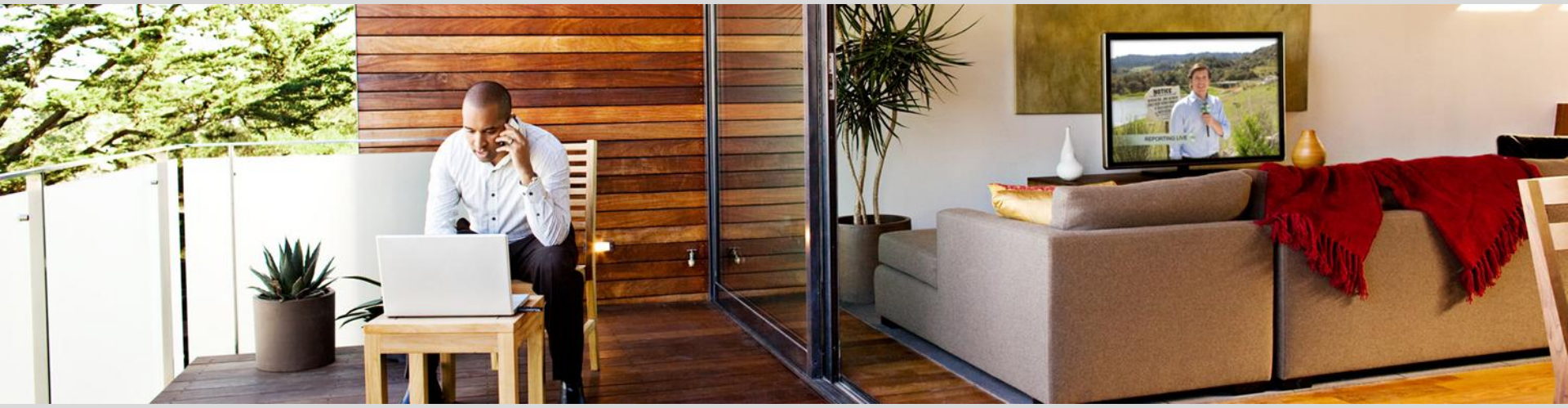


# Massively Scaling your DOCSIS 3.0 Network

December, 2010

Daniel Etman, Product Management, Cable Access BU
John Horrobin, Strategic Marketing, Cable Access BU

# Agenda

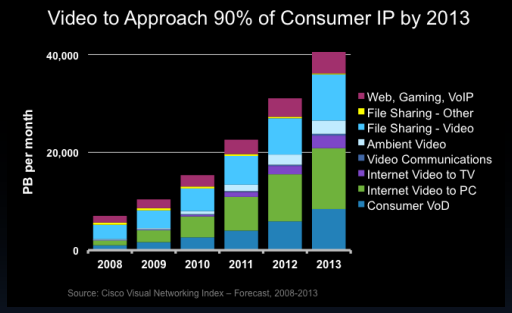
- Market Dynamics
- uBR/3G60 Product Overview
- Modular CMTS Architecture
- Channel Bonding
- Designing for High Availability
- Summary
- Q & A

# Market Growth

## Video Intensive, Multi-platform, Personal, and Interactive

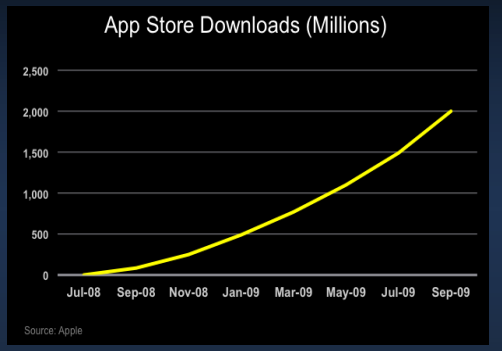
### Massive Video Growth

- Rapid growth in HD and VoD services
- Video expected to be 90% of consumer internet traffic by 2013
- Content owners looking for new outlets with piracy protection



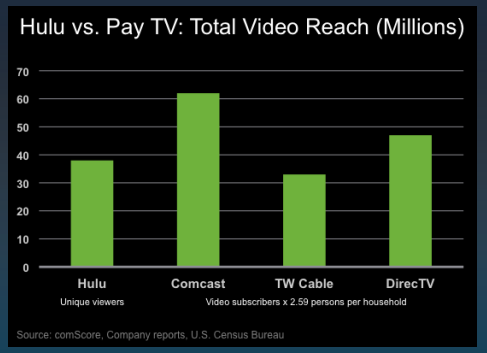

### Personalization

- Consumers want custom applications & user interfaces
- Consumers want to watch what they want, when and where they want
- 2 billion apps downloaded from Apple, over 40 apps per iPhone /Touch
- Recently updated to 3B apps in <18 months




### Consumers Looking Beyond Traditional Video

- Internet video increasing in quantity
- Broadband speeds & streaming technology improving
- Consumers looking at new viewing options



# MSOs Moving Towards Enabling Converged Services

**Internet & Premium Content Services**

Roku, sling media, hulu, BIG TEN CONFERENCE, YouTube, NETFLIX, ESPN360.com, FANCAST, Rhapsody

**Personal Content**

**View Personal Content on the TV**

**Home Telepresence – Cisco ūmi**

**Interactive & Community / Social Applications**

skype, flickr BETA, FANDANGO

**Voice Over IP & Data Services**

**Communications**

**TWC's TV Everywhere!** "We're looking to create a model that's friendly to cable, works for consumers... so if you're paying for it in your living room, you can also watch it online," Schwartz said.

**Liberty Global CEO Mike Fries:** "The rate of return (for DOCSIS 3.0) is phenomenal…I have never seen a new product make so much business sense…the cost of upping speeds from 8 Mbps to 100 Mbps is in the region of $15-$20 per household…it creates a halo effect that attracts new subscribers…"

"It's not just the network and digital rights management (DRM); it's getting content and features from the TV to the PC, from the telephone to the TV to the PC, and more," says **Charter Communications CTO Wayne Davis**.

