



Backhaul Capacity for Optics for Remote PHY

And answers to questions so far

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Adding detail to messaging so far...

- Remote PHY and Ethernet
- DWDM, how many wavelengths
- 100G and/or 200G
- Non RPHY services
- Context for OTN
- Context for Cost
- Context for timelines



What is Remote PHY ?

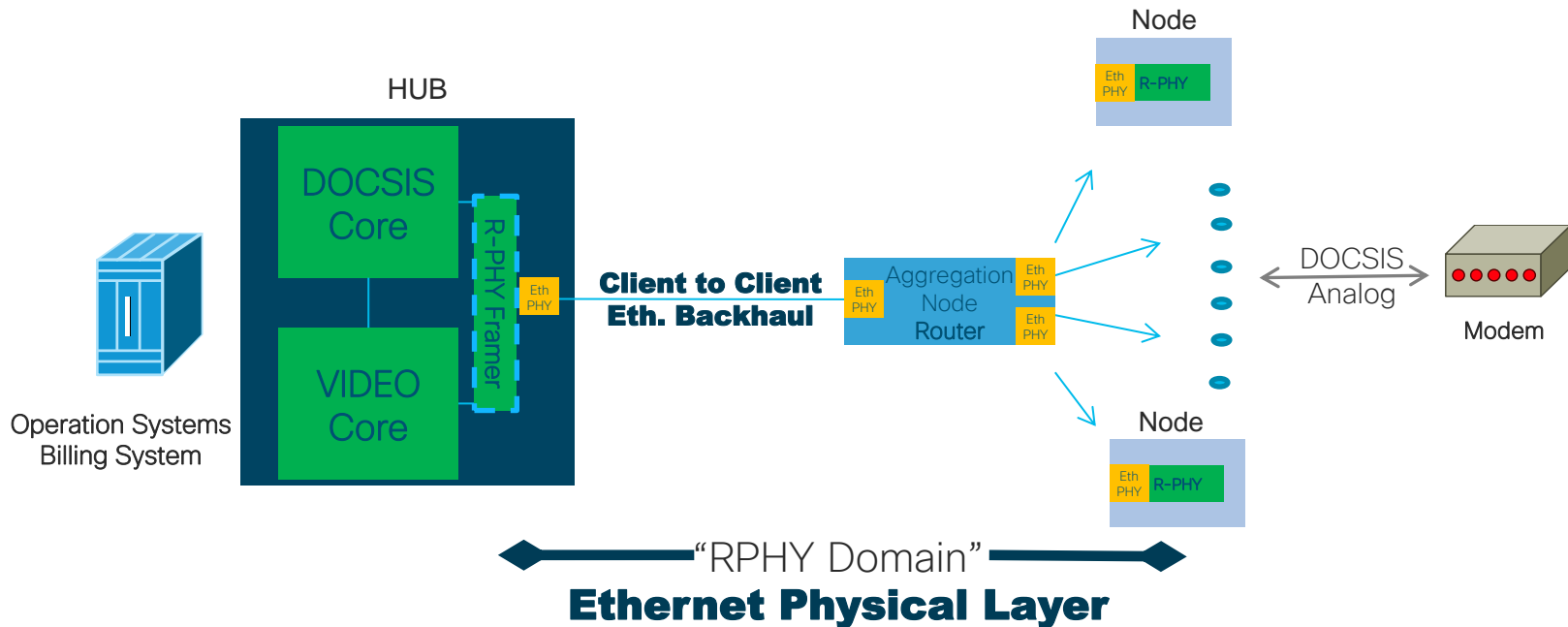
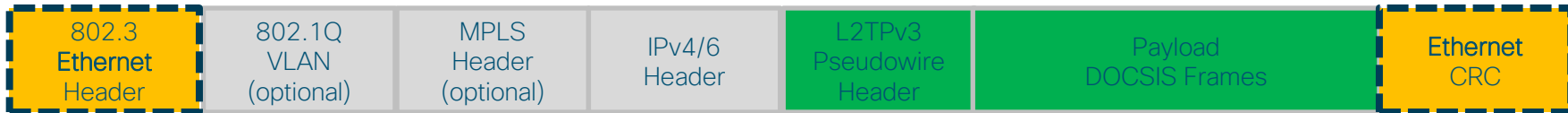
“Remote PHY” is a collection of specifications sanctioned by CableLabs that allows DOCSIS to ride over an Ethernet Network

