SP Cable Update – Cisco CMTS & RFGW

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Logistik

- Alle er Muted under præsentationen. Alle bliver Un-muted, når Q&A starter.
- Der er mulighed for at sende chat beskeder under sessionen i chat window eller spørgsmål i ? window
- Der er Q&A efter præsentationen
- Vi optager sessionen, så den er tilgængelig for genafspilning eller for kolleger, der ikke deltager live
- Der vil være evaluering til slut.

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Agenda

- Introduction
- RFGW. DS384 /288 for RFGW-10
- 3G-WB-SPA for uBR10k
- PRE4 for uBR10k
- IOS

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Cable Operator Challenges to Meet the Video Traffic Growth

More Video + More Devices = More Traffic

- More Video
- More Devices

- More Personal
- More Interactive

Keep up with unprecedented bandwidth growth

Pressure to reduce rack space and power

Migrate to an all-IP network with the existing infrastructure

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CCAP

- The Converged Cable Access Platform (CCAP) is intended to provide a new equipment architecture option for manufacturers to achieve the Edge QAM and CMTS densities that MSOs require in order to address the costs and environmental challenges resulting from the success of narrowcast services. The CCAP leverages existing technologies, including DOCSIS 3.0, Modular Headend Architecture, and current HFC architectures.

- http://www.cablelabs.com/cablemodem/specifications/ccap.html

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CCAP Highlights

- Convergence!
- Flexible use of QAM channels for the various services offered by MSOs. MPEG TS based services vs. DOCSIS
- Individually configurable assignment of QAM channels to various service groups, such that it would be possible to have HSI/voice service groups, VOD service groups, and/or SDV service groups overlap in different ways without requiring that these service groups be identical
- Simplification of the RF combiner network by providing all QAM channels for all digital services from a single RF port
- Significant operational improvements, including environmental efficiencies

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What is DOCSIS 3.1?

- Goals
  - Allow DOCSIS over HFC to compete with FTTH solutions.
  - Achieve 5+ Gbps in the downstream.
  - Achieve 1+ Gbps in the upstream
  - Backward compatibility story with DOCSIS 3.0, 2.0, & 1.1.
  - Better spectral efficiency.
- Technology
  - OFDM and LDPC
  - Re-use SCDMA MAC concepts

- Standardization is underway at CableLabs

Technology Potential of DOCSIS 3.1

	DOCSIS 3.0		DOCSIS 3.1	
	Now	Phase 1	Phase 2	Phase 3
DS Range (MHz)	54 - 1002	108 - 1002	300 - 1152	500 - 1700
DS QAM Level	256	256	≥ 1024	≥ 1024
# DS Channels	8	24	"142"	"200"
DS Capacity (bps)	300M, 400M	1G, 1.2G	7G	10G
US Range (MHz)	5 – 42 (65)	5 - 85	5 - 230	5 - 400
US QAM Level	64	64	≥ 256	≥ 1024
# US Channels	4	12	"33"	"60"
US Capacity (bps)	100M	300M	1G	2.5G

Note: TBD values are underlined, Channels in quotes = Equivalent # of SC-QAMs

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Cisco's Commitment to the Industry

Market Leadership

Leading CMTS vendor

First with EuroDocsis 3.0 ds bonding, IPv6 and Multicasting

Technology Leadership

4 worldwide development centers

San Jose, Boxborough, Bangalore, Shanghai

300 development engineers working on CMTS's

Over 2000 development engineers company wide working on CMTS related development

Largest Product Portfolio in the Industry

uBR10K

uBR7246VXR

uBR7225VXR

All have **EuroDocsis 3.0**

Investment Protection

Only vendor with Investment Protection track record.

All in house development, no acquired technology forcing forklift

Over 10,000 ubr10K's shipped

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Cisco Multi-Service Cable Solution

IP Services

Data
VoIP
IP Video

Digital Video Services

Linear
VoD
NPVR

Converged Cable Access Network

uBR10012 CMTS with
uBR7246VXR CMTS with
uBR-MC8X8V

EuroDOCSIS Upstream Channels

EuroDOCSIS Downstream Channels

Prisma II Optics

Optical Node

RFGW-1

RFGW-10 Universal-EQAM with DS-48

EuroDOCSIS and Digital Video Downstream Channels

Connected Home

EuroDOCSIS 3.0 Data Modem

EuroDOCSIS 3.0 eMTA

EuroDOCSIS 3.0 Residential Gateway

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RFGW-1
RFGW-10
DS384 card for RFGW-10

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RF Gateway 1 – Universal Edge QAM

48/96 QAMs in 1 RU

- Stackable – Front to Back Air Flow
- Universal QAM - VOD, SDV, DOCSIS 3.0 M-CMTS
- Frequency agile 50Mhz - 1 GHz
- Meets DOCSIS 3.0 RF Specs (DRFI)
- Over 11,000 units deployed (700K QAM Channels)

Dual Redundant Power Supplies

Input Card:
- 4 GbE Inputs
- Dual Redundant DTI Ports
- Management and CA ports

Same Modular QAM Card (6 slots):
- Blocks of 4 or 8 (2x4) QAMs per port
- 2 ports / Card
- Meets/Exceeds DRFI

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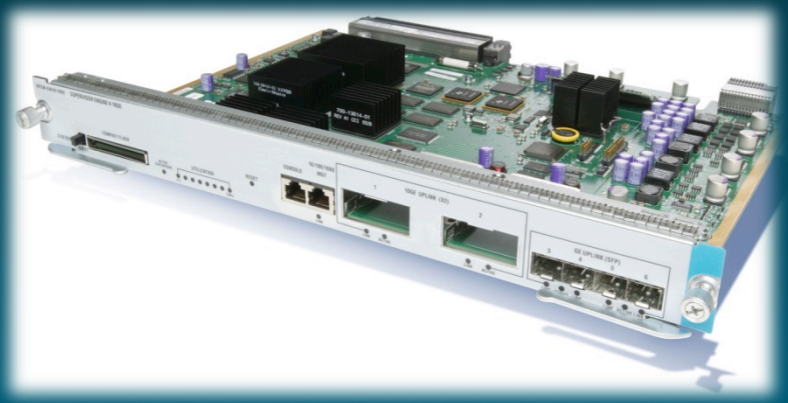
RF Gateway-10

- 13RU Chassis (22.75”H X 22.25”D)
  - NEBS Compliant – Carrier Class Architecture
  - Front to Rear airflow
  - Front Panel LCD Display and Push Button Navigation Module
- 10 Universal RF Line Card Slots
  - >20Gbps midplane connectivity / slot
  - >300 watt capacity / slot
  - 12 RF midplane connectors / slot
- 2 Supervisor Engines
  - 60Gbps line rate Switching performance
  - DOCSIS and Video Control Plane processing
  - 2 x 10GE, 4 x GE
  - 12.2S Service Provider Cisco IOS
    - GUI, CLI, SNMP, Debugging
- NGAA Ready



