OTN Support for 50GbE, next generation 100GbE, 200GbE

Steve Trowbridge

Alcatel-Lucent

Supporters

- Pete Anslow (Ciena)
- Sam Sambasivan (AT&T)
- Ghani Abbas (Ericsson)
- John McDonough (NEC)
- Juan-Carlos Calderon (Inphi)
- Steve Gorshe (PMC-Sierra)
- Peter Stassar (Huawei)

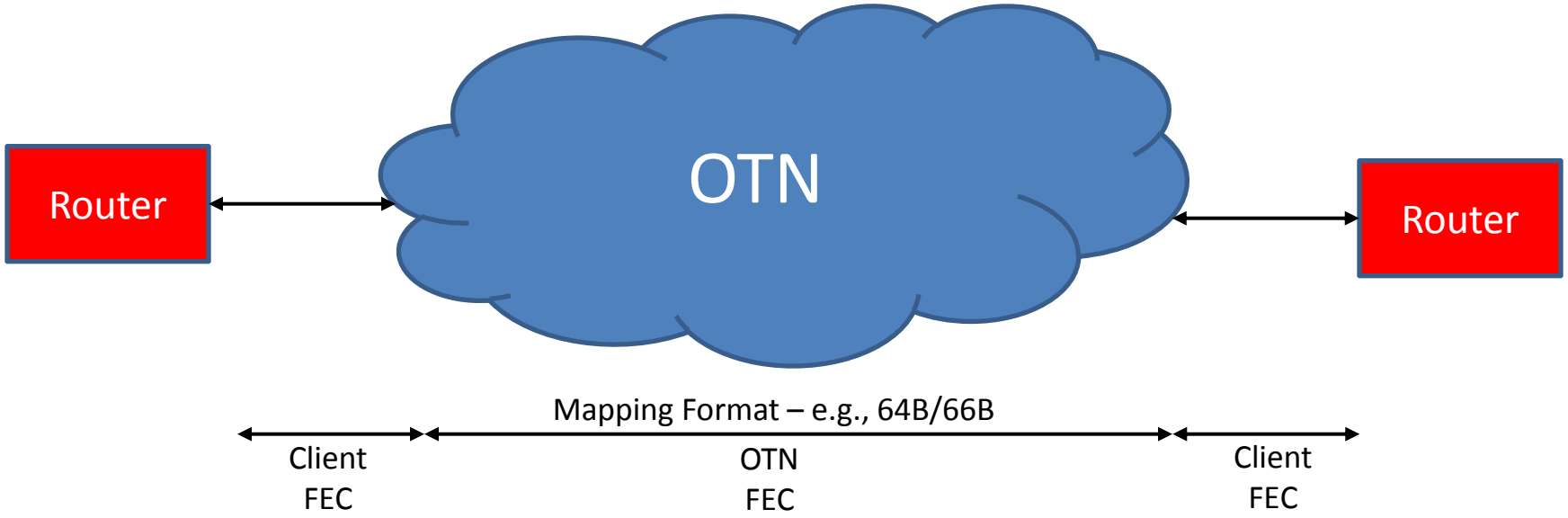
Key Aspects of OTN Support

- The Ethernet signal can be efficiently mapped into transport network
- There is a common mapping format that can be used for all PMDs of a given rate, and hence the same PMD type does not need to be used at the OTN ingress and egress
- Where applicable, pluggable optical modules for Ethernet can be reused for OTN client/IrDI interfaces of the corresponding rate

Applicability of OTN Support Requirements

	Efficient mapping into OTN	All PMDs can be mapped into OTN the same way	Reuse pluggable modules for OTN client interfaces
50GbE	✔	✔	NA
100GbE	✔	✔	✔
200GbE	✔	✔	✔

