Meeting CCAP objectives

DOCSIS and Video Convergence, Scalability and Density with RFGW-10 and uBR10012

Luis Martins, Sr. Mgr, NG Access & Transport Architectures – EMEAR Service Provider

Dominique De Paepe, Sr. Product Manager Cable Access BU

John Knox, Consulting Systems Engineer Sales

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Agenda

- Cisco CCAP Strategy
- RFGW10 and uBR10k Platform Review
- Scaling DOCSIS Deployment
- Converging Video and DOCSIS
- Q&A

Cisco CCAP Strategy

A Phased Approach to Meet Today's Challenges with Scale and Convergence

Reduce OPEX

Phase 1

Scaling DOCSIS downstream capacity and converging into a high density UEQAM

Maximize ROI

Phase 2

Maximizing and scaling downstream capacity with the existing platform

Unprecedented Scale

Phase 3

Optimizing OPEX savings with a high density, next generation cable access platform, beyond 1Gbps/SG

Cisco CCAP Strategy Key Take-aways

Migration	Migration to CCAP is more than an equipment upgrade
Convergence	Multi-service convergence for DOCSIS and video networks requires significant operational preparation and readiness
Modular CCAP	Cisco's modular CCAP solution, uBR10012 and RFGW-10 offers an incremental deployment approach and meets key CCAP objectives today
Integrated CCAP	Cisco's integrated CCAP solution dramatically reduces the footprint and provides the scalability needed to support the next decade of growth in IP services

Phase 1 and 2 Platform Review

Cisco Multi-Service Cable Solution

IP Services

Data
VoIP
IP Video

Digital Video Services

Linear
VoD
NPVR

Converged Cable Access Network

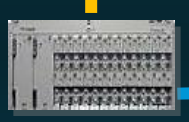
uBR10012 CMTS

RF Switch

DOCSIS Upstream Channels

DOCSIS Downstream Channels

Prisma II Optics



Optical Node

RFGW-10 Universal EQAM

DOCSIS Downstream Channels And Digital Video

Connected Home

DOCSIS 3.0 Data Modem

DOCSIS 3.0 eMTA

DOCSIS 3.0 Residential Gateway

RFGW-10

- Carrier Class High Availability Architecture
  - Redundant Power, WAN, Timing, GE Switching and N+1 EQAM LC
- 13RU Chassis (22.75”H X 22.25”D)
  - NEBS Compliant
  - 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
  - 848 Gbps line rate switching performance
  - DOCSIS and Video Control Plane processing
  - 2 x 10GE, 2 x GE Uplinks
  - IOS-XE 3.2SQ
  - GUI, CLI, SNMP

RFGW-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)
  - Dual Zone RF Switch - *N+1 (DS), M+1 (US)*
  - Two slots in the chassis can be designated as protect slots, each with its own redundancy group.
- (2) Redundant DC Power Supplies
  - Load sharing
  - Fully Redundant
- (2) DTI / System Timing Card Slots
  - M-CMTS Redundant External DTI Interface
  - Provides internal system and DOCSIS clocking