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RF Gateway-10 Rear View

- 4 Fan, Dual Vane Fan Tray
  - Cooling for up to 4400 W
  - Hot Swappable
  - Temperature Sensing Variable Speed
- (12) RF Switch Cards
  - 120 Bi-Directional RF (Coax) ports – *5 to 1GHz*
  - Dense-style coaxial connectors (RU-1459)
  - Two slots in the chassis can be designated as protect slots, each with its own redundancy group.
- (2) Redundant Power Supplies
  - Load sharing
  - Fully Redundant
- (2) DTI / System Timing Card Slots
  - M-CMTS Redundant External DTI Interface
  - Provides internal system and DOCSIS clocking

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DS384 Line Card Features

- Compatible with Existing RFGW-10 Chassis, Power Supplies and Common Cards
- Requires New Callista Supervisor
- 384 Downstream Channels (Annex B)
- 288 Downstream Channels (Annex A)
- 8 Ports per Card
- 4x, 8x, 12x …up to 128 QAMs per port-stacking per Card
- Line Card Inputs:
  - N=2 10/1 GBE SFP+'s
  - N=2 1 GBE SFP's

RFGW DS384

- Software Licensing for Downstream Channel Capacity and Encryption Allows QAM Density to be Assigned to each Port
- Support for On-Board PowerKEY and DVB Encryption (192 QAMs max)

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RFGW-10 Power Consumption

	DS48-1G 4 per Port	DS384-64 8 per port	DS384-96 12 per Port	DS384-192 24 per Port	DS384 -384 48 per port	DS384 -768 128 per port
Power per QAM (based on Fully Loaded RFGW-10)	4.7W	3.6W*	2.4W*	1.2W*	<1.0W*	<0.5W* * estimates

Power Calculator	Description	Units	Average Power Consumption (W)	
	RFGW-10 Base Platform (chas, fan, FPD, 12xRFSW modules)	1	300	
	RFGW-TCC1	2	40	
	RFGW-X4516-10GE	2	270	
	RFGW-DS384 (DS384 LC)	10	3,000	
	Total Power Consumption (W)		**3,610**	**Watts**

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RFGW-10 DS384 RF Spanning (Q2 2013)

- The RFGW-10's Advanced Architecture Utilizes an Innovative Digital Upconverter and Hardware Architecture
- The DS384 Upconversion Capacity Scales Independently from the MPEG and Modulation Processing
- The DS384 Has MPEG and Modulation Capacity for up to 384/288 (Annex B/A) Unique QAMs with Replication of an Additional 640/480 QAMs
- Replication Enables Copies of Unique QAMS to be Spanned Across 1 or More Physical Ports
- RF Spanning Enables "Service Group per Port" Archictures which Increase Utilization of Dense QAMs and Reduces / Eliminates External Downstream Combining

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SG Combining – Today's Approach

Converged QAM Network

RFGW-10

DS384/1-1	48 Broadcast VIDEO QAMs
DS384/1-2	20 DOCSIS QAMs
DS384/1-3	20 Narrowcast Video QAMs
DS384/1-4	20 DOCSIS QAMs
DS384/1-5	20 DOCSIS QAMs
DS384/1-6	20 Narrowcast Video QAMs
DS384/1-7	20 DOCSIS QAMs
DS384/1-8	

DOCSIS and Digital Video Downstream Channels

External RF Combining Network

- SG1 (1–2–9): 20 DOCSIS QAMS, 20 Nc VIDEO QAMs, 48 BC VIDEO QAMs
- SG10 (10–2–9): 20 DOCSIS QAMS, 20 Nc VIDEO QAMs, 48 BC VIDEO QAMs
- SG20 (20–2–9): 20 DOCSIS QAMS, 20 Nc VIDEO QAMs, 48 BC VIDEO QAMs
- SG30 (30–2–9): 20 DOCSIS QAMS, 20 Nc VIDEO QAMs, 48 BC VIDEO QAMs

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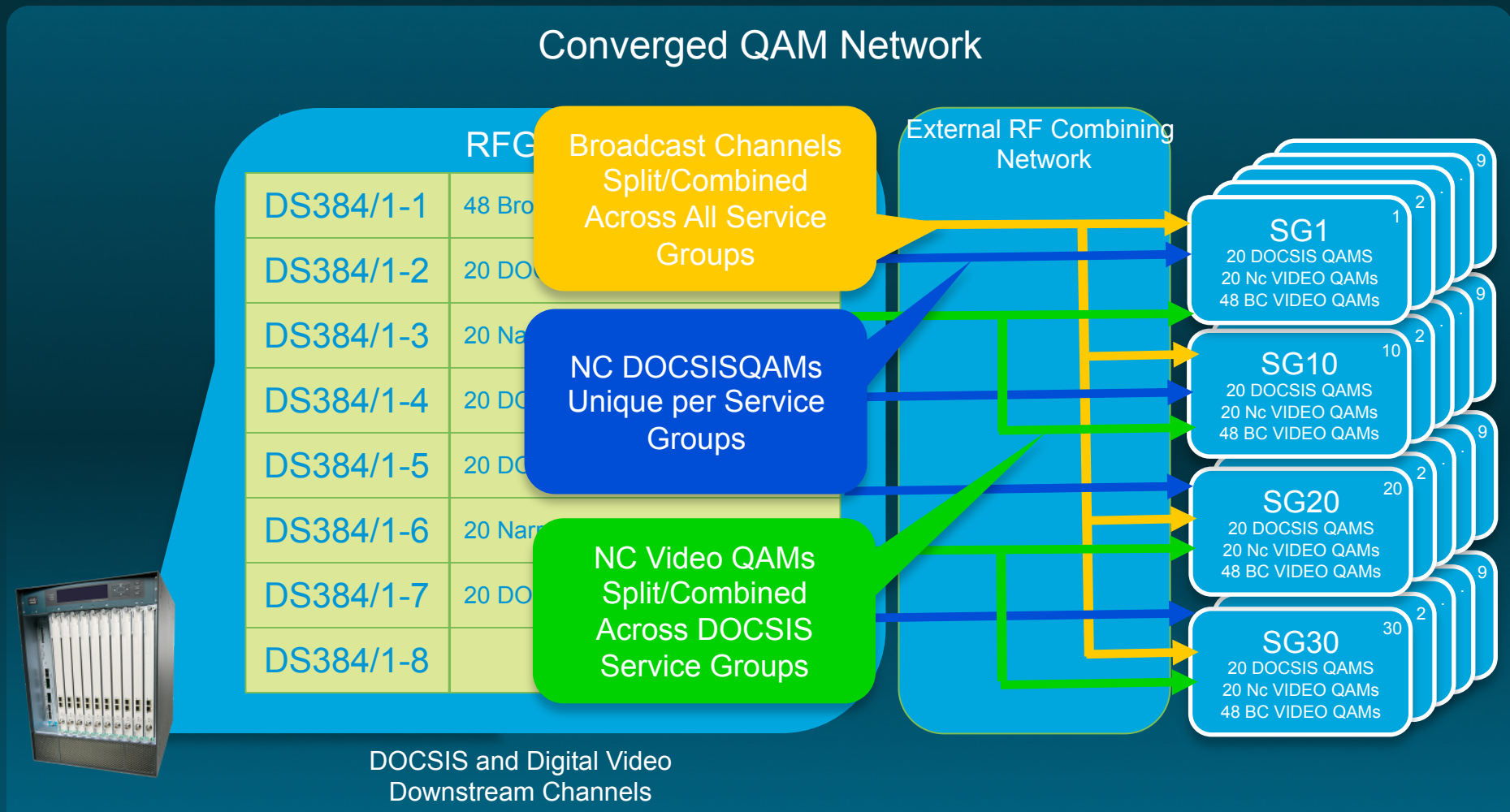
SG Combining – Today's Approach