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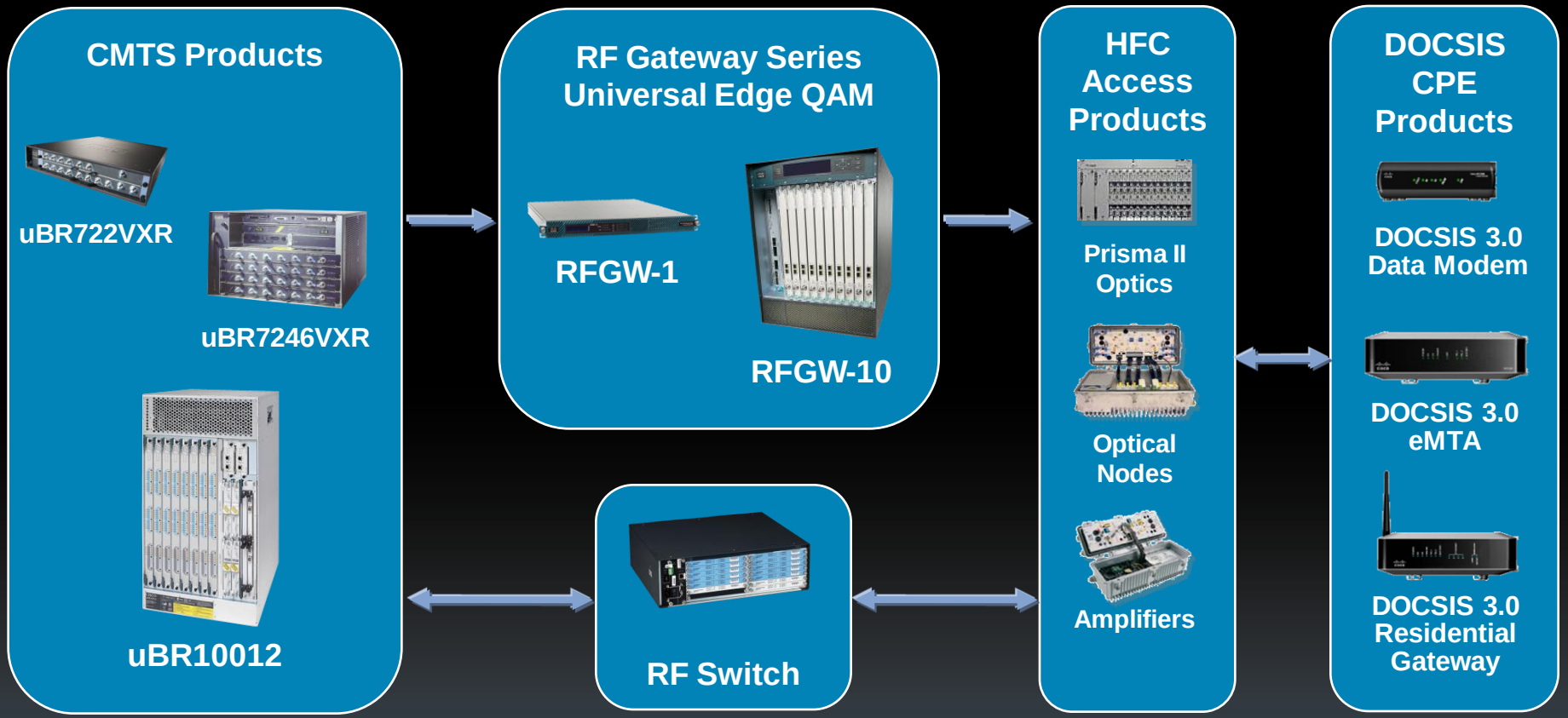
# End-to-End Cisco DOCSIS 3.0 Solution



# CMTS Product Portfolio

## uBR7225VXR

- 1M pps
- Up to 16 DS and 16 US channels per chassis
- I-CMTS
- Full DOCSIS® 3.0

## uBR7246VXR

- 1M pps
- Up to 32 DS and 32 US channels per chassis
- I-CMTS
- Full DOCSIS® 3.0

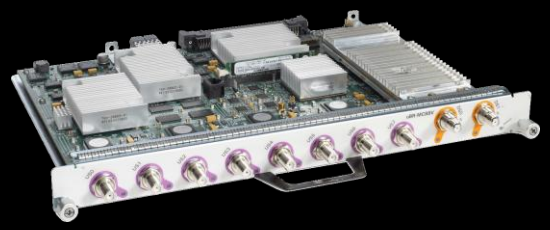
## uBR10012

- 10M pps
- Carrier Class
- Up to 576 DOCSIS DS and 480 US channels per chassis
- I-CMTS & M-CMTS
- Full DOCSIS® 3.0

# CMTS Product Portfolio

## uBR-MC88U Line Card

Extending uBR7200 Series to DOCSIS 3.0



**uBR-MC88V**

- Full DOCSIS 3.0 line card for uBR7200 Series
- 8 DS channels on 2 DS ports with 4-QAM stacking
- 8 US channels (8 US ports)
- Up to 2 line cards per uBR7225VXR chassis
- Up to 4 line cards per uBR7246VXR chassis
- 4x DS density of the MC28U line card
- Supported in 12.2(33)SCD and later

# CMTS Product Portfolio

## uBR7225VXR

- 1M pps
- Up to 16 DS and 16 US channels per chassis
- I-CMTS
- Full DOCSIS® 3.0

## uBR7246VXR

- 1M pps
- Up to 32 DS and 32 US channels per chassis
- I-CMTS
- Full DOCSIS® 3.0

## uBR10012

- 10M pps
- Carrier Class
- Up to 576 DOCSIS DS and 480 US channels per chassis
- I-CMTS & M-CMTS
- Full DOCSIS® 3.0

# CMTS Product Portfolio

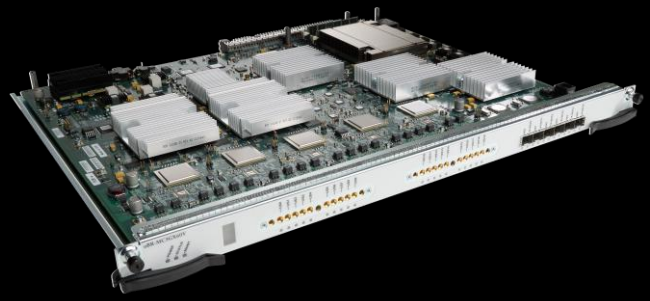
## Wideband Downstream SPA Module

**SPA-24XDS-SFP SPA Module In 10000-SIP-600 Carrier Card**

- Most widely deployed EuroDOCSIS 3.0 Downstream Channel Bonding solution
- 20 EuroDOCSIS downstream channels per SPA Module
- SPA Modules hosted by SIP-600 carrier card in WAN slot
- Up to 6 SPA Modules per uBR10012 chassis provide 120 EuroDOCSIS downstream channel capacity
- Backward compatible with EuroDOCSIS 1.x/2.0
- M-CMTS architecture works with external EQAM