DS384 Line Card Overview

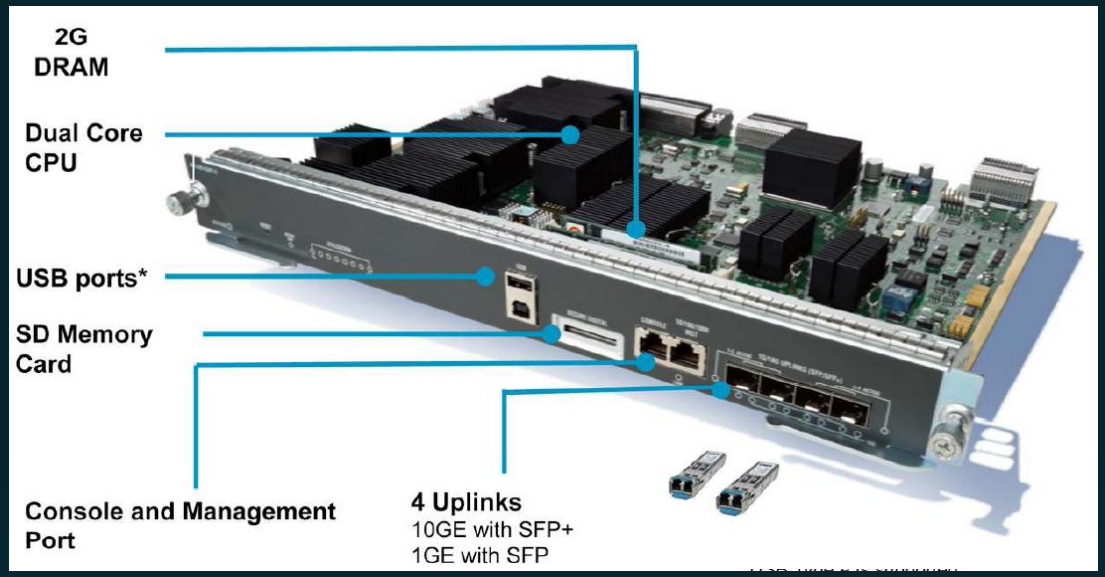
RFGW DS384

- 768 (1024 Annex B) QAMs per Line Card
  - 288 (384) Unique QAMs
  - 480 (640) RF Spanned QAMs
- 8 Ports per Card
- 1x, 2x, 4x, 8x, 12x …up to 96 (128) QAMs per port-stacking per Card
- **Single QAM Spectrum Assignment**

- Line Card Inputs:
  - N=2 10/1 GBE SFP+'s
  - N=2 1 GBE SFP's
- Licensing for DS Channel Capacity
- New Licenses in Video Release
  - RF Spanning (Capacity License)
  - PowerKEY Encryption (Feature)

Remark: Requires Upgraded RFGW-10 Chassis, TCC's and New Supervisor 7-E

SUP7-E Supervisor Overview



Modular Optics
(DS384 and Sup7-E)

- SFP-10G-SR
- SFP-10G-LR
- SFP-GE-T
- **GLC-SX-MMD**
- **GLC-LH-SMD**

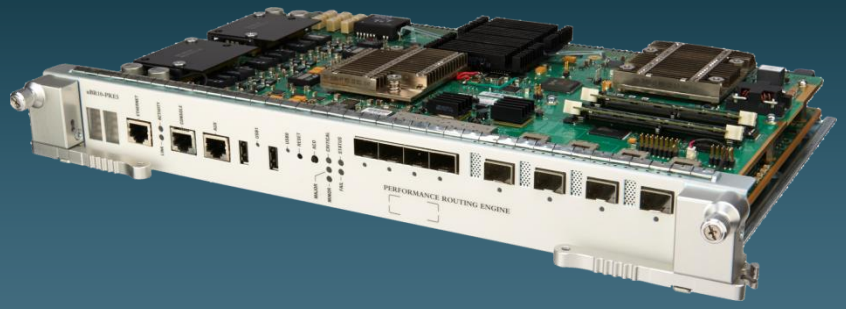
- Next Gen RFGW-10 Supervisor
- Required to Support DS384
- Derived from Catalyst 4500
- IOS-XE 3.2SQ Based (NOVA IOS on Linux)
- Multi-processor Engine
- 848 Gbps Switching Capacity
- 250 Mpps of Throughput

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

Routing Engine Enhancements
PRE5 Overview

- ***PRE5 enables up to 40 Gbps of WAN backhaul***
  - 4x10GE WAN backhaul ports
  - 10Mpps for both IPv4 and IPv6 with commonly used features

- ***WAN backhaul ports on PRE5 free up SPA slots***
  - 8 x 3G60 + 8 x 3G-SPA in single chassis
  - Increases capacity of uBR10K upto 1152 DOCSIS DS channels
  - Enables deploying 16-24+ DOCSIS channels per SG at scale