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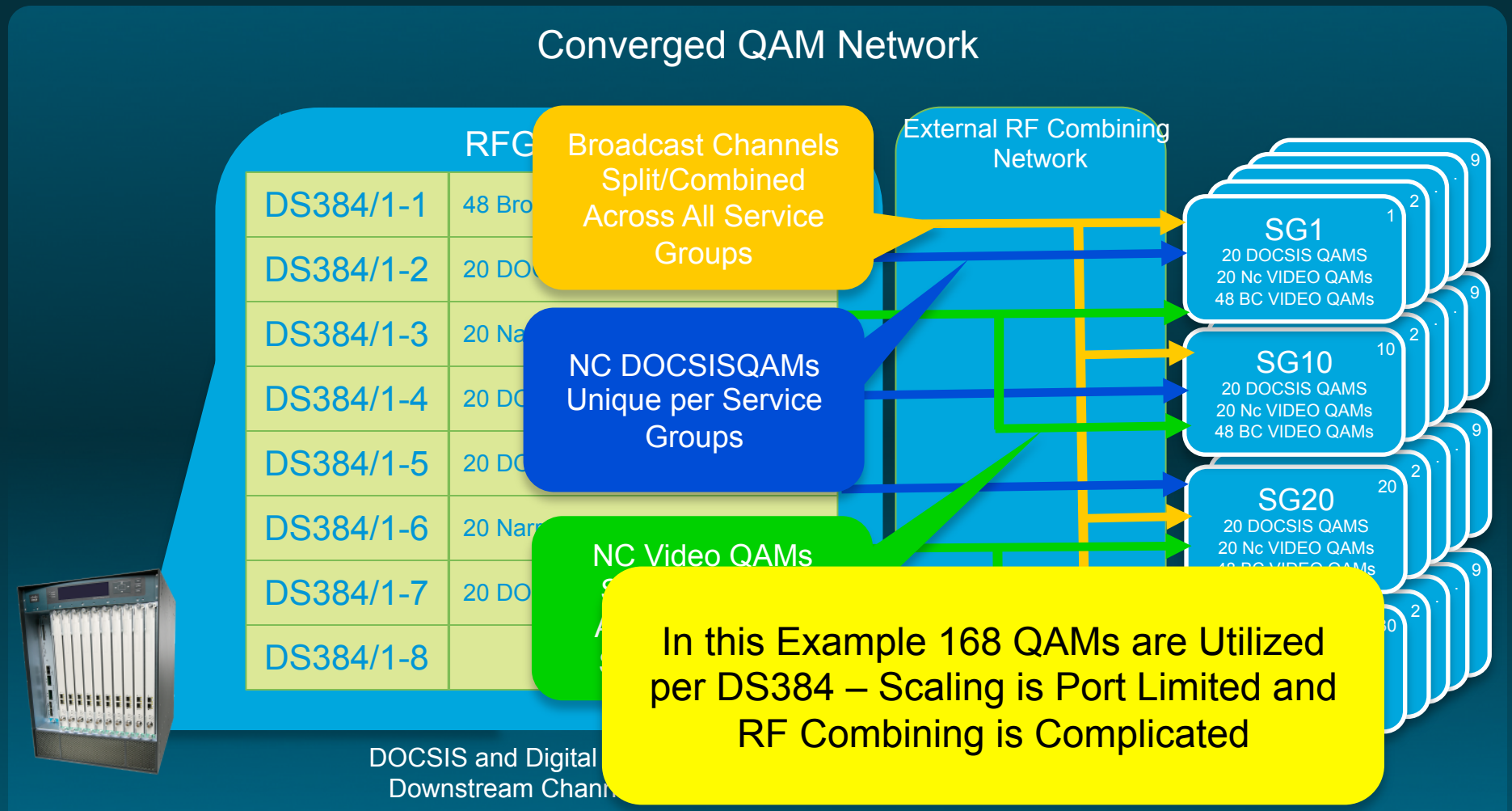
SG Combining – Today's Approach



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SG Combining Using RF Spanning

Converged QAM Network

BC Video | NC Video | NC DOCSIS

RFGW-10

DS384/1-1	48 BC, 20 NC Video, 20 DOCSIS,
DS384/1-2	48 BC, 20 NC Video, 20 DOCSIS
DS384/1-3	48 BC, 20 NC Video, 20 DOCSIS
DS384/1-4	48 BC, 20 NC Video, 20 DOCSIS
DS384/1-5	48 BC, 20 NC Video, 20 DOCSIS
DS384/1-6	48 BC, 20 NC Video, 20 DOCSIS
DS384/1-7	48 BC, 20 NC Video, 20 DOCSIS
DS384/1-8	48 BC, 20 NC Video, 20 DOCSIS

RFGW-10
Universal EQAM

EuroDOCSIS and Digital Video
Downstream Channels

SG1 1 2 9
SG11 11 2 9
SG21 21 2 9
SG31 31 2 9
SG41 41 2 9
SG51 51 2 9
SG61 61 2 9
SG71 71 2 9

- QAMs are Replicated Across Ports to Reduce / Eliminate External Combining
- Total QAM Capacity:
  - 288 Unique QAMs
  - 480 Replicated QAMs

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SG Combining Using RF Spanning

Converged QAM Network

BC Video

NC Video

NC DOCSIS

RFGW-10

DS384/1-1	
DS384/1-2	
DS384/1-3	
DS384/1-4	
DS384/1-5	48 BC, 20 NC Video, 20 DOCSIS
DS384/1-6	48 BC, 20 NC Video, 20 DOCSIS
DS384/1-7	48 BC, 20 NC Video, 20 DOCSIS
DS384/1-8	48 BC, 20 NC Video, 20 DOCSIS

Broadcast Channels are Spanned Across All Ports

SG1 1

SG11 11

SG21 21

SG31 31

SG41 41

SG51 51

SG61 61

SG71 71

RFGW-10
Universal EQAM

EuroDOCSIS and Digital Video Downstream Channels

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SG Combining Using RF Spanning

