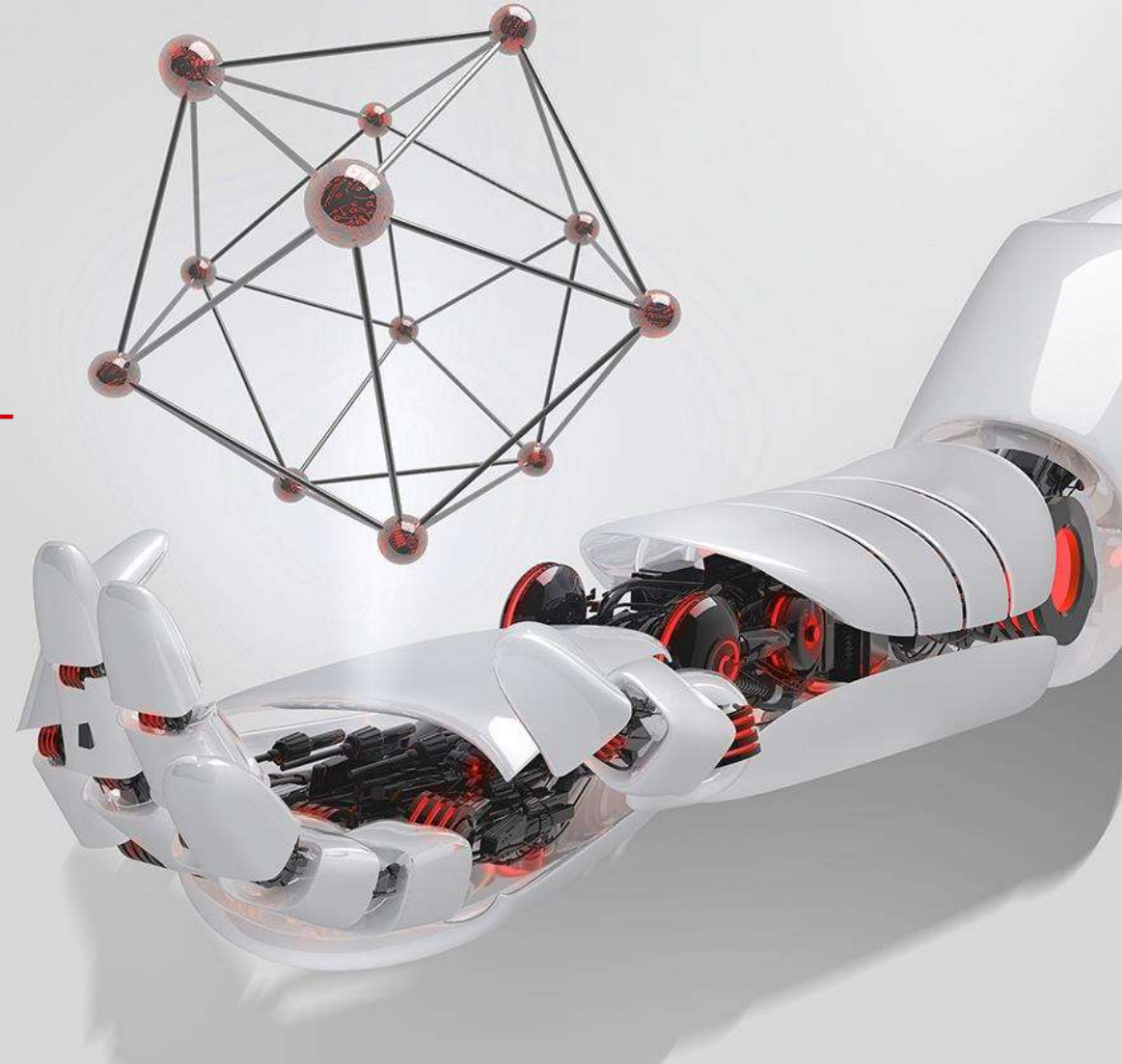


Overview of Technology standards for F5G

Frank Effenberger
Futurewei Technologies
6 Dec 2020



Introduction

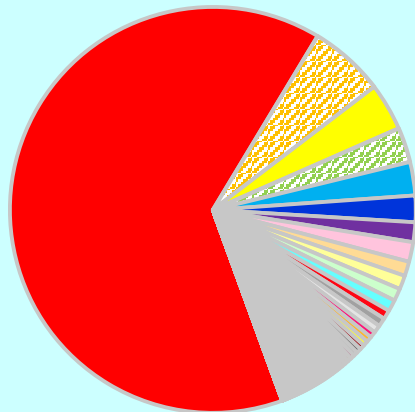
- A large part of F5G is PON
 - PON evolving through time
 - PON evolving in application
- The user network must keep up
 - Advanced WiFi is growing
 - Optical in-home networking
- Transport integration is needed
 - Data plane evolution
 - Management plane revolution



