



Future-proofing your access network with a consolidated platform: vCMTS & vPON

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- Introduction
- Key Concepts
 - PON
 - Virtualization
- The Consolidated Access Platform
 - How virtualization and disaggregation enable a single platform for access networks
- MSO Network migration
 - Squeezing the most out of HFC while offering a seamless transition to PON

Introduction

BROADBAND SERVICE EXPANSION

Greater connectivity in
rural & urban areas

Increasing development
of high-bandwidth apps

NETWORK CONVERGENCE

Multiple access
technologies

Sustainability

Leaner operations

DATA & ANALYTICS

Improvements in
proactivity & monitoring

Flexibility & capacity
management

DISRUPTION – TRANSFORMATION – SUCCESS

LAY THE FOUNDATION FOR THE ULTRA-CONNECTED FUTURE



Avoid Regrettable Spend

- Maximize your existing HFC network



Boost Capacity & Efficiency

- Scale sustainably
- Step on the path to 10G



Improve cost savings

- Reduce operational complexity
- Eliminate legacy hardware & related costs



Enable Future Evolution

- Gain flexibility & agility
- Get a versatile multi-access solution



Key Concepts

- PON
- Virtualization

PON 101

For this market, is your company

- a) Actively deploying PON?
- b) Planning to deploy PON?
- c) Considering to deploy PON?
- d) No PON plans at all

