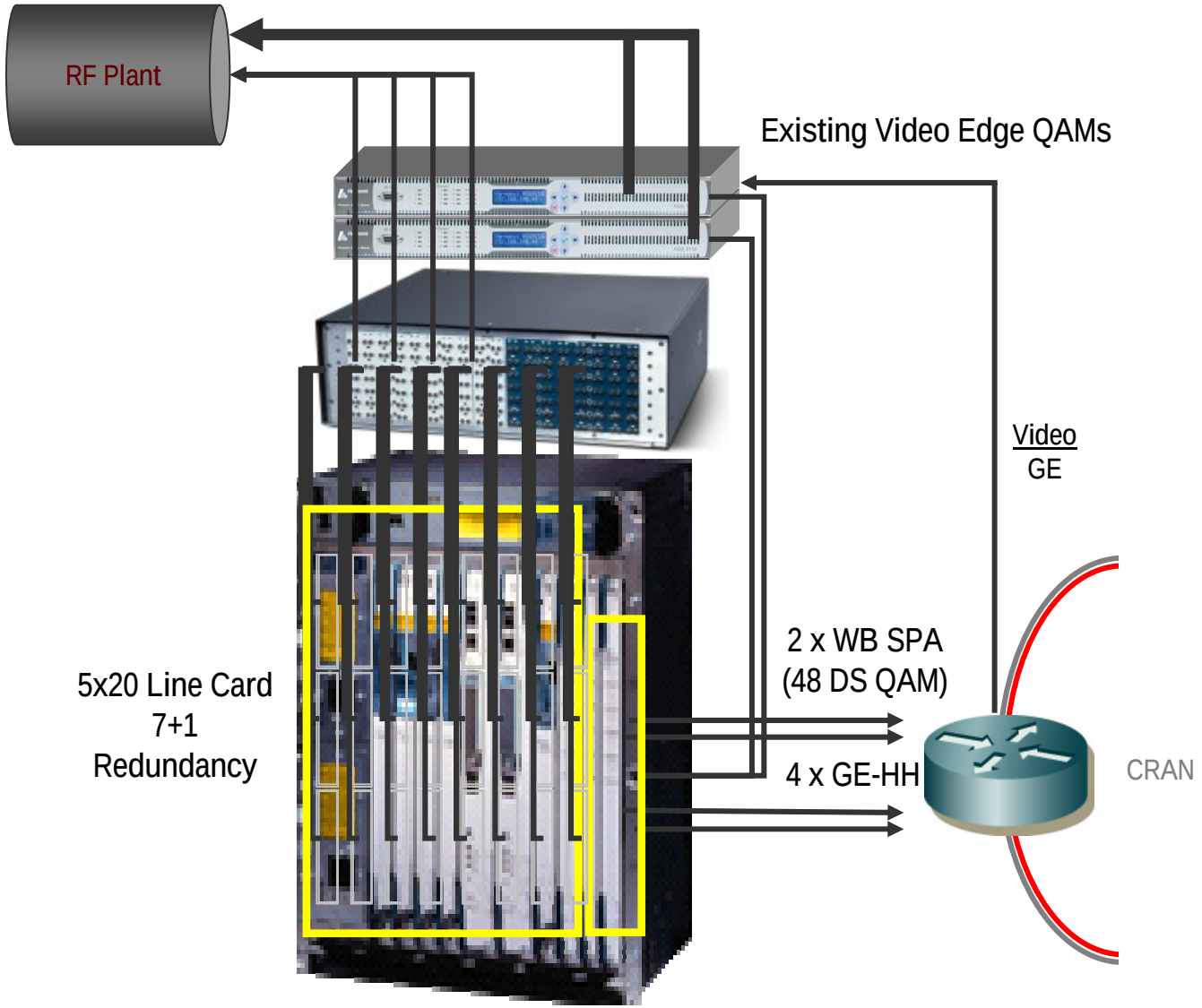
Step 1 – uBR10012 with 5x20U

Market leading ADV PHY solution for CDV



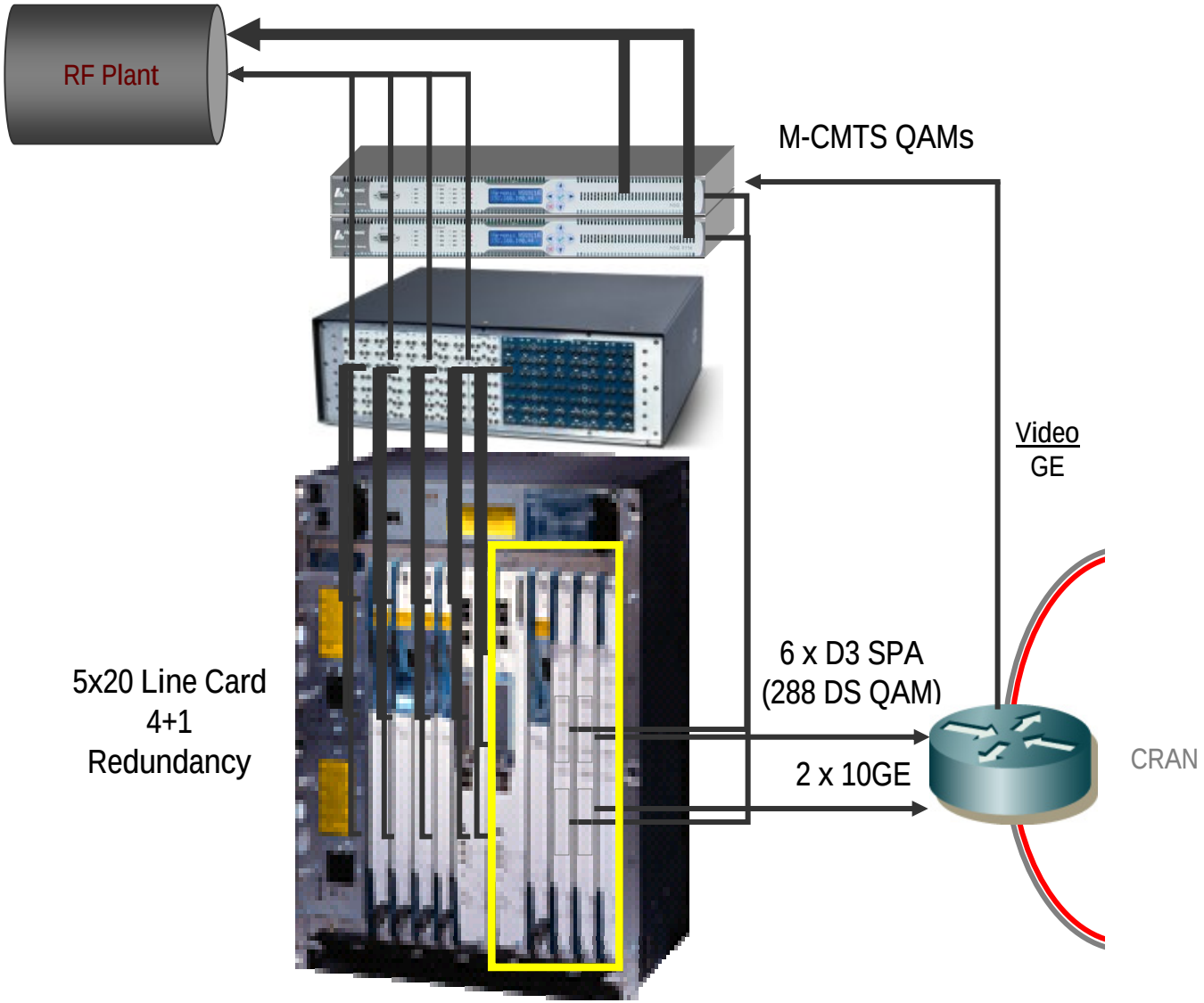
Step 2 – uBR10012 with Wideband SPA

FiOS Killer – Scales to 1Gbps per Cable Modem



Step 3 – uBR10012 with D3.0 DS-SPA

Evolutionary path to DOCSIS 3.0 and M-CMTS



Step 4 – uBR10012 with Cisco D3.0 DS/US SPA

Fully Modular SPA Enabled Platform