Active development of passive optical networks

Where we are: G-PON ITU-T G.984

Total FTTx sub = 652 M
Vast majority is PON

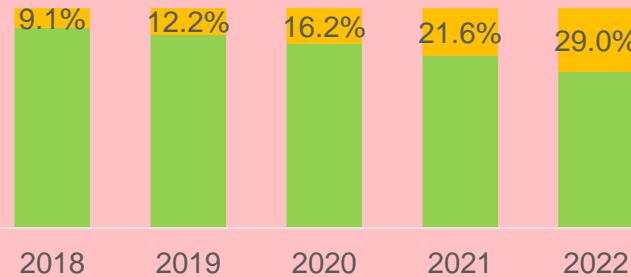


■ China
■ Japan
■ Russia

G-PON was not the first PON, but it was the first to reach 100M customers
The importance of deploying all that fiber cannot be underestimated

Where we're going: XG(S)-PON G.987 & G.9807

10G PON will account for ~20% in 2020



■ PON ■ 10G PON

Source: Ovum

Upgrading to XG(S)-PON is enabled by the coexistence features
It is driven by application BW growth and peak BW competition

Where to after that? 50G-PON G.9804

China Telecom and China Unicom



China Mobile



The conversion to 10GPON is worldwide

49 countries have launched gigabit services.