Please answer in the chat

Passive

No active components - Better reliability

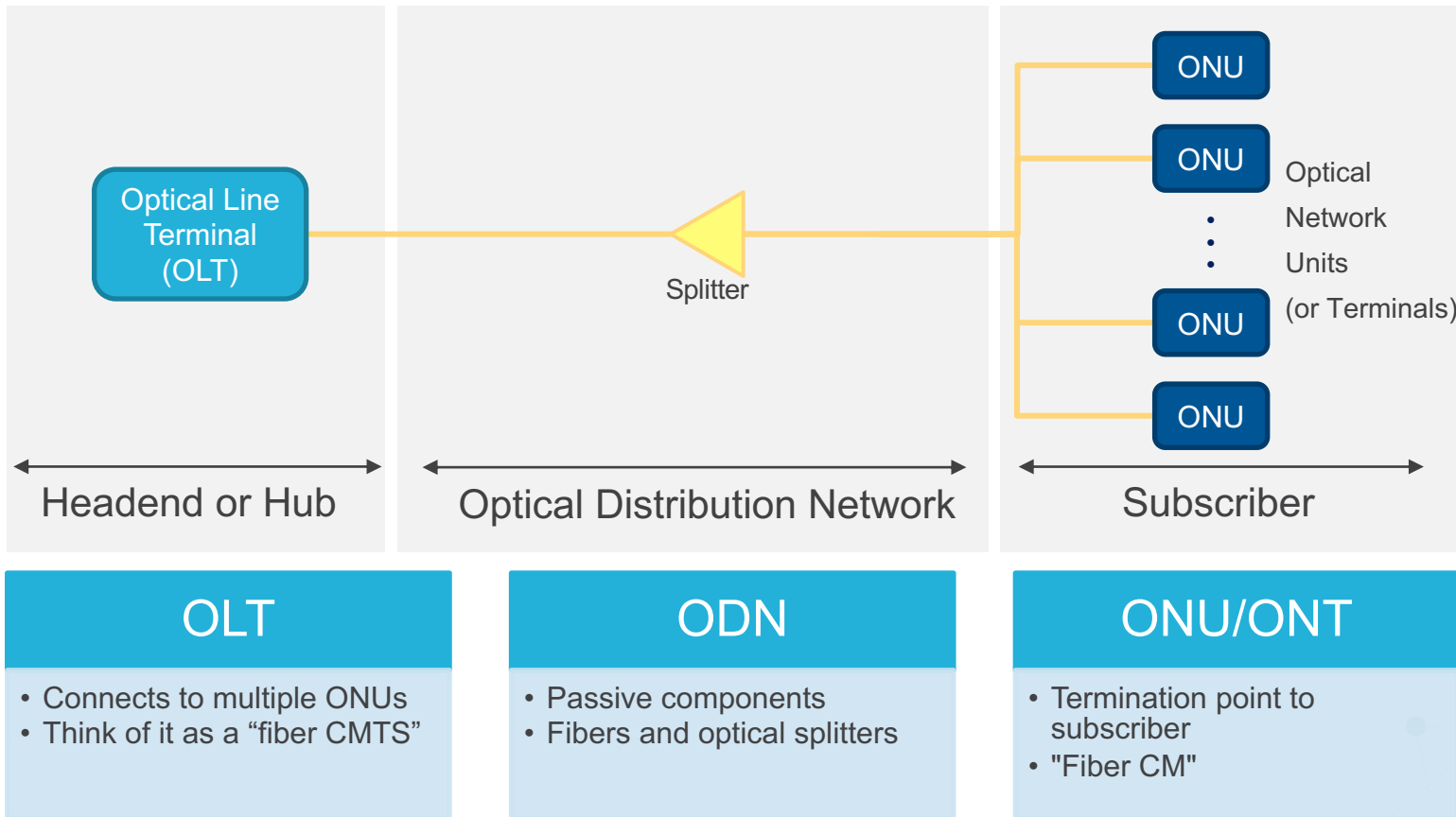
Optical

Fiber all the way (FTTx) - More bandwidth capacity

Network

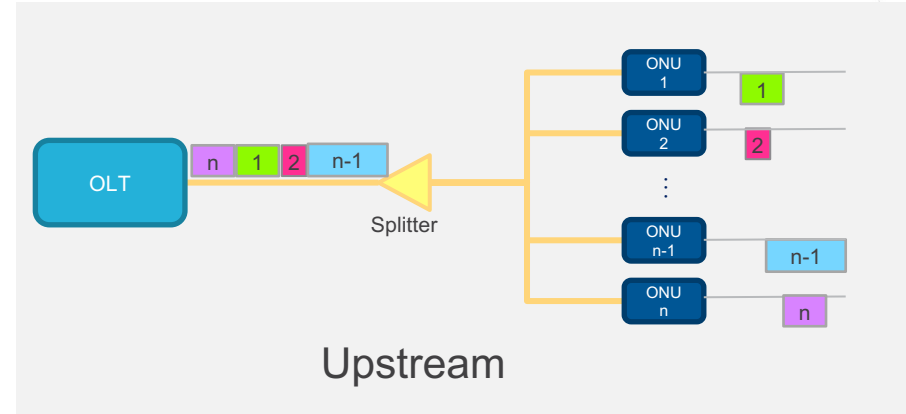
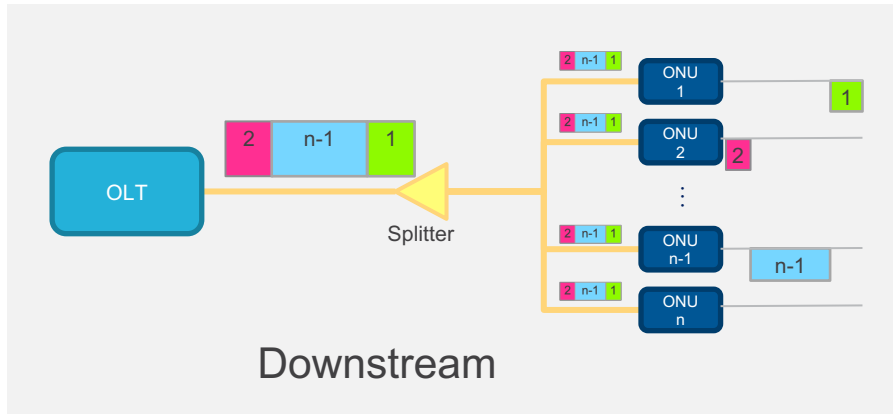
Point-to-multipoint - Minimizes fiber buildout

Components



Similarities between DOCSIS and PON

- Network architecture
 - Both are point to multipoint networks
 - Centralized controller (CMTS / OLT) distributes traffic across multiple users (CMs / ONUs)
- Transmission mechanism
 - PON is similar to early versions of DOCSIS
 - TDM in Downstream, TDMA in Upstream



Main differences between DOCSIS and PON

DOCSIS	PON
RF (Coax)	Light (Fiber)
Modulated (QAM/OFDM)	Baseband
Variable Power Output - dBmV	Fixed Power Output - dBm
Configurable Frequencies	Set Wavelengths
Channel Bonding	No Bonding (yet)
Up to 160km	Around 20km
CMs are L3 devices	ONUs are *L2* devices
Contention based BW requests from CM	OLT polls ONUs for BW requests

PON is a much simpler protocol than DOCSIS

- ITU: International Telecommunications Union
- Developed PON standards since the mid 90s, focused is on the Telco market
- Gigabit PON (GPON) and 10Gig Symmetric (XGS PON) are the most widely deployed PON standards
- Designed to carry multiple types of traffic, like Ethernet, MPLS, or even legacy TDM voice or SDH.



- GPON has been deployed worldwide, mostly by Telcos but also by some MSOs
- XGS has started to gain traction in the last couple of years
 - XGS reuses the same transceivers used by 10G EPON
- NG-PON2 (40gig) is being deployed in small numbers by Verizon in the US
 - Seen as expensive due to the use of tunable transceivers
- Like DSL, ITU-PON is very layer 2 oriented
 - Most ONUs are unable to classify based on layer 3 parameters (i.e. src/dst IP address/port)
 - OLTs are simple switches (no routing)
- Unlike CableLabs, focus wasn't initially on interoperability
 - ONUs and OLTs need to be from the same vendor
 - Broadband Forum's TR-156 and TR-180 have tried to address this limitation with some limited success beyond provisioning

- IEEE: Institute of Electrical and Electronic Engineers
- Same standard body that created Ethernet (802.3) and WiFi (802.11)
- Developed 1G Ethernet PON (EPON) and 10G Ethernet PON (10G EPON)
- Released 25/50G standard in July 2020
- Main users are:
 - Tier 1 MSOs in US and Canada
 - Telcos in China, Japan, South Korea, Taiwan
- ONUs support L3 filtering and classification, similar to a cable modem.



- EPON is based on Ethernet (that's the "E" in EPON😊)
 - No additional encapsulation takes place
 - Limited to Ethernet traffic (no legacy support for TDM or SDH like ITU)
 - Overall is a simpler protocol than ITU's
- CableLabs standardized the messages between an EPON OLT and ONU to provision ONUs using cable modem configuration files
 - Solves the ONU/OLT interoperability problem

XGS vs 10G EPON

- Differences:

XGS PON	10G EPON
Multiple types of traffic like Ethernet, TDM, SDH, etc (GEM encapsulation)	Ethernet only
L2 centric - limited traffic classification/filtering on L3	L3 traffic classification – similar to cable modems
Slightly more complex ONU management (3 types of management messages)	Simpler ONU management (uses Ethernet slow protocol messages)
No MAC addresses on ONUs (serial numbers instead)	Plays nicer with DOCSIS provisioning