- CableLabs, MHA v2 Series
 - CM-SP-R-PHY: Remote PHY System Specification
 - **CM-SP-R-DEPI**: Downstream External PHY Interface Specification
 - **CM-SP-R-UEPI**: Upstream External PHY Interface Specification
 - CM-SP-R-DTI: Remote DOCSIS Timing Interface Specification
 - CM-SP-R-OSSI: Operation support Systems Interface Specification
 - CM-SP-R-GCP: Generic Control Plan Specification
 - CM-SP-R-OOB: Out of Band signals Specification

**No new Ethernet requirements.



RPHY Framing



Remote-PHY defines Pseudowires (L2TPV3) that transmit:

- DOCSIS (data traffic)
- Broadcast Video
- and management

within an IP packet and an Ethernet frame.

- Transmitted over Ethernet physical layer
- Ethernet/IP frames make DOCSIS/Video invisible to the network
- no impact to coaxial plant, packet cores, modems & OSS/BSS
- DOCSIS data makes up the bulk of the payload volume
- Allows a multivendor interoperable environment.

A note on Service Cores

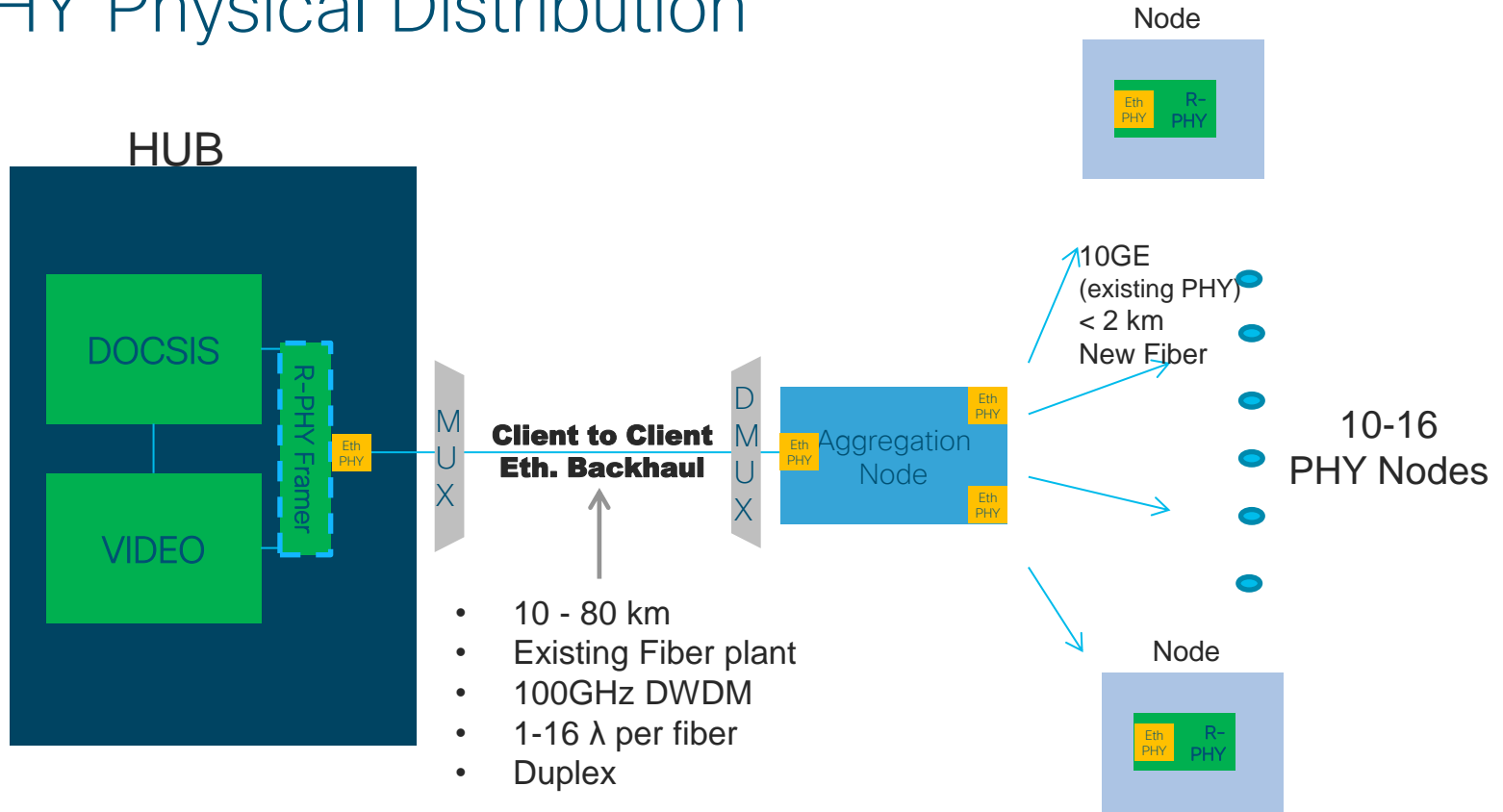
- DOCSIS and Video cores organize and distribute a bandwidth availability per the policy given by Operation and Billing systems. (OSS/BSS)
 - DOCSIS data is unique per service group.
 - Video can be unique per service group or the same for two or more service groups.
 - When video is the same for all service groups we call it broadcast – Fox, CBS, NBC, etc.