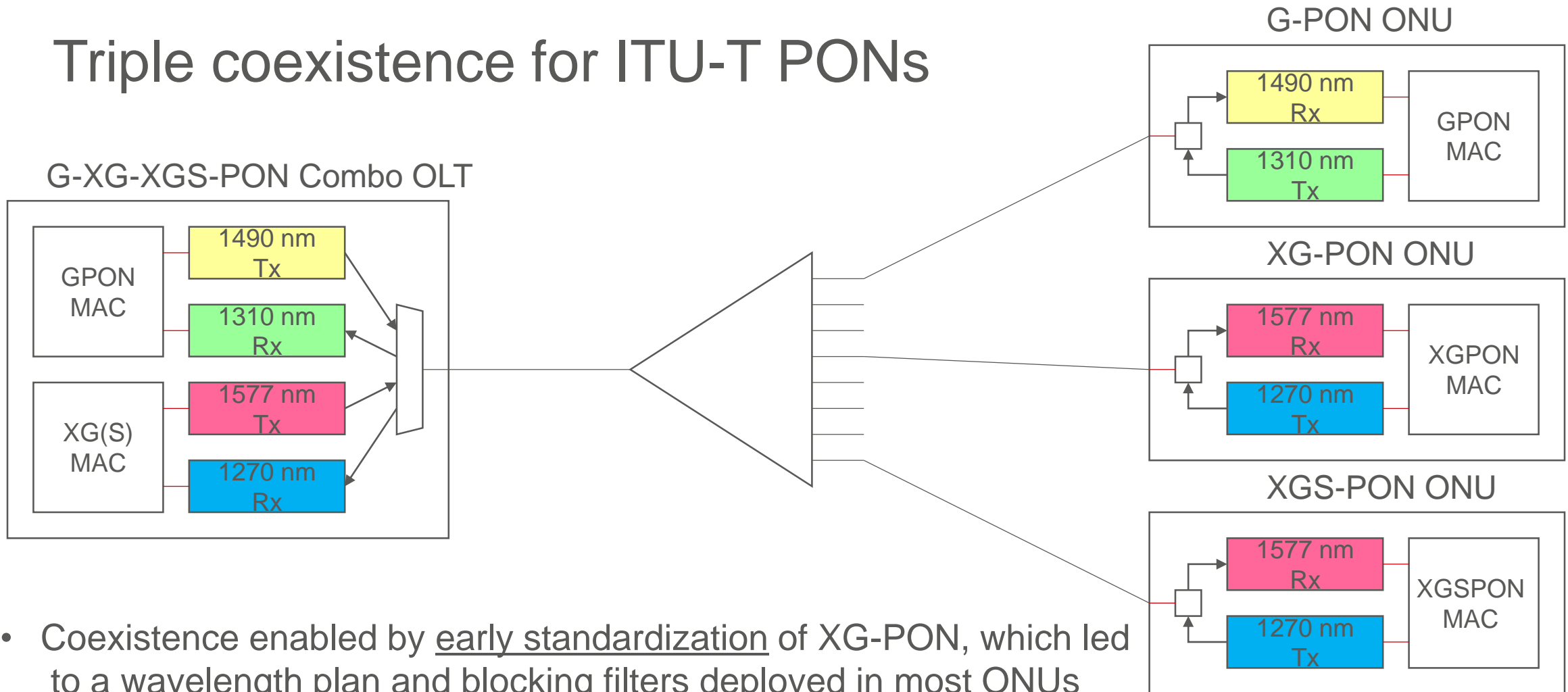
Service Driven

1Gbps, 4K, VR services
SME, 4K Camera, 5G MBH

Competition Driven

ILEC vs CLEC: China Mobile, SKB etc.
MSO DOCSIS3.1, Bell, etc.

Triple coexistence for ITU-T PONs



- Coexistence enabled by early standardization of XG-PON, which led to a wavelength plan and blocking filters deployed in most ONUs
- G-PON coexists with the others by pure WDM
- XG and XGS-PON coexist with each other by TDM (enabled by multi-rate receiver)

New application: Mobile operators deploying fixed fiber networks

Challenges



Insufficient CO Sites

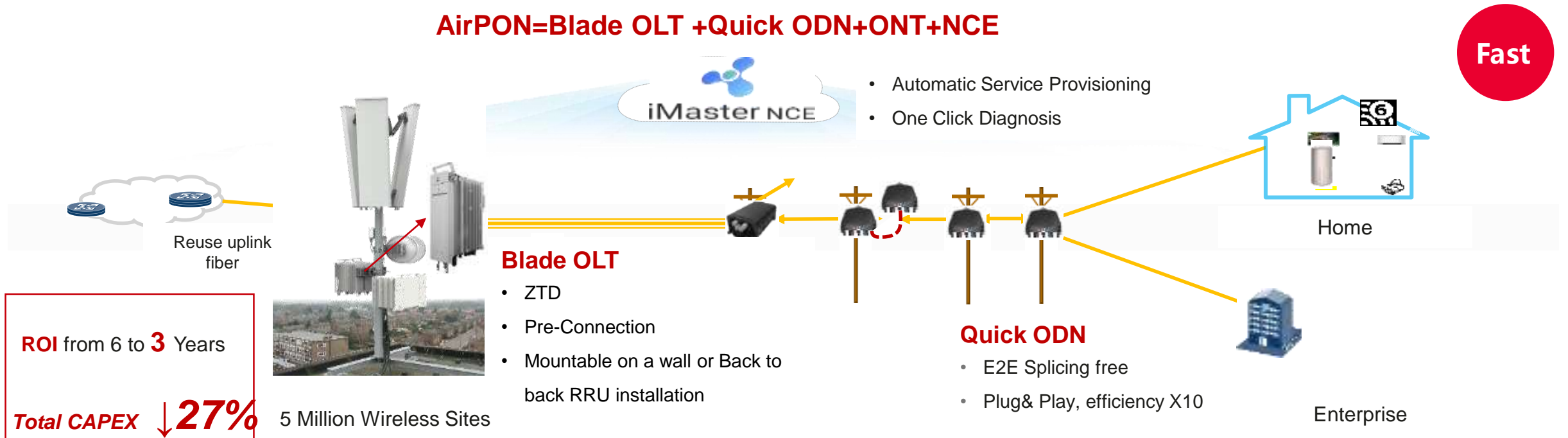


Right of Way Acquisition **8-10 Month**



Network Construction Cost > **500 \$ / line**

AirPON=Blade OLT +Quick ODN+ONT+NCE



0 Site Acquisition

- Reuse mobile sites, enabling one-stop installation
- Site construction: **3 months -> 3 days**