- Similarities:

- Same data rates (10G symmetric)
 - Same optics
 - Same split ratios (up to 128 ONUs per port)
- ONUs based on latest Broadcom, Cortina, or TiBiT chipsets support both (different FW)

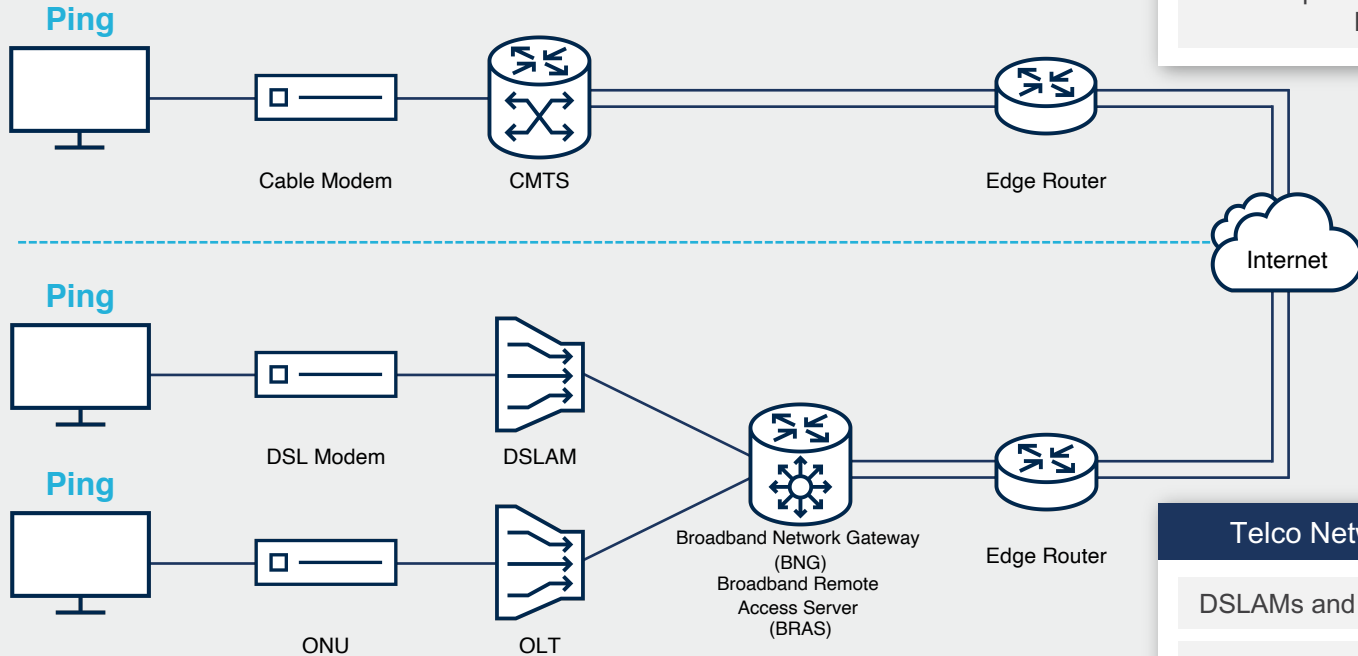
If your company is planning or deploying PON, what standard are you considering/using?

