

Q11/15 800G & B1T Update

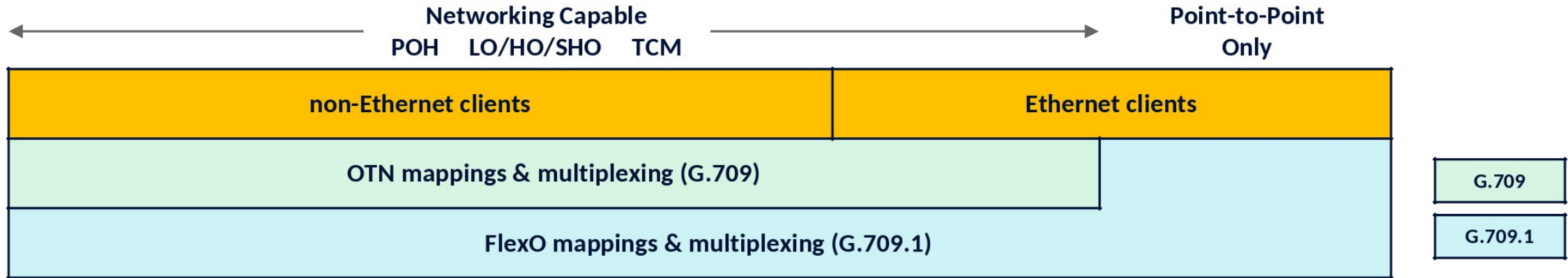
David W Martin, Nokia

13 July 2024 Workshop, Montréal

Outline

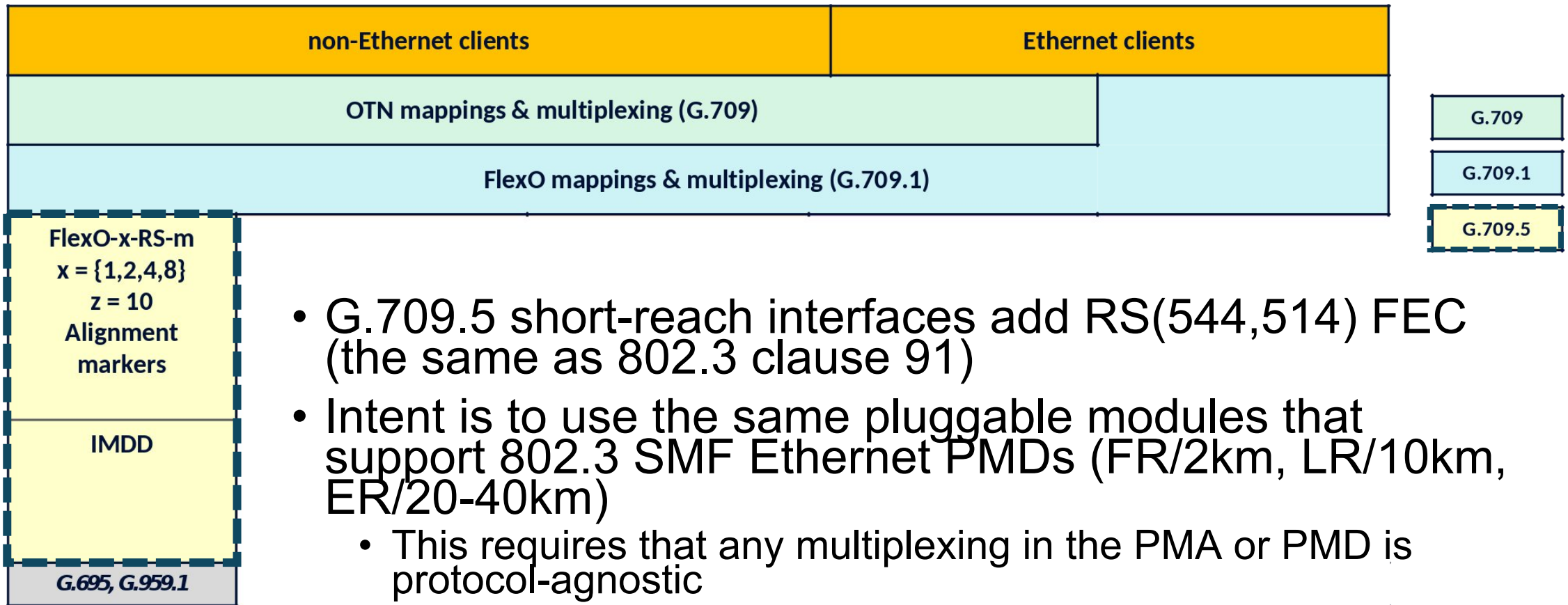
- Recap of recently published 800G FlexO Recommendations
- SG15 optical transport applications
- Early view of Beyond 1 Terabit (B1T) work
- Q6/15 optical metrics