# CMTS Product Portfolio

## uBR-MC3GX60V Line Card



uBR-MC3GX60V

- Industry-leading EuroDOCSIS 3.0 Scalability
- UP to ~480 EuroDOCSIS DS and 480 US per uBR10012 chassis
- 10X the downstream channel capacity of DOCSIS 2.0 solution
- 1 Gbps DS speed with ~20 channel bonding -- 20X the speed of DOCSIS 2.0 solution
- High channel capacity enables lower cost per channel
- Greater capex control with Cisco software licensing
- N+1 Redundancy provides carrier-class availability
- Supported in 12.2(33)SCE and later

# CMTS Product Portfolio

## uBR-MC20X20V Line Card

Full DOCSIS 3.0 Solution
for uBR10012

uBR-MC20X20V

- Full EuroDOCSIS 3.0 line card for uBR10012 CMTS
- 20 DS channels on 5 RF ports with 4-QAM stacking
- 20 US channels (20 US ports)
- Up to 160 DS channels and 160 US channels per CMTS
- Up to 280 EuroDOCSIS DS channels per CMTS when used with Wideband SPA
- Same RF connectivity as MC5X20 for ease of deployment
- Full High Availability support
- Greater capex control with Cisco software licensing of DS channels
- Supported in 12.2(33)SCC and later

# CMTS Product Portfolio

## uBR7225VXR

- 1M pps
- Up to 16 DS and 16 US channels per chassis
- I-CMTS
- Full DOCSIS® 3.0

## uBR7246VXR

- 1M pps
- Up to 32 DS and 32 US channels per chassis
- I-CMTS
- Full DOCSIS® 3.0

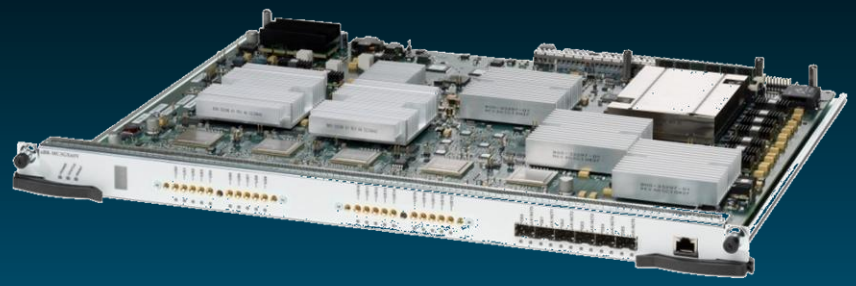
## uBR10012

- 10M pps
- Carrier Class
- Up to 576 DOCSIS DS and 480 US channels per chassis
- I-CMTS & M-CMTS
- Full DOCSIS® 3.0

**Common DOCSIS & IOS Software Features**

# uBR-MC3GX60V Line Card Overview

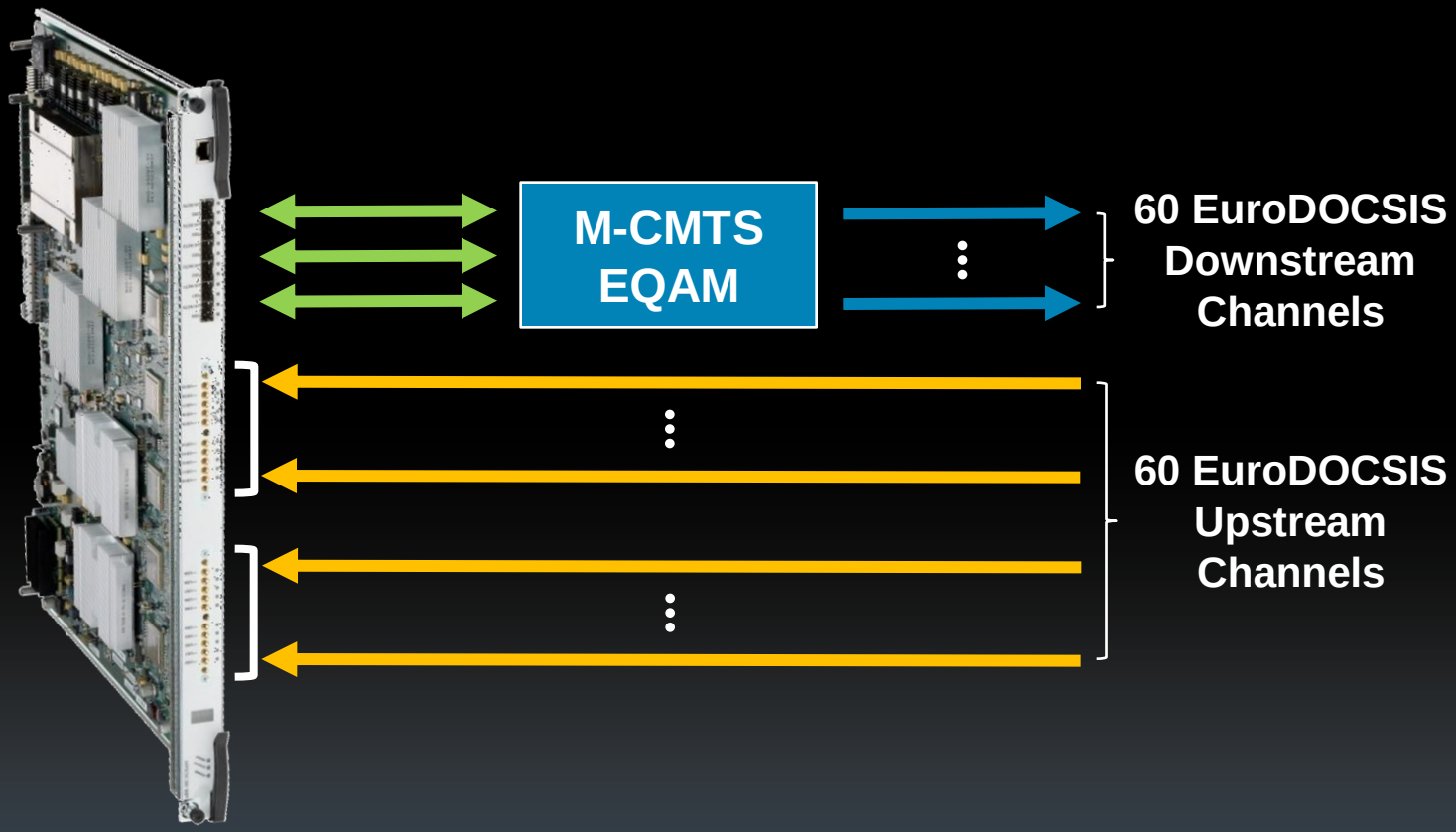
- Full DOCSIS 3.0 & M-CMTS Features
- 72 Downstream Channels (Annex B)
- 60 Downstream Channels (Annex A)
  - 54 DS Channels @ line rate
- 3x3 GigE ports for connectivity to external M-CMTS Edge QAM
- 60 Upstream Channels
  - 20 US ports; up to 12 US channels per port
  - 5-85 MHz US frequency range
- Up to 8 MC3G60V Line Cards per uBR10012 Chassis
  - Up to 576/480 (Annex B/A) DS and 480 US channels per chassis