0 Fiber Splicing

- Quick ODN enables splice free deployment
- Installation : **40 min -> 13 sec**

0 Configuration

- One-click OLT/ONT configuration.
- Provisioning: **1 week -> 0.5 day**

New application: Developing high value 2B services to increase revenue

Challenges



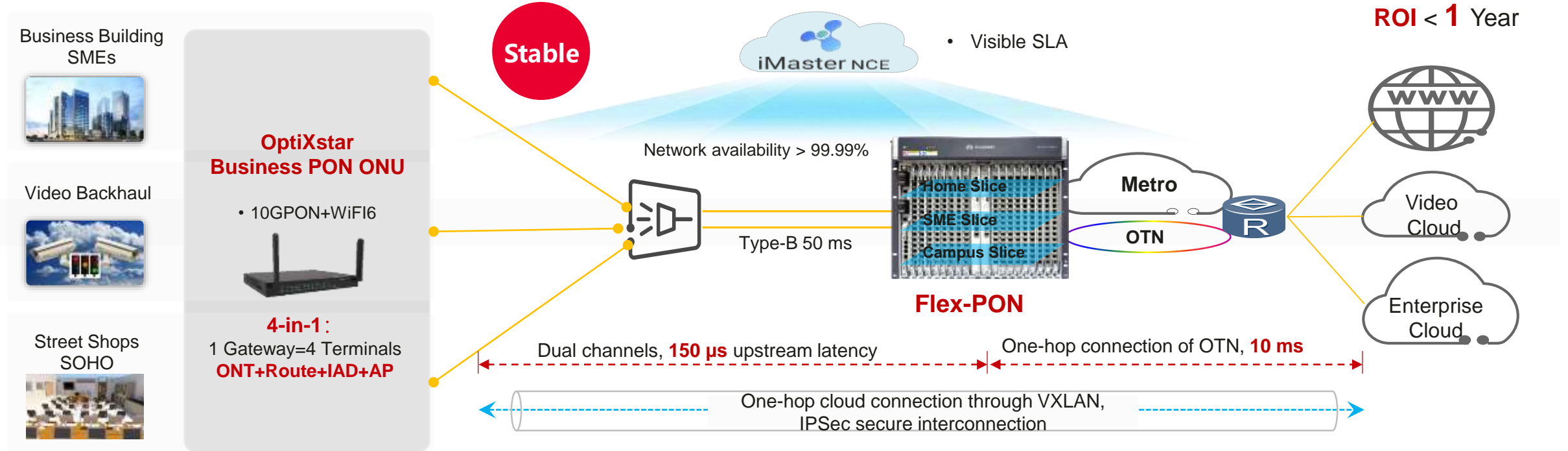
- Single Business, NO Value-added
- Many Boxes, Difficult to Maintain



- NO Guaranteed Bandwidth
- Poor Business Experience



- NO commitment SLA
- Long Time to Repair



0 Freezes

Dedicated Network planning, smart slicing, HQoS, guaranteeing zero freezes for key services

0 Disconnection

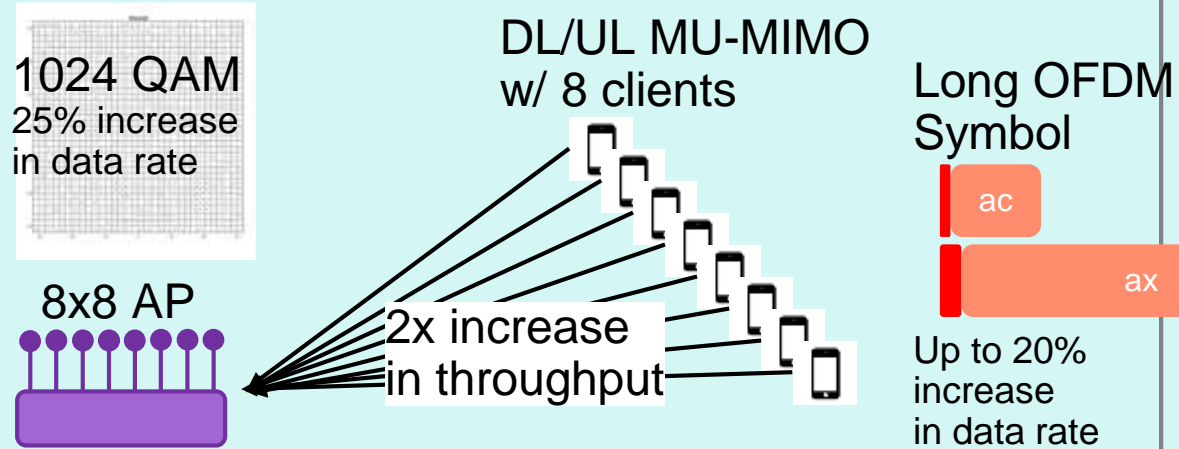
ONU dual uplink, ODN Type B protection, OLT redundant backup, ensuring service availability of 99.99%