G.709 (OTN) and G.709.1 (FlexOTN)

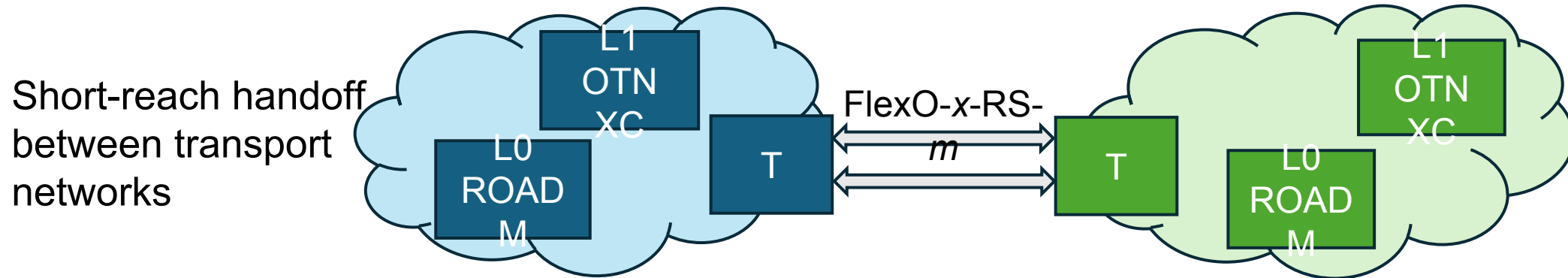


- OTN enables networking applications
 - Path OH, Tandem Connection OH, Low/High/Super-High Order mux
 - L1 switching, OTN regens
- FlexO supports inverse multiplexing, section OH, optional security
 - Direct Ethernet-optimized mapping for point-to-point applications
 - FlexO regens

G.709.5 FlexO short-reach



G.709.5 FlexO short-reach applications



- Between the transport networks of different operators (ENNI)
- Within one network operator (INNI), for example between
 - Metro and Core networks
 - Islands of equipment from different transport vendors
 - Internal operations groups (e.g., routing and transport)

G.709.3 and G.709.6 FlexO long-reach

non-Ethernet clients			Ethernet clients	
OTN mappings & multiplexing (G.709)				
FlexO mappings & multiplexing (G.709.1)				
FlexO-x-RS-m $x = \{1,2,4,8\}$ $z = 10$ Alignment markers	FlexO-x-DSH-m $x = \{1,2,4\}$ $z = 10$ Alignment markers 63 GBaud	FlexO-x-DO-m $x = \{1,2,4\}$ $z = 10$ Alignment markers 63 GBaud	FlexO-x-DO-m $x = \{4,8\}$ $z = 128$ FA word 124 GBaud	FlexO-xe-DO $x = \{4,8\}$ $z = 128$ $m = 1$ FA word 118 GBaud
IMDD	FlexO-1-DSH-QPSK FlexO-2-DSH-QPSK FlexO-2-DSH-16QAM FlexO-4-DSH-16QAM	FlexO-1-DO-QPSK FlexO-2-DO-QPSK FlexO-2-DO-16QAM FlexO-4-DO-16QAM	FlexO-4-DO-QPSK FlexO-8-DO-16QAM	FlexO-4e-DO-QPSK FlexO-8e-DO-16QAM
G.695, G.959.1	G.698.2			