**uBR-MC3GX60V**

- Software Licensing for Downstream and Upstream Channels
  - Minimum 16x16 configuration
- DEPI Control Plane
- N+1 Linecard Redundancy
- Shipping since October 2010

# 3G60 Connectivity to HFC Network



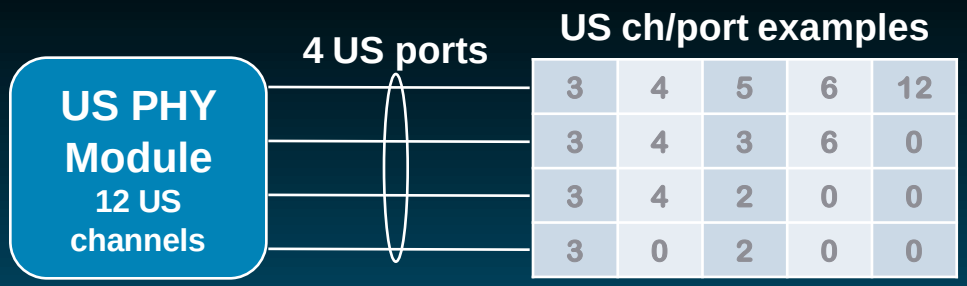
# Audience Poll

**On a scale of one to five;**

**Please rank the OpEx impact of inserting new CMTS line-cards and re-cabling due to continuous capacity expansions.**

A. 1 [lowest]
B. 2
C. 3
D. 4
E. 5 [highest]

# uBR-MC3GX60V Line Card
## *High Level Design Considerations*




US ch/port examples

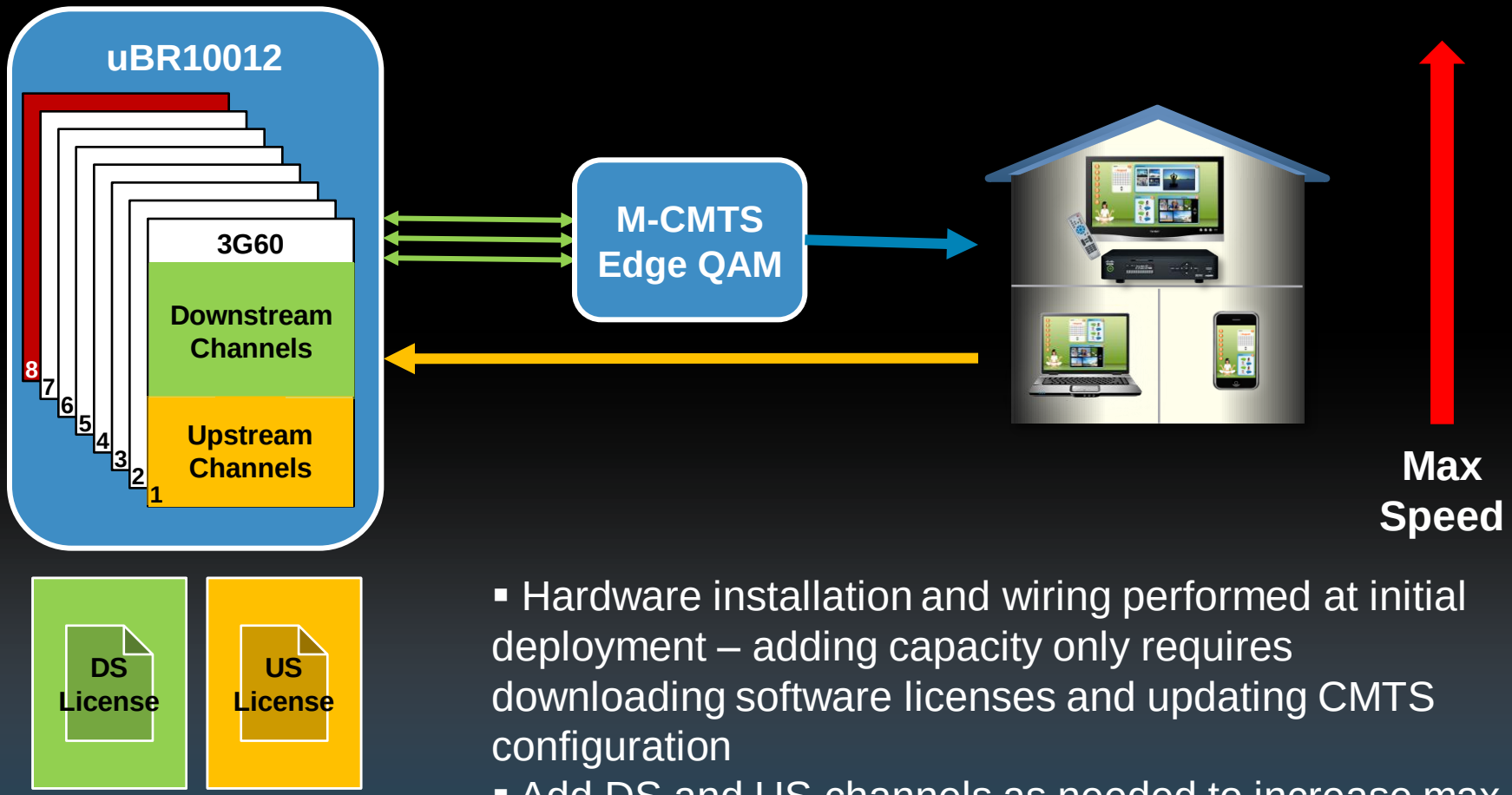
| | | | | |
|---|---|---|---|---|
| 3 | 4 | 5 | 6 | 12 |
| 3 | 4 | 3 | 6 | 0 |
| 3 | 4 | 2 | 0 | 0 |
| 3 | 0 | 2 | 0 | 0 |