0 Maintenance

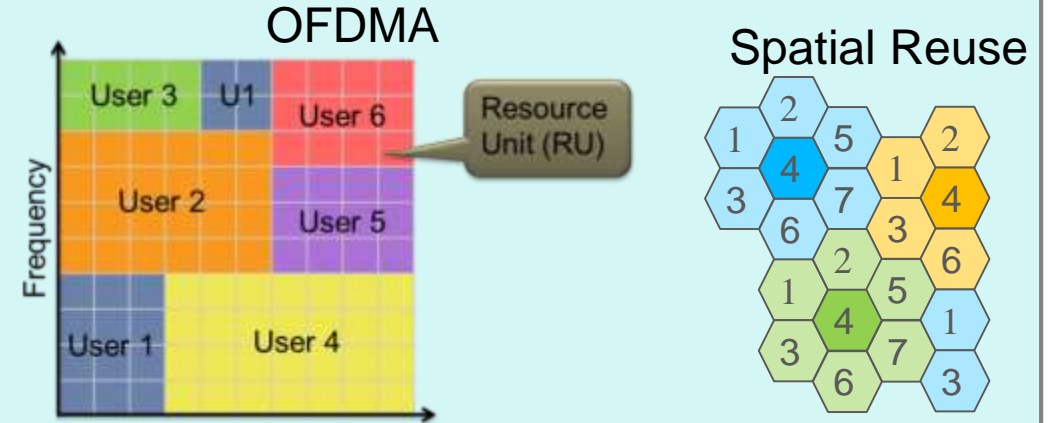
ONT + IAD + Router + AP 4-in-1 box, plug and play, one day provisioning, no O&M for enterprise