Converged QAM Network

BC Video | NC Video | NC DOCSIS

RFGW-10

DS384/1-1	
DS384/1-2	
DS384/1-3	
DS384/1-4	48 BC, 20 NC Video, 20 DOCSIS
DS384/1-5	48 BC, 20 NC Video, 20 DOCSIS
DS384/1-6	48 BC, 20 NC Video, 20 DOCSIS
DS384/1-7	48 BC, 20 NC Video, 20 DOCSIS
DS384/1-8	48 BC, 20 NC Video, 20 DOCSIS

NC VIDEO QAMs Can in fact Span Across DOCSIS Service Groups for Alignment But can be Unique

SG1 SG11 SG21 SG31 SG41 SG51 SG61 SG71

RFGW-10
Universal EQAM

EuroDOCSIS and Digital Video Downstream Channels

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- Total QAM Capacity:
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SG Combining Using RF Spanning

Converged QAM Network

BC Video

NC Video

NC DOCSIS

RFGW-10

DS384/1-1	
DS384/1-2	
DS384/1-3	
DS384/1-4	48 BC, 20 NC Video, 20 DOCSIS
DS384/1-5	48 BC, 20 NC Video, 20 DOCSIS
DS384/1-6	48 BC, 20 NC Video, 20 DOCSIS
DS384/1-7	48 BC, 20 NC Video, 20 DOCSIS
DS384/1-8	48 BC, 20 NC Video, 20 DOCSIS

DOCSIS QAMs Span Across DOCSIS Service Groups

SG1 SG11 SG21 SG31 SG41 SG51 SG61 SG71

RFGW-10
Universal EQAM

EuroDOCSIS and Digital Video Downstream Channels

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- Total QAM Capacity:
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  - 480 Replicated QAMs

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SG Combining Using RF Spanning

Converged QAM Network

BC Video

NC Video

NC DOCSIS

RFGW-10

DS384/1-1	
DS384/1-2	
DS384/1-3	
DS384/1-4	48 BC, 20 NC Video, 20 DOCSIS
DS384/1-5	48 BC, 20 NC Video, 20 DOCSIS
DS384/1-6	48 BC, 20 NC Video, 20 DOCSIS
DS384/1-7	48 BC, 20 NC Video, 20 DOCSIS
DS384/1-8	48 BC, 20 NC Video, 20 DOCSIS

DOCSIS QAMs Span Across DOCSIS Service Groups

Unique DOCSIS QAMs

Unique DOCSIS QAMs

Unique DOCSIS QAMs

Unique DOCSIS QAMs

RFGW-10
Universal EQAM

EuroDOCSIS and Digital Video Downstream Channels

- QAMs are Replicated Across Ports to Reduce / Eliminate External Combining
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SG Combining Using RF Spanning

Converged QAM Network

BC Video

NC Video

NC DOCSIS

RFGW-10

DS384/1-1	
DS384/1-2	
DS384/1-3	
DS384/1-4	48 BC, 20 NC Video, 20 DOCSIS
DS384/1-5	48 BC, 20 NC Video, 20 DOCSIS
DS384/1-6	48 BC, 20 NC Video, 20 DOCSIS
DS384/1-7	48 BC, 20 NC Video, 20 DOCSIS
DS384/1-8	48 BC, 20 NC Video, 20 DOCSIS

DOCSIS QAMs Span Across DOCSIS Service Groups

Unique DOCSIS QAMs

Spanned DOCSIS QAMs

Spanned DOCSIS QAMs

Spanned DOCSIS QAMs

Spanned DOCSIS QAMs

RFGW-10
Universal EQAM

EuroDOCSIS and Digital Video Downstream Channels

- QAMs are Replicated Across Ports to Reduce / Eliminate External Combining
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SG Combining Using RF Spanning

Converged QAM Network

BC Video

NC Video

NC DOCSIS

RFGW-10

DS384/1-1	48BC, 48NC Video, 24 DOCSIS,
DS384/1-2	48BC, 48NC Video, 24 DOCSIS
DS384/1-3	48BC, 48NC Video, 24 DOCSIS
DS384/1-4	48BC, 48NC Video, 24 DOCSIS
DS384/1-5	48BC, 48NC Video, 24 DOCSIS
DS384/1-6	48BC, 48NC Video, 24 DOCSIS
DS384/1-7	Not Availa
DS384/1-8	Not Availa

SG1 1 2 9

SG11 11 2 9

SG21 21 2 9

SG31 31 2 9

SG41 41 2 9

SG51 51 2 9

RFGW-10
Universal EQAM

DOCSIS and Digi
Downstream Cha

RF Spanning Benefits:
- Optimal Port Utlization
- Increased Density
- Downstream RF Combining is Greatly Reduced / Eliminated

o
g

- 640 Replicated QAMs

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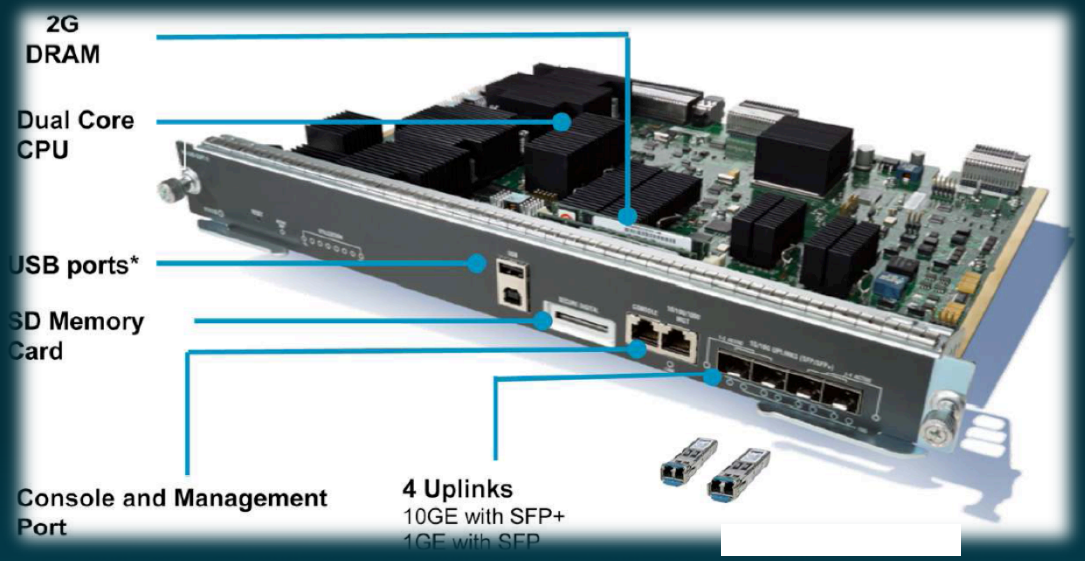
Callista Supervisor Features



Modular Optics

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

- Next Gen RFGW-10 Supervisor
- Derived from Catalyst 4500
- IOS-XE 3.3.0 SQx (NOVA IOS on Linux)
- Multi-processor Engine – 800+ Gbps
- 200+ Gbps Line Rate Switching Performance
  - 20 +GPS per Slot