- 5 US PHY modules per 3G60
- 12 US channels stackable across 4 connectors per module
- Configurable from 1-12 US per port
- 2 logical channels per US receiver
- 8 US's per MAC domain
- Any upstream can be assigned to any MAC domain
- 15 MAC domains per 3G60

- Flexible downstream bonding group overlay topologies supported
- WAN options include 5x1GE and 1x10GE SPAs
- PRE4 required with 3G60

# Scaling a DOCSIS 3.0 Network with 3G60

## Strategic Planning can reduce Capex and Opex




- Hardware installation and wiring performed at initial deployment – adding capacity only requires downloading software licenses and updating CMTS configuration
- Add DS and US channels as needed to increase max speed and/or average rate per user

# uBR-MC3GX60V Key Features

## Scalable

**Industry-leading DOCSIS 3.0 Scalability**

- Up to 576/480 (Annex B/A) downstream channels – 24 Gbps DOCSIS DS Connectivity per uBR10012 chassis
- Up to  480 upstream channels – 14.4 Gbps DOCSIS US Connectivity per uBR10012 chassis
- 10X the downstream channel capacity of DOCSIS 2.0 solution

# uBR-MC3GX60V Key Features

## Faster

**Faster & More Reliable Broadband Services**

- Up to 1 Gbps downstream speed with 24/20-channel bonding (Annex B/A)
- Up to 100 Mbps upstream speed with 4-channel bonding
- 20X the speed of DOCSIS 2.0 solution

# uBR-MC3GX60V Key Features

## Cost-effective

**Most Cost-effective CMTS Architecture**

High channel capacity enables lower cost per channel

Modular design leverages low-cost Edge QAM

Substantial reduction in cost compared to DOCSIS 2.0 solution

# Agenda

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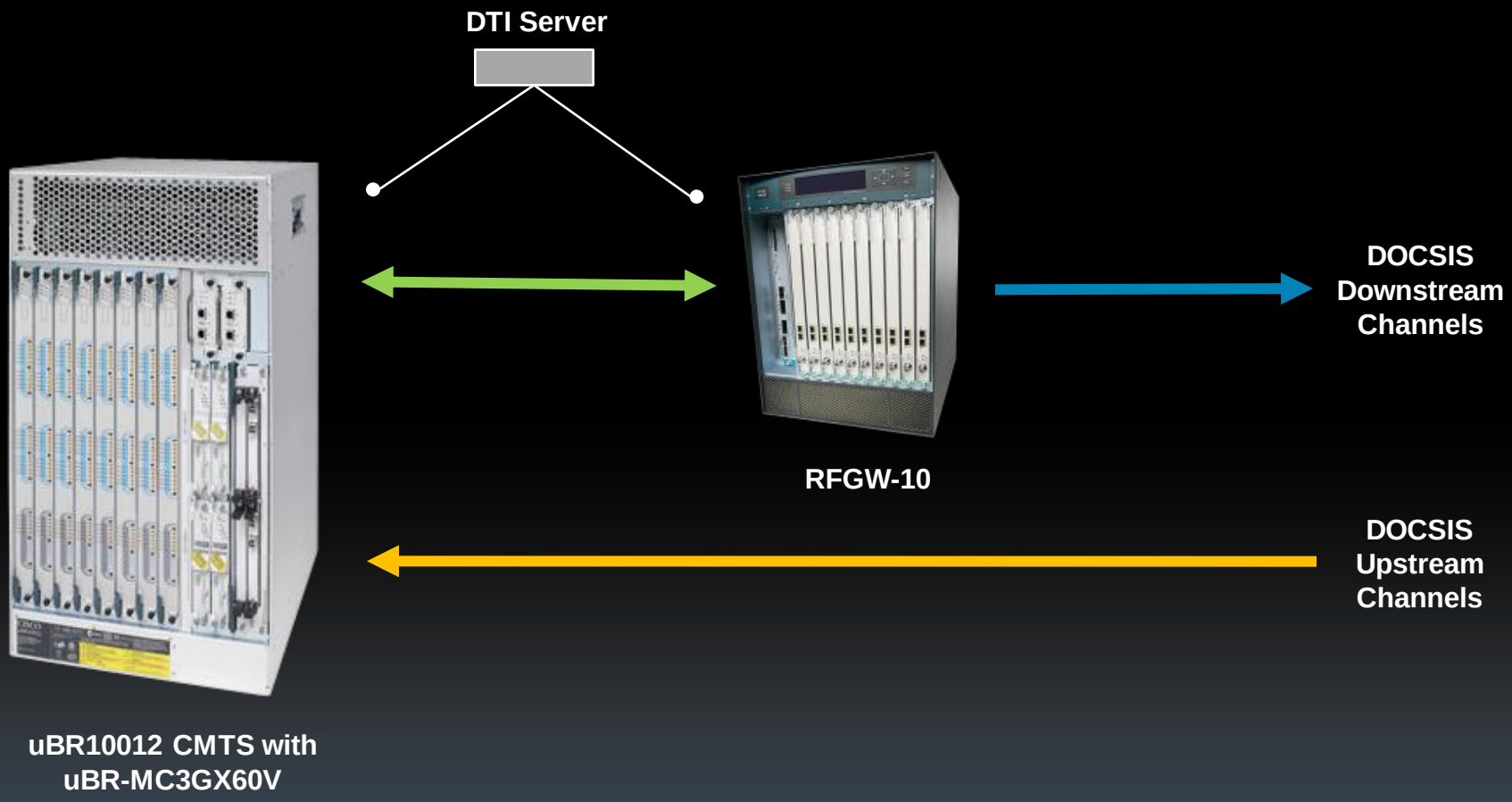
# Audience Poll

