Backhaul Capacity for Optics in Remote PHY

and answers to other questions

Fernando Villarruel, Cisco Systems
Michael Eggert, Cox Communications
Harj Ghuman, Cox Communications
Marek Hajduczenia, Charter Communications

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Beyond 10km Optical PHYs Study Group

Adding detail to messaging so far…

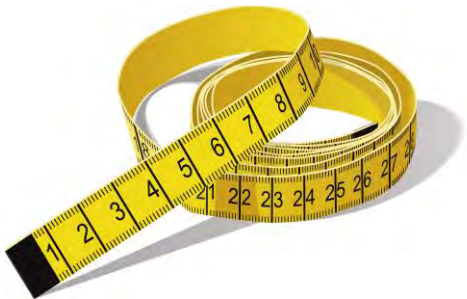
- Remote PHY and Ethernet
- DWDM, how many wavelengths
- 100G and/or 200G
- Non RPHY services
- Context for OTN
- Context for Cost
- Context for timelines

What is Remote PHY ?

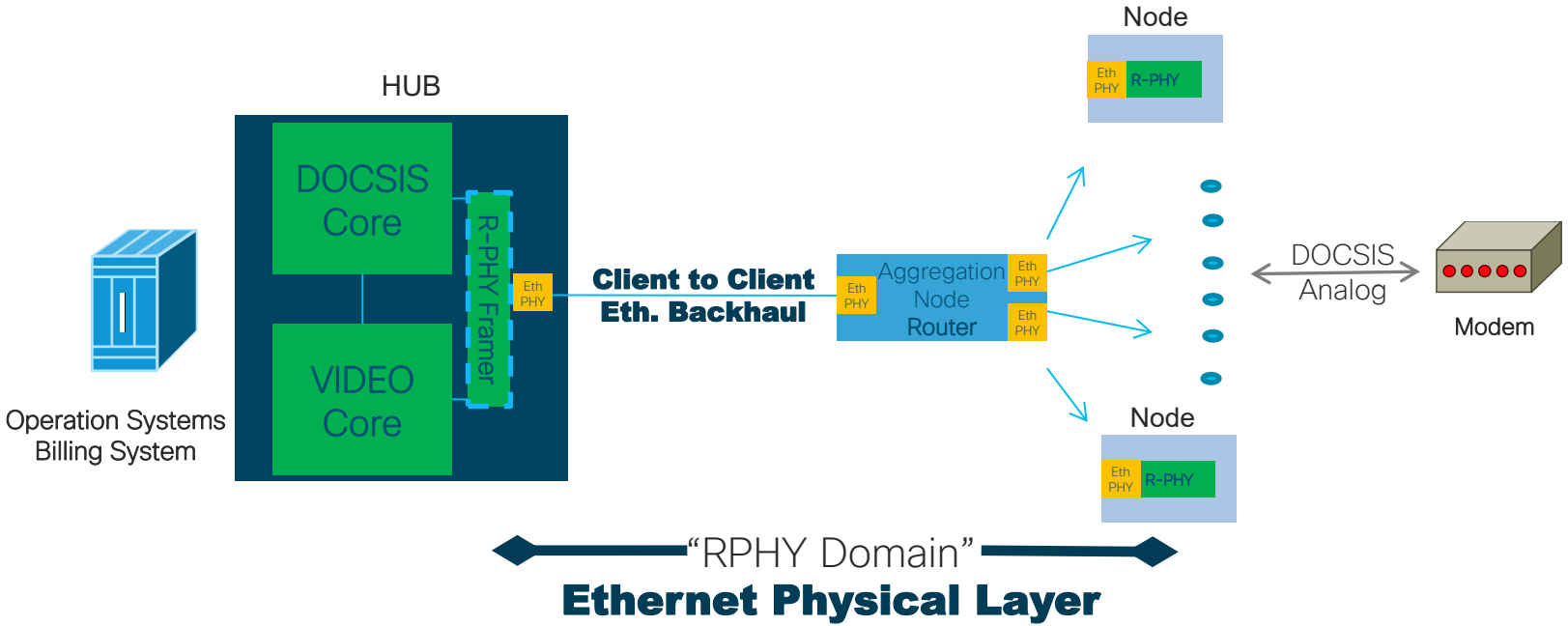
“Remote PHY” is a collection of specifications sanctioned by CableLabs that allows DOCSIS to ride over an Ethernet Network

- CableLabs, MHAv2 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.

