



Cisco RF Gateway Family Update

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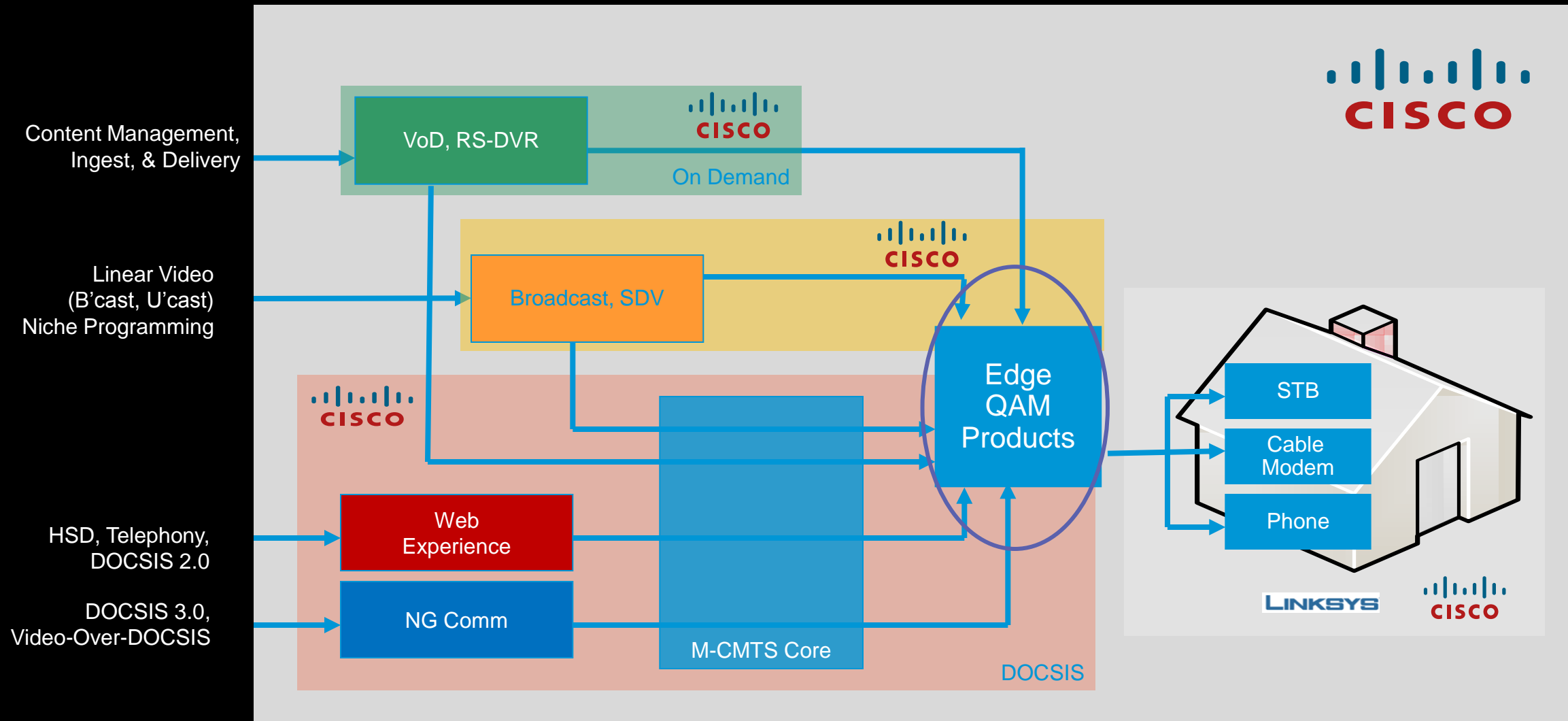
Agenda

- Product Family Overview
- RFGW-1
- RFGW-10
 - DS384 Linecard
 - High Availability Architecture
 - Roadmap
 - RF Spanning
 - RFGW-10 Summary

Product Family Overview



Universal QAM



The Cisco RF Gateway (RFGW) Series

Fully featured product family of Universal QAM Modulators, supporting Digital Broadcast, SDV, VOD and DOCSIS solutions, with leading performance, density, high availability, power consumption and scale.



RFGW-1-D	RFGW-10
48 QAMs in 1 RU	480 QAMs up to 3840 QAMs in 13 RU
Redundant Power, WAN and Timing	Carrier Class High Availability Architecture Redundant Power, WAN, Timing, GE Switching and N+1 EQAM LC Software upgrade to NSF & SSO
2000+ Video Streams	10,000+ Video Streams
1GHz Support	Upgradeable to 3000+ QAMs in same chassis
SDV, VoD, HDTV, Broadcast, DOCSIS 3.0, M-CMTS, Annex A, B, C Powerkey, DVB-CAS	