**What is the timeframe you expect for full IP convergence (IP Video)?**

A. 2 years
B. 3 years
C. 4 years
D. Distant future

# M-CMTS Architecture

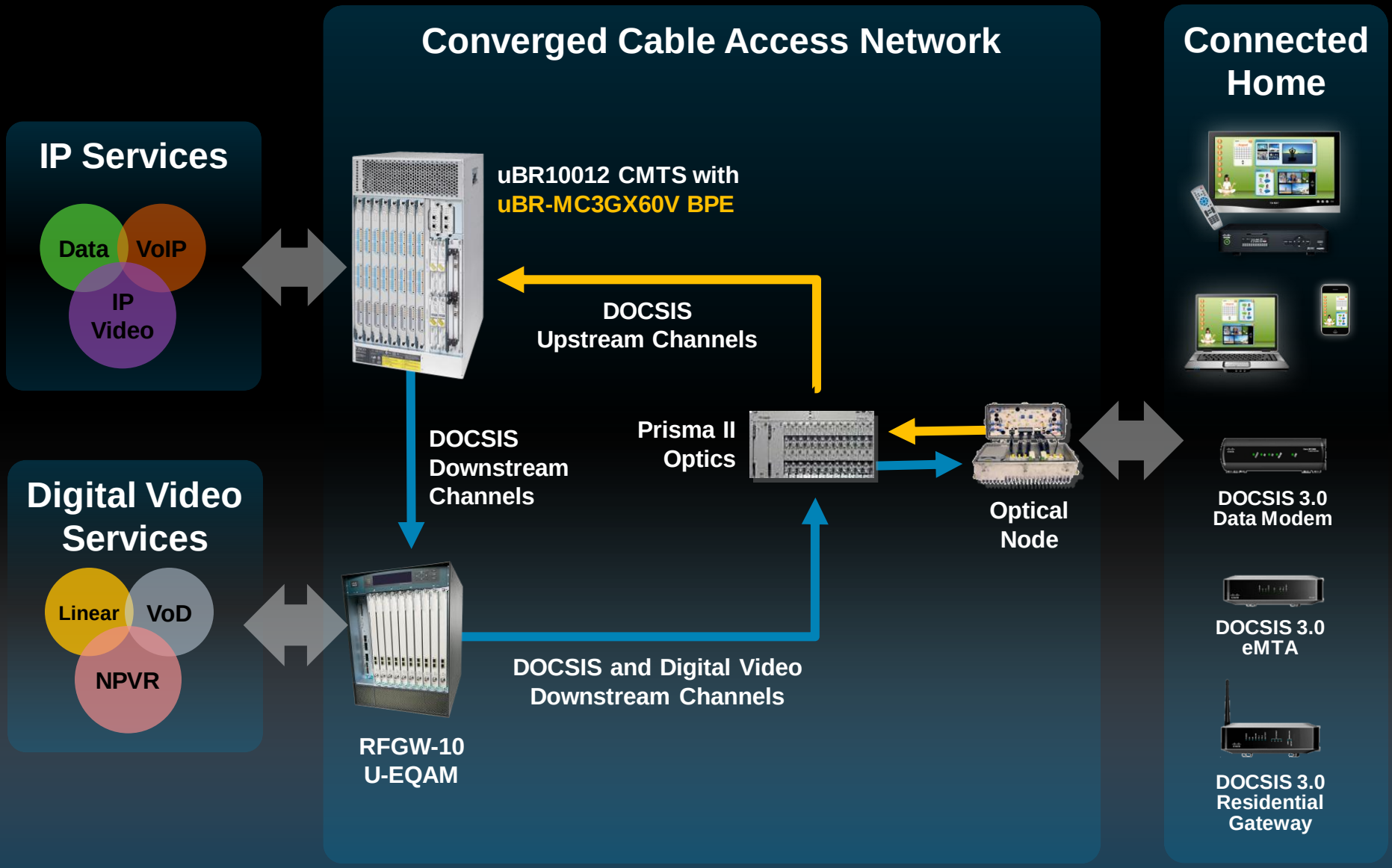



**M-CMTS architecture specified by CableLabs**

# Benefits of M-CMTS

- **Massively scale the CMTS**
  - Exporting DS PHY enables greater DS density on CMTS
  - Substantially reduces cost per bit for all IP services
- **Utilize high-density, low-cost Universal Edge QAMs**
  - Stack more QAM channels per RF port
  - Lower the capex and opex for all services
- **Protect investment in digital video QAM capacity**
  - Repurpose as DOCSIS QAMs in migration to all-IP

# Cisco Multi-Service Cable Solution



# Cisco Multiservice Cable Solution

## Helping Cable Operators Transform Consumer Experiences

### Scaled Service Delivery

### Deliver More Services to More Subscribers

- Provides Industry-leading DOCSIS 3.0 and universal edge QAM scalability
- Deliver 500 HDTV channels, VoD and ultra-broadband services to 20,000 homes
- Industry's lowest cost per bit for IP services

### Efficient Convergence

### Converge All Services with Universal Edge QAM

**IP video, digital video, voice, data**

- Support IP and digital video services on single QAM platform…reduces cost for all services
- Deploy DOCSIS 3.0 capacity that can leverage high-density edge QAM…no need to wait for next-generation CMTS
- Green-friendly solution reduces environmental overhead for all services

### Seamless Migration

### Seamless Migration to an all IP Network

- Add DOCSIS and digital video capacity as needed to keep pace with customer demands
- Simply repurpose digital video QAMs to DOCSIS QAMs via configuration change for easy migration to all-IP