- External USB and SD Storage – Flexible Storage Options
  - 2GB SD
    4GB USB
- Maximum Resiliency with Nonstop Forwarding / Statefull Switchover (NSF/SSO)
- IPv6 Support for Management and Uplink Ports

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RFGW-10 Roadmap

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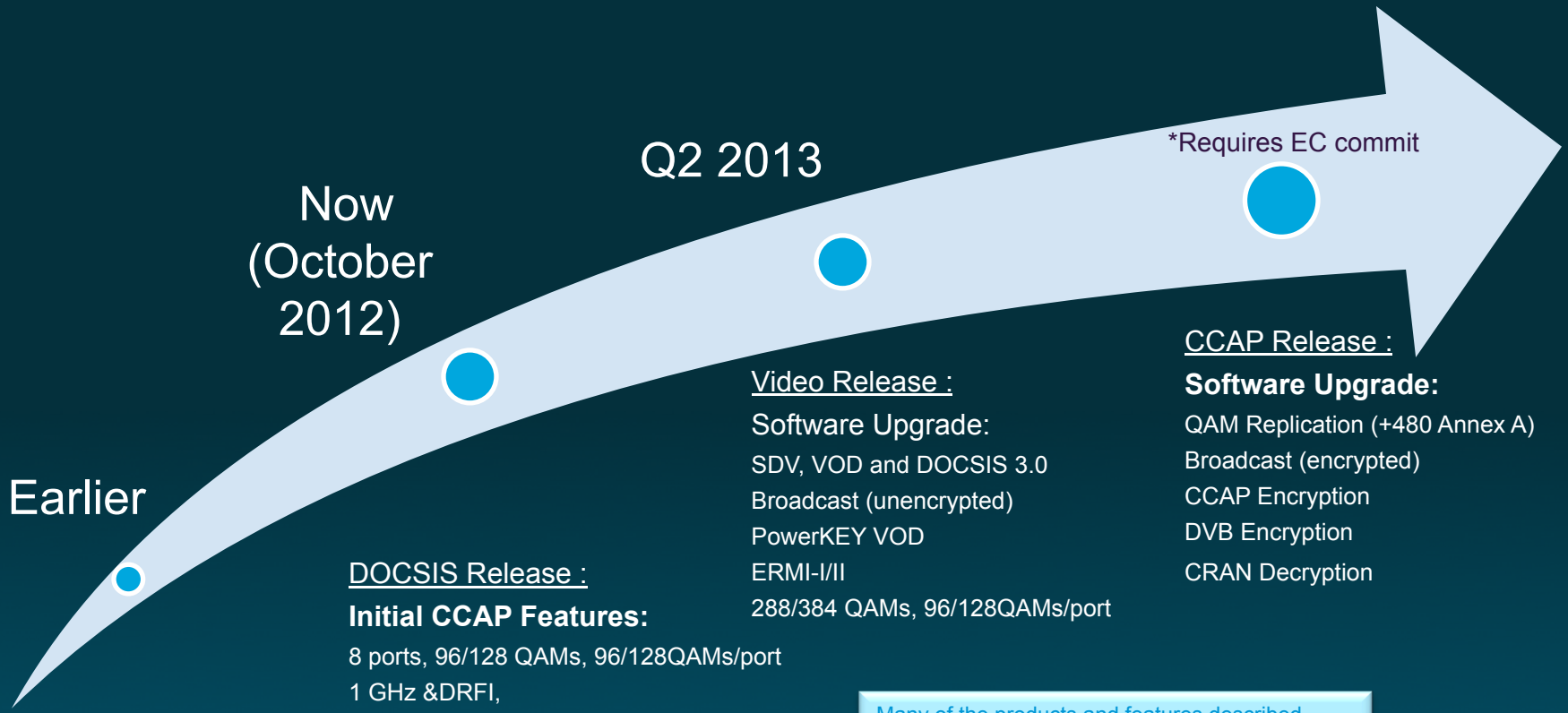

Earlier

RFGW-10/DS48-1G
DOCSIS 3.0
SDV
1Ghz & DRFI

Now (October 2012)

DOCSIS Release :
Initial CCAP Features:
8 ports, 96/128 QAMs, 96/128QAMs/port
1 GHz &DRFI,
DOCSIS 3.0/DEPI Control Plane

Q2 2013

Video Release :
Software Upgrade:
SDV, VOD and DOCSIS 3.0
Broadcast (unencrypted)
PowerKEY VOD
ERMI-I/II
288/384 QAMs, 96/128QAMs/port

*Requires EC commit

CCAP Release :
Software Upgrade:
QAM Replication (+480 Annex A)
Broadcast (encrypted)
CCAP Encryption
DVB Encryption
CRAN Decryption

Many of the products and features described herein remain in varying stages of development, and the information provided in this Roadmap is for informational purposes only and is subject to change at the sole discretion of Cisco. Cisco will have no liability to customer for delay in the delivery or failure to deliver any or all of the products or features set forth in this document.

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3G-WB-SPA for uBR10k

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3GE WB-SPA

- Downstream only M-CMTS line-card
- Doubles downstream capacity of uBR10K
- 60 Annex A downstreams per card, 8 per chassis
- Provides significant growth and investment protection

uBR10K will support 960 EuroDocsis Downstreams.

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3G WB-SPA Overview

- uBR10012 downstream capacity can be expanded further
  - From 24G (8x 3G60) to 48G (8x 3G60 + 8 x 3G SPA)
- 3G SPA has the same functionality as 24DS-WB-SPA
  - RF channel can be bonded as bonding group (wide band channel) or used as primary channel for WB or NB modem separately
  - Single wide, half height
  - 4 x 3G SPA per Spumoni SIP card (Jacket card)
  - 72 downstream RF channels hosted by 3 or 1 controller
- Hardware features
  - 2 SFP+ ports & 1 SFP port on front panel, 2 SFP+ ports can be used as SFP port.
  - 2 SFP+ ports can be configured as 1+1 redundancy
  - No redundancy if used as 3 SFP 1G ports
  - Hardware ready for future capacity expansion ……at least 6G or even more
- Forecast FCS date
  - Q2 CY2013