- a) ITU GPON
- b) ITU XGS
- c) EPON

Please answer in the chat

CABLE VS TELCO RESIDENTIAL DEPLOYMENTS

The Broadband Network Gateway



Cable Networks are Layer 3 based

CMTS performs DOCSIS MAC, routing, DS QoS, filtering

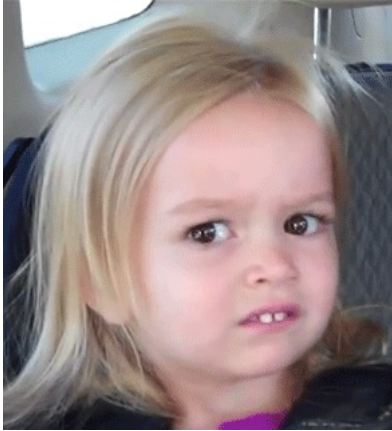
Telco Networks are Layer 2 based

DSLAMs and OLTs perform MAC functions

BNG performs routing, DS QoS, filtering

Virtualization Concepts

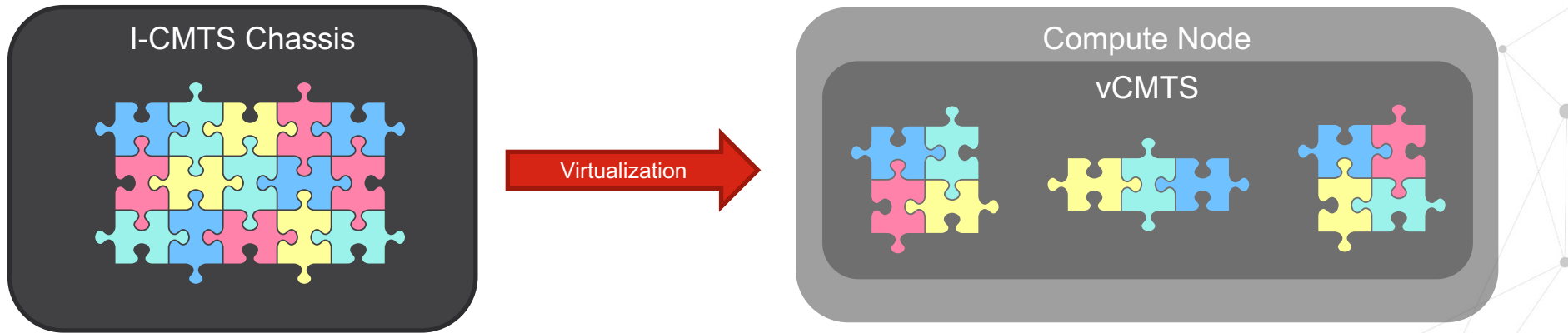
TECHNOLOGIES ENABLING NETWORK TRANSFORMATION



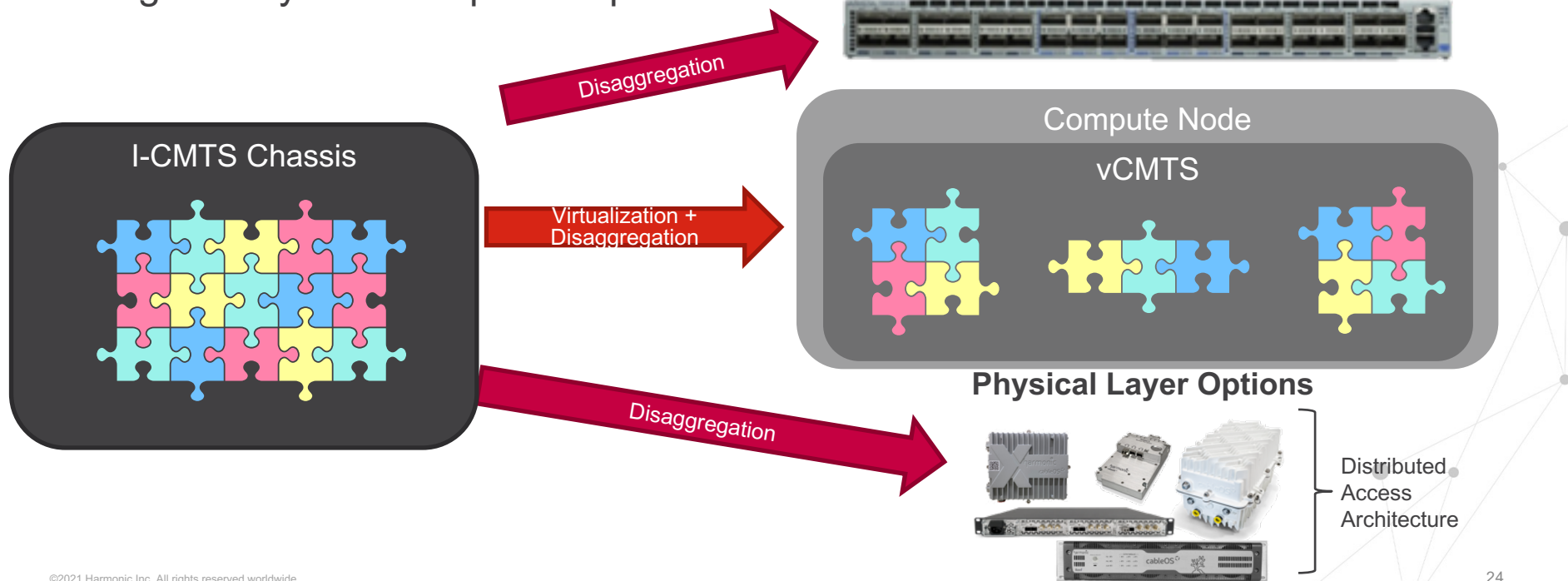
Virtualization?
Disaggregation??
Cloud Native???
What does that actually mean?

... and how does that help me?

- CMTS virtualization is the process of moving the functions performed by an integrated CMTS hardware to software, using off the shelf servers



- Disaggregation is the process of separating different functions performed by a single entity into multiple components



Virtualization

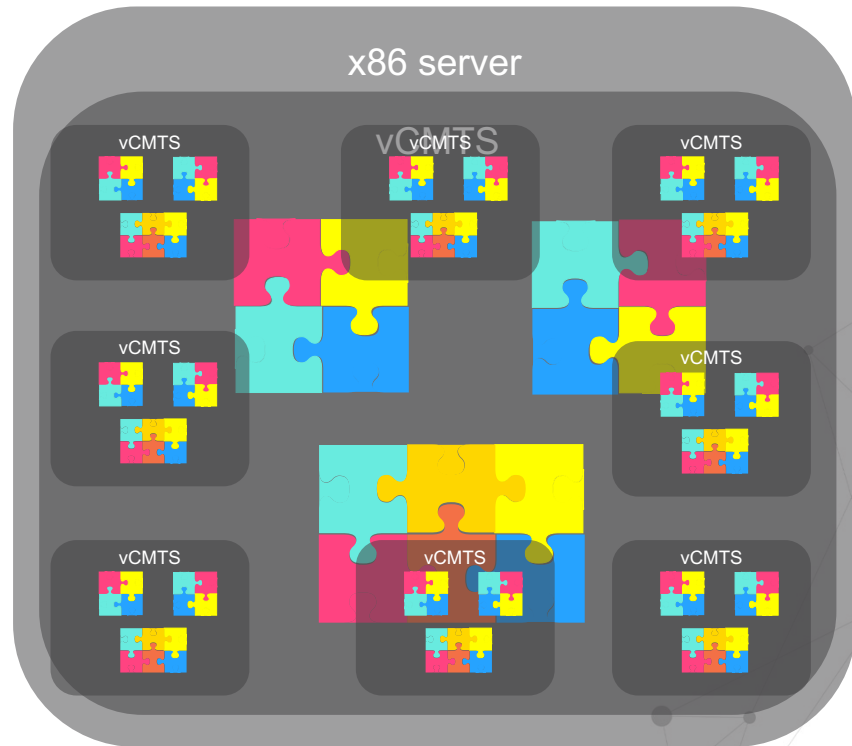
- Immediately benefit from **savings** on space, power, cooling and cabling
- Perfect fit for small scale and large scale with **sustainable growing capacity**
- Feature **velocity** to adapt to customer demands fast
- Runs on **generic** servers
- In volume deployments

