

## Second Joint ETSI ISG F5G, BBF, CCSA TC6 and ITU-T SG15 Workshop on "FTTR" (Fibre to the room)

# FTTR : Fiber To The Room

# Fiber inside the customer premises

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Orange Innovation Networks, Fixed Access Networks

The 28<sup>th</sup> June 2022



# Agenda

## Use cases

WIFI roadmap, throughput, latency

The combinatory OLT/Gateway/Wifi Extender

Interoperability

## Innovation

PON functional split for cascaded PON

Centralised Fixed Access Network

## Conclusion



# FTTH and WiFi companion technologies

**Access network** and **Smart Home** is a unified business segment :

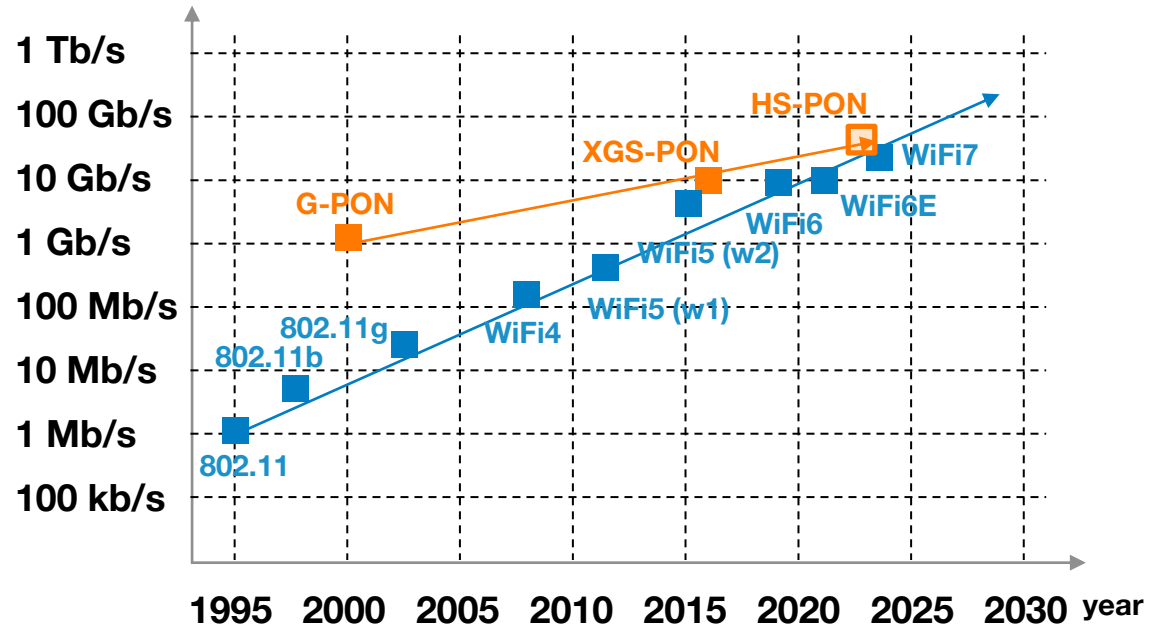
- commercial offers include the bundle “Box and access technology”

**Customer experience** :

- for migration ADSL to G-PON : customer are keen on the change of medium (Copper to Fiber)
- for migration G-PON to XGS-PON : user experience are strongly linked to Home LAN performances (Wi-Fi, other...)

**Customer throughput companion** :

Maximum physical layer data rate





# FTTH and WiFi companion technologies for throughput

## The main developments of WiFi

	WiFi 6 /6E	WiFi 7
Frequency	2.4 , 5 , 6 GHz	2.4 , 5 , 6 GHz
Maximum bandwidth	160 MHz	320 MHz
Best modulation	QAM 1024	QAM 4096
MIMO	8	16



WiFi 7 is 20% more data rate close to the access point

	WiFi 6 /6E		WiFi 7		
Bandwidth	80 MHz	160 MHz	80 MHz	160 MHz	320 MHz
Maximum theoretical physical layer data rate	4.8 Gbps (8x8)	9.6 Gbps (8x8)	11.5 Gbps (16x16)	23 Gbps (16x16)	46 Gbps (16x16)
e.g. laptop →→ Maximum theoretical physical layer data rate (3x3:3)	1.8 Gbps	3.6 Gbps	2.1 Gbps	4.3 Gbps	8.6 Gbps
e.g. smartphone →→ Maximum theoretical physical layer data rate (2x2:2)	1.2 Gbps	2.4 Gbps	1.4 Gbps	2.8 Gbps	5.7 Gbps