RFGW1



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

Modular 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

RFGW-1 Value Highlights

RFGW-1 Features	Benefits
Full Function and Cisco Validated UE-QAM	Low Risk, Real world end-to-end testing and support
DDS	Superior RF performance, growth, and reliability
Density up to 96/RU	Space, Power, Cost efficiency
Edge Encryption (PowerKey or DVB)	Lower cost/Lowers power/More reliable. Allows QAMs sharing
Frequency Range to 1 GHz	Support current or future plant upgrades.
QAM Sharing in the same chassis	Chassis can be shared across multiple applications on a QAM by QAM basis (SDV, VOD, DOCSIS)
Modularity/Redundancy	Reliable and cost effective configurations
Multi MSO Approved and widely deployed	Proven product

RFGW1 Current Developments

- Current development focused on new firmware
- New firmware code name *AJAX*
Scheduled to be available early Q3 CY12
- New firmware will add a number of features to RFGW1

AJAX key features

- Consolidate Features / Applications to Fewer Software Releases
Goal is to have single firmware for all applications
- DEPI-CP Functionality Between CMTS and RFGW 1
Allows for easier setup of RFGW1 in an M-CMTS scenario
- Configuration Option for Source Selection Based on Multi-Cast Stream Status
- Configuration Option for Global Input Port Assignment

RFGW10



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
>350 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 Uplinks
12.2S Service Provider Cisco IOS
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

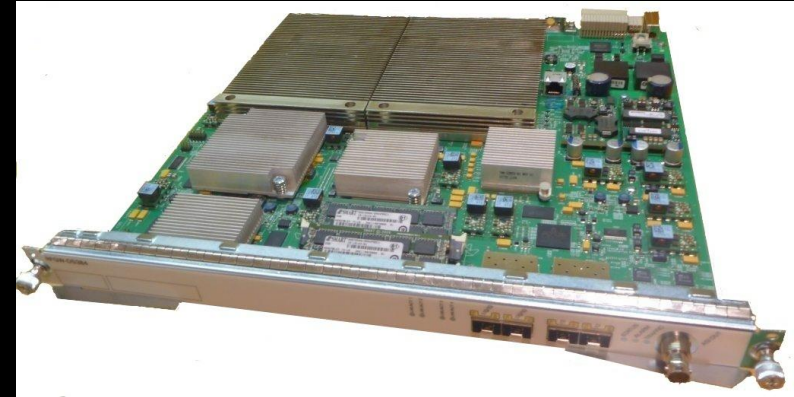


DS384 Linecard



DS384 Line Card Overview

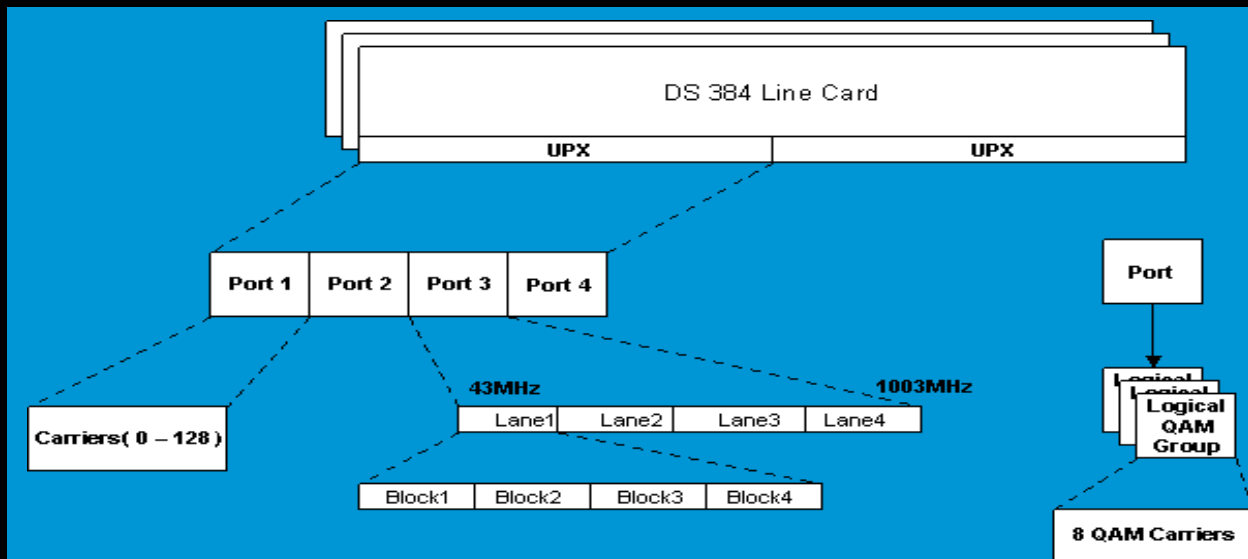
- Compatible with Existing RFGW-10 Chassis, Power Supplies and Common Cards
- Requires New Callista Supervisor
- 384 Downstream Channels (Annex B)
- 288 Downstream Channels (Annex A)
- 8 Ports per Card
- 1x, 2x, 4x, 8x, 12x ...up to 128 QAMs per port-stacking per Card (max 96 QAMs under Annex A)
- Line Card Inputs:
 - N=2 10/1 GBE SFP+'s
 - N=2 1 GBE SFP's
- Full DEPI-CP Support



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)