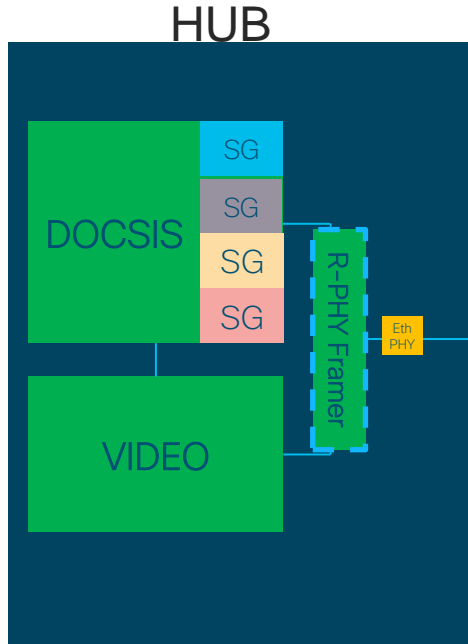
Remote PHY Backhaul

Physical vs. logical functions

R-PHY Physical Distribution



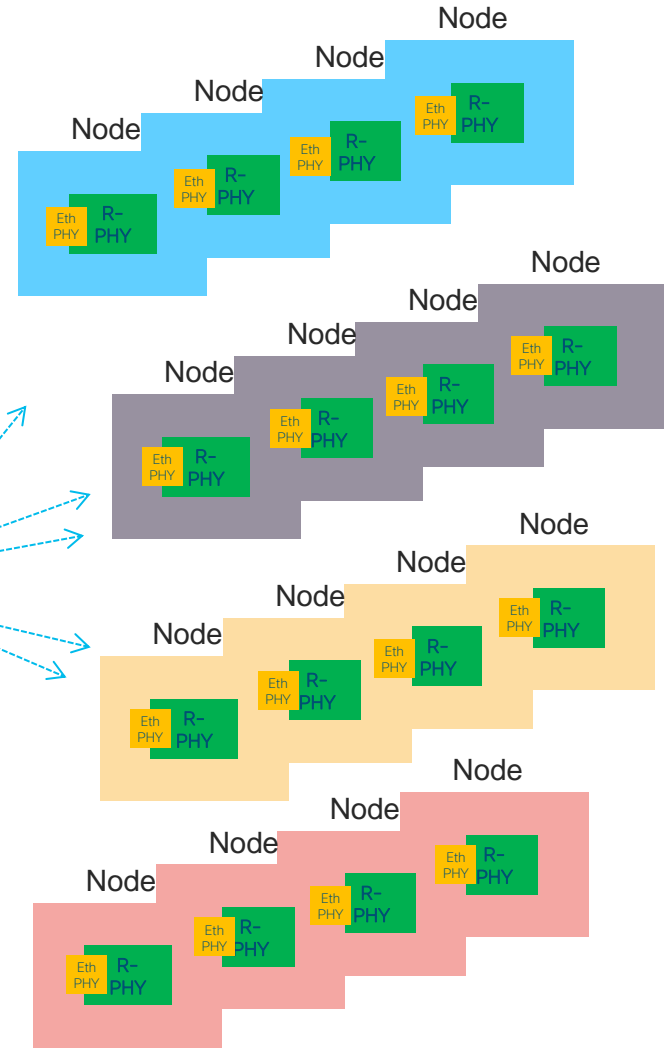
Logical Distribution