Supported by  
G-PON

Supported by  
XGS-PON



# FTTH and WiFi companion technologies for throughput

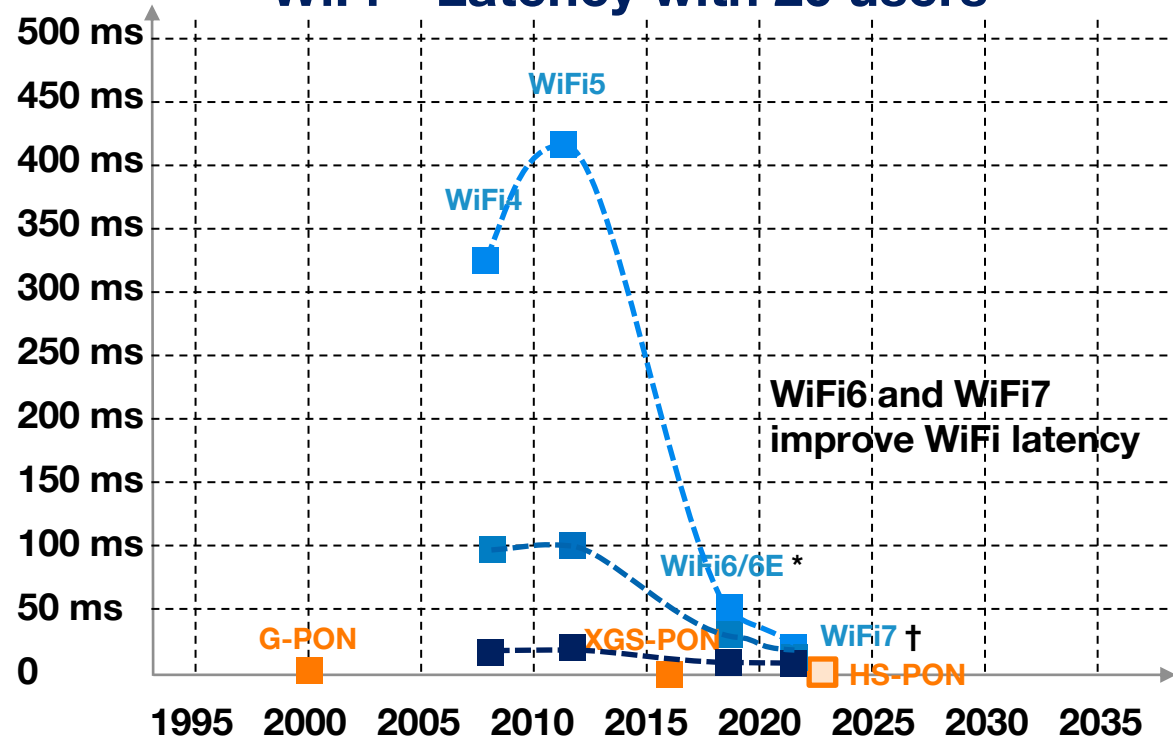
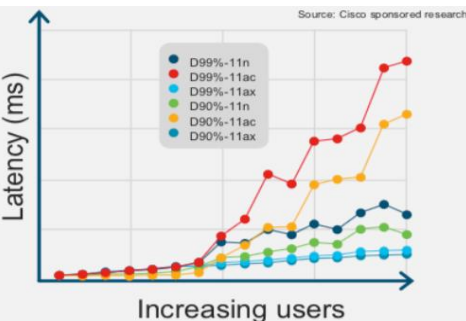
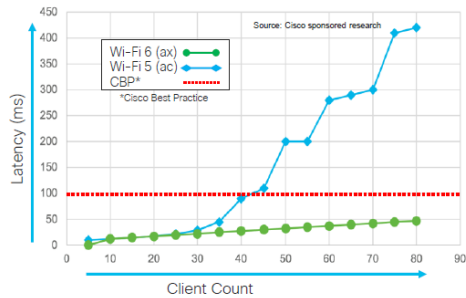
Latency is not a driver for FTTRoom.