# Audience Poll

**What top speed do you expect to offer in 2013?**

A. 100 Mbps
B. 200 Mbps
C. 400 Mbps
D. 500+ Mbps

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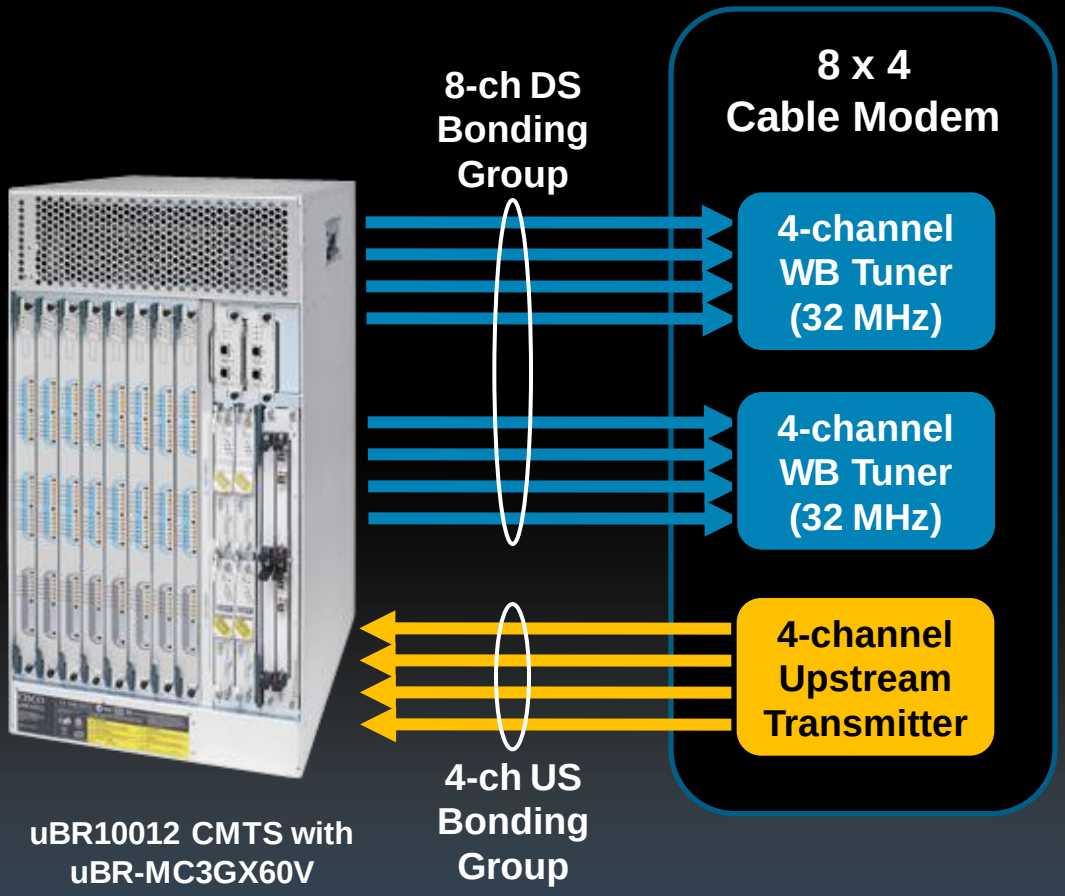
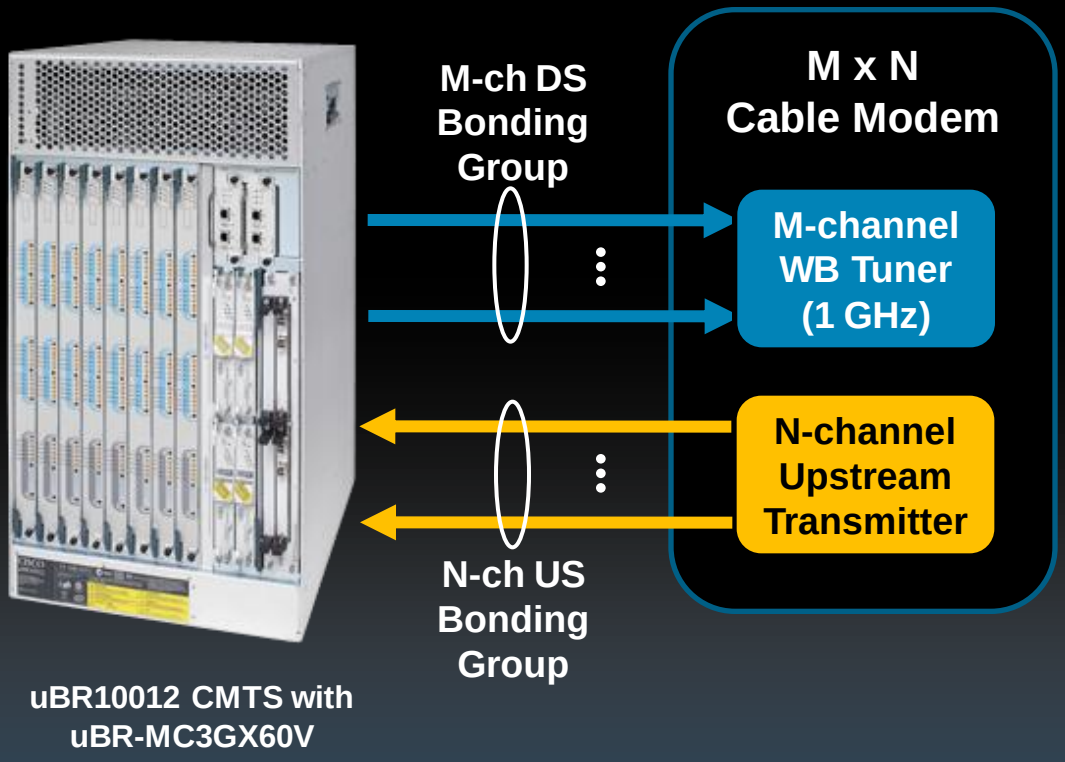
# DOCSIS 3.0 Channel Bonding - Today