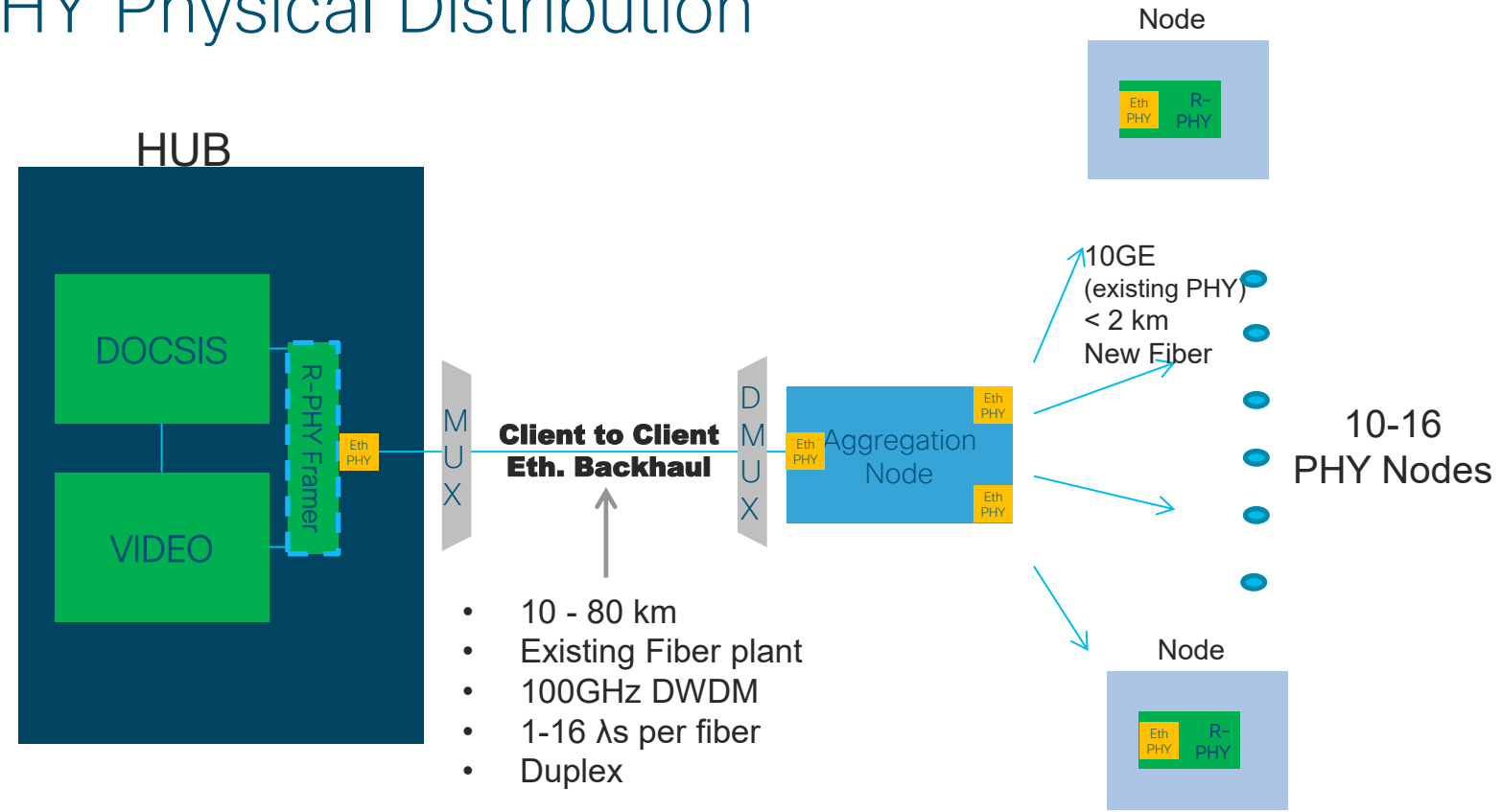
A note on Service Cores

- 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.