WiFi – Latency with 80 users

WiFi – Latency with 40 users

WiFi – Latency with 20 users

Source Cisco:



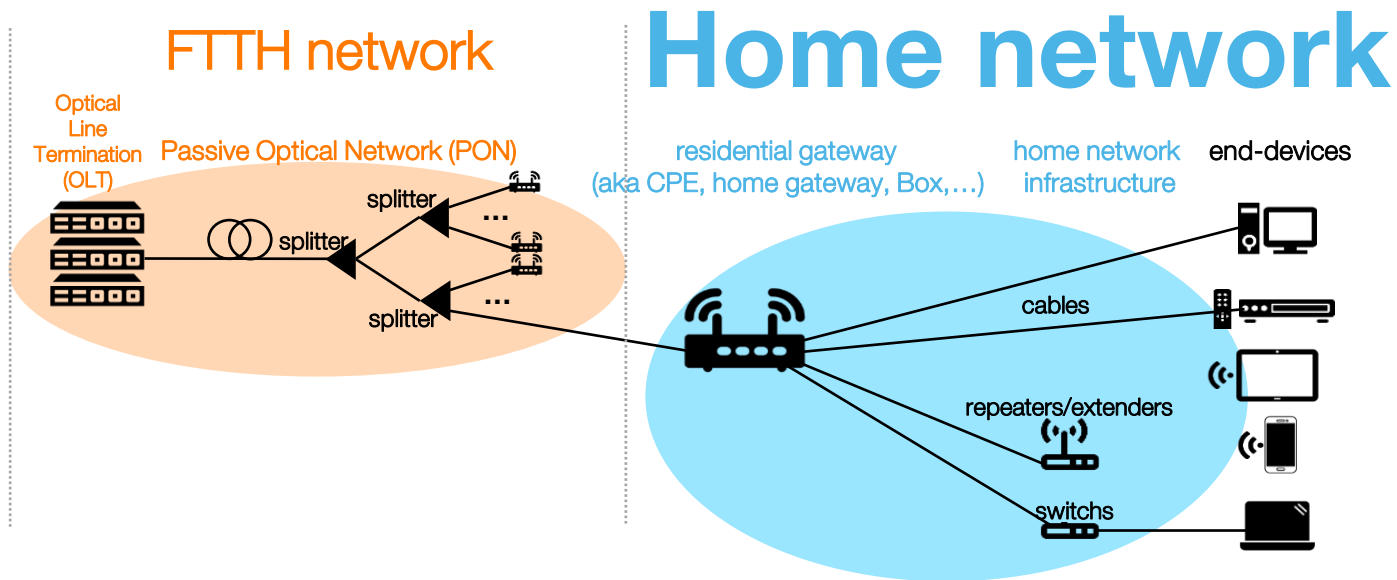
Without fiber, Latency PON D/S 40μs & U/S <1ms (n x125μs)

\* OFDMA, preamble puncturing features

† Multi-Link Operation (MLO)



# What role does the **smart home** have in telco strategy



**Connectivity** is essential, but undervalued and commoditized

Telcos need to make themselves a part of customers digital lives, **provide value**

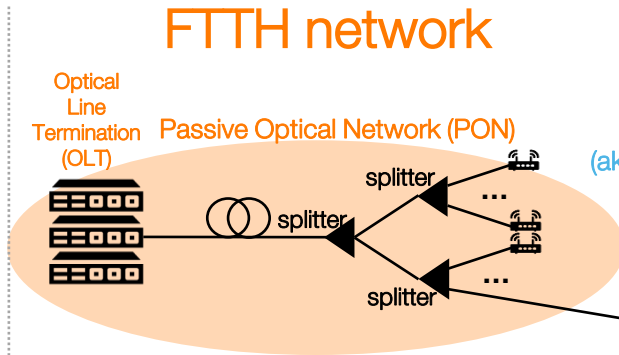
**Best in class fiber** access includes **best in class Home LAN**

Offering a **seamless experience**, the last Home LAN offer includes:

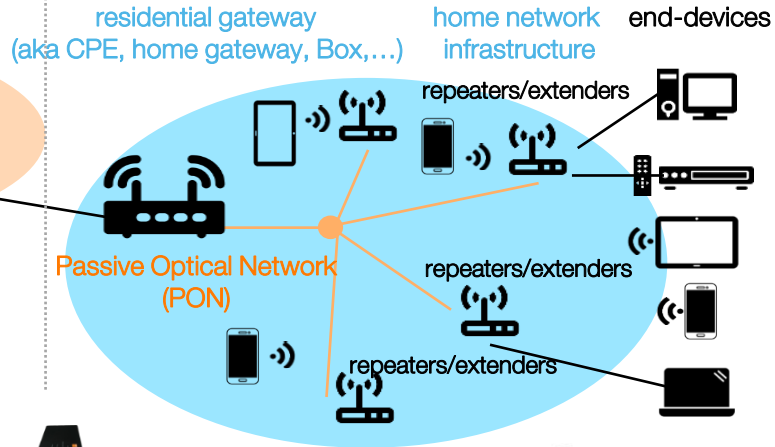
- fiber **gateway WiFi 6E** including **3 Wi-Fi6 extenders** & a support by an **expert Wi-Fi advisor**