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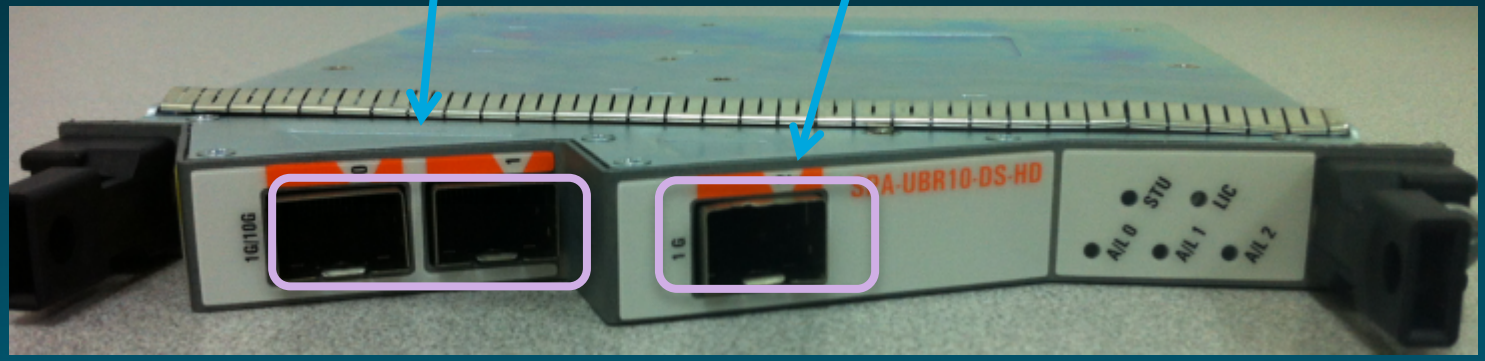
3G SPA Front View

2 1G/10G compatible SFP+ Ports

1 1G SFP Port



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PRE-5 for uBR10k

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Why PRE-5?

- Prepare for video becoming significant portion of DOCSIS traffic

  Bursty data model and oversubscription model are changing

- Enable use of DS-SPAs (3G-DS-SPA) with 3G60 at scale

  uBR10k will support up to 960 EuroDOCSIS downstreams and up to 1152 DOCSIS downstreams

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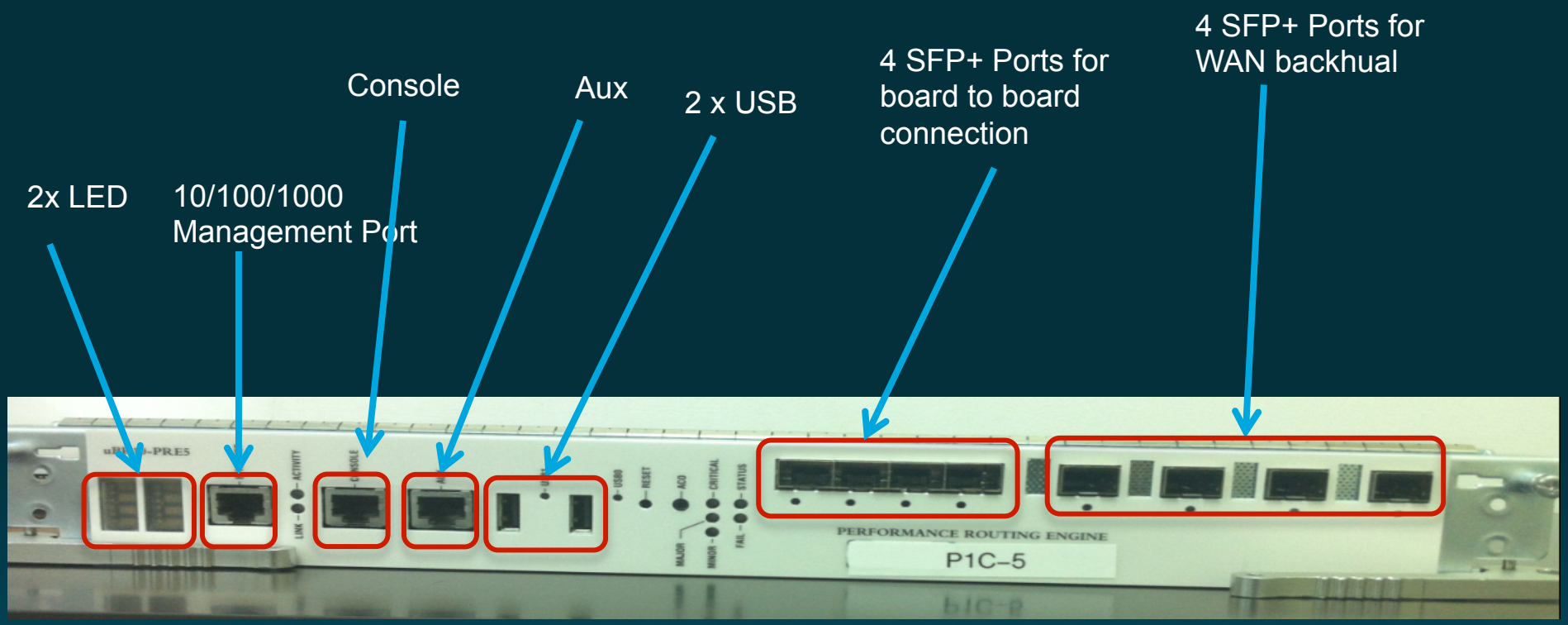
PRE-5 Front Panel Overview



- There are totally 8 10G ports on the front panel, the lower 4 SFP+ ports are for WAN backhaul, the upper 4 SFP+ ports are for board to board interconnection purpose.

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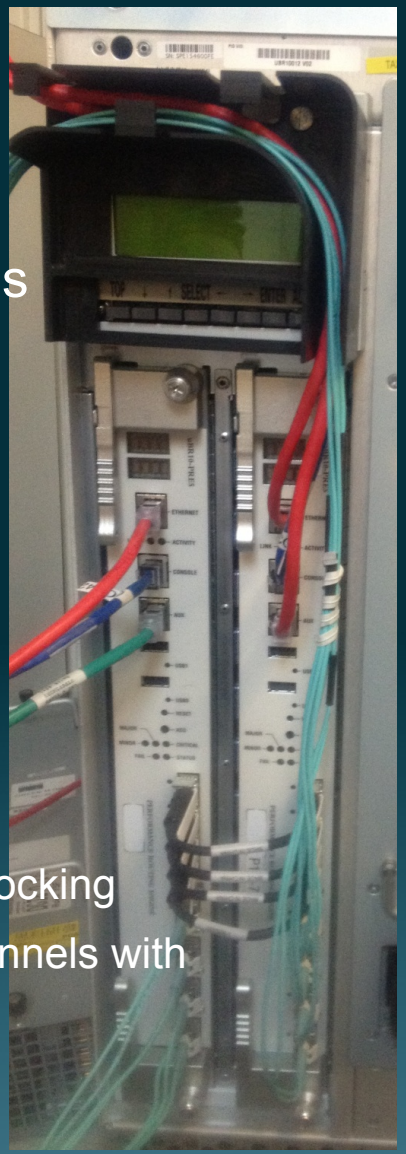
Routing Engine Enhancements
PRE-5 Overview



- DOCSIS capacity of uBR10K (with 8 3G60) is 24 Gbps
  - PRE-4 supports this with 2.4:1 DOCSIS:WAN oversubscription
- PRE-5 enables up to 40 Gbps of WAN backhaul
  - 4x10GE WAN backhaul ports
  - 60 Gbps aggregate throughput (for typical video applications)
  - +10Mpps for both IPv4 and IPv6 with commonly used features
    - (i.e. doubles IPv6 performance compared to PRE-4)
- WAN backhaul ports on PRE-5 free up SPA slots
  - 8x 3G60 + 6–8x 1G WB SPAs in single chassis with almost no blocking
  - Increases number of DS per uBR10K to 720 or 768 DOCSIS channels with PRE4 and GE-SPA card
  - Enables deploying 18/24/36 DOCSIS channels per SG at scale
- Target date end of Q4CY12, commit date begin Q2CY13