- Up to 400 Mbps DS speed with 8-channel bonding (DOCSIS)*
- Each set of 4 DS channels must be within 32 MHz tuning range
- DS frequency blocks can be contiguous or split
- Up to 120 Mbps US speed with 4-ch bonding*

*Theoretical limit

# DOCSIS 3.0 Channel Bonding - Future




- 3G60 supports 24+ DS channel bonding
- Up to 1 Gbps DS speed with 24-ch bonding (DOCSIS)
- With full-spectrum tuner DS channels can operate at any frequency up to 1 GHz
- 100+ Mbps US speed with 4 or more US channels per bonding group operating at up to 85 MHz

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# Audience Poll

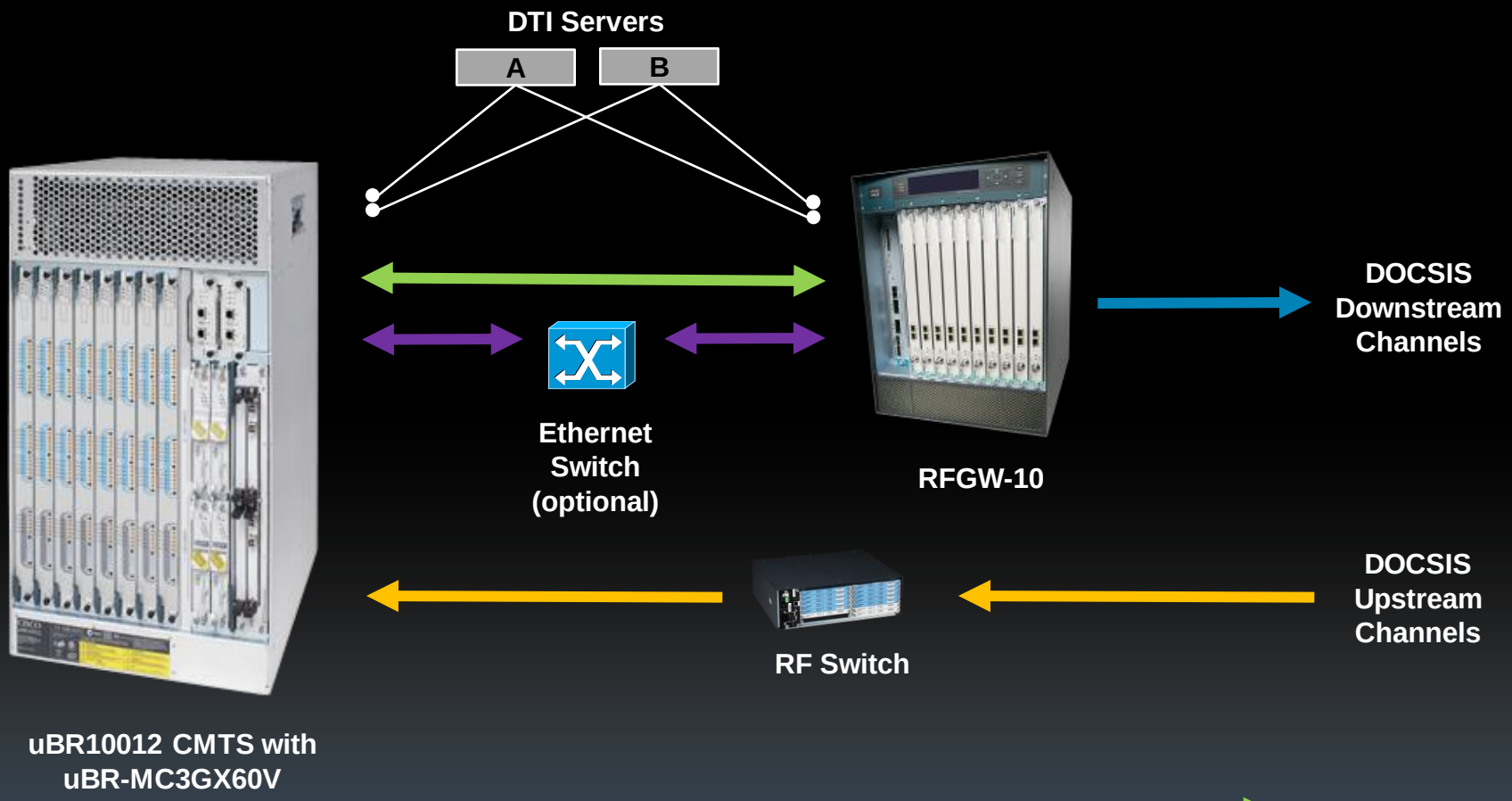
**In a fully converged network, how important do you rate High Availability for the access solutions?**

A. 1 [lowest]
B. 2
C. 3
D. 4
E. 5 [highest]

# M-CMTS Solution Redundancy

- uBR10012
  - 1+1 system component redundancy
  - N+1 line card redundancy (with external RF Switch for upstreams)
  - GigE port/link redundancy from 3G60 line card to RFGW-10
  - WAN and DTI port/link redundancy
- RFGW-10
  - 1+1 system component redundancy
  - N+1 QAM card redundancy
  - Integrated RF switch
  - WAN and DTI port/link redundancy
- DTI Server
  - Chassis and port/link redundancy options available

# Fully Redundant M-CMTS Solution




Note: Use of redundant GigE links and Ethernet Switch between 3G60 and RFGW-10 is optional; N+1 line card redundancy provides protection in the event of primary GigE link loss without redundant GigE links

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# Summary

- Consumer broadband consumption will continue to grow at a high rate with innovation in video technologies and applications
- Cisco uBR10012 with 3G60 offers industry-leading scalability so cable operators can keep pace with broadband consumption
- 3G60 enables faster speeds as a competitive advantage over DSL
- Modular CMTS solution drives down costs for all services
- Cable operators can invest in their DOCSIS 3.0 and digital video networks today and migrate to all-IP tomorrow

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# Resources

- Cable High Speed Solutions/DOCSIS 3.0

  http://www.cisco.com/en/US/netsol/ns3/networking_solutions_solution_category.html

- Cisco uBR10012 CMTS

  http://www.cisco.com/en/US/products/hw/cable/ps2209/index.html

- Cisco MC3GX60V

  http://www.cisco.com/en/US/products/ps11291/index.html