# What role does the **FTTRoom** have in telco strategy



## Home network



- Vendor OLT-A
- Vendor OLT-A (new card/shelf)
- Vendor OLT-B
- Vendor OLT-C



- Vendor Gateway-D
- Vendor Gateway-E
- Vendor Gateway-F
- Vendor Gateway-G
- Vendor Gateway-H



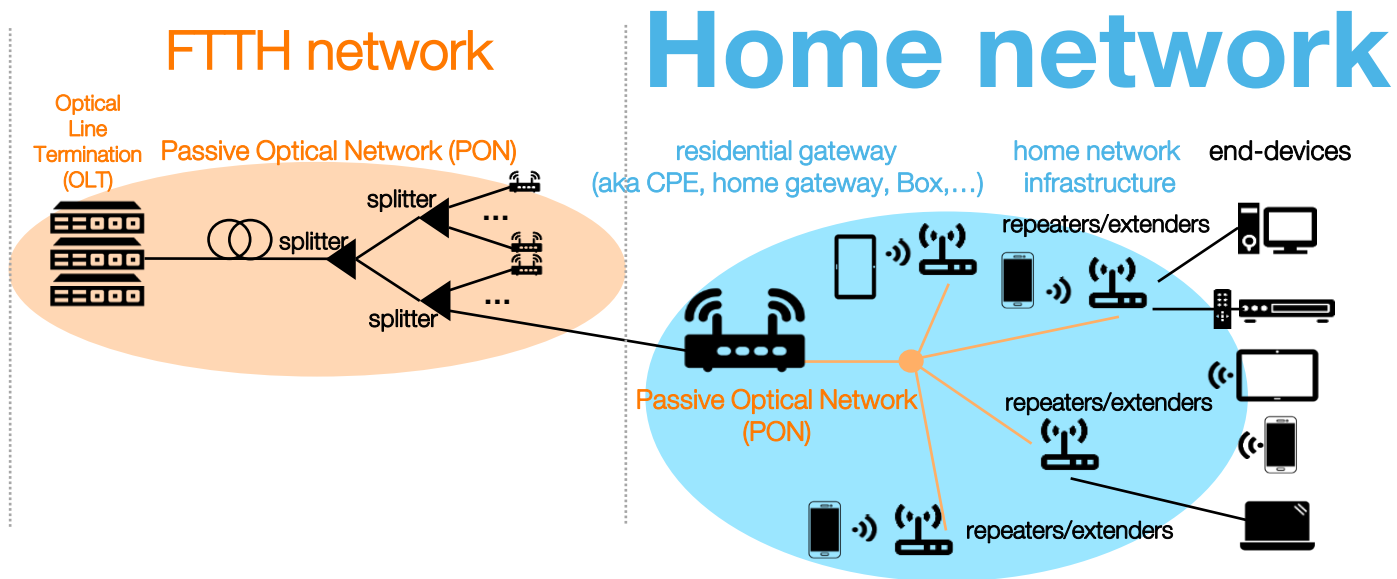
- Vendor WiFi Extender-I
- Vendor WiFi Extender-J
- Vendor WiFi Extender-K
- Wifi Extender not sourced by Telco-L/M....

### Example of combinatory OLT/Gateway/Wifi Extender by footprint (country):

≈ 2 OLT vendors	≈ 4 fiber Gateway vendors	≈ 2 WiFi extender vendors
≈ 6 to 8 OLT card / shelf	≈ 12 Gateway products	≈ 3 WiFi extender products