DAA

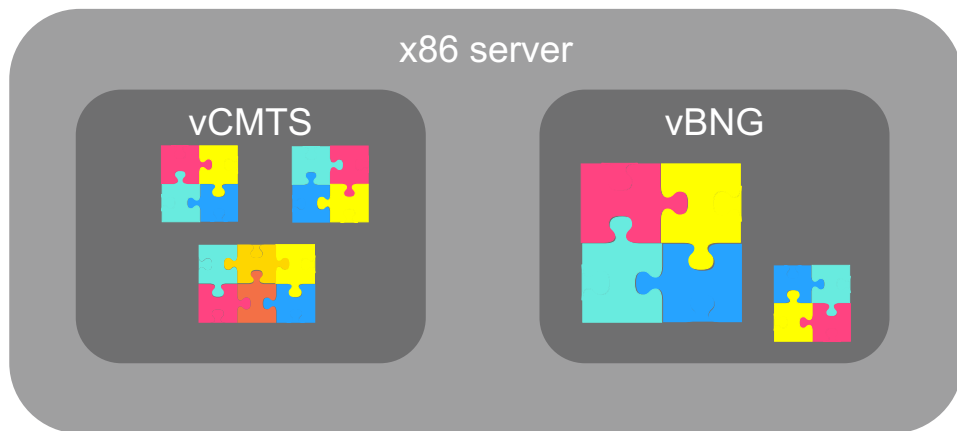
- **Improved** plant performance
 - SNR/MER = better Speed performance
 - Reduce maintenance / labor
- **No proprietary optics** – move to standard ethernet
- **Remove RF** combining from the headend
- Better **fiber utilization**
 - Increase number of λ s per fiber

A term that describes applications and services built to exist in the cloud

- Allows for quick up/down scaling
- Platform independent
- Managed by a central orchestrator



- Many of the building blocks from the vCMTS can be used for PON
 - Example: User traffic manipulation (i.e. QoS, classification, filtering)
- The entity in charge of IP user traffic is the virtual Broadband Network Gateway (vBNG)





A Cloud-Native Access Platform can support different access architectures, such as DOCSIS and PON



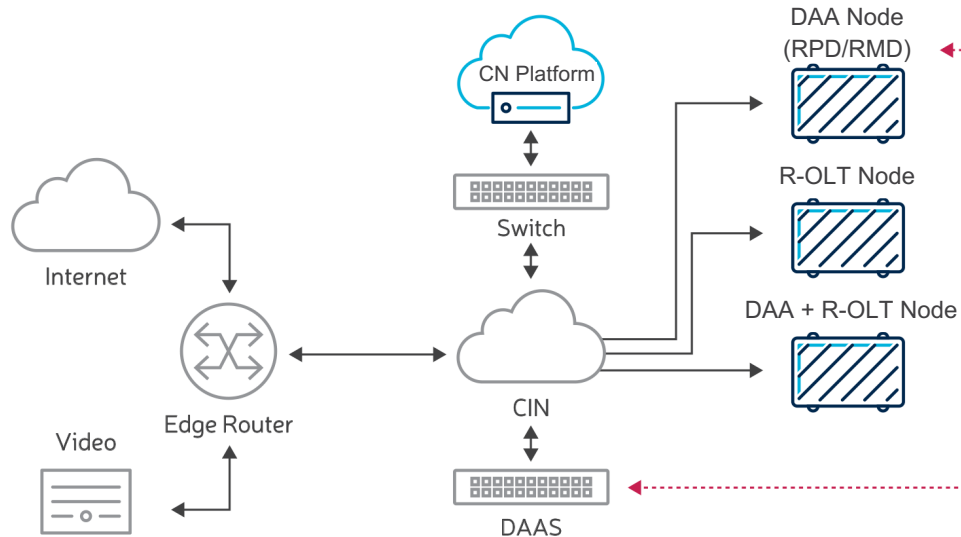
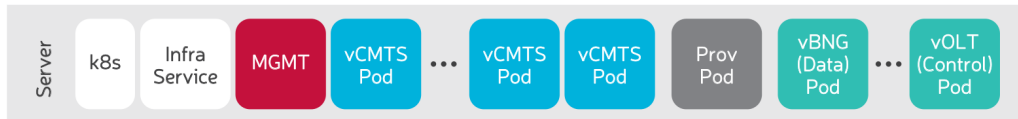
Key benefits include:

- **Orchestration:** dynamically deploy different apps on the platform
- **Scalability:** scales from very small to very large number of service groups
- **Flexibility:** deployable in centralized, distributed and hybrid architectures
- **Resiliency:** smaller domains, increased uptime and hitless upgradability

Consolidated Access Platform

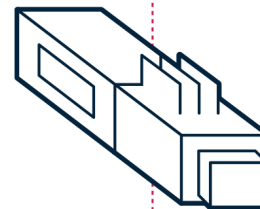
A SINGLE SOLUTION FOR HFC DOCSIS AND PON/FTTH

Cloud-Native Platform



PON Interface SFP+

Outdoor



Indoor

MSO Network Migration

What are your access plans for the next few years?