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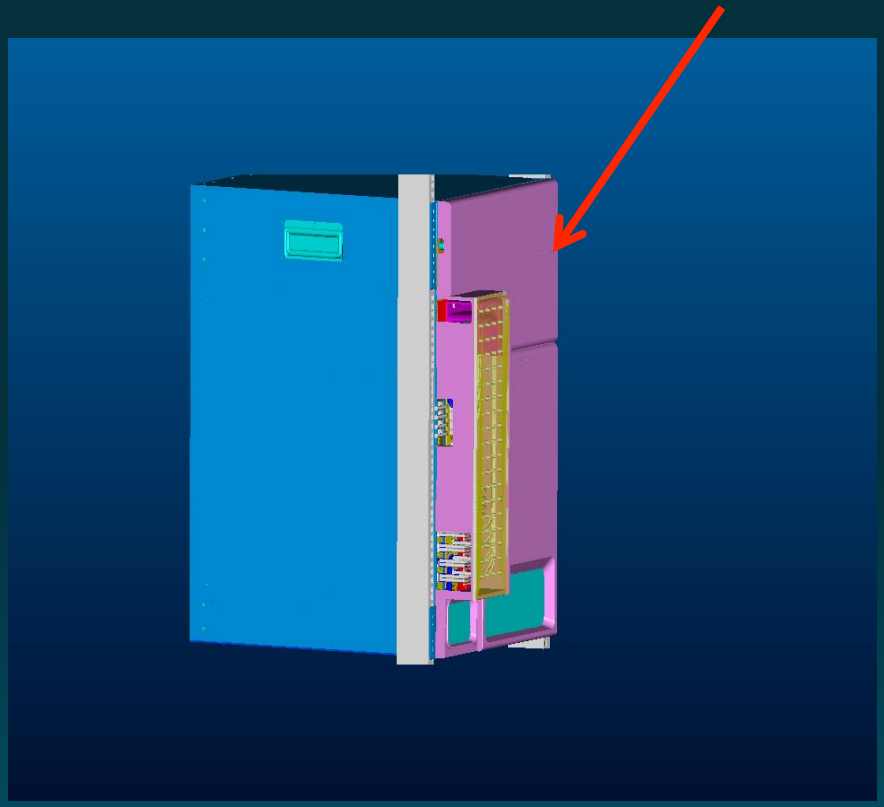
UBR10K With PRE5 Front View

New chassis cover



- A new chassis cover will be required to accommodate PRE5 cabling on the front panel
- If some customers don't want to purchase new chassis cover, they can purchase new air filter instead

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Key Features

Feature	Description
60 Gbps max system aggregate throughput	Typical: 40 Gbps DS + 20 Gbps US
Max PPS system performance 10M PPS	The performance will vary depending on packet size
Backhaul I/F integrated backhaul	Moved from SPA to PRE-5; SFP+ modules
4 x10G Backhaul SFP+	4 SFP+ per PRE-5 for WAN backhaul
DWDM Backhaul SFP+ support	Supports DWDM SFP+ modules for Backhaul
Has the ability to absorb 80G burst traffic	With 2 PRE5 (HA) each has 4 active 10G ports
Improved IPv6 forwarding performance	Improve the IPv6 forwarding from 5M pps to 9M pps
Software licensing support	One per WAN SFP+ port basis, min 10G, max 40G
USB based file system displacing CF card	4G eUSB flash and external USB disk

Upgrade to PRE5 will require upgrade to new PSU's;
UBR10-PWR-DC-PLUS or UBR10-PWR-AC-PLUS

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PRE4 vs PRE5 Comparison

	PRE2	PRE4	PRE5
WAN Backhaul Capacity	5G	10G*	40G
Forwarding Performance	6.2M PPS	9M PPS	10M PPS
CPU Frequency	500MHZ	800MHz	1.5GHz
Max Throughput		17Gbps	60Gbps (40G DS+20G US) **
	64 MB bootflash. 2 additional 128 MB flash disks		
Integrated WAN connectivity	N/A	N/A	Yes
System Memory	1G SDRAM	**4 GB DDR SDRAM**	4G DDR3 SDRAM
USB Controller	No	No	Yes
VDOC channel change Performance		100 Channel Change Per Second	500 Channel Change Per Second
IPv6 Performance		5M PPS	10M PPS

- * 10G SPA provides WAN connectivity
- ** This is the maximum throughput. The real throughput will vary depend on the feature set configured and average packet size.

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Capacity Matrix, 8 * 3G60 + 6 or 8 SPA

PRE	SPA	EuroDOCSIS, #DS	DOCSIS. #DS
PRE4	6 * GE-WB-SPA	600	720
PRE5	8 * GE-WB-SPA	640	768
PRE5	8 * 3GE-WB-SPA	960	1152

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IOS

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Cable Train Feature Release Timeline

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Flatrock Release (12.2SCF)

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Flatrock (12.2SCF) Features – (1)

Feature	uBR10K	uBR72xx/ VXR
Fairness Across DOCSIS Interface (ACFE)	Y	N/A
IPv6: IPv6-enabled CPE (IPv6 Router)	Y	Y
IPv6: 6PE & 6VPE	Y	Y
IPv6: DHCPv6 with full 6VPE support (VRF steering)*	Y	Y
ECN: IPv6 prefix stability	Y	Y
IPv6: DHCPv6 Unitary Lease Query (RFC 5007)	Y	Y
DHCPv6: Configurable SAS DHCPv6 relay address	Y	Y
Optimize downstream queues for high speed services (>200 mbps)*	Y	Y**
CM VRF steering	Y	Y
DOCSIS 3.0: Static LB	Y	Y
CM: 16x4 CM interop support with SPA, 3G60 and 20x20	Y	Y
ECN: DOCSIS 3.0 USCB Power increase ECN's (MULPIv3.0-N-10.0943-5.doc & PHYv3.0-N-10.0942-5.doc)	Y	Y
Voice: VoIP over DOCSIS 3.0 MTAs	Y	Y
Voice: MGPI support	Y	Y
BSoD and VPN: EoMPLS Pseudowire Redundancy	Y	Y
BSoD and VPN: QoS enhancements for MPLS & VLAN (802.1Q)	Y	Y
BSoD and VPN: DSX support for L2VPN-enabled CMs	Y	Y

*SCF4 **SCF5

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Flatrock (12.2SCF) Features – (2)