In the home: WiFi6 aka 802.11ax

Spectral Efficiency & Area Throughput

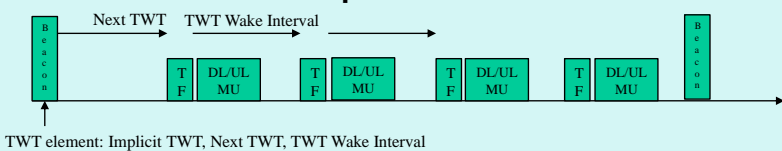


High Density

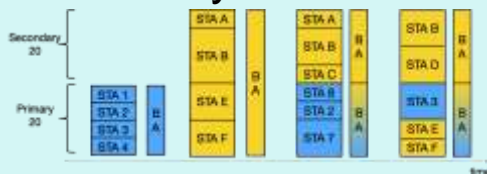


Power Saving

Scheduled sleep and wake times

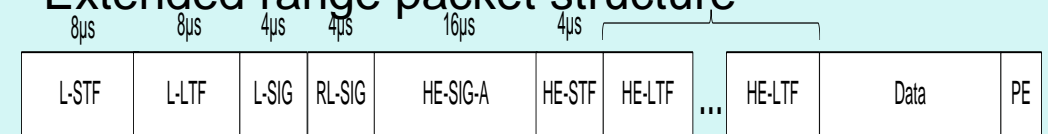


20 MHz-only clients

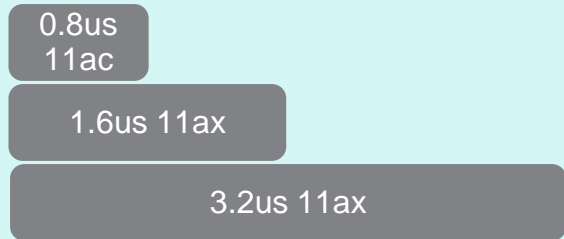


Outdoor / Longer range

Extended range packet structure



Enhanced delay spread protection-long guard interval

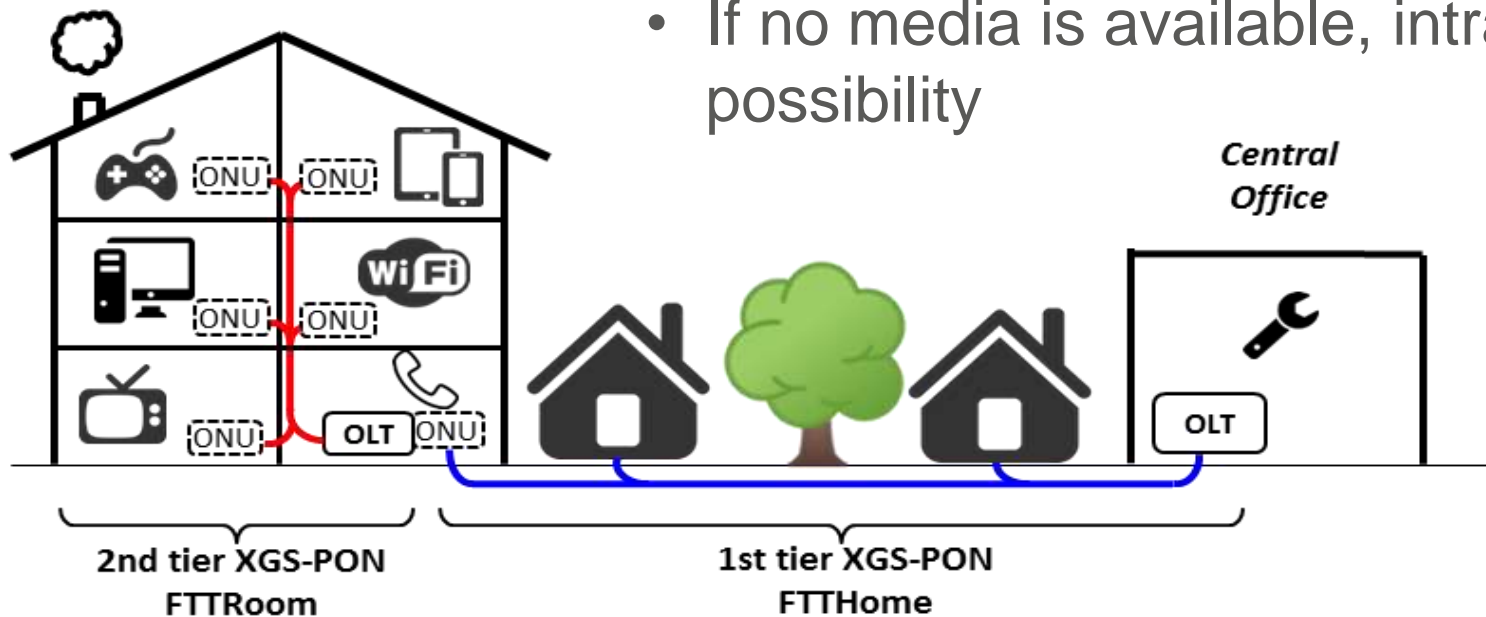


In the home: When radio doesn't reach

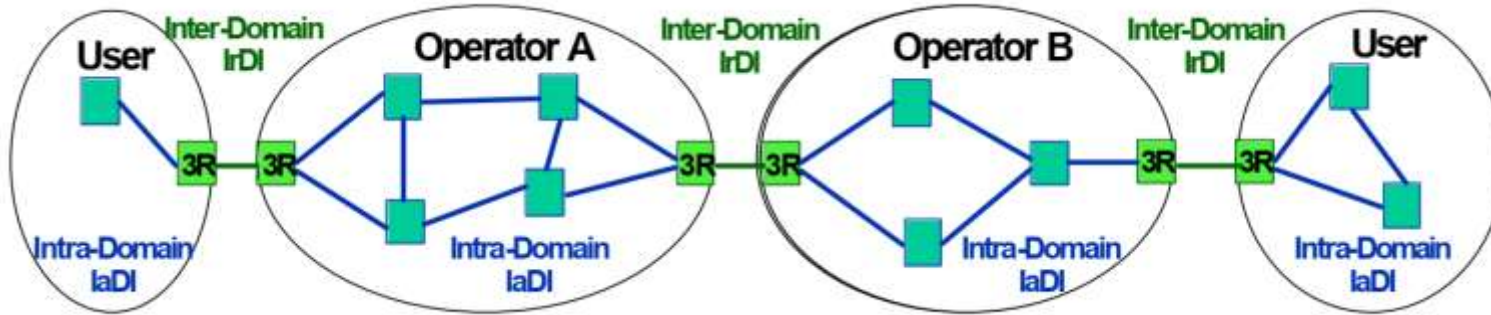
- In many cases, WiFi doesn't provide a complete solution, as its signals may be blocked by structural elements or jammed by interference
- In these cases, a fixed solution is needed