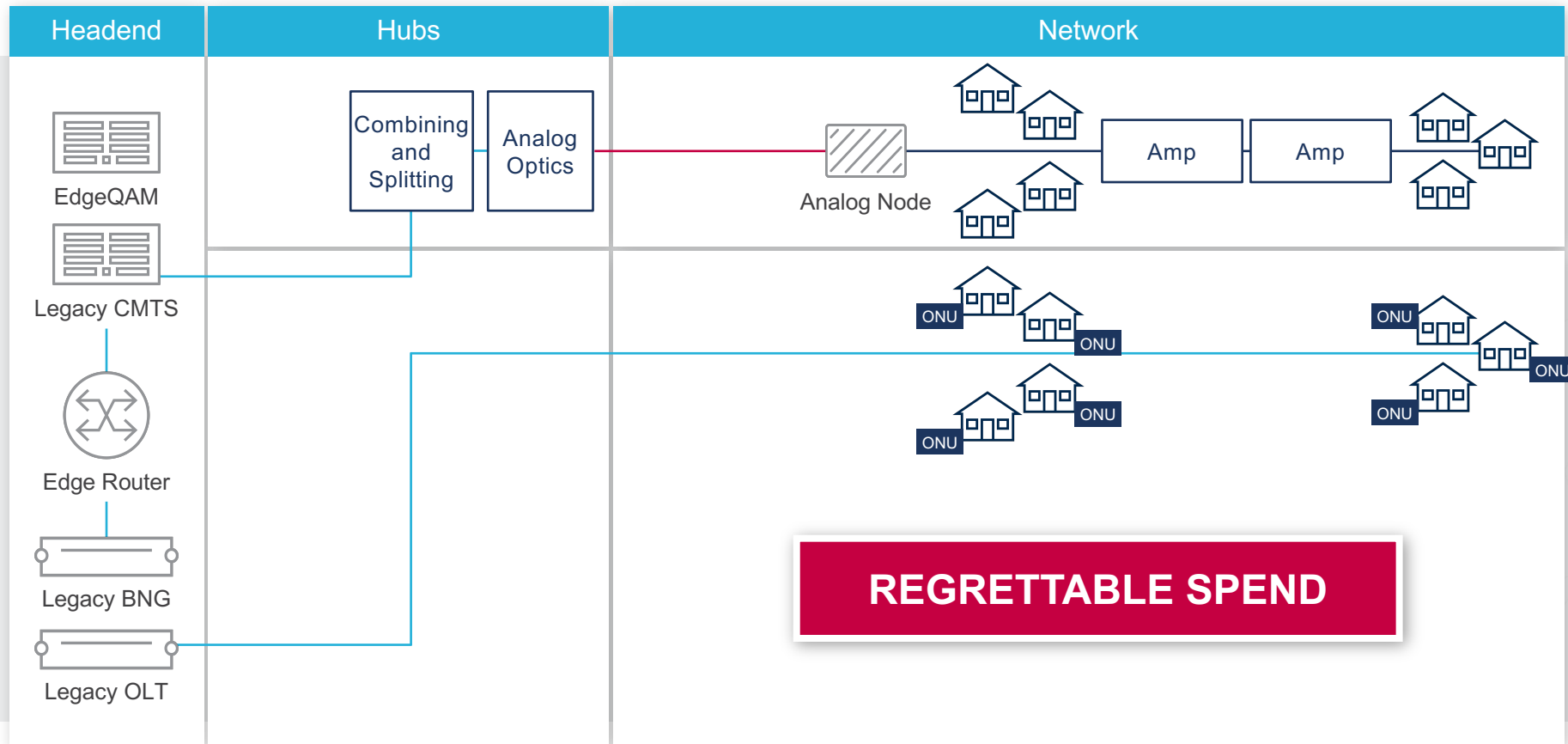
- a) Deploy DAA devices (R-PHY/R-MAC PHY)
- b) Deploy Mid splits (85MHz) / High Splits (204MHz)
- c) Migrate to D4.0 (FDX/ESD)
- d) Cap and grow to PON

Please answer in the chat
(Multiple answers ok)