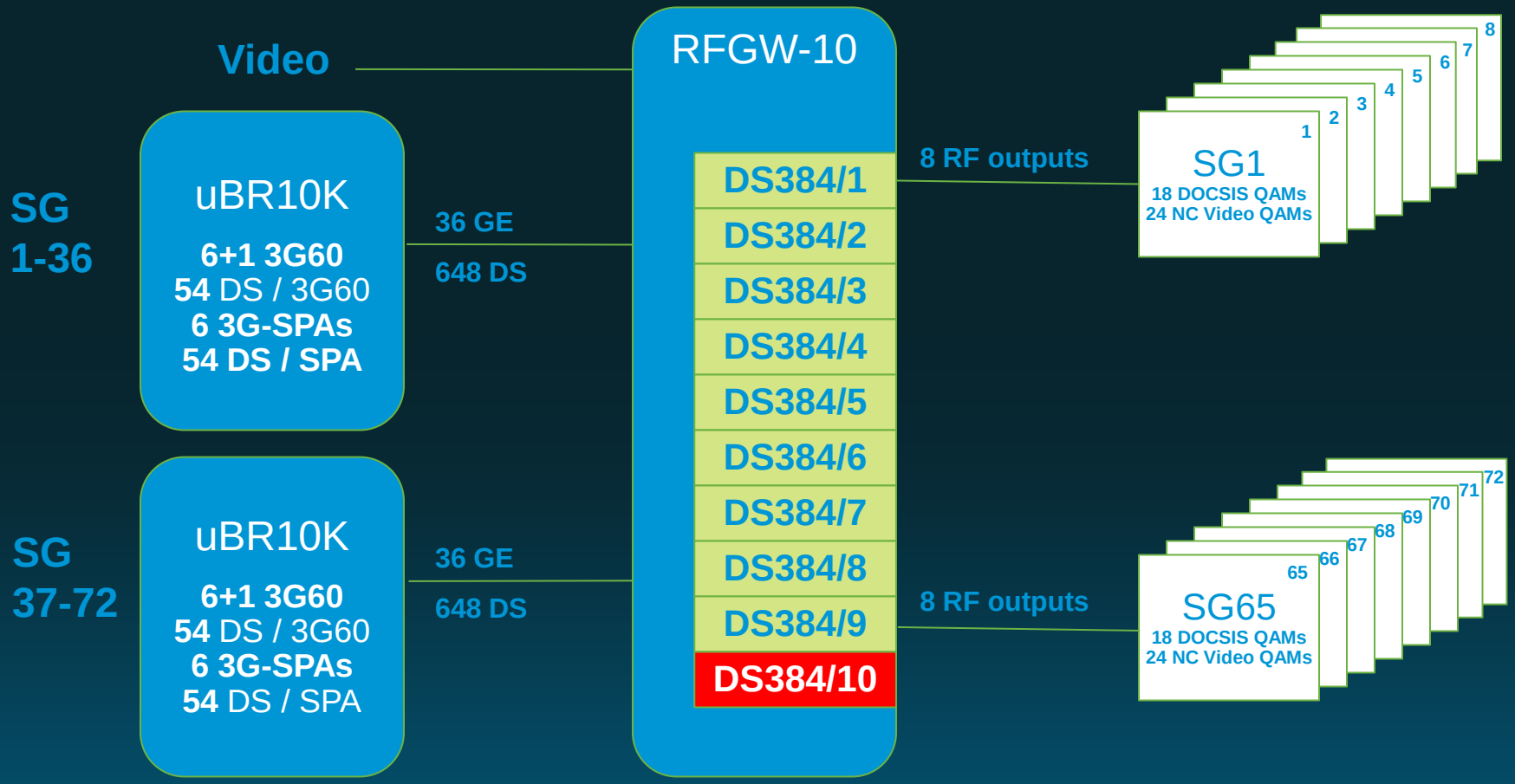
3G SPA Overview

- Doubles the downstream capacity of uBR10K
- 3G-SPA has functional parity with current Wideband SPA
  - 54 downstream channels hosted by 3 controllers (Annex A)
  - 72 downstream channels hosted by 3 controllers (Annex B)
  - 4 x 3G-SPA per SIP-600 card (Jacket card)
  - Cable modems can use the DS channels from 3G-SPA and US channels from 3G60
- Hardware features
  - 2 SFP+ ports & 1 SFP port on front panel; SFP+ ports can be used as SFP port
  - 2 SFP+ ports can be configured for 1+1 redundancy

