TIME WARNER CABLE

DOCSIS 3.0

SCTE Rocky Mountain Chapter Meeting

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A Short Disclaimer

During today's presentations, we will be discussing features of DOCSIS 3.0 that will be beneficial to customers and cable operators in the future.

These are examples for discussion only, and specifically do NOT represent any plans for services or products from Time Warner Cable or any other cable operator.

We encourage comments and suggestions, but we will NOT be able to make any announcements or commitments.

Brief History of HSD

1985: Institutional Networks – Franchise Wars
- T1 point-to-point (1.5 Mbps)
- Packet switched networks @ 19.2 kbps

1994: First residential service
- WWW, ISPs (AOL, Prodigy), e-mail, e-commerce

1996: Legacy service becomes widespread
- Motorola, Toshiba, Hybrid Networks (10/2 Mbps up/down)

1996: DOCSIS Project begins at CableLabs

1999: First DOCSIS 1.0 equipment Certified
- Best-effort, modest security. (40/10)

2000: First DOCSIS 1.1 equipment available
- Added true D-QOS and better encryption

2002: First DOCSIS 2.0 equipment Certified.
- More aggressive and robust upstream modulation (40/30)
- TWC never really deployed this version on a large scale

2008: DOCSIS 3.0 becomes available

How We Got to 3.0

Why such a big time gap between 2.0 and 3.0 ?

- **After the 2.0 spec was done, we –**
  - **Continued work on PacketCable MultiMedia**
  - **Completed NGNA spec with Comcast & Cox**
    - **Next Generation Network Architecture**
      - **Basically this was the modular CMTS to reduce cost**
  - **Defined e-DOCSIS which became DSG**
    - **DOCSIS Signaling Gateway for OpenCable devices**
  - **Debated the value of 2.0+ (3.0 Lite) for RNG boxes**
- **3.0 is VERY complicated because of bonding**
  - **And IPv6 isn't trivial either**

What's New in 3.0 ?

Kitchen Sink !

What's New in 3.0 ?

The Four Main Benefits

- Channel bonding for >> 100 Mbps service
- Modular CMTS (M-CMTS) to reduce the cost per bit
  - And to add significant flexibility to future deployments
- IPv6 Addressing
- AES Encryption

- (And a bunch of new management and diagnostic stuff)
  - Like IPDR, for example

Channel Bonding

Important: it's fully backward-compatible

- **Additional upstream and downstream channels**
  - **"Glued" together for higher aggregate speed**
  - **And obviously, higher aggregate capacity**
  - **Can be deployed incrementally**
  - **4D/4U = 150 Mbps down, 120 Mbps up**
  - **Essentially no upper limit to how many channels**
    - **But, HFC sub-split effectively limits upstream #**
- **Existing 1.1 & 2.0 modems can share these channels**
  - **With no negative impact**

Channel Bonding

To put this another way:

A: One customer can do something 4x as fast, or

B: Four customers can do the same thing just as fast

- **(as one does now)**

- **Realistically, for residential customers –**
  - **It's much more like # B**
  - **Internet servers just don't push out bits THAT fast**
  - **So, "maximum data rate" is basically marketing**
- **But, for Commercial Customers, speed wins**
- **Of course, as time goes on ……**

True Wideband Communication

With 100 Mbps service:

- Multichannel HDTV Streaming
  - To multiple clients in the home
- HDTV downloads at 10x real-time
  - BluRay DVD movie in ~ 10 minutes
- HD quality upstream in real time
  - For next-level User-generated content
    - "YouTube" that you can actually stand to watch

Competitive Business Services

With 100 Mbps service:

- DS-3 Equivalent Speeds
- Facilitates Multi-line Commercial Voice Service
  - Including “Centrex” features
  - High-quality video conferencing
  - Remote training
  - Off-site backups
  - Many others

It Speaks TCP/IP

- Many current sources of On-demand content are already on IP servers.
- IPTV can mean Linear Television on the PC
- But, it can also mean Internet Video on the TV
- A LOT more users watch TV on the TV than on a PC.
- Error-free protocol –
  - No more video or audio glitches

And Our DVR Boxes Listen

- Modern cable set top boxes have DOCSIS embedded (DSG).
- We can either send content via MPEG QAM
  - For linear TV, including Switched Digital Video
    - Which in itself is a form of “on demand”
- Or we can send it via TCP/IP
  - For narrowcast internet video
- In this manner, there’s almost no limit to simultaneous use.
- Watch one, record a couple, download a bunch
  - At the same time via the same “box”

Speed or Capacity ?