DS384 Frequency Agility & Assignment



Upconverter Architecture

- Two Upconverters (UPX) per DS384 Line Card
- Each DS384 Line Card has 8 ports – 4 per UPX
- Each Port Supports up to 128 (96) QAM Carriers
 - Tunable from 43 to 1003 MHz (Band Edges)
 - Tunable from 48 – 999 MHz (Center Freq)
- Each UPX has 4 - 216 MHz Lanes per Port
 - Supports up to 32 (24) QAMs
- Each Lane has 4 Blocks 54 MHz Wide
 - Supports up to 8 (6) QAMs

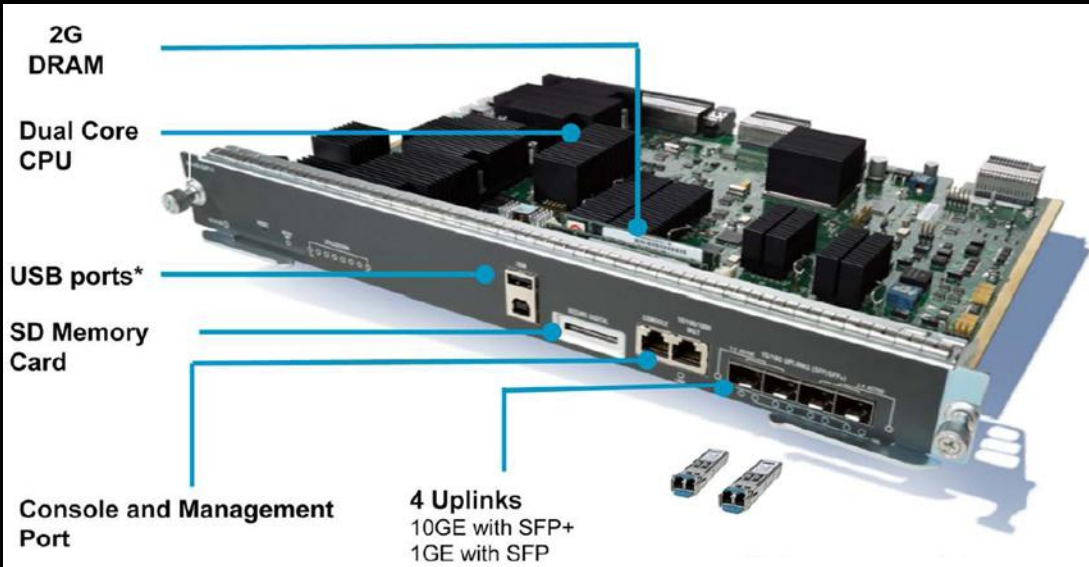
Fixed Frequency Assignment Mode

- Hides Lane/Block Assignment from User
- User Specifies Port F_{start}
- Spectrum Configured Contiguously from F_{start}
 - 774 MHz of Spectrum (Annex B/C)
 - 744 MHz of Spectrum (Annex A)
- Users Assigns QAMs to the Port as Required

User-Defined Frequency Assignment Mode

- User Specifies Port Block / Lane Assignments
- Provides Full Control and Maximum Utilization of Spectrum
- Lane / Block Overlap Allowed – No QAM Overlap
- After Configuration – Users Assigns QAMs to the Port as Required

Callista Supervisor Overview



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

RFGW-10 Power Consumption

	DS48 4 per Port	DS384-72 9 per Port	DS384-144 18 per Port	DS384 -288 36 per port
Power per QAM (based on Fully Loaded RFGW-10)	5.6W	5,6 W	2,8 W	1.4 W

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	533	
	RFGW-DS-384	10	3222	
	Total Power Consumption (W)			4,095

DS384 Key Features Summary

Feature	Description
1. Up to 384 (288) QAMs per Card	Capable of up to 32 to 384 (288) Output QAMs Flexible Licensing Enables Pay-as-You-Grow Capacity
2. 8 output ports per Linecard	8 ports / Line Card. Up to 128 (96) QAMs per Port
3. Non-Adjacent Frequency Support	Flexible QAM Channel Assignment
4. DOCSIS 3.0	DOCSIS 3.0 DEPI-CP Support
5. 1G or 10G inputs	4 x1GigE input or 2x1GigE and 2x10GigE input optics on each Line Card
6. SDV and Broadcast Video	Capable of conducting switched digital video and broadcast video traffic via GQI and ERMI-1/2 protocols
7. VOD support	UDP-Table based VOD
8. GQI Support	Integration with DNCS 5.0 for VOD
9. ERMI-I and ERMI-II	Session-based Video using CableLabs Protocols
10. Software licensing	Capable of licensing QAMs and PowerKEY feature per LC
11. GUI and CLI configuration	GUI based configuration for DOCSIS and video
12. Bulk Provisioning via RPU	Video bulk provisioning using Excel file input with the Remote Provisioning Utility (RPU)