*Home Local Area Network (HAN):
House, apartment, ...*

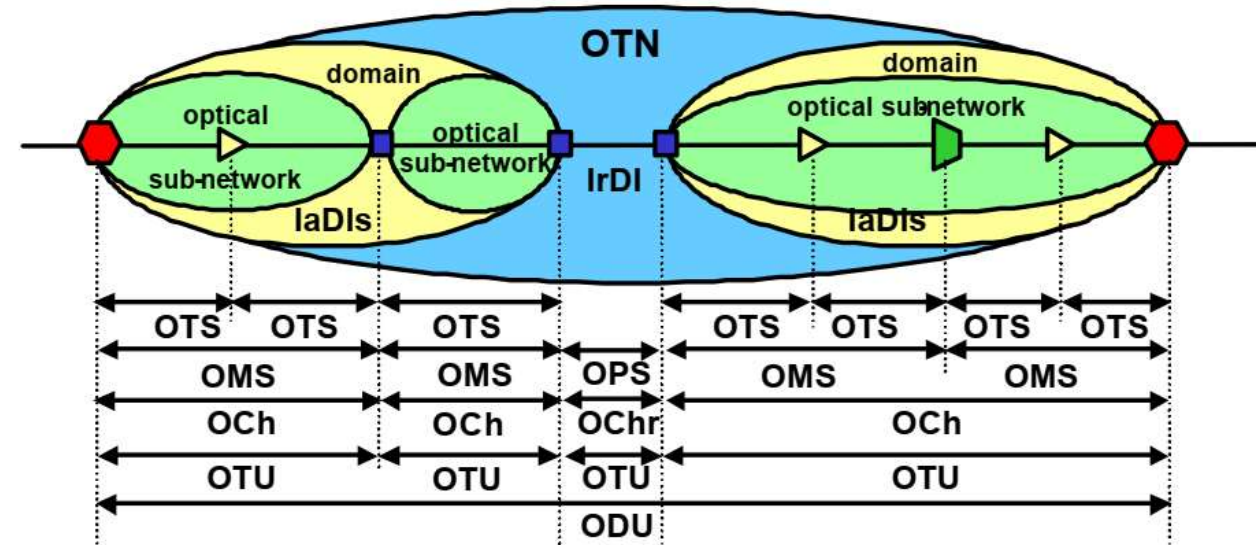
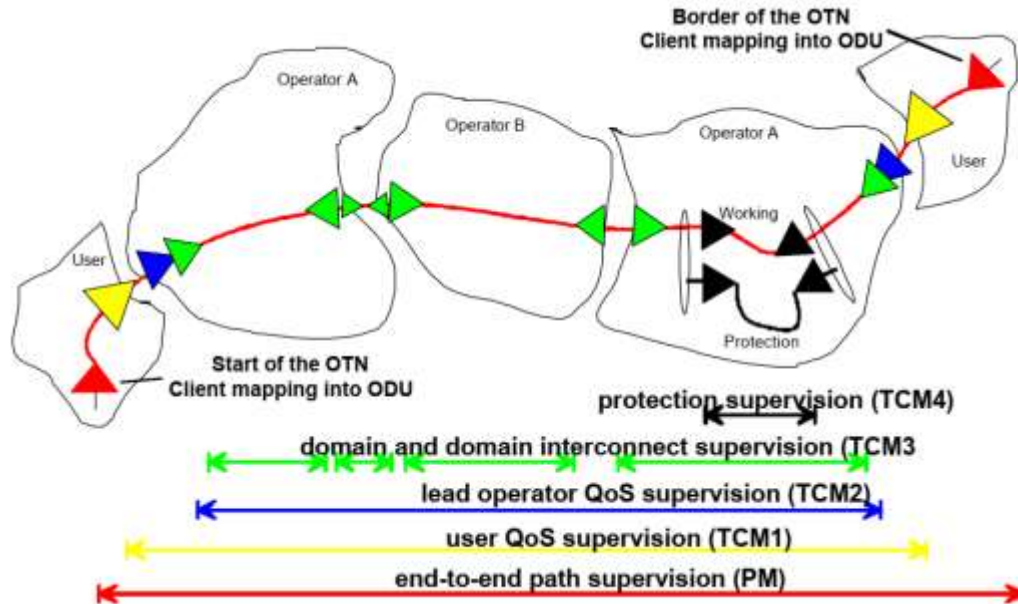
- If CAT5/6 is available: IEEE 802.3 Ethernet
- If other metallic media are present: ITU-T G.hn (G.996x)
- If no media is available, intra-premises fiber is a possibility