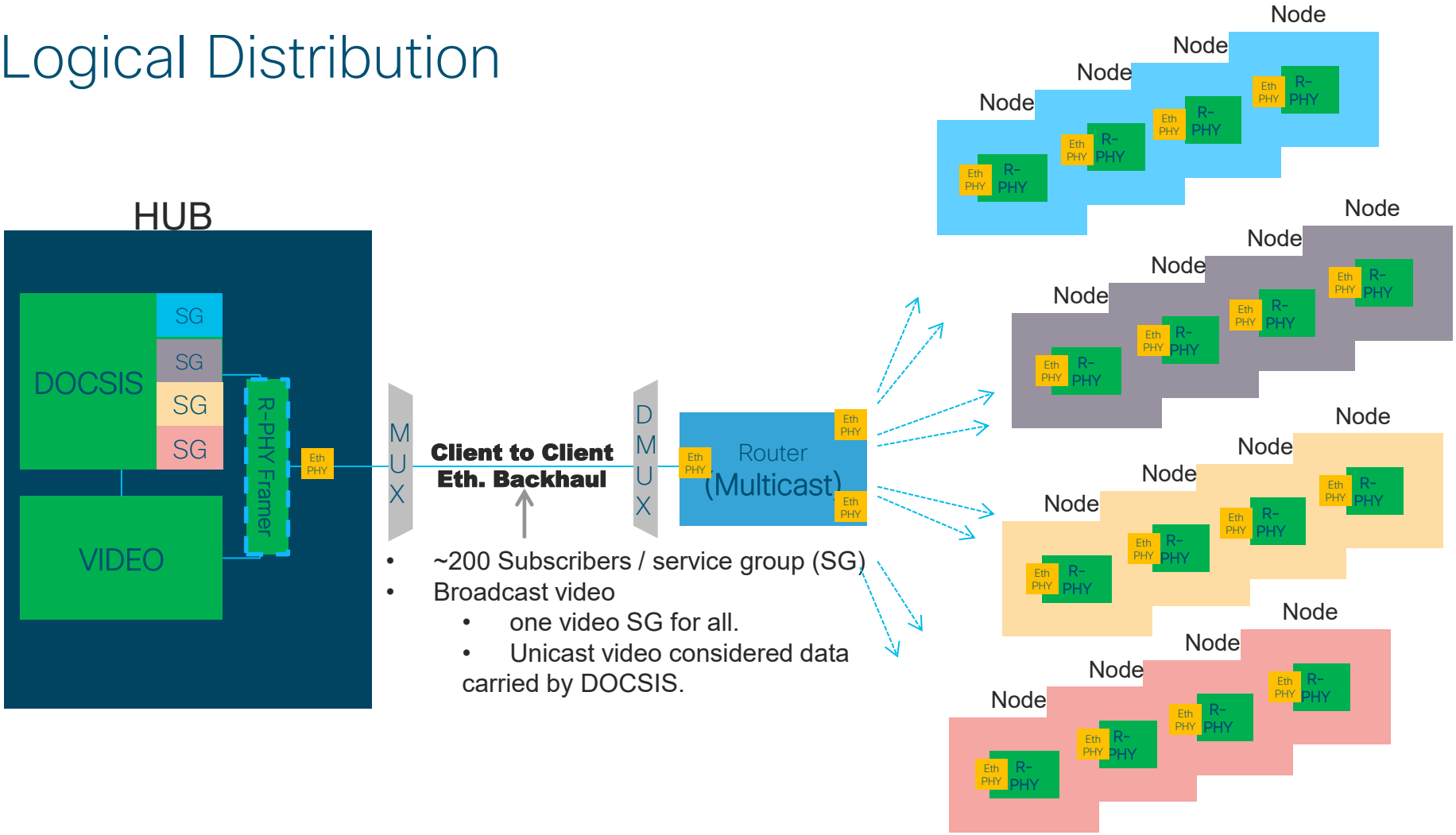
Remote PHY Backhaul

Physical vs. logical functions

R-PHY Physical Distribution



Logical Distribution