Scaling DOCSIS Deployments with PRE5 and 3G-SPA

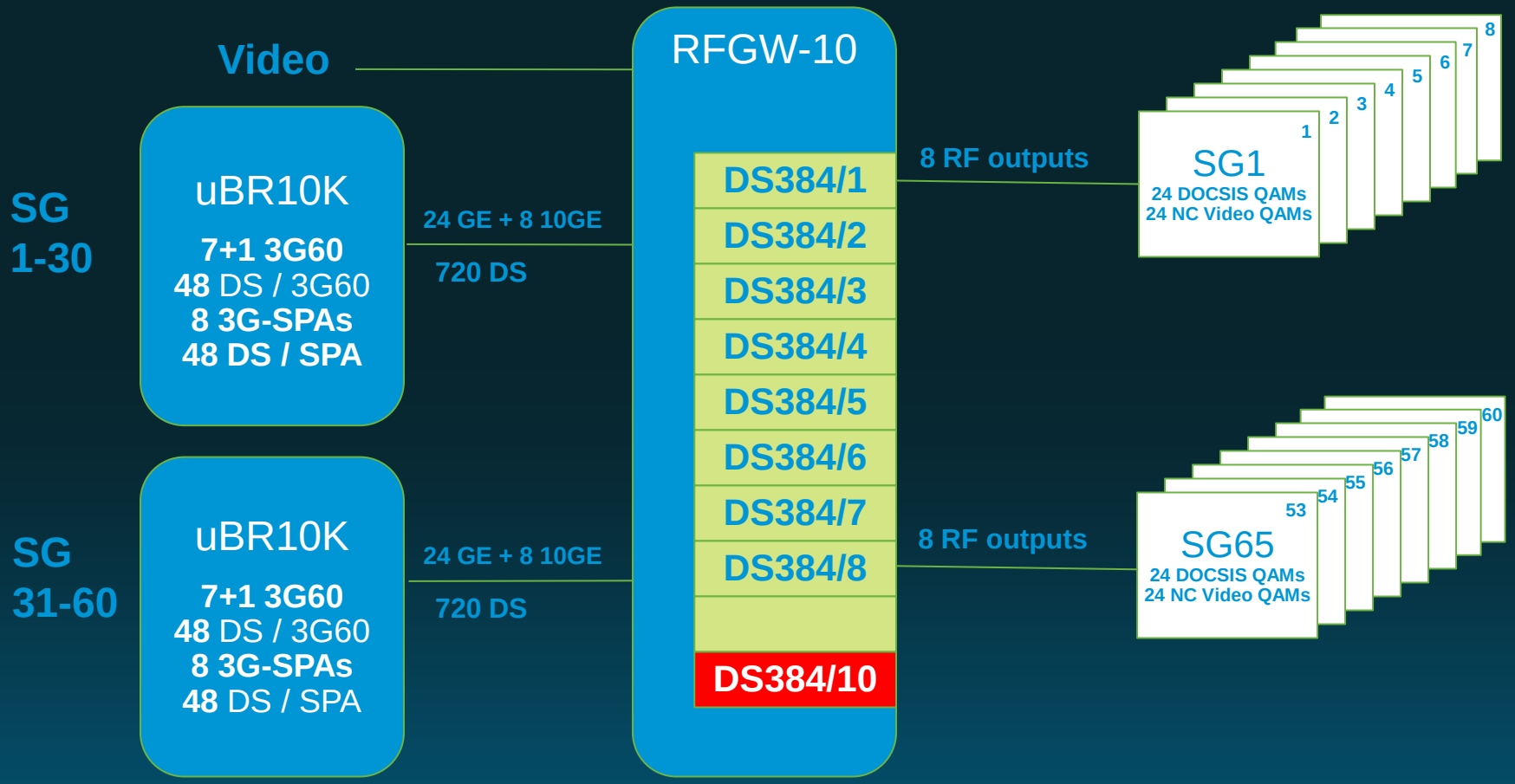
Plan Today for 1Gbps of EuroDOCSIS per SG