Speed Facilitates:

- **Legitimate long-form content downloads fast !**
- **Network backups and storage**
- **Sending User-generated content**
  - **Affordable HD camcorders, for example**
- **Downloading “Demo” software applications**
  - **Some >> 1 GB**
- **Statistical advantage of speed with large packets**
  - **Less contention if job gets done quickly**

Speed or Capacity ?

Capacity Facilitates:

- **Explosive growth in consumption**
  - **Even among “normal” users**
- **Mainstream media adding Web presence**
  - **Magazines with “Bonus Internet Content”**
  - **Short-form video from commercial News sites**
  - **Did you miss an episode of “Lost ?”**
  - **Want to see a Superbowl commercial again?**
  - **Learn more about dinosaurs ?**
- **Social networking is here to stay**
  - **And it’s not just typed blogs**

Speed or Capacity ?

Capacity Facilitates:

- **Frequent updates of computer software**
  - **Vista, virus definitions, Flight Simulator**
- **On-line multiplayer games**
- **Consumer electronics products**
  - **BRD & HD-DVD essentially require access**
- **Home security monitoring**
- **Web cams built into laptops**
  - **Slingbox remote viewing**
- **Too many to fit on this slide**

What Will 3.0 Enable ?

- Maybe it's a mistake to think of Wideband as enabling a single high-data-rate service, or a "few" prominent things simultaneously.
  - Like watch & record HD-IPTV
- Rather, it's a large collection of modest rate "bits" that are happening all of the time.
  - Some in the foreground, and thus customer-facing
  - Some in the background, unknown to the user
    - Like monitored home security & telemetry
  - And we take advantage of the wide pipe and statistical multiplexing to insure that all of these work well, all of the time.

AES -- Privacy Protected !

With AES Encryption:

- 21st Century security keeps ALL content safe
- (Even though the current and previous versions haven't been broken)
- Removes concerns about eavesdropping
  - Especially for Commercial Accounts
  - SOHO, SMB
  - Government contracts require this
- Content owners like it
- Assures the longevity of next-generation equipment

IPv6 Addressing

Courtesy of Leslie Ellis – used with permission

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Content Tailored to Client

With IPv6 Addressing:

- We can know the capability of the client device
  - No wasted bits sent to “small” displays
- Static IP addresses solve numerous problems
  - For both the provider AND user
- Potential for more granular Digital Rights Management
  - Which could mean wider availability of some content