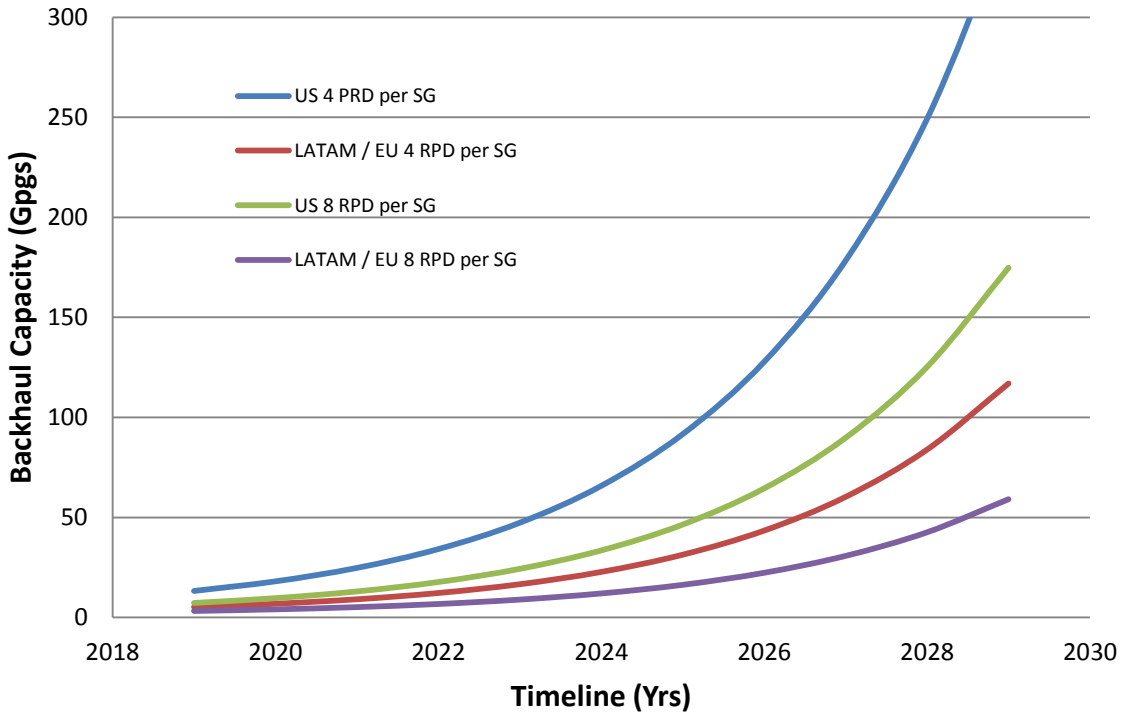


- ~200 Subscribers / service group (SG)
- Broadcast video
  - one video SG for all.
  - Unicast video considered data carried by DOCSIS.