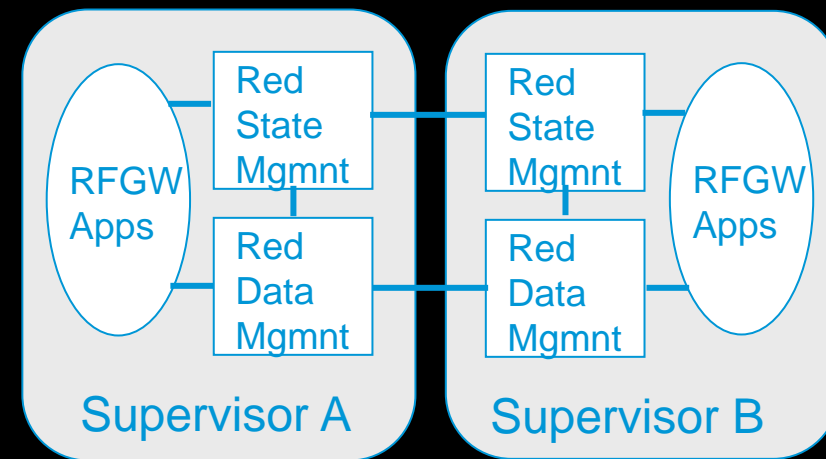
RFGW-10 High Availability Architecture

RFGW-10 HA Comprised of Four Components

- High Reliability HW Design and Components
- Redundant Supervisors with SSO (Supervisor Stateful Switchover)
- Linecard Redundancy (LCRED)
- Port Redundancy

Supervisor Stateful Switchover (SSO)

- **Hot Standby Supervisor**
The redundant Supervisor is fully configured and initialized.
- **Redundancy State Management**
State progression control
Change notification to applications
- **Redundancy Data Management**
Config sync: Bulk, Incremental
RFGW Database checkpointing
- **Failover Operation**
Newly Active Sup continues to forward traffic while the DEPI and Video control planes are re-established.



RFGW-10 Line Card Redundancy

- 1:N LC redundancy model

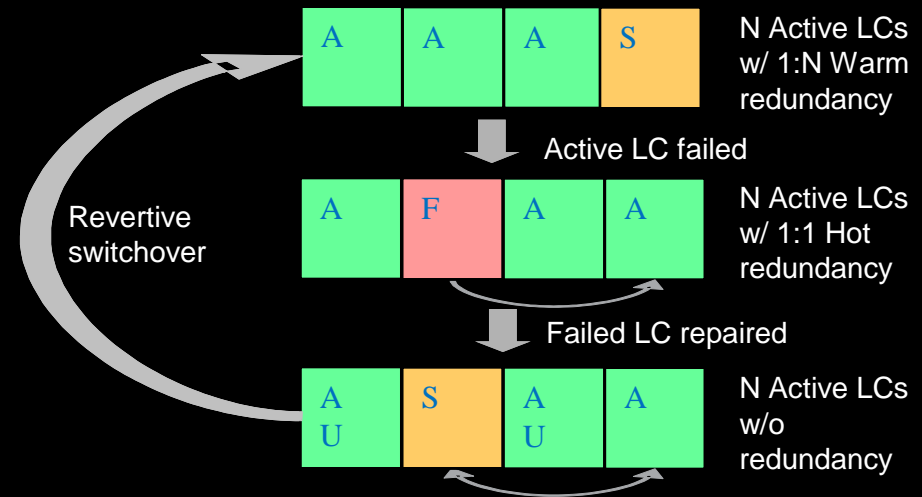
- Up to 2 redundancy groups with each having N Active LCs backed up by 1 Standby

- LC failure modes

- System memory ECC error
- Processor L2 cache parity error
- System bus error
- RF up-converter failure
- DTI interface failure
- Software process failure
- DEPI Data Session Packet Loss

- Failure detection and recovery

- Fast SW and HW failure detection (< 100 msec).
- SW failure recovery: fast standby line card re-configuration (< 300 msec)
- Overall failover time < 500 msec (LC detection + Sup reaction + standby LC re-configuration).
- OIR caused LC switchover takes longer time (~1 sec) due to Supervisor “review”



RFGW-10 Roadmap



RFGW-10 DS384 Roadmap

Today

Blackstone

Apr CY11

Jul CY12

Oct CY12

TBD

Hardware
Chassis / Commons
Supervisor (20Gbps)
DS48 1HHz DRFI

Video
GQI (SDV/VOD)
Broadcast
Table based VOD
RTP passthru

Data
DEPI (D-MPT)
DEPI CP
DTI

HA
SUP RPR
DEPI LCRED
TCC 1+1
PS LS & LB
SUP SSO

Core Platform
Cisco IOS CLI
GUI - Monitoring

Hardware
Pre-Release
EFT Units
Early customer testing

Pre-release Eval
units

Hardware
Initial Customer shipments
DS384 Line Card HW
Callista Switch
32 – 96 QAM per LC (Annex A)

Software
Data Feature set
3G60 Integrated

Core Platform
Callista Supervisor

Data Feature set
release

Software
32 – 288 QAMs per LC (Annex A)

Video Features
SDV
ERMI I&II, GQI
PowerKey for VOD

Video Feature set
release

Software
RF Spanning
QAM Efficiency
(288+288)

Video Features
PowerKEY for Broadcast
DVB Encryption

CCAP Features
CCAP Encryption
CRAN Decryption

Gen 2 HW, Faster, Denser

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.