Never Re-map IP Addresses Again

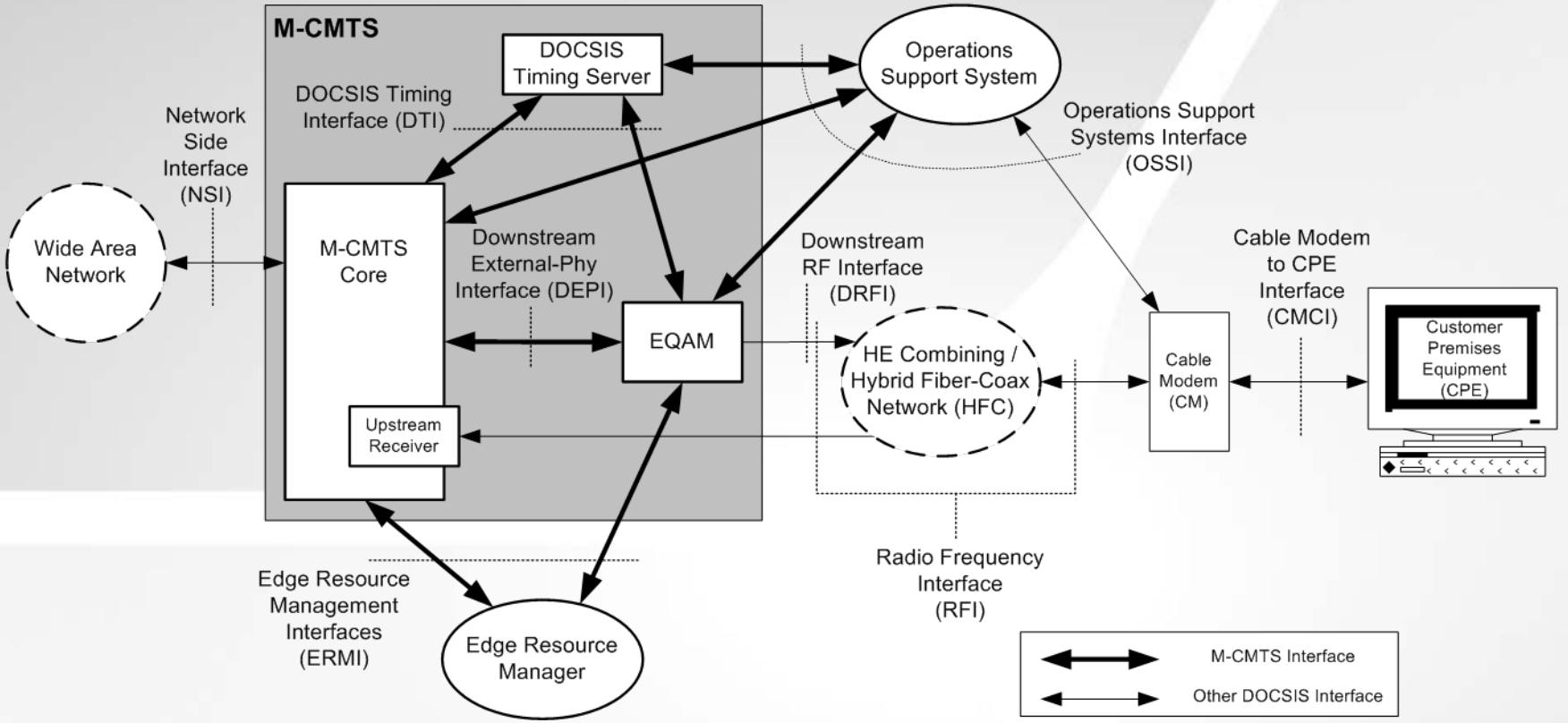
- Managing IP addresses is a real chore
  - Substantial staff needed
  - Disruptive to customers
  - Especially those that have Internet Cams
    - Or servers at home
- The HUGE number of addresses in v6 –
  - Means that every grain of sand on every beach could have its own, permanent IP address. Literally!

Flexible CMTS Architecture

A Modular CMTS:

- Edge QAMs can be “service agnostic”
  - Used for data, or for TV (or even IPTV)
  - Eliminates need to know the “mix” now
- Originally part of NGNA
  - Adopted by DOCSIS 3.0
  - But not required
- Already have dramatic QAM cost reduction

Modular CMTS Architecture



Courtesy of CableLabs – used with permission

Expanded Management

We added quite a few “utilities” to assist with management of the CMTS, modems and customers.

