DPoE™, DPoG™, and other PON Activities

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## Access Networks for Business Services

- Motivation for PON access networks

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<tr>
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<th>DOCSIS</th>
<th>PON</th>
<th>P2P Fiber</th>
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<tbody>
<tr>
<td>Latency</td>
<td>Poor</td>
<td>Good</td>
<td>Great</td>
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<tr>
<td>Jitter</td>
<td>Poor</td>
<td>Good</td>
<td>Great</td>
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<tr>
<td>Upstream bandwidth</td>
<td>Poor</td>
<td>Great</td>
<td>Great</td>
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<tr>
<td>Downstream bandwidth</td>
<td>Good</td>
<td>Great</td>
<td>Great</td>
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<tr>
<td>Symmetric</td>
<td>Poor</td>
<td>Great</td>
<td>Great</td>
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<td>Cost</td>
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<tr>
<td>SLA Enforcement</td>
<td>Poor</td>
<td>Great</td>
<td>Great</td>
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DOCSIS Provisioning of EPON (DPoE™)

- Brings the mature systems and business processes of the DOCSIS OSS to EPON access networks
- Enables full vendor/equipment interoperability – similar to CMTS and Cable Modems
- Leverages existing technical and customer care knowledge base, systems, and processes
- Developed by MSOs, CableLabs, and vendors
DPoE Specifications

• Version 1.0

• Version 2.0

• Extensions to v2.0 are being discussed with more focus on residential
DPoE Architecture

- Each registered ONU has a corresponding virtual cable modem (vCM) which acts as an IP proxy for the ONU
- vCM then configures/manages the ONU using extended OAM (eOAM)
Mapping DOCSIS Concepts to EPON

Ethernet interfaces are the same as in DOCSIS, including the concept of Cable Modem Interface Mask (CMIM).

Additional classification fields are defined for DPoE Networks due to layer 2 emphasis, but the concept remains the same.

LLIDs are similar to SIDs and are scheduled by the DPoE System for upstream transmission.

L2VPN spec used to define 802.1ad, 802.1ah tags and TPID translations.
2G-EPON

- 2 Gbps downstream was already “standardized” in Chinese specifications
- An Engineering Change (EC) to DPoE specs will specify the method in detail
DPoE Certification Testing

DPoE Specification Validation Continues

- DPoEv1.0 certification testing began in July 2012
- Five (5) ONUs, four (4) DPoE Systems successfully certified (so far)
- DPoEv2.0 Interop events to begin June, 2014
- DPoEv2.0 certification testing to begin Q42014
DPoE – Next Steps

• V2.0 Interop events in 2014
  – Interop #1 :: June, 2014
    • Improving chip diversity
    • 10G interop testing
    • Includes new IP(HSD) requirements
  – Interop #2 :: August, 2014 (??)
• V2.0 qualification testing
  – ~Q4 2014 or Q1 2015
DOCSIS Provisioning of GPON (DPoG)

Specifications for IP High Speed Data using GPON technology

- Comcast-lead effort converted DPoE specifications to support GPON
- Directly mirrors the DPoE requirements, except where underlying technologies differ, such as Logical Links versus GEM Ports
- DPoGv1.0 specifications support only IP High Speed Data (IP(HSD)) services for residential or business deployments
DPoG Architecture

- Each registered ONU has a corresponding virtual cable modem (vCM) which acts as an IP proxy for the ONU
- vCM then configures/manages the ONU using extended OAM (eOAM)
Mapping DOCSIS Concepts to GPON

- Ethernet interfaces are the same as in DOCSIS, including the concept of Cable Modem Interface Mask (CMIM).
- TCONTs and GEM ports replace LLID and SID.
- L2VPN spec used to define 802.1ad, 802.1ah tags and TPID translations.
- Service flows (a well-known DOCSIS concept) “carry” frames and are configured with a QoS.
- Extra classification fields are defined for DPOG Networks due to layer 2 emphasis, but the concept remains the same.
Common Architectures/Interfaces

Expanding Network Tool Chest

- DPoE/DPoG solutions look identical for a reason
  - For either flavor of PON to get deployed, they need to have the same northbound and southbound interfaces and functionality as back office requires
- DOCSIS provisioning today, NFV/SDN tomorrow
Two Parallel PON Activities

- Not the best scale
- Not the most efficient
- Still a lot to leverage!
What We Really Need…
Mission
To facilitate a single global passive optical network standard which meets the future needs of service providers worldwide
One Wireless

For the first time in ~20 years (since analog) mobile standards have converged into a single worldwide standard (LTE)

Resulting in a large device ecosystem with excellent economics and selection

*Courtesy Tim Burke – Liberty Global
One Wireless Pricing and Timing

Dongle Unit Price

CPE Dongle Prices (Volumes < 1 Mil.)

3G HSPA

WiMAX

LTE

LTE CPE costs dropping much faster than HSPA & WiMAX

*Courtesy Tim Burke – Liberty Global

CableLabs®
OnePON Progression

No overlap
Same PHY: Same wavelengths, power budgets, wavelength spacing
ONU Config & Management: Easy and extensible
Framing: Transporting only Ethernet frames, use Ethernet framing
MAC: Discovery, registration, bandwidth allocation
OnePON
Fiber Deep Strategy Map

- MSO strategies for pushing fiber deeper will vary depending on FTTH and IP video timelines, and of course, investment timeline
What’s Next?

Opportunities for Engagement

- **DPoE Specs**
  - ATP development and validation
  - DPoEv2.0 interoperability testing
  - DPoEv2.0 qualification testing

- **DPoG Specs**
  - DOCSIS PON IPR pool
  - Specification development
  - Interoperability testing

- **Fiber Deep**
  - Provisioning and management
  - SDN and virtualization applications
  - Fiber installation, connectors, prefab
  - Optical modulation improvements
  - Network topologies

- **OnePON™ Initiative**
  - Service provider / vendor meetings
  - Establish key tenets
  - Engage operators, SDOs