Current
Release

RF Spanning

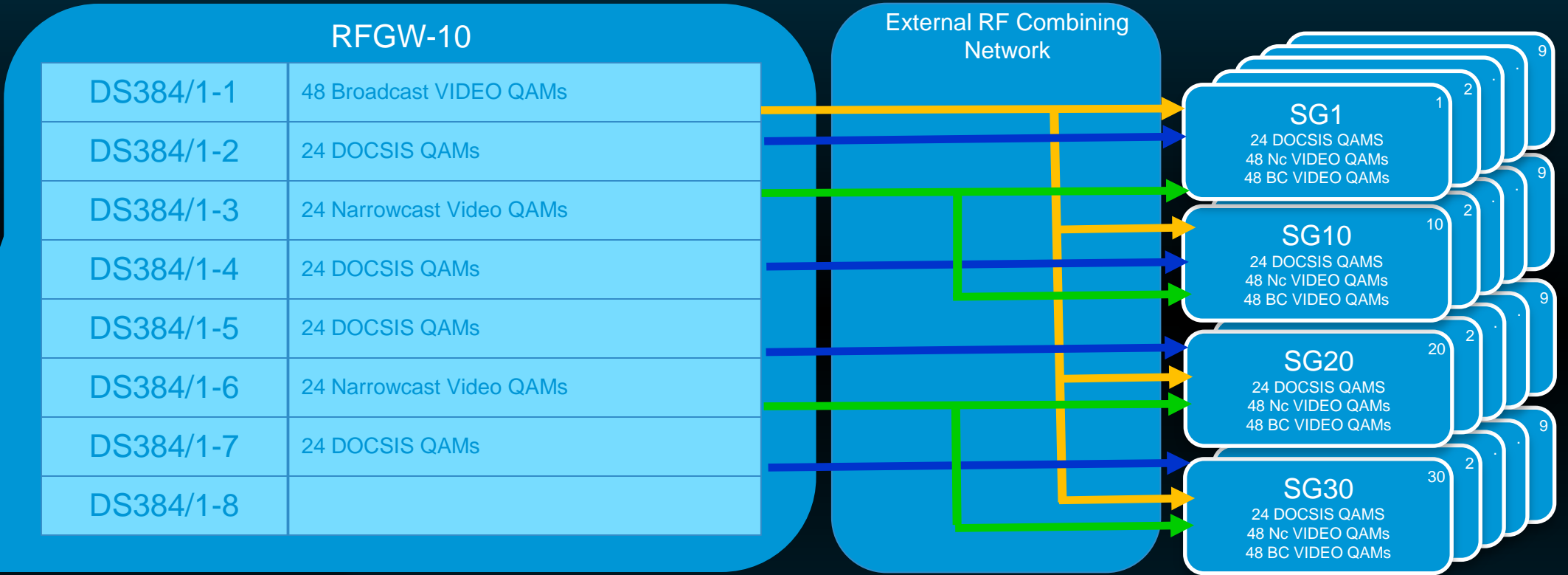


RFGW-10 DS384 RF Spanning

- 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 Unique QAMs with Replication of an Additional 384 QAMs – Double the QAM Capacity
- Replication Enables Copies of Unique QAMS to be Spanned Across 1 or More Physical Ports
- RF Spanning Enables “Service Group per Port” Architectures which Increase Utilization of Dense QAMs and Reduces / Eliminates External Downstream Combining