PRE5, MC3Gx60V/DS384 with N+1, and 3G-SPAs



Plan Today for 24 Ch. of EuroDOCSIS per SG

PRE5, MC3Gx60V/DS384 with N+1, and 3G-SPAs



Plan Today for 1Gbps+ of EuroDOCSIS per SG

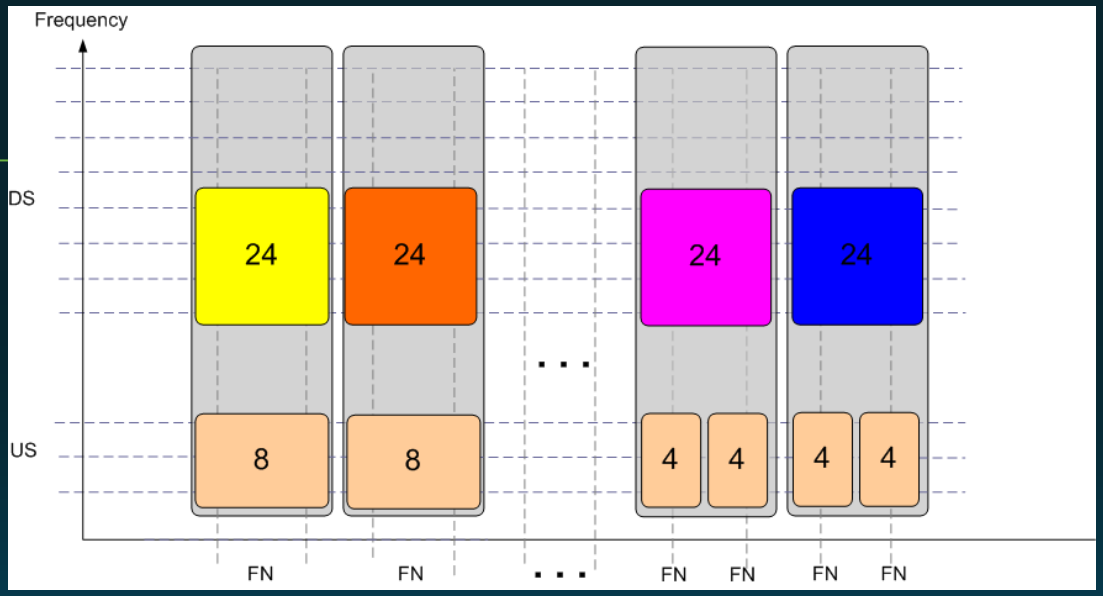
PRE5, 3G60/DS384 with N+1, and 3G-SPAs

uBR10K

8 3G60
48 DS / 3G60
8 3G-SPAs
48 DS / SPA

48 GE

768 DS



- **Fully loaded uBR10k with HW**
- **32 Downstream Service Groups**
- **30 Downstream Service Groups with 3G60 N+1**
- **8 US per MAC domain shown**
- **15 US per DS SG possible**

Audience Poll

What year-over-year growth rate do you expect for your DOCSIS bandwidth demand in the next 3 years?

A. Less that 30%
B. 30-40%
C. 40-50%
D. 50-60%
E. Greater than 60%

Converging Video and DOCSIS with DS384

Agenda

- Video Release
  - Features
  - Video Configuration and Management
  - RF Spanning
- Converging DOCSIS/Video on the RFGW-10

RFGW-10
Video Release Features

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Video Release 1 Feature Overview

(IOS-XE 3.3 SQ – IOSd 15.0(2)SQB)

Video Features

- Embedded PowerKEY Encryption for VOD
- SDV (Pre-Encrypted)
- Table Based VOD (Un-Encrypted or Pre-Encrypted)
- Pre-Encrypted Broadcast
- GQI 2.0
- ERMI – I and II

Other Features

- RF Spanning (QAM Replication - Licensing)

Video Configuration and Management

- CLI is the Primary Configuration Method
- Embeddd GUI Supports Status and Configuration of Video QAMs
- RPU-10 Supports Mass Configuration of SDV and VOD QAMs
- Cisco Prime Network and Prime Analytics support the RFGW-10 in the Summer Release
- TACACS recommended for Roll-Based Configuration
  - Must choose an owner for the PHY

RF Spanning Overview

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RF Spanning Overview

- RF Spanning is replication of QAMs Across Ports on the same DS384 Line Card
- Any QAM Type Can be Replicated
  - Narrowcast / Broadcast
  - Unicast / Multicast
  - DOCSIS / MPEG Video
- RF Spanning Applications
  - DOCSIS / Video Service Group Alignment
  - MPEG Broadcast Video
  - DOCSIS RF Spanning
  - VDOC Static Multicast (VDOC Broadcast)
- RF Spanning Enables
  - Service Group per Port Architecture
  - More Service Groups per Chassis = Fewer Chassis / Less Power
  - Increased Service Deployment Velocity
  - Reduced OPEX

SG Combining – Today's Approach

Converged QAM Network

RFGW	
DS384/1-1	48 Broad
DS384/1-2	18 DOCS
DS384/1-3	24 Narr
DS384/1-4	18 DOC
DS384/1-5	18 DOC
DS384/1-6	24 Narrow
DS384/1-7	18 DOCS
DS384/1-8	