**Client to Client
Eth. Backhaul**



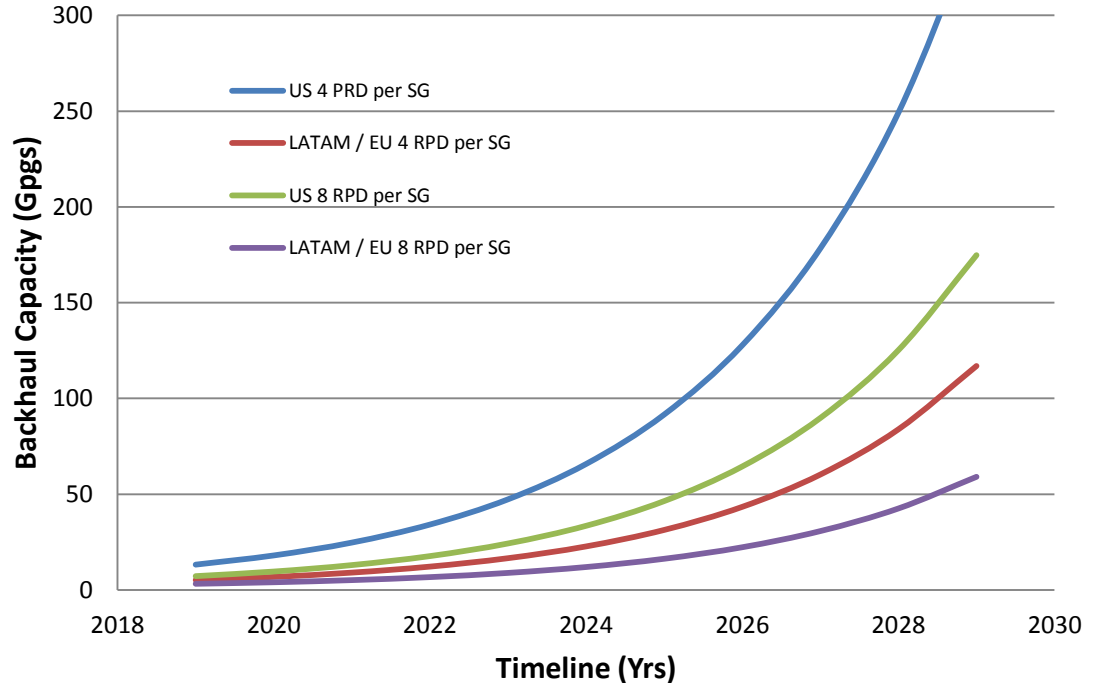
- ~200 Subscribers / service group (SG)
- Broadcast video
 - one video SG for all.
 - Unicast video considered data carried by DOCSIS.