SG Combining – Today's Approach

Converged QAM Network

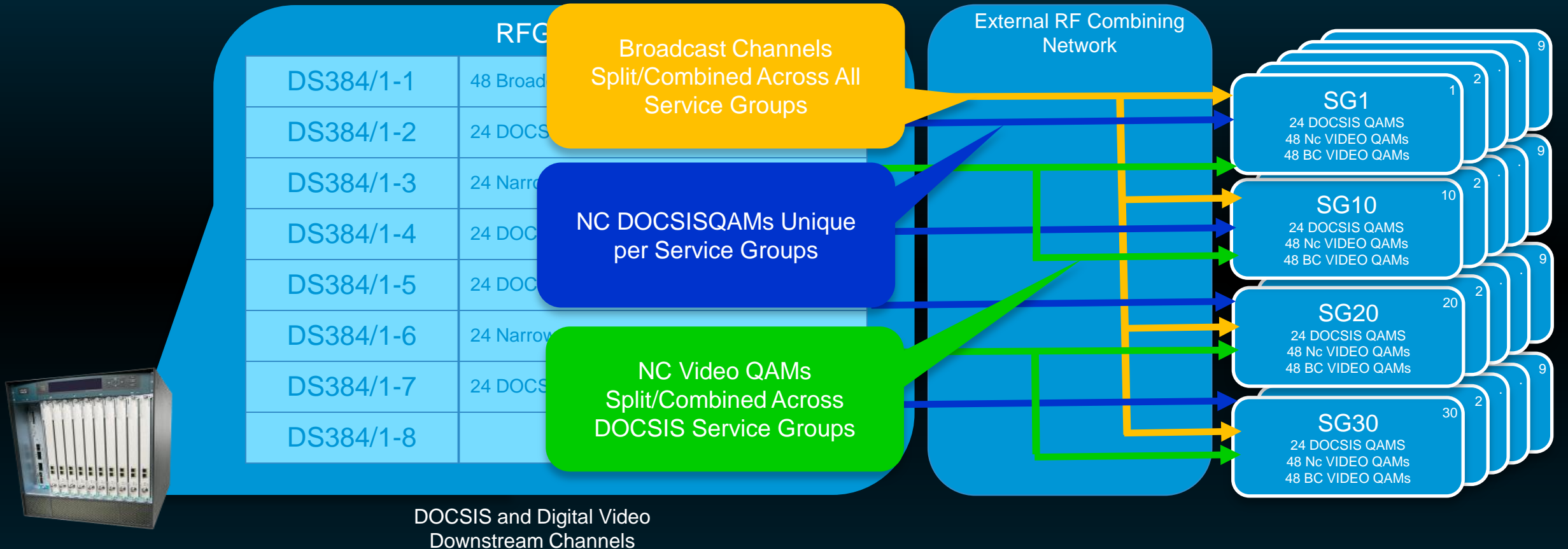


RFGW-10	
DS384/1-1	48 Broadcast VIDEO QAMs
DS384/1-2	24 DOCSIS QAMs
DS384/1-3	24 Narrowcast Video QAMs
DS384/1-4	24 DOCSIS QAMs
DS384/1-5	24 DOCSIS QAMs
DS384/1-6	24 Narrowcast Video QAMs
DS384/1-7	24 DOCSIS QAMs
DS384/1-8	

DOCSIS and Digital Video Downstream Channels

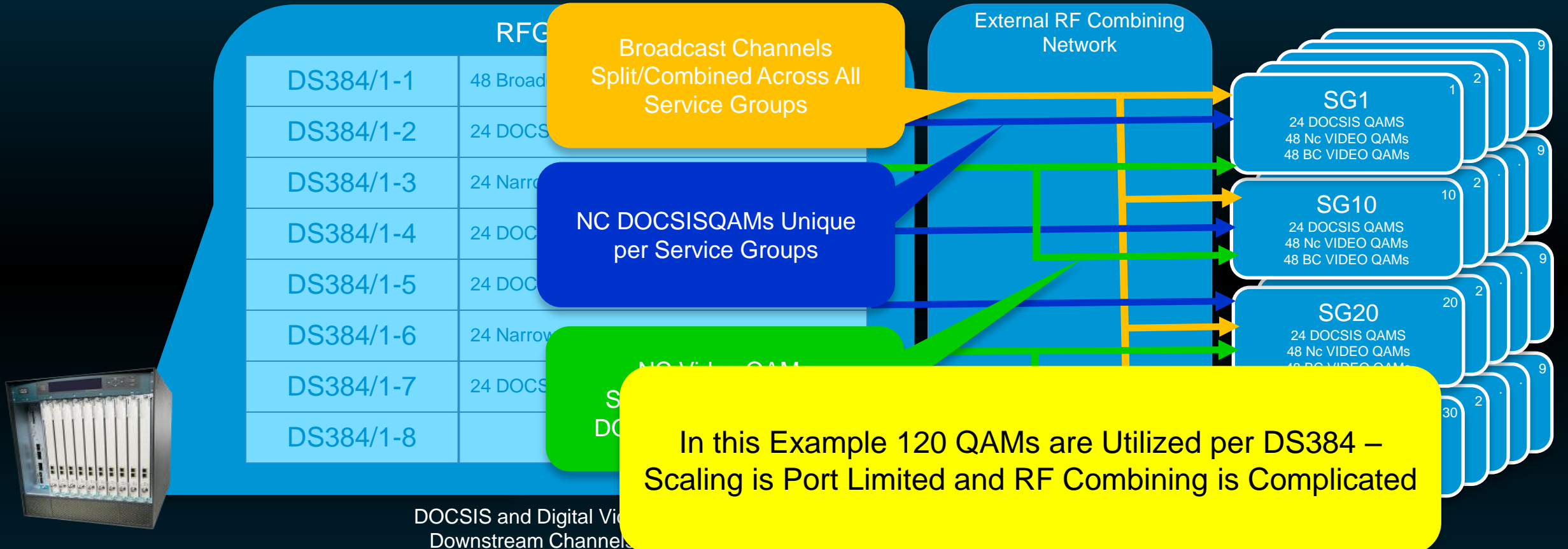
SG Combining – Today's Approach

Converged QAM Network



SG Combining – Today's Approach

Converged QAM Network



SG Combining Using RF Spanning

Converged QAM Network

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 Available
DS384/1-8	Not Available