Optical transport network

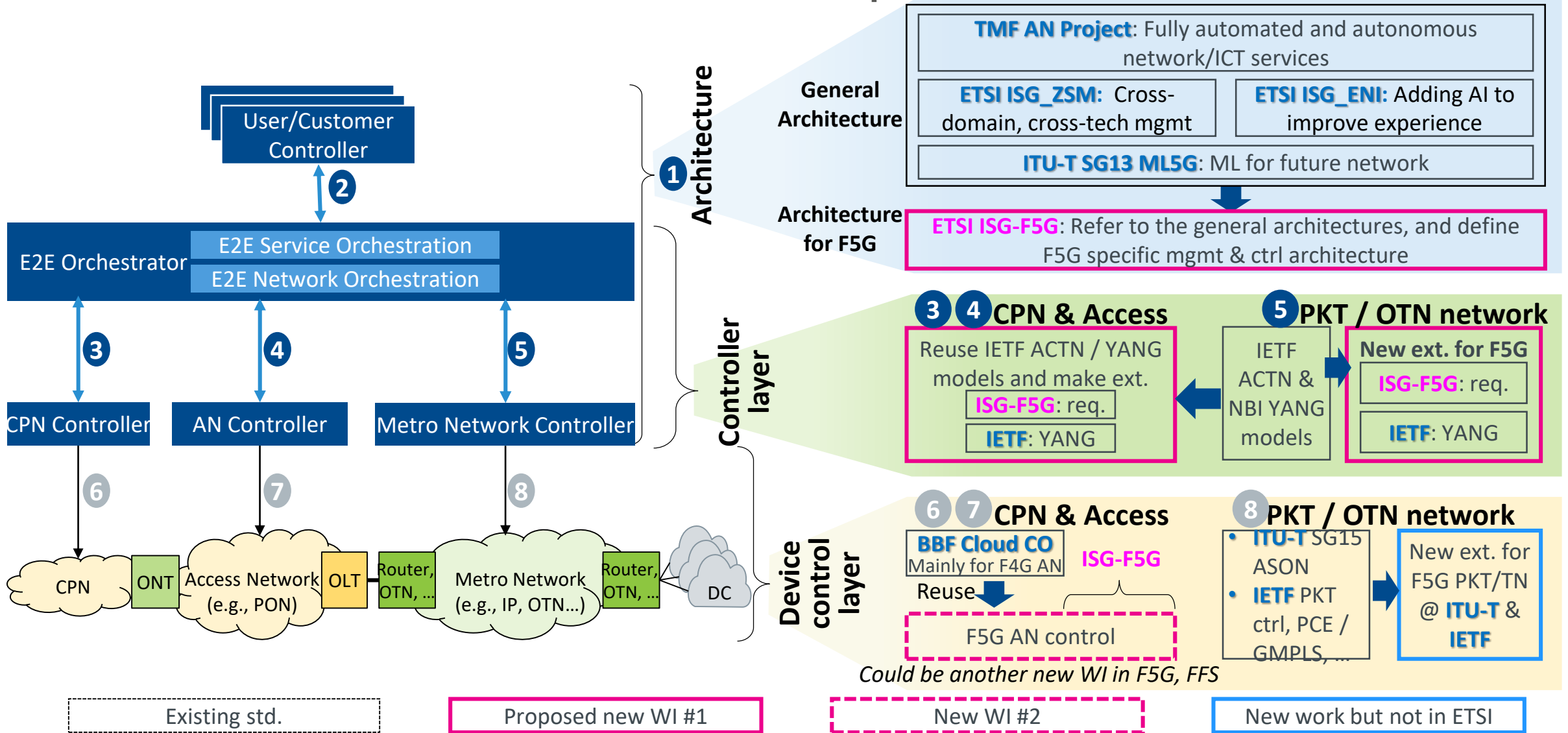


All these features and systems can flexibly handle a wide range of tributary and transport line rates



- Optical line amplifier (OTS termination)
- Optical cross connect/addrop/terminal mux (OMS termination)
- 3-R regeneration (OCh, OTU termination)
- Client access (ODU termination)

Global Standardization Landscape



Thank You.

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