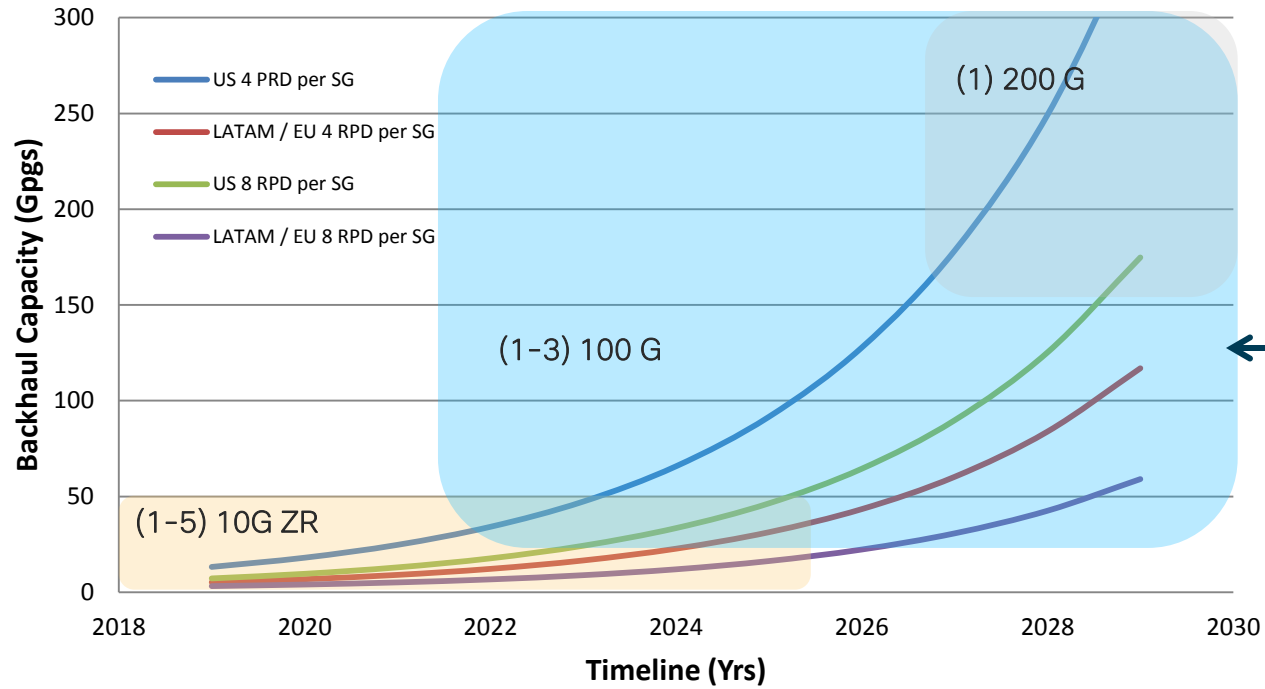
What is the capacity
needed for the Remote PHY
Ethernet Backhaul?

Client to Client R-PHY Backhaul Capacity

- Single direction capacity- download
- Router in Agg Node servicing:
 - 16 PHY Nodes
 - 4 or 8 PHY nodes per DOCSIS service group
 - Compounded annual growth rate CAGR 40% DOCSIS Data
 - Static 1.25 Gpbs Broadcast video
- Broad Market View
 - United States (US) SG start at 3 Gbps
 - Lating America / Europe (Latam/EU) start at 1 Gbps
- Start in 2019 because most capacity has already been purchased until then.