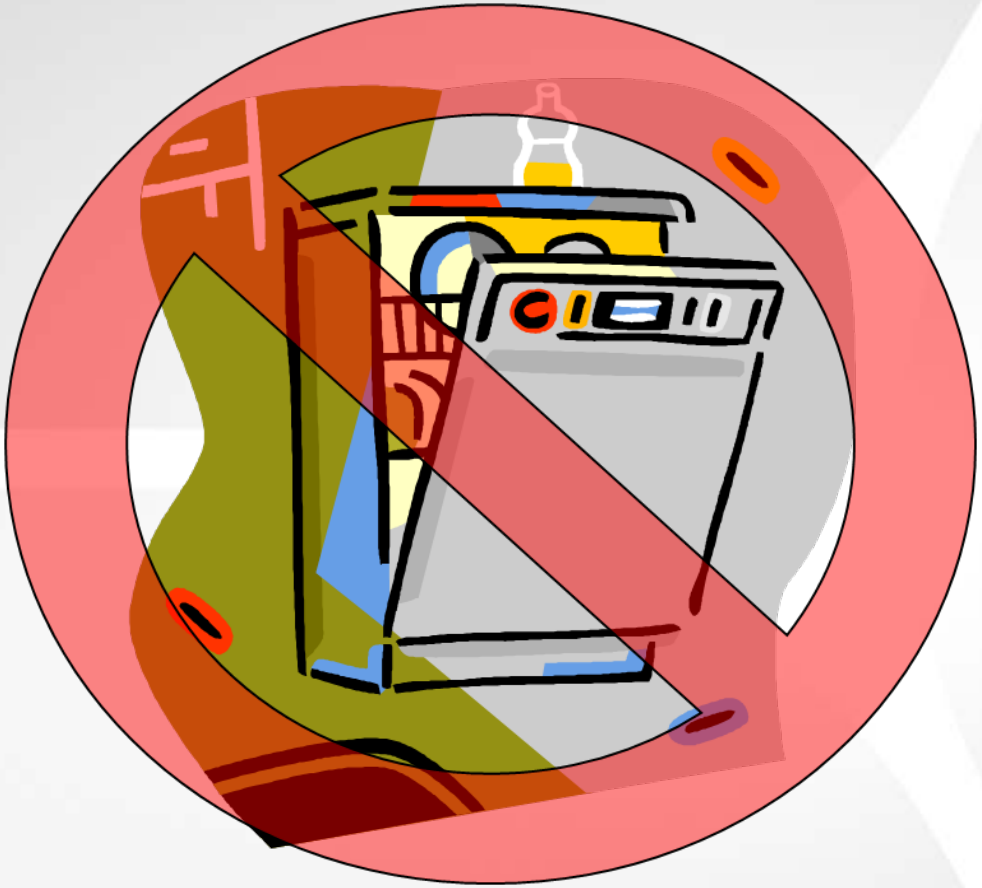
- IPDR – Internet Protocol Detail Record
  - Useful for consumption billing, byte caps
  - Was possible with previous versions, but better now
- Remote diagnostics
  - For facilitating customer service and repair
  - Signal quality monitoring is an important example

Expanded Bandwidth

- Downstream tuning range extended to 1 GHz
  - Implementation is optional, but expected
- Upstream “band” extended to permit Mid-split
  - From normal 5-42 MHz to 5-85 MHz.
  - Effectively doubles available upstream

What's NOT in 3.0 ?

But not everything we could think of ---



What's NOT in 3.0 ?

- **M-CMTS is NOT required !**
  - iCMTS is still allowed
  - In fact, one could make a 2.0 M-CMTS
  - The first 3.0 CMTS Qualified was an iCMTS
- No new modulation schemes
  - All modulation profiles are the same as 2.0
- No requirements on operators to bond
  - A 3.0 CMTS can still use 1 up, 1 down
  - Additional channels may be added as needed

DOCSIS 3.0 “Phases”

- Modems DO require 4x4 to be Certified
  - As a minimum. Some will do 8x4 initially.
- However, a CMTS may be Qualified in “Phases”
  - Bronze: IPv6, downstream bonding
  - Silver: Adds upstream bonding, AES, IPDR
  - Full (Gold): Adds everything else
    - Specifically, SCDMA bonding, some multicast and IPDR enhancements
- DSG (A-DSG) updated to allow 3.0
  - But A-DSG does NOT require 3.0 silicon

3.0 Certification Status

- As of today: *
- 9 DOCSIS 3.0 modems from 7 vendors
  - 3 DOCSIS 3.0 eMTAs (a modem with integral voice circuits)
  - 8 3.0 CMTS, broken down as follows –
    - 5 Bronze
    - 1 Silver
    - 2 Full
  - We expect many more to be submitted before the end of the year.

* A current list of all Certified and Qualified products is always available in the Public area of CableLabs' web site:
  - http://www.cablelabs.com/certqual/lists/certqual_ie.html

How 3.0 Might Benefit Other CableLabs Projects

- PacketCable:
  - High quality voice
  - Streaming video to IP CE devices
- Tru2Way (Open Cable)
  - DSG is required in these CE devices
  - Could facilitate delivery of content
- Our Next-generation Set Top Boxes
  - Again, via DSG, delivery of IPTV?
  - Enhanced Guide utilities
    - Such as live preview

FAQs About DOCSIS

- **Will there be a DOCSIS 4.0 ?**
  - Probably
- **When ?**
  - Unknown, we've only just started talking about it
- **What might it include ?**
  - More aggressive modulation: 1024/256 QAM down/up
  - Advanced MAC – optimized for streaming services
  - DIBA (DOCSIS IPTV Bypass Architecture)
    - Saves cost because it bypasses CMTS for IPTV
  - Optical DOCSIS – for fiber to the home
  - Chocolate cake delivered via HFC

Questions? Discussion ?

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