Energy Efficient Ethernet (EEE) for 40 Gb/s and 100 Gb/s optical interfaces

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Background

- In Geneva the following motion failed:

  Adopt the following objective: Specify optional fast-wake Energy Efficient Ethernet (EEE) for 40 Gb/s and 100 Gb/s operation over fiber optic cables.

  Results (y/n/a): 16/6/28
  Motion Fails (Y: ~ 73%)

- This presentation reviews the reasons why the motion failed, and based on a better understanding of the issues proposes that the objective be reconsidered.

Why did the motion fail ?

- A general lack of understanding on the overall system implications of the motion, as indicated by:
  - The long and diverse Q&A session
  - The large number of Abstains
- In discussions with several people afterwards, there appeared to be two primary areas of concern:
  - Backwards compatibility with ‘legacy’ equipment already deployed in the field
  - Interoperability with OTN

Backwards Compatibility

- There are really two separate concerns here:

  A Technical concern

  - What happens when we connect a new EEE capable host to a legacy host which doesn't support EEE ?
  - Addressed with EEE 'Capability Exchange' between the two end ports, i.e. EEE enabled only if supported on both ends

  A Marketing concern

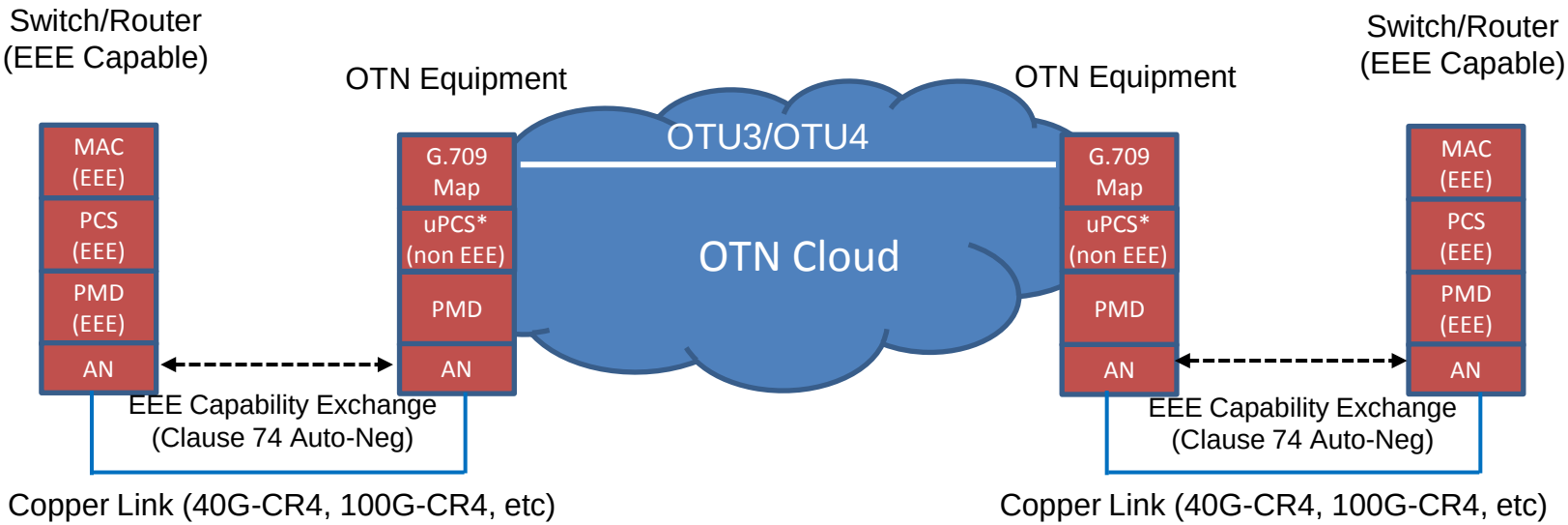
  - Is existing equipment in the field being unfairly disadvantaged ?
  - Market confusion over which equipment does and does not support (optional) EEE

- The marketing concern is real and legitimate, but an issue for the marketing department. It should not prevent us from doing the right thing for the standard (and the industry long term).