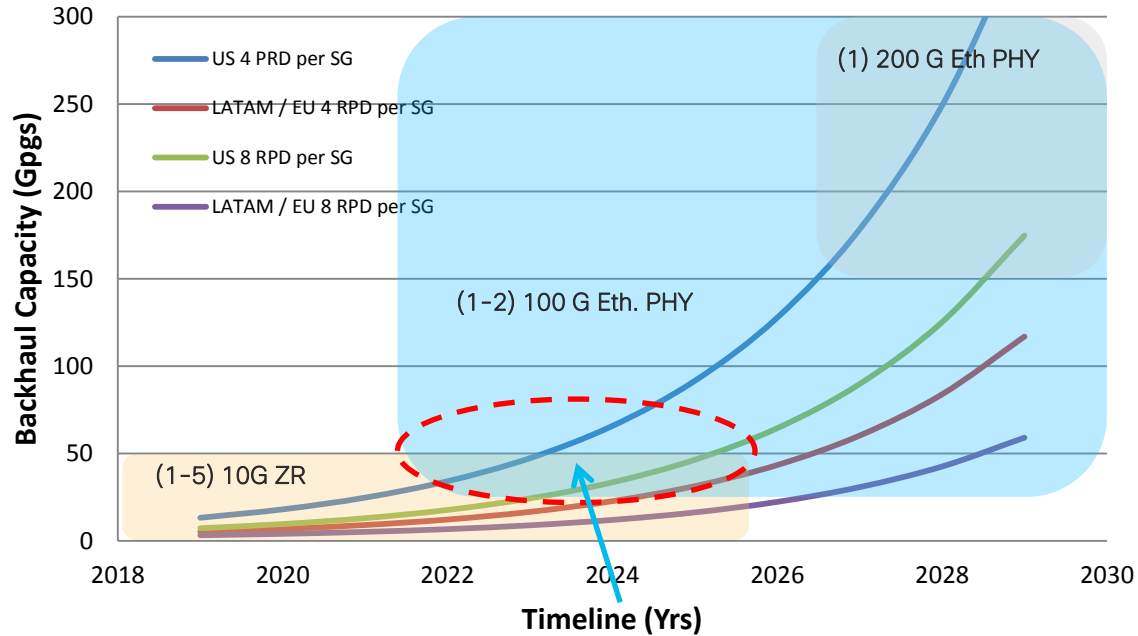


Backhaul Optics Planning



- 100G DWDM Ethernet PHY needed to make this transition
- Leverage mature technology

Backhaul Optics Adoption Timelines

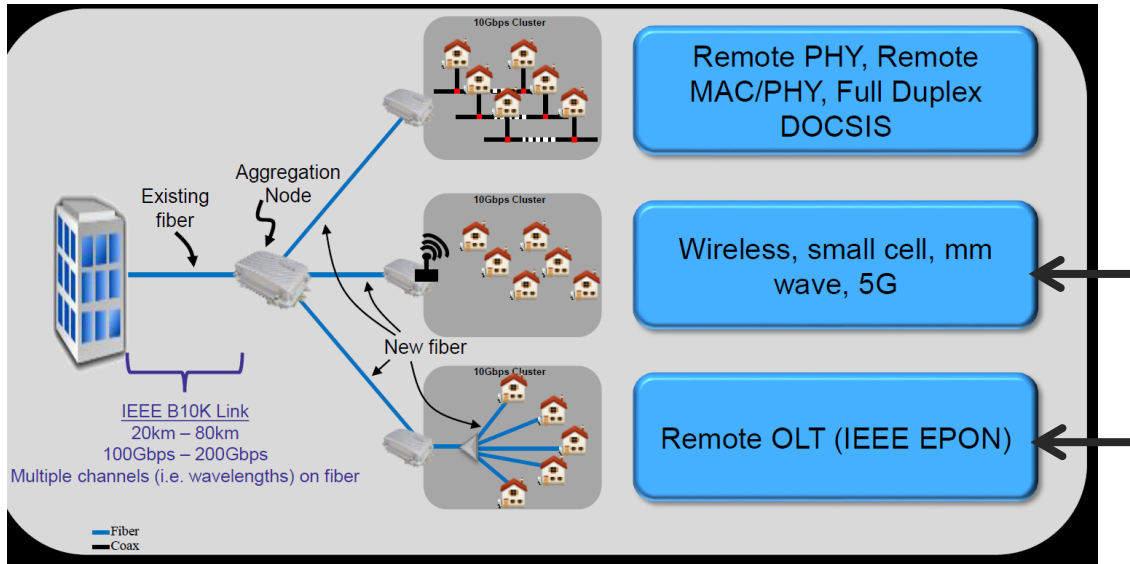


- Adoption time frame is dependent on cost delta between 1-5 10G DWDM ZR to 100G DWDM optics
- Early deployments with DWDM 10G ZR, quickly exhaust fiber capacity.

100G client (Ethernet) specification is needed today to enable RPHY is full scale deployments.

- 100G PHY standard is necessary now. Routers must be installed day one with capability to grow to 100G backhaul.
- note, 200G is also useful, but 100G is the high volume runner with expected robust cost reductions.