DOCSIS and Digital Video Downstream Channels

Broadcast Channels Split/Combined Across All Service Groups

NC DOCSISQAMs Unique per Service Groups

NC Video QAMs Split/Combined Across Service

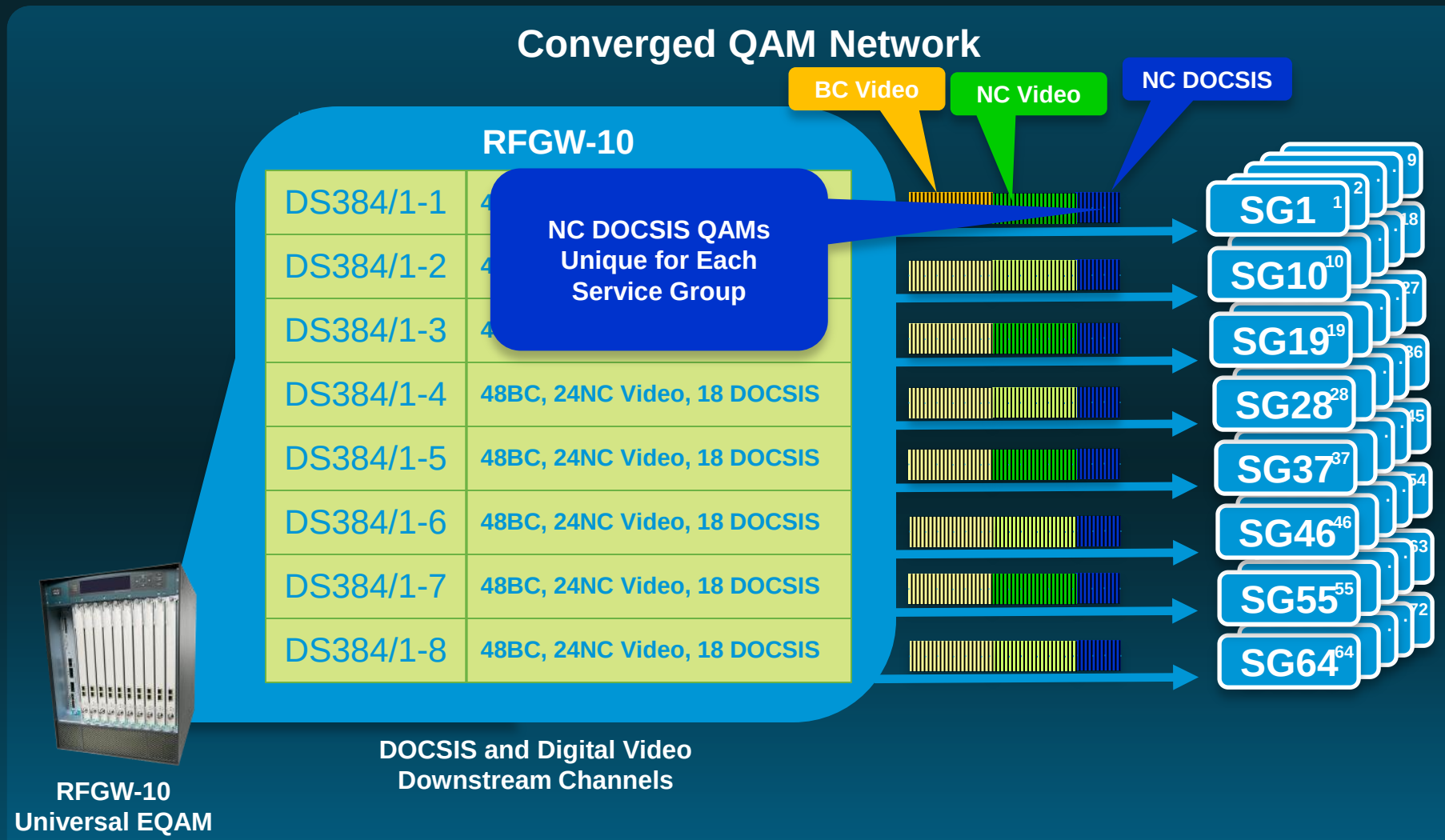
External RF Combining Network

- **SG1** (1): 18 DOCSIS QAMs, 24 NC VIDEO QAMs, 48 BC VIDEO QAMs
- **SG10** (10): 18 DOCSIS QAMs, 24 NC VIDEO QAMs, 48 BC VIDEO QAMs
- **SG19** (19): 18 DOCSIS QAMs, 24 NC VIDEO QAMs, 48 BC VIDEO QAMs