OTN Interoperability

- Both 802.3ba and 802.3bm have an objective to “provide appropriate support for OTN”
- This is taken to mean an ability to transport 40Gb/s and 100Gb/s Ethernet links over a long-haul OTN link, using the mappings defined in ITU G.709
- (If enabled) The fast-wake EEE scheme proposed for 40Gb/s and 100Gb/s optical links is not interoperable with OTN
  - See trowbridge_01_1112 for more details
- If we are to add an objective to support EEE for 40Gb/s and 100Gb/s optical interfaces, then we need to address OTN interoperability

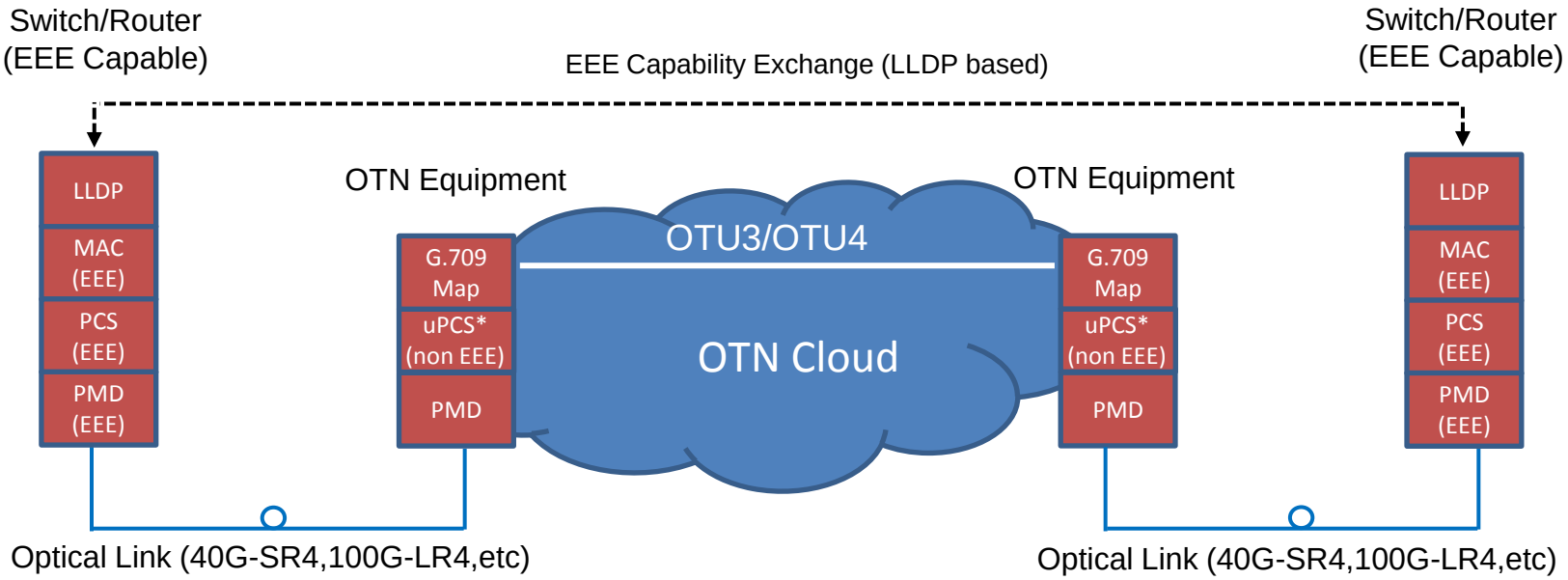
Why is there no issue with copper interconnect?



- Step 1: Switch/Router ports power up with “EEE OFF” – default mode
- Step 2: Mngt system enables optional EEE feature on both Ethernet ports
- Step 3: Switch/Router ports negotiate EEE capability via Clause 74 Auto-Neg
- Step 4: OTN is “EEE unaware”, so Switch/Router ports remain in “EEE OFF”

* uPCS refers to PCS lane recovery and deskew based on Figures 82-10, 82-11 of approved IEEE Std 802.3-2012

Why is there an issue with optical interconnect?