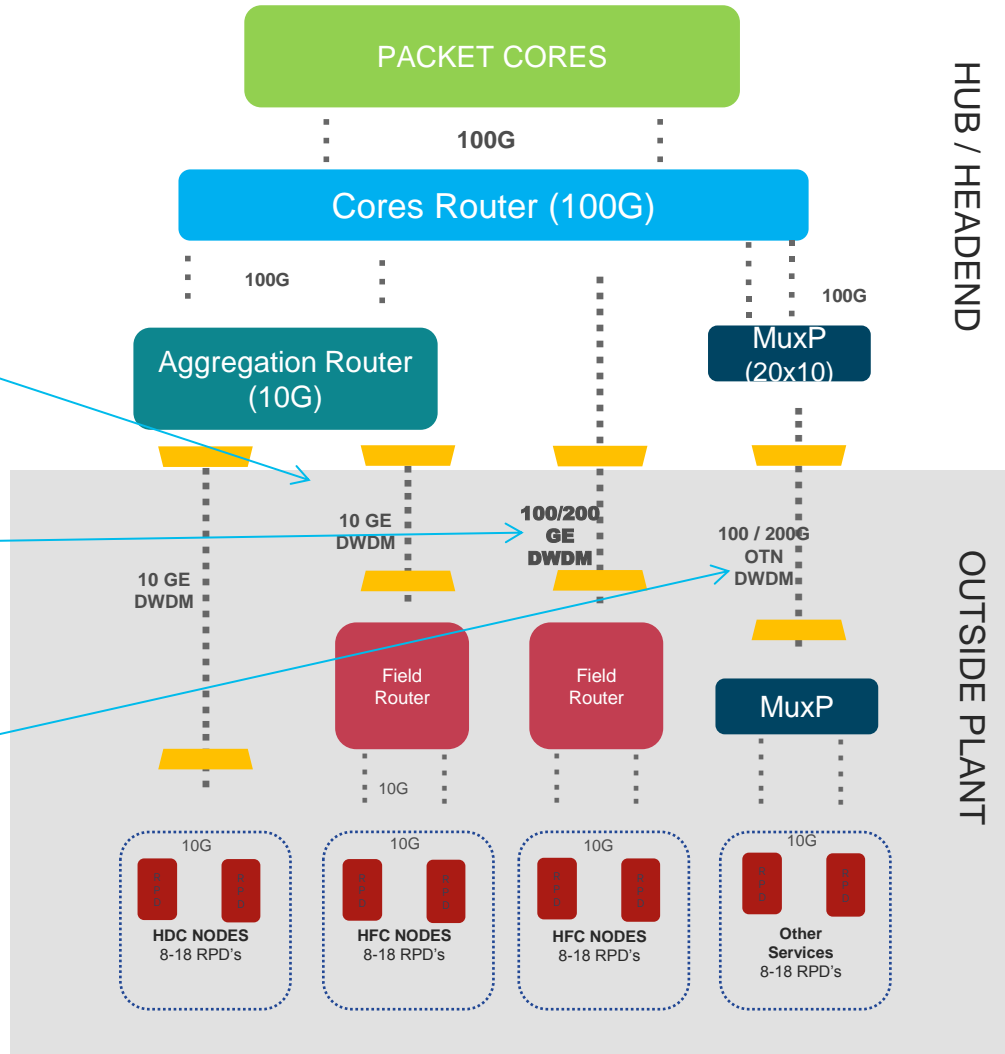
What about other services' impact on backhaul ?



See: http://www.ieee802.org/3/B10K/public/18_01/knittle_b10k_01_0118.pdf

- Unicast.
- Terminate at multiple packet cores.
- 12-18, 10G downlinks
- 200G useful
- Don't have to use a router could use an (OTN) Muxponder at aggregation node
- A minority of links compared to R-PHY.

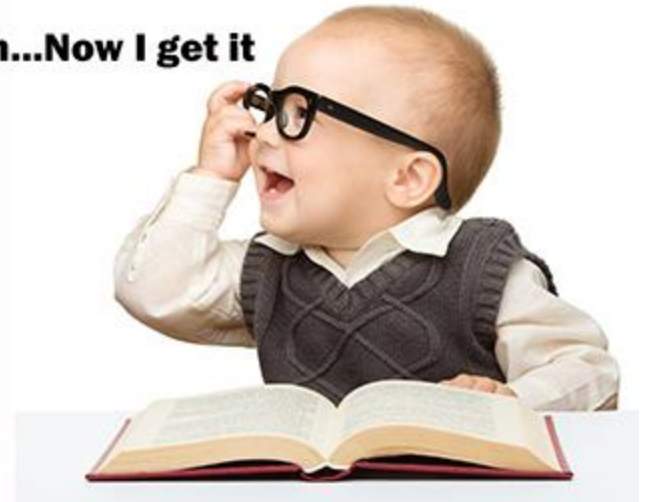
- Available today
- In definition and CableLabs and this study group
- Proprietary solutions



Added detail to messaging so far...

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- DWDM, how many wavelengths
- 100G, 200G
- Other services
- Context for OTN
- Context for Cost
- Context for timelines

Oh...Now I get it





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