About CableLabs

• Founded in 1988
• Non-profit R&D consortium dedicated to pursuing innovative cable telecommunications technologies
• Headquartered in Louisville CO
• New innovation lab in Silicon Valley
• ~ 175 employees (+ ~ 100 contributing engineers)
• Nearly 40 cable operator members worldwide
  o U.S., Canada, Mexico, Europe, Asia
  o Represents nearly 85 M subscribers
## Diversity of Cable Devices & Functionality

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD DVR STB</td>
<td>Provides linear TV (both SD &amp; HD), DVR, VoD, and optionally may be a server for multi-room DVR</td>
</tr>
<tr>
<td>HD STB</td>
<td>Provides linear TV (both SD &amp; HD), VoD, and optionally may be a client for multi-room DVR</td>
</tr>
<tr>
<td>DTA STB</td>
<td>Provides linear TV (SD &amp; HD) only</td>
</tr>
</tbody>
</table>

Small network devices:
- Cable Modem provides High Speed Data (HSD) service
- Media Terminal Adaptor provides digital phone service and optionally HSD
- Gateway provides HSD, home networking, and digital phone service
Historic Energy Reductions In Cable STBs

<table>
<thead>
<tr>
<th>Device</th>
<th>2002 (Watts)</th>
<th>2011 (Watts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refrigerator</td>
<td>59.5</td>
<td>51.5</td>
</tr>
<tr>
<td>HD-DVR</td>
<td>43.5</td>
<td>23</td>
</tr>
<tr>
<td>HD STB</td>
<td>30</td>
<td>14.6</td>
</tr>
<tr>
<td>SD STB</td>
<td>20</td>
<td>12.7</td>
</tr>
<tr>
<td>DTA</td>
<td>3.85</td>
<td></td>
</tr>
</tbody>
</table>
Cable Network Overview

Continuous flow of:
- TV programming
- EPG data (except to DTAs)
- System Information
- Software updates
- Subscriber Entitlements

STBs in home must constantly monitor this information to respond to changes correctly.

Two-way IP network for HSD & digital phone.

Not a typical Cable Home
Industry Voluntary Agreement

- Signed December 6, 2012
- 15 Signatories, including
  - Cable
  - Satellite
  - Telco
  - Manufacturers
- Light sleep
- 90% of new STBs will meet or exceed ESv3 metrics
- Whole-home DVR
- Field trial deeper sleep modes, deploy if successful
- Independent Administrator
VA Signatories
Light Sleep

- Deployed on many existing STBs today
- Spin down hard disks, in-band tuners, video outputs
- Auto Power Down
Benefits to the Voluntary Agreement

• Increased energy efficiency (and savings)
  o Retrofitting deployed STBs not just new STBs
• Doesn’t stifle innovation and creativity
• Faster adoption and deployment
• Annual review for improvement
  o Consider new products
  o Consider new efficiencies
• Save US$1.5 Billion Annually
  o (4+ Power Plants)
CableLabs Energy Lab

- Energy tracking program for measuring and reporting energy consumption of new set-top boxes
- Test and development facility for designers of energy efficient software and hardware
- Create energy efficiency specifications for semiconductor and hardware suppliers and the network operations systems that support cable devices
“Network Standby” for Cable Modems

- “Active mode” energy consumption is already proportional to throughput
- “Sleep modes” are not feasible or appropriate for cable modem technology due to network architecture, functional role, and service expectations
- “Idle modes” may be appropriate to reduce quiescent power
  - Trade-off network performance for energy savings
  - Challenges created by resume time expectations and by “chatty” end-use appliances
Cable Modem “Idle Modes”

- **DOCSIS 3.0 “1x1 Mode”**
  - Defines requirements for cable modems to automatically enter a lower power state that preserves network connectivity at a performance level equivalent to DOCSIS 2.0 equipment.

- **DOCSIS 3.1**
  - Specification development underway
  - Energy management considered a core component
CableLabs Specifications
Engineering Changes

• DOCSIS 1x1 Mode
  o Protocol interface
  o Management and reporting

• CableCARD startup times

• tru2way® Host update to notify eCM when going into sleep mode
Additional Approaches

- More efficient digital tuners and use of DTAs
- Continued SoC (System on a Chip) integrations
- Improved home networking and “whole-home” technology development and deployment
- IP video delivery to devices such as tablets, smart TVs, game consoles
- Service provider applications in the cloud
- Network-based DVR
Thank You

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