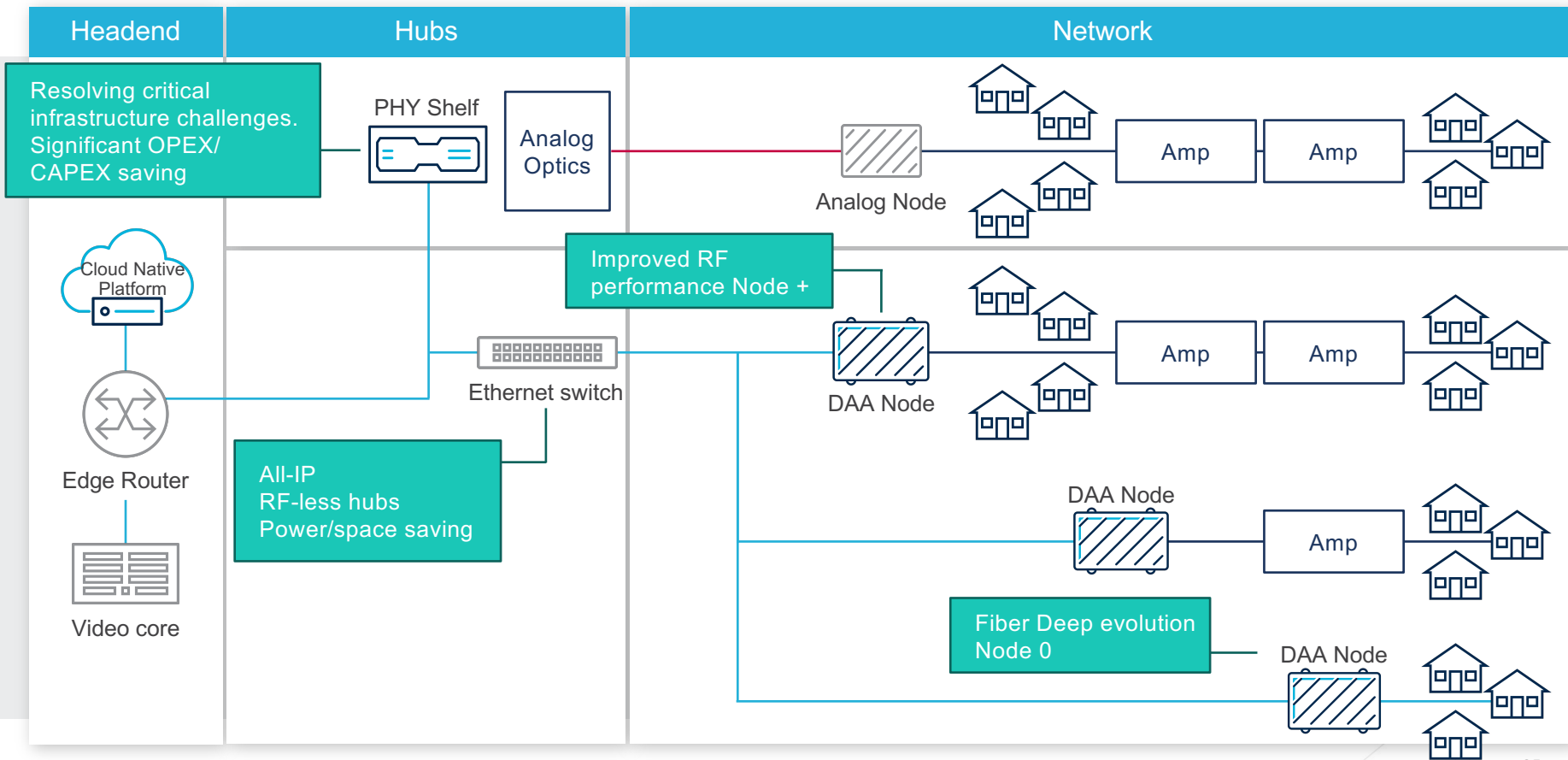
- MSOs have a considerable investment in HFC
 - An HFC network is still capable of providing Gigabit speeds for the foreseeable future
- Goal is to *maximize* the use of the existing HFC network while deploying PON *efficiently*