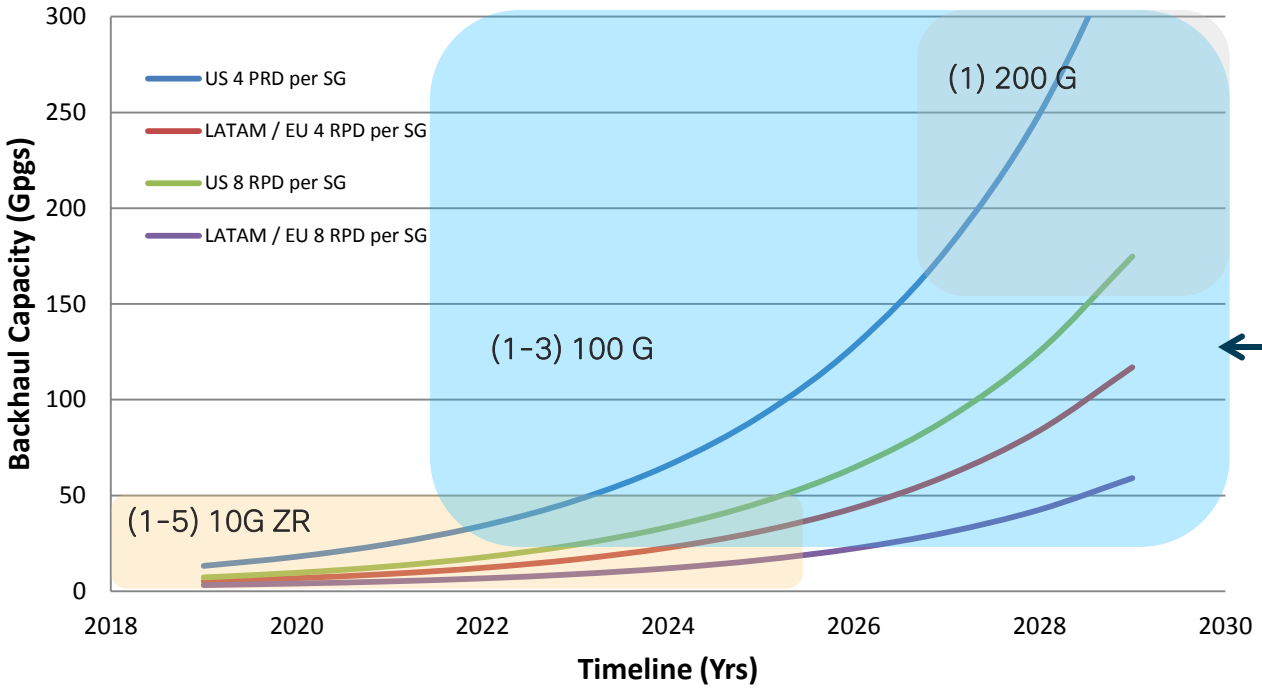
What is the capacity needed for the Remote PHY Ethernet Backhaul?

Client to Client R-PHY Backhaul Capacity

- Single direction (downstream) capacity, per lambda
- Router in Agg Node servicing:
  - 16 R-PHY Nodes
  - 4 or 8 R-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
  - Latin America / Europe (Latam/EU) start at 1 Gbps
- Start in 2019 as most capacity has already been planned for then.