G.709

G.709.1

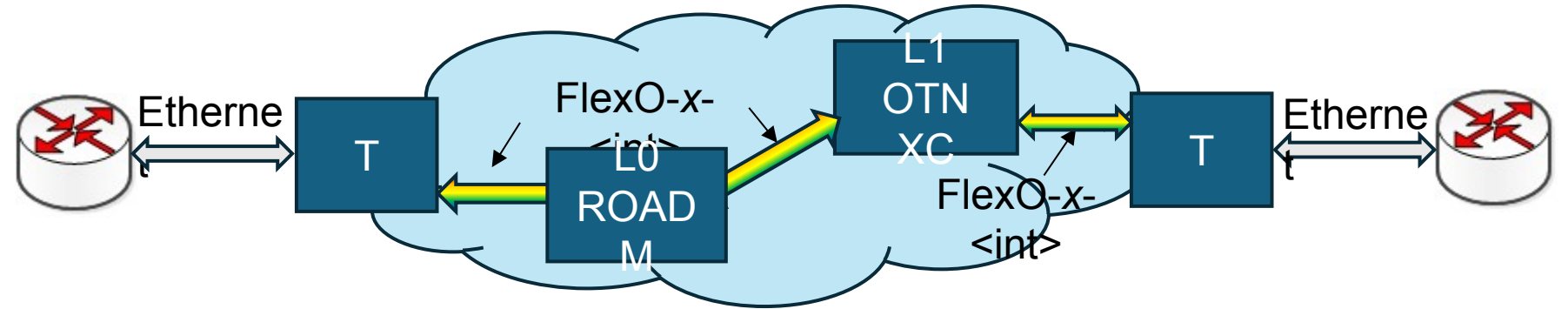
G.709.5

G.709.3

G.709.6

G.709.3 and G.709.6 FlexO long-reach applications

Long-reach connectivity within a metro transport network (e.g., for router interconnect)



Direct router interconnect using Ethernet-optimized FlexO-xe



Beyond 1 Terabit (B1T) status

- Solid progress made during the April 2024 interim meeting
 - Drafted a list of requirements
 - A key goal is reducing the disparity between the 802.3 and FlexO bit rates, several methods were noted
 - Pluggable modules supporting future 1.6TBASE-FR/LR/ER PHYs could then be used for FlexO-16 short-reach interfaces as long as the PMA continues to be protocol-agnostic
 - High-level functional models introduced
 - New ODU and FlexO frame format options discussed
- Follow-on correspondence to iterate/refine the frames and models
- Work continued during the plenary meeting held the last two weeks

Q6/15 optical metrics

- Q6/15 started a new work item to develop an 800G application code for multi-vendor interoperability at the November 2023 SG15 plenary meeting
- It has been agreed to consider Transmitter Constellation Closure (TCC) and Error Vector Magnitude (EVM) as potential Transmitter Quality Metrics (TQM) for 800G type signals
- At the April 2024 interim meeting, multiple contributions about TCC and EVM definition for DP-16QAM signals were discussed and it was agreed to develop two documents with the needed equations for defining those metrics
- During the discussions it was noted that both TCC and EVM require the definition of reference receivers, that may have commonalities, however, it was agreed to continue the reference receiver discussion after the two metrics were more fully defined

Summary

- Updated and restructured G.709.x FlexO series of Recommendations providing support for:
 - Short-reach applications
 - Long-reach applications
 - Modules using bit rates of 100G, 200G, 400G, and 800G
 - Regenerators to support multi-span applications
 - Frame formats and interfaces optimized for Ethernet
- There is an opportunity for P802.3dj SMF optical modules to be reused for 1.6T FlexO-16 short-reach interfaces, enabled by the Q11 work on B1T, if the PMA continues to be protocol-agnostic

IEEE
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