Normal treatment of OTN client FEC



- The client (e.g., Ethernet, Fibre channel) FEC has been selected to correct single-link and not double-link errors, and hence it is normally terminated at the OTN ingress and regenerated at the OTN egress.
- OTN has its own FEC, chosen according to factors such as the link distance
- The mapping format normally includes coding (e.g., 64B/66B) but not the client FEC. Converting from the client format to the mapping format may involve terminating and removing the FEC (correcting errors), and trans-decoding 256B/257B to 64B/66B to maintain MTTFPA across the OTN mapped connection
- What needs to fit in the expected capacity in the OTN network is the mapped signal format, which may be lower bit-rate than the FEC encoded format

50GbE Considerations
Mapping Format and Size

- Most likely mapping format: terminate FEC, trans-decode to 64B/66B, bit-synchronously map into ODUflex
- Should fit into forty 1.25G tributary slots of ODU4 (current 100G signal) or ten 5G tributary slots of future ODUCn ("beyond 100G" signal)

Likely ODUflex Size	$50Gb/s \times \frac{66}{64} \times \frac{239}{238} = 51.77914916\ Gb/s \pm 100ppm$
Forty 1.25G TS of ODU4	$1.301709251Gb/s \times 40 = 52.06837004Gb/s \pm 20ppm$
Ten 5G TS of ODUCn	$5.240886372Gb/s \times 10 = 52.40886372Gb/s \pm 20ppm$

50GbE Considerations
All PMDs mapped in the same way

- Single lane 50GbE PMDs likely to be 25Gbaud PAM4
- Whichever FEC is used (RS(528,514), RS(544,514) or something else), should have a CWM at the same interval
- No rate adaptation should be required to interconnect 50GbE PMD types, and there should be no obstacle (as we had at 25GbE) to providing a single, PCS-codeword transparent mapping for 50GbE over OTN

Next Generation 100GbE Considerations for OTN Support

- IEEE 802.3 has numerous, previously standardized 100GbE PMDs (100GBASE-ER4, 100GBASE-LR4, 100GBASE-SR10, 100GBASE-CR10, 100GBASE-CR4, 100GBASE-KR4, 100GBASE-KP4, 100GBASE-SR4). All use the same Clause 82 PCS
- There is a single, standardized PCS codeword transparent mapping (serialized and deskewed PCS lanes including alignment markers, GMP mapped into OPU4)
- New 100GbE PMDs must use the same Clause 82 PCS. If a new lane architecture is required for 50G or 100G lanes, similar to 802.3bj, it must be described how this can be converted to/from the Clause 82 PCS format
- The 1/16K alignment marker ratio must be maintained, and no rate conversion should be needed to interconnect new 100GbE PMDs with existing 100GbE PMDs across an OTN

200GbE Considerations
Mapping Format and Size

- Most likely mapping format: deskew PCS lanes, terminate FEC, trans-decode to 64B/66B, either remove alignment markers or replace with pad blocks to simplify clocking, bit-synchronously map into ODUflex (similar OTN mapping reference point to 400GbE in P802.3bs draft)
- Should fit into forty 5G tributary slots of future ODUCn ("beyond 100G" signal)

Likely ODUflex Size	$200Gb/s \times \frac{66}{64} \times \frac{239}{238} = 207.1165966\ Gb/s \pm 100ppm$
Forty 5G TS of ODUCn	$5.240886372Gb/s \times 40 = 209.6354549Gb/s \pm 20ppm$

200GbE Considerations
Module Reuse Considerations

- Just as it is expected that 400GbE modules can be used for OTUC4 client/IrDI interfaces, it will be expected that 200GbE modules can be used for OTUC2 client/IrDI interfaces
- Assuming that 200GbE uses a similar PCS lane architecture to P802.3bs 400GbE and that the 200GbE PMA uses blind bit-multiplexing (as does the 400GbE PMA), there should be no obstacle to this kind of module reuse.

Proposal

- All new task forces arising from the 50 Gb/s Ethernet Over a Single Lane Study Group or the Next Generation 100 Gb/s Ethernet & 200 Gb/s Ethernet Study Group should adopt the following objective:

Provide appropriate support for OTN

THANKS!