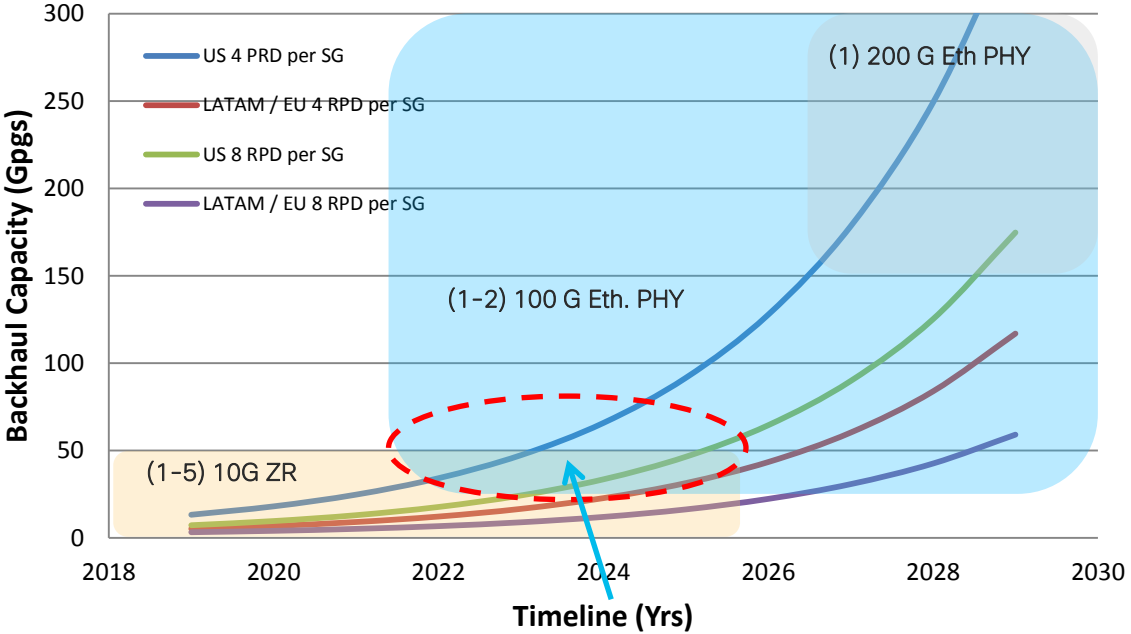


Backhaul Optics Planning



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

Backhaul Optics Adoption Timelines

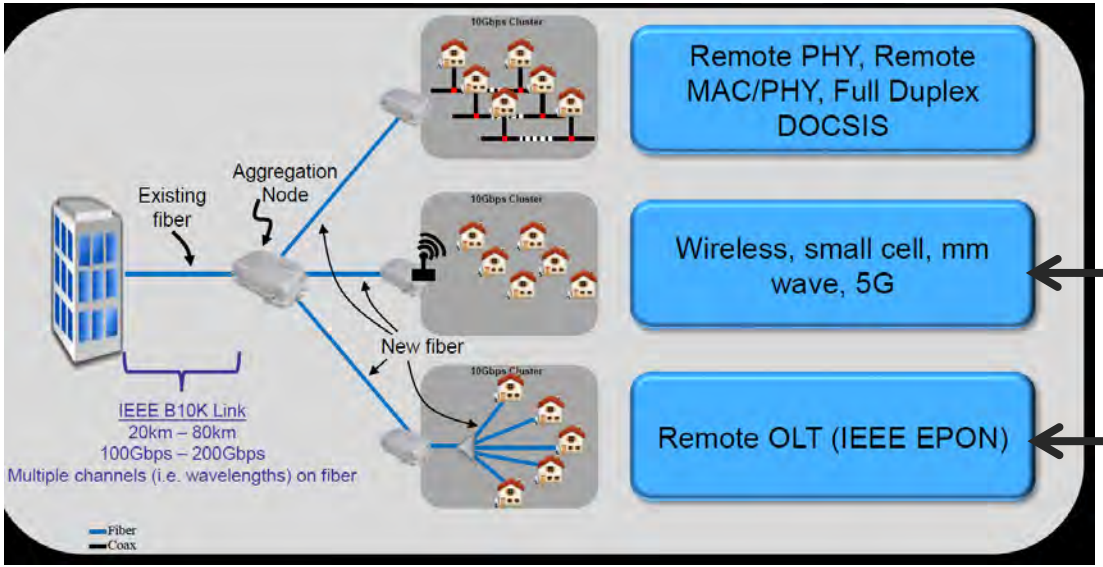


- Adoption time frame is dependent on cost delta between 1-5 10G DWDM ZR and 100G DWDM optics
- Early deployments with DWDM 10G ZR, quickly exhaust fiber capacity.