- Step 1: Switch/Router ports power up with “EEE OFF” – default mode
- Step 2: Mngt system enables optional EEE feature on both Ethernet ports
- Step 3: End Switch/Router ports negotiate (via LLDP) for “EEE ON”
- Step 4: Intermediate “Non EEE aware” OTN Interfaces take link down
  - uPCS/G.709 blocks don’t recognize RAMs > Insert OTN AIS / Report BIPs/etc

* uPCS refers to PCS lane recovery and deskew based on Figures 82-10, 82-11 of approved IEEE Std 802.3-2012

OTN Interoperability – Potential Solutions

There are several potential ways to address this OTN issue. Some examples are listed below[1]:

1. Add a warning note in the standard to state that EEE should not be enabled for 40Gb/s or 100Gb/s Ethernet ports connecting over an OTN network.
   (note: management default for EEE is 'disabled').
2. Change EEE 'fast wake' mode to not send RAM (Rapid Alignment Markers). Send LPI control characters while maintaining normal lane alignment markers to preserve compatibility with OTN mapper.
3. Do something slick and clever …..

1. The intent of this presentation is not to propose a specific solution, but just highlight that the issue is solvable

Summary

- Issue is now better understood by disapproving voters
- Marketing issues around ‘legacy’ equipment are just that … i.e. marketing issues.
- Technical issues around OTN Interoperability are solvable
- We support optional Energy Efficient Ethernet (EEE) for 40 Gb/s and 100 Gb/s operation over fiber optic cables

Motion

Adopt the following objective:

Specify optional Energy Efficient Ethernet (EEE) for 40 Gb/s and 100 Gb/s operation over fiber optic cables.

Mover: Seconded:

Technical (≥ 75%)

Yes: No: Abstain:

Pass/Fail

What we (802.3bm) are signing up for [1]

- Leverage Fast Wake from P802.3bj
  - No PMD shutdown
- Use a LLDP based mechanism for EEE “Capability Exchange”
  - No Clause 74 Auto Negotiation
- Apply to new and existing 40G and 100G optical PMDs
  - Need to change the scope of the project to cover old PMDs (as per P803.3bj)
- Resolve OTN interoperability issue

[1] updated slide from bennett_01_0912_optx.pdf

Backup

EEE References

- 802.3bj: Jan 2012
  - "Options for EEE in 100G" http://www.ieee802.org/3/bj/public/jan12/barrass_01a_0112.pdf
  - "EEE Support for 100 Gb/s" http://www.ieee802.org/3/bj/public/jan12/gustlin_02_0112.pdf
- 802.3bj: March 2012
  - "Detailed EEE baseline presentation" ** http://www.ieee802.org/3/bj/public/mar12/barrass_01_0312.pdf
- 802.3bj: May 2012
  - "Gaps in D.0.0 for EEE" http://www.ieee802.org/3/bj/public/may12/barrass_01_0512.pdf
- NG 40Gb/s and 100Gb/s Optical Ethernet Study Group: May 2012
  - "Energy Efficient Ethernet for 40G and 100G Optical Ethernet" http://www.ieee802.org/3/100GNGOPTX/public/may12/bennett_01a_0512_optx.pdf
- NG 40Gb/s and 100Gb/s Optical Ethernet Study Group: July 2012
  - "LLDP for EEE" http://www.ieee802.org/3/100GNGOPTX/public/jul12/diab_01_0712_optx.pdf
  - "EEE for 40G/100G NGOPTX: Open Issues and Objective Proposal" http://www.ieee802.org/3/100GNGOPTX/public/jul12/bennett_01a_0712_optx.pdf

** highly recommended presentation

EEE References

- 802.3bm: Sept 2012
  - “EEE status in 802.3bj
    http://www.ieee802.org/3/bm/public/sep12/barrass_01_0912_optx.pdf
  - “EEE for P802.3bm Objective Proposal”
    http://www.ieee802.org/3/bm/public/sep12/bennett_01_0912_optx.pdf