Feature	uBR10K	uBR72xx/ VXR
CM US RF adapt (move CM between logical channels)	Y	Y
CNIR on data-burst for enhanced signal quality monitoring	Y	Y
SII support for host behind a routed subnet (Routed CPE support)	Y	Y
10G XFP support on uBR10K	Y	N/A
CM Registration throttling (for >20K CMs)	Y	N/A
VDOC: Inter LC RF spanning for 3G60	Y	N/A
VDOC: IGMP triggered DCC (for DOCSIS 2.0 CM)	Y	Y
VDOC: Scaling improvement	Y	N/A
US QoS: BW request rate limit (3G60 CPU protection for US scheduler)	Y	N/A
ECN: CM Maximum Queue Depth (MULPIv3.0-N-10.0953-3)	Y	Y
LB: Support for 256 legacy LBGs to handle fully loaded 3G60 systems	Y	N/A
WB Resiliency: Support for Secondary Service flows	Y	Y
Multicast: IPv6 support for Broadcom DOCSIS 3.0 CM (MDF 1 for DOCSIS 2.0 hybrid CM)	Y	Y
DSG: Support for DSG 2.0+ devices without DSG 3.0 functionality (Disable MDF for DSG STB)	Y	Y
ECN (Relay Agent): Service Class Relay Agent option enhancement	Y	Y
OSS: Support for FAT32 disk format for PC compatibility (monlib update to support FAT32 and FAT16_LBA)	Y	Y

*SCF4

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Flatrock (12.2SCF) Features – (3)

Feature	uBR10K	uBR72xx/ VXR
OSS: SCM enhancements (command updated with SCN, QoS, BG, WB i/f details)	Y	Y
OSS: Channel utilization statistics (via SNMP) for WB interface	Y	Y
OSS: Auto ROMMON upgrade for all uBR10K LC's	Y	N/A
OSS: APS collection tool	Y	N
DOCSIS 3.0: Added force option to test cable DCC CLI command	Y	Y
Debug: OOD for 20x20	Y	N/A
Debug: 3G60/2020 Hardware assisted silent reload detection	Y	N/A

*SCF4

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Hardware Support List in Flatrock

- Supported hardware
  - uBR10K
    - PRE2
    - PRE4
    - DTCC
    - 520H
    - HHGE (w/ PRE-2 only)
    - Saratoga SIP (w/ PRE-2 only)
    - Spumoni SIP
    - Modena WB SPA
    - WAN SPAs: 5x1GE, and 1x10GE (10GE w/ PRE-4 only)
    - MC20x20V
    - MC3GX60V
  - uBR7200
  - uBR7246 VXR
    - NPE-G2
    - MC28U
    - MC88U
  - uBR7225 (Pizza Box)
    - NPE-G2
    - MC28U
    - MC88U
    - E-28U

- Unsupported hardware
  - uBR10K
    - LCP+MC28C/16C/16S
    - 520S
    - 520U
    - OC12 POS/SRP
    - OC48
    - PRE1
    - PRE3
    - Full Height GigE
    - TCC+
  - uBR7100 Series
  - uBR7200
    - NPE-400 (or lower)
    - MC28C/16C/16S/16U/16X/28X
    - E-16U
    - NPE-G1

* 12.2(33)SCF is the last IOS release supporting PRE-2

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Ganges Release (12.2SCG)

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Ganges (12.2SCG) Features – (1)

Feature	uBR10K	uBR72xx/ VXR
3G60: SPA DS sharing w/3G60	Y	N/A
Optimize downstream queues for high speed services (>200 mbps)	Y	N**
DSG: Support for MDF modems (DOCSIS 3.0 DSG Support)	Y	Y
DSG: FQDN support for configuring DSG tunnel	Y	Y
DSG: CLI simplification	Y	Y
DSG: Disable DSG traffic on a per DS channel basis	Y	Y
IPv6: Packet intercept (SII - IPv6 Address)	Y	Y
IPv6: DHCPv6 with full 6VPE support (VRF steering)*	Y	Y
DOCSIS 3.0: DOCSIS 3.0 USCB power increase ECN	Y	Y
LB: DOCSIS 3.0 Load Balancing for 3G60 + SPAs*	Y	N/A
CM: 16x4 CM interop support with SPA, 3G60 and 20x20	Y	Y
BSoD and VPN: Inter-area MPLS TE tunnel	Y	Y
BSoD and VPN: MPLS QoS via TLV for non-L2VPN SF	Y	Y
QoS: Input MQC and QoS Group (Input MQC on uBR10K cable interfaces)	Y	N/A

*SCG1 ** Feature will be added to the uBR72xx in SCG1

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Ganges (12.2SCG) Features – (2)

Feature	uBR10K	uBR72xx/ VXR
Resiliency: WB N - 1 BG	Y	Y
Resiliency: US channel resiliency for RTPS SF	Y	Y
OSS: IPDR ECN's • CM-SP-OSSIv3.0-I14-110210 (adding of new Service Flow Schema) • OSSIv3.0-N-10.0914-3 (field type revision) • OSSIv3.0-N-10.0923-5 (CMTS-CM-SERVICE-FLOW-TYPE schema) • OSSIv3.0-N-10.0967-3 (CMTS-CM-SERVICE-FLOW-TYPE update) • OSSIv3.0-N-10.0968-2 (field type revision)	Y	Y
OSS: DOCSIS MIB performance enhancement	Y	Y
OSS: SFP link up/down trap	Y	Y
OSS: PRE4 IOFPGA Auto upgrade	Y	Y
OSS: DEPI control SNMP MIB	Y	N/A
OSS: USCB show CLI enhancement	Y	Y

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Hardware Support List in Ganges

- Supported hardware
  - uBR10K
    - PRE4
    - 5x20H
    - RFSW
    - 20x20V
    - 3G60
    - DCTT
    - 3300W
    - PS's (AC and DC)
    - SPA
    - **NGRFSW**
  - uBR7200
  - uBR7246 VXR
    - MC28U
    - MC88V
    - NPE-G2
  - uBR7225 (Pizza Box)
    - MC28U
    - MC88V
    - NPE-G2

- Unsupported hardware
  - uBR10K
    - **PRE2**
    - Saratoga
  - uBR7100 Series
  - uBR7200
    - **NPE-G1**

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Hudson Release (12.2SCH)

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Hudson (12.2SCH) Features

Feature	uBR10K	uBR72xx/ VXR
PRE5	Y	N/A
3G60 bonding across controllers	Y	N/A
LB: Independent US/DS throughput rules	Y	Y
LB: Configurable min-threshold of utilization method	Y	Y
LB: Static LB based on primary channel load for bonded modems	Y	Y
LB: Operational enhancements • Auto-generate DOCSIS 2.0 General LB Group (GLBG) • Display status information of modem-list in a LB group • Default settings for D3.0/D2.0 GLBG • Cable tags extension • Exclude cable modems from LB	Y	Y
VDOC enhancements (Channel change performance PRE4 & PRE5)	Y	Y
MAC+IP Classification	Y	Y
DOCSIS: UCD TLV for ranging hold-off	Y	Y
DOCSIS: Increase # of service class names*	Y	Y

*pre-EC

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