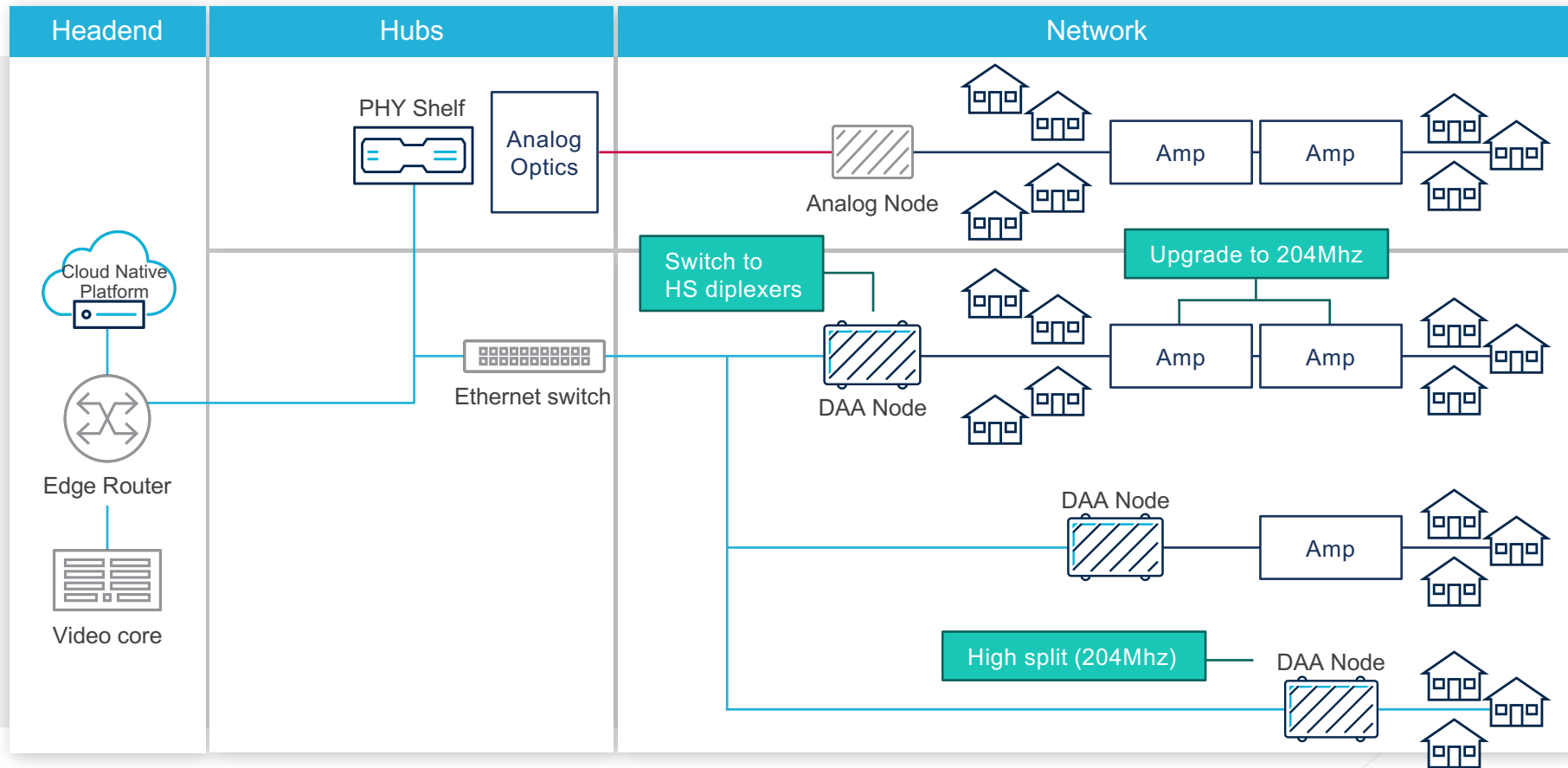
LEGACY NETWORK ARCHITECTURE



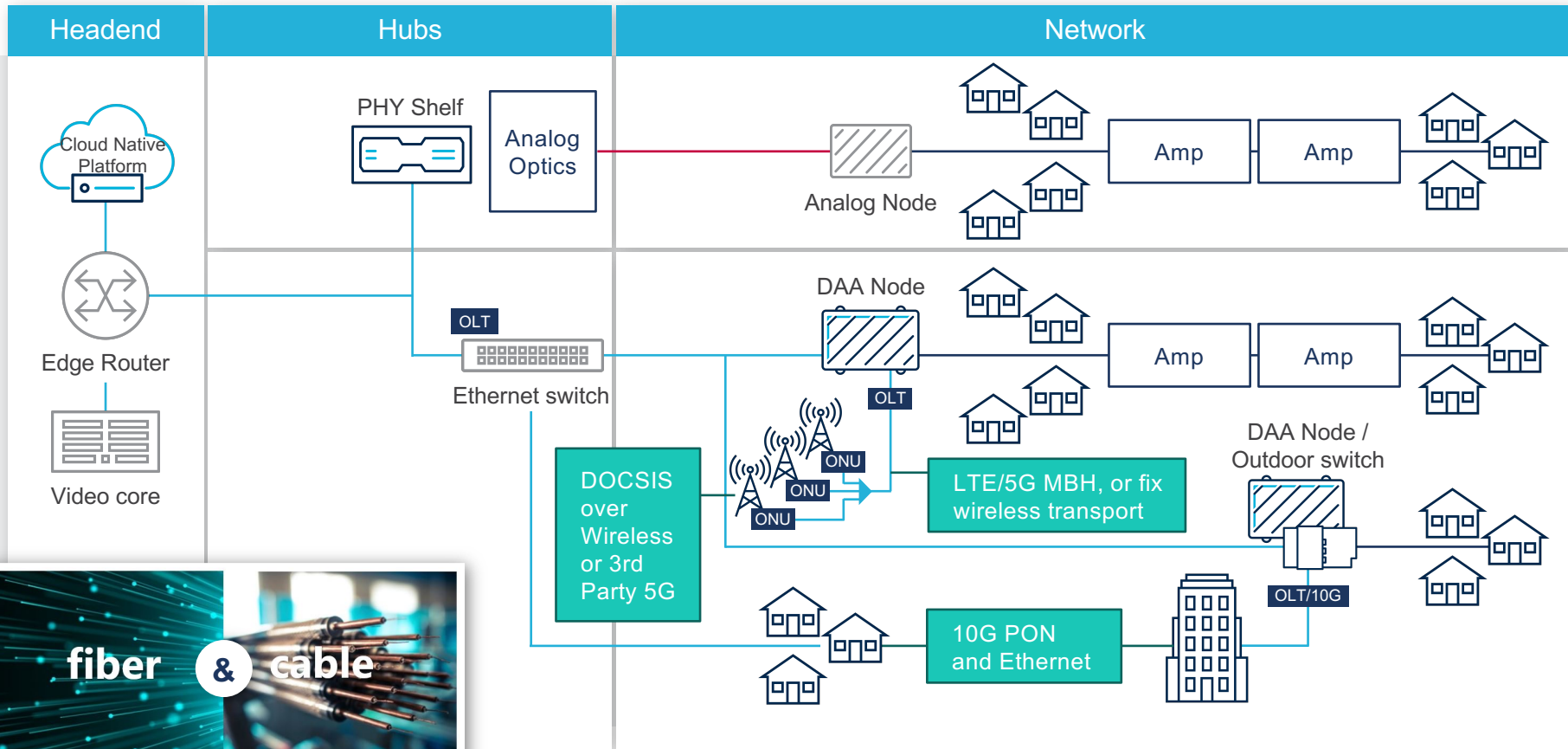
NETWORK EVOLUTION WITH A CLOUD NATIVE PLATFORM



NETWORK EVOLUTION – INCREASING UPSTREAM CAPACITY WITH MID/HIGH SPLIT



NETWORK EVOLUTION WITH A CLOUD NATIVE PLATFORM



- Cloud native technologies consolidate DOCSIS and PON on a single platform
- *Maximizes* the use of the HFC network while allowing a seamless transition to PON
- *Simplifies* operations and reduces time to market
 - Less training required for internal teams
 - Integrates with existing back-office provisioning systems
- Reduces space/power/cooling requirements

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THANK YOU.