In this Example

- External RF Splitting / Combining Used
- Scaling is Port Limited
- 200 QAMs Utilized per DS384
- 1 RFGW-10 Serves 36 SG's with Redundancy

SG Combining Using RF Spanning



SG Combining Using RF Spanning

Converged QAM Network

BC Video

NC Video

NC DOCSIS

RFGW-10

DS384/1-1	4
DS384/1-2	4
DS384/1-3	4
DS384/1-4	48BC, 24NC Video, 18 DOCSIS
DS384/1-5	48BC, 24NC Video, 18 DOCSIS
DS384/1-6	48BC, 24NC Video, 18 DOCSIS
DS384/1-7	48BC, 24NC Video, 18 DOCSIS
DS384/1-8	48BC, 24NC Video, 18 DOCSIS

Broadcast Channels are Processed Once and Spanned Across All Ports

SG1 1 2 9

SG10 10 18

SG19 19 27

SG28 28 36

SG37 37 45

SG46 46 54

SG55 55 63

SG64 64 72

RFGW-10
Universal EQAM

DOCSIS and Digital Video
Downstream Channels

SG Combining Using RF Spanning

Converged QAM Network

BC Video

NC Video

NC DOCSIS

RFGW-10

DS384/1-1	4
DS384/1-2	4
DS384/1-3	4
DS384/1-4	48BC, 24NC Video, 18 DOCSIS
DS384/1-5	48BC, 24NC Video, 18 DOCSIS
DS384/1-6	48BC, 24NC Video, 18 DOCSIS
DS384/1-7	48BC, 24NC Video, 18 DOCSIS
DS384/1-8	48BC, 24NC Video, 18 DOCSIS

NC VIDEO QAMs Span Across DOCSIS Service Groups for Alignment

Unique NC VIDEO QAMs

Spanned NC VIDEO QAMs

Spanned NC VIDEO QAMs

Spanned NC VIDEO QAMs

Spanned NC VIDEO QAMs

SG46

SG64

RFGW-10
Universal EQAM

DOCSIS and Digital Video Downstream Channels

SG Combining Using RF Spanning

Converged QAM Network

BC Video

NC Video

NC DOCSIS

RFGW-10

DS384/1-1	48BC, 24NC Video, 18 DOCSIS,
DS384/1-2	48BC, 24NC Video, 18 DOCSIS
DS384/1-3	48BC, 24NC Video, 18 DOCSIS
DS384/1-4	48BC, 24NC Video, 18 DOCSIS
DS384/1-5	48BC, 24NC Video, 18 DOCSIS
DS384/1-6	48BC, 24NC Video, 18 DOCSIS
DS384/1-7	48BC, 24NC Video, 18 DOCSIS
DS384/1-8	48BC, 24NC Video,

SG1 1 2 9

SG10 10 18

SG19 19 27

SG28 28 36

SG37 37 45

SG46 46 54

63

72

RFGW-10
Universal EQAM

DOCSIS and Digital Video
Downstream Channels

RF Spanning Enables:

- Service Group per Port Architecture
- Elimination of External Combining
- Higher Service Group Density per Chassis
  - Up to 72 SG's per Chassis (redundant)
- Fewer Chassis (Lower Power / Footprint)
- Service Groups can be Wired Once and Future Changes Accomplished via Config

Deploying Video with the RFGW-10 DS384

Converged DOCSIS / Video Deployment Recommendations

1. High Availability Operation Recommended
   1. Power and TCC's
   2. PEMs (Power Entry Modules)
   3. Supervisors (NSF/SSO)
   4. Line Cards (LCRED)
2. Deploy DOCSIS then Converge SDV and VOD on Same RF Port
3. Leverage the RFGW-10 DS384 RF Spanning to Enable Service Group / Port Architecture
4. Enable SDV/VOD QAM Sharing using the VSRM
5. Converge Broadcast Services Last

Audience Poll

When do you plan to converge DOCSIS and Video services?

A. Within 6 Months, by 2013
B. By 2014
C. By 2015
D. By 2016
E. No plans to converge

Summary

Cisco CCAP Phase 2 Summary

- Doubles the downstream capacity of the existing platform
- Scalability to meet rapid growth in IP video and HSD services
- Incremental upgrade results in Opex and Capex savings
- High-density solution reduces cost per bit for all services
- Convergence of CCAP on a widely deployed platform
- Meets the key CCAP objectives and enables a manageable migration execution strategy

Q&A

Thank you.