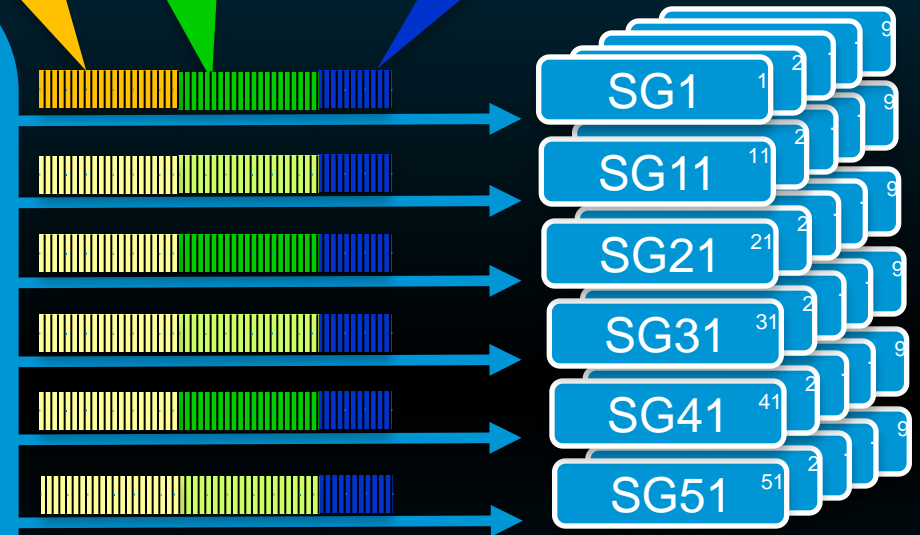
RFGW-10
Universal EQAM

DOCSIS and Digital Video
Downstream Channels

BC Video

NC Video

NC DOCSIS



- QAMs are Replicated Across Ports to Reduce / Eliminate External Combining
- Total QAM Capacity (Annex A):
 - 288 Unique QAMs
 - 288 Replicated QAMs

SG Combining Using RF Spanning

Converged QAM Network

RFGW-10

DS384/1-1	
DS384/1-2	
DS384/1-3	
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 Available
DS384/1-8	Not Available

Broadcast Channels are Spanned Across All Ports

BC Video

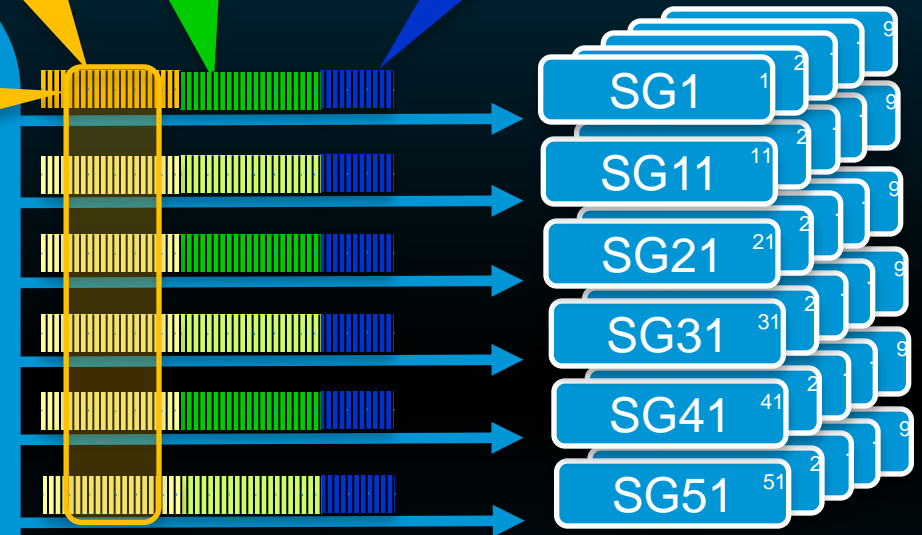
NC Video

NC DOCSIS



RFGW-10
Universal EQAM

DOCSIS and Digital Video
Downstream Channels



- QAMs are Replicated Across Ports to Reduce / Eliminate External Combining
- Total QAM Capacity (Annex A):
 - 288 Unique QAMs
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SG Combining Using RF Spanning

Converged QAM Network

RFGW-10

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

NC VIDEO QAMs Span Across DOCSIS Service Groups for Alignment

BC Video

NC Video

NC DOCSIS

Unique NC VIDEO QAMs

Unique NC VIDEO QAMs

Unique NC VIDEO QAMs



RFGW-10
Universal EQAM

DOCSIS and Digital Video
Downstream Channels

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SG Combining Using RF Spanning

