10GEPON
Co-Existence Alternatives

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Issues

- Assumptions
- US Alternatives
- DS Alternatives
- Further Study
Assumptions

- Coexistence of 10GEPON with current GEPON ONUs is a fundamental requirement
- Use the same fiber optic cable (SMF G.652)
- Allow Overlay RF Video
- Bandwidth efficiency – targeted to be the same as GEPON
- 2 new ONUs
  - Asymmetric 10GEPON (10G DS / 1G US)
  - Symmetric 10GEPON (10G DS / 10G US)
Mixed PON Network Architecture

OLT

- DBA
- Scheduler
- Discovery
- Grants

1G/1GEPON ONU

- TRx
- Video Rx

10G/10GEPON ONU

- TRx
- Video Rx

Video Provider

• DBA
• Scheduler
• Discovery
• Grants

1G TRx

10G TRx

1G/1GEPON ONU

- TRx
- Video Rx

10G/1GEPON ONU

- TRx
- Video Rx

10G/10GEPON ONU

- TRx
- Video Rx
Options for upstream wavelength plan

<table>
<thead>
<tr>
<th></th>
<th>1G / 1G</th>
<th>10G / 1G</th>
<th>10G / 10G</th>
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<tbody>
<tr>
<td>Full TDM</td>
<td>1310nm</td>
<td>1310nm</td>
<td>1310nm</td>
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<tr>
<td>Full WDM</td>
<td>1310nm</td>
<td>1(\lambda)</td>
<td>2(\lambda)</td>
</tr>
<tr>
<td>1G / 10G WDM</td>
<td>1310nm</td>
<td>1310nm</td>
<td>2(\lambda)</td>
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Full TDM Upstream option - observations

- Need only a single Transceiver at the OLT

- Receiver needs to operate at multiple rates
  - Further study
  - Increase Guard Time in between Bursts

- Need full synchronization between the DBA that manage 1G and the DBA for 10G
Full WDM Upstream option – Observations

- Need 3 different transceivers at the OLT
  - Separate transceiver for each lambda

- Need a WDM splitter at OLT to distribute signal to transceivers
  - 0.3db penalty

- No need for synchronized DBA
TDM Upstream for 1G / WDM for 10G - Observations

- Need dual (single-rate) Transceivers at OLT
  - Single Transceiver for 1G/1G and 10G/1G
  - Dedicated Transceiver for 10G/10G

- WDM splitter
  - 0.3db penalty

- Need Synchronized DBA
Observations – WDM DS

- **Observation 1**: Only WDM DS is possible
  - Additional Band-pass filter needed
  - Existing ONUs may need an external filter
  - Looks like a *deal breaker* for coexistence
  - Cost
BiDi Module Architecture

Existing GEPON Architecture

1310nm Transmitter
Beam Splitter
1490nm Receiver
(Analog)
1550nm Receiver
(Digital)
Fiber Optic

10GEPON Architecture

1310nm Transmitter
Beam Splitter
1490nm Receiver
(Analog)
1550nm Receiver
(Digital)
Fiber Optic
Band pass Filter
Sphere Lens
## Conclusion

<table>
<thead>
<tr>
<th></th>
<th>PRO</th>
<th>CON</th>
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<tbody>
<tr>
<td><strong>Full TDM</strong></td>
<td>• Single TRx</td>
<td>• Multi Rate OLT</td>
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<tr>
<td></td>
<td></td>
<td>• Increase Guard Time</td>
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<tr>
<td></td>
<td></td>
<td>• Full DBA Sync</td>
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<tr>
<td></td>
<td></td>
<td>• Low DBA efficiency</td>
</tr>
<tr>
<td><strong>Full WDM</strong></td>
<td>• No DBA</td>
<td>• 3 types of OLT TRx</td>
</tr>
<tr>
<td></td>
<td>• Single rate OLT RX</td>
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</tr>
<tr>
<td><strong>1G / 10G WDM</strong></td>
<td>• Dual rate OLT RX</td>
<td>• 2 types of OLT TRx</td>
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Further study

- Single Rate OLT Transceiver
- 10G US & DS wavelengths allocation
  - O-band, E-band, S-band, C-band or L-band
- ONU optical Band pass filter