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

- Routers must be installed day one with capability to grow to 100G backhaul. Can use a handful of 10G ports to start, but not for long.
- note, 200G is also useful, but 100G is the high volume runner with expected robust cost reductions.

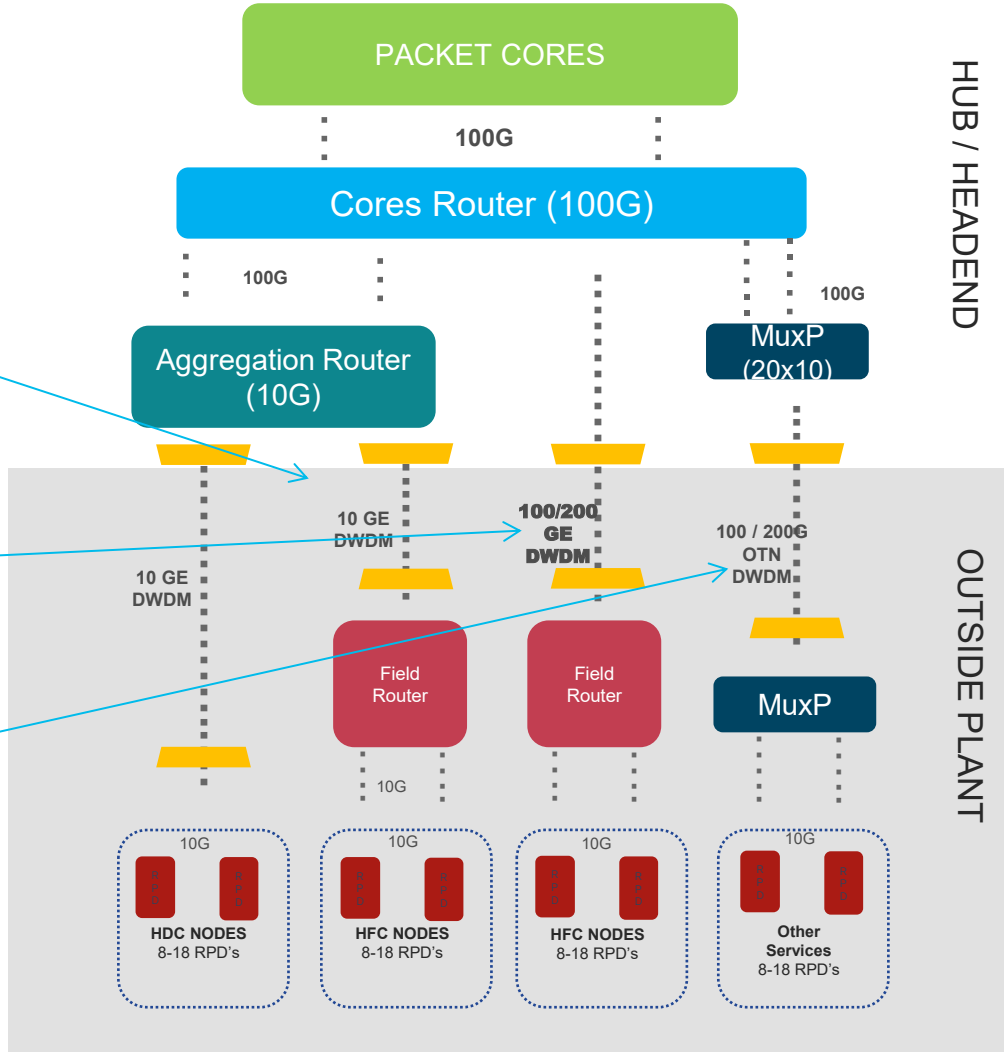
What about other services' impact on backhaul ?



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 proposed at this study group
- Proprietary link solutions



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