Converged QAM Network

RFGW-10

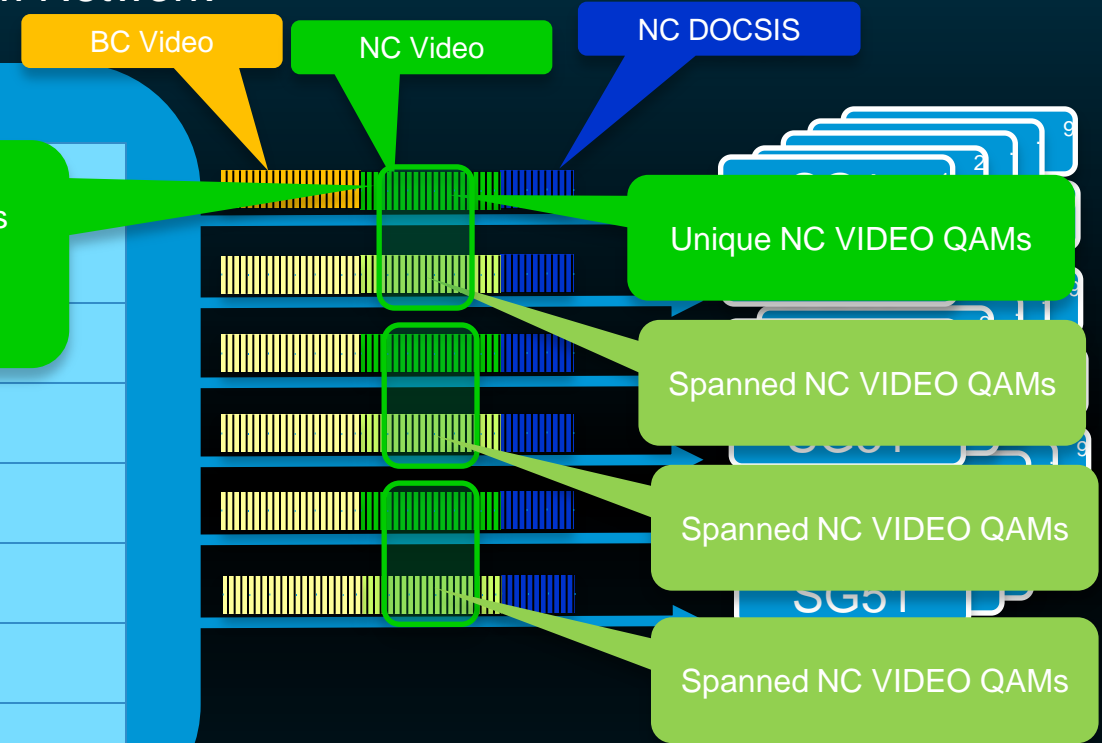
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DS384/1-8	Not Available

NC VIDEO QAMs Span Across DOCSIS Service Groups for Alignment



RFGW-10
Universal EQAM

DOCSIS and Digital Video
Downstream Channels



- QAMs are Replicated Across Ports to Reduce / Eliminate External Combining
- Total QAM Capacity (Annex A):
 - 288 Unique QAMs
 - 288 Replicated QAMs

SG Combining Using RF Spanning

Converged QAM Network

RFGW-10

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

NC DOCSIS QAMs Unique for Each Service Group

BC Video

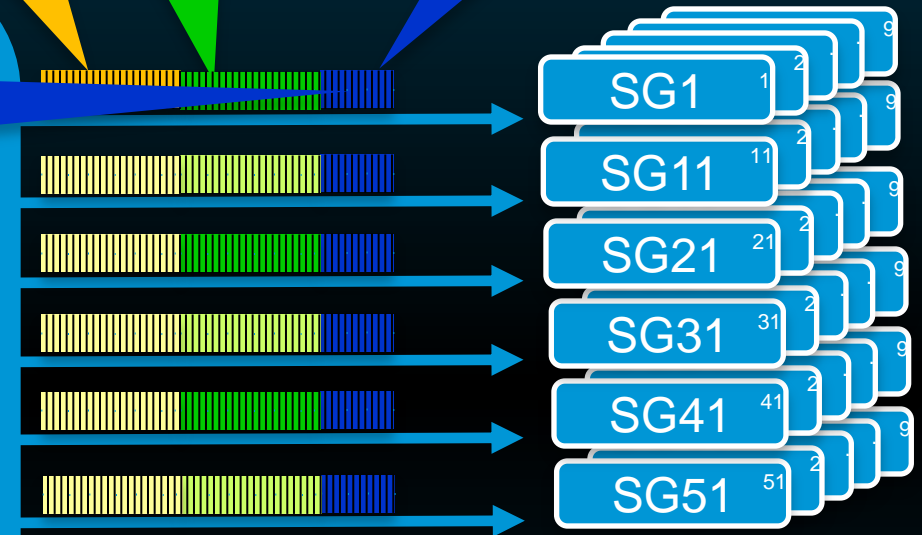
NC Video

NC DOCSIS



RFGW-10
Universal EQAM

DOCSIS and Digital Video
Downstream Channels



- QAMs are Replicated Across Ports to Reduce / Eliminate External Combining
- Total QAM Capacity (Annex A):
 - 288 Unique QAMs
 - 288 Replicated QAMs

RFGW-10 Summary



Universal Edge QAM Solution

RFGW-10 Value Proposition



RFGW-10 Features	Benefits
Full Function Universal Edge QAM for both Video & Data Applications	Time to market with reliable new standards-based integrated services with real world end-to-end testing.
HA: RF Switching, protection for both Video & Data Services.	No down time for any RF output failure.
HA: In-Service Software Upgrade	No Interruptions on Video or Data Applications.
Lower Power per QAM (DDS Technology)	Reduced local power consumption / Reduced OpEx.
Able to support output ports densities of: 4 to 128	Future proofing for convergence of multiple applications
Integrated PowerKey Encryption	Reduces Cost / Add Flexibility for providing Encrypted Video Services.
GigE Input Switching	Reduced cost for source switching.

Thank you.