# What role does the **FTTRoom** have in telco strategy



## Niche FTTRoom deployments [2022 - XXXX]:

- Necessary to install ONU-WiFi Extender from same vendor as FTTH fiber Gateway

## To address mass market FTTRoom deployment, we need to decrease prices and reduce vendors dependency:

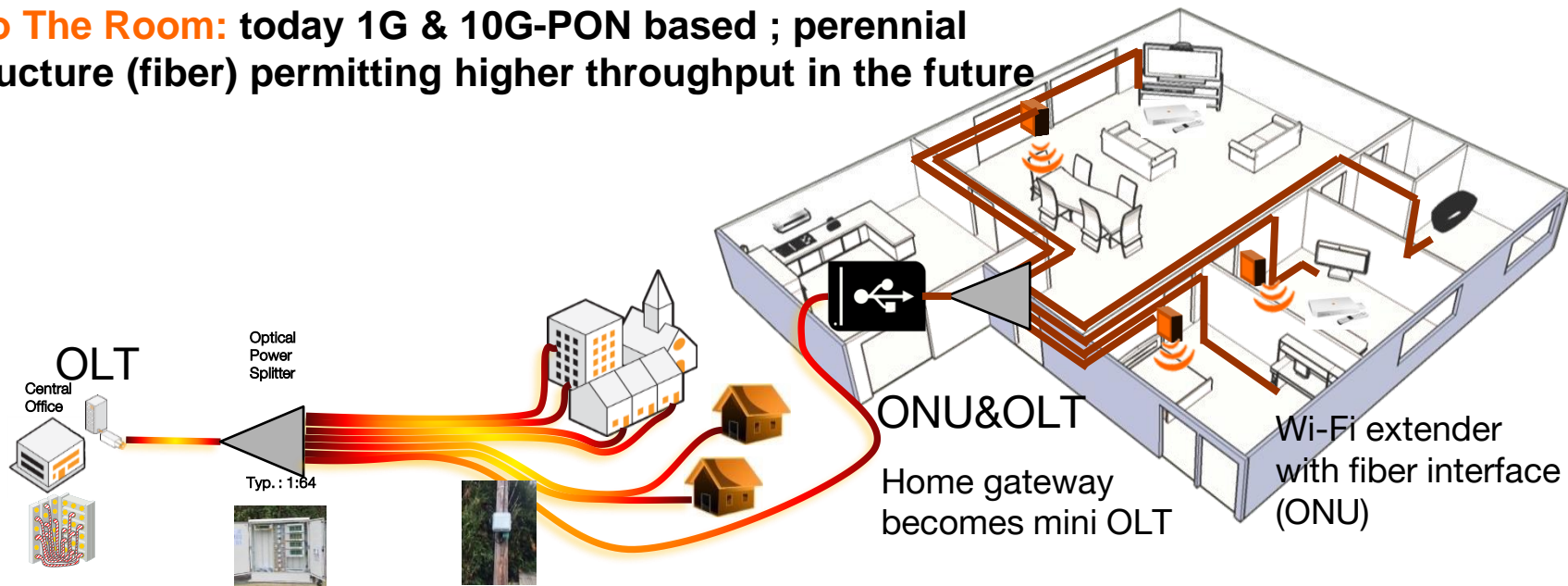
- Interoperability based standard specification, the key word for sourcing and to respond to increasing volume demands
- Facilitate equipment, network and services evolution





# Fiber for smart Home: FTTRoom

- Deeper fiber to connect everything at Home: Fiber to the Room
- A cost effective, Home network infrastructure associating optical fiber and radio for a wireless end connectivity to the very high bit rate services everywhere in the home
- Skills opportunity: A pool technicians (network operation) with the FTTH skills in time for FTTRoom
- **Fiber To The Room:** today 1G & 10G-PON based ; perennial infrastructure (fiber) permitting higher throughput in the future



# Agenda

## Use cases

WIFI roadmap, throughput, latency

The combinatory OLT/Gateway/Wifi Extender

Interoperability

## Innovation

PON functional split for cascaded PON

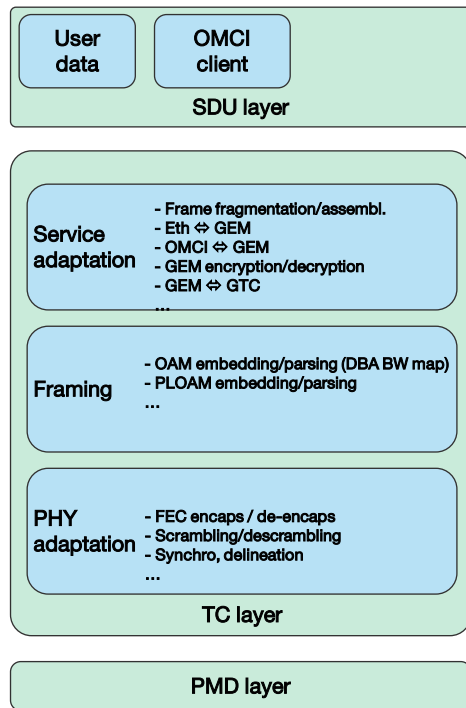
Centralised Fixed Access Network

## Conclusion

# Existing ITU-T PON protocol stack (simplified)



- The ITU-T PON stack
- TC layer manages:
  - Ethernet encapsulation
  - Encryption
  - FEC
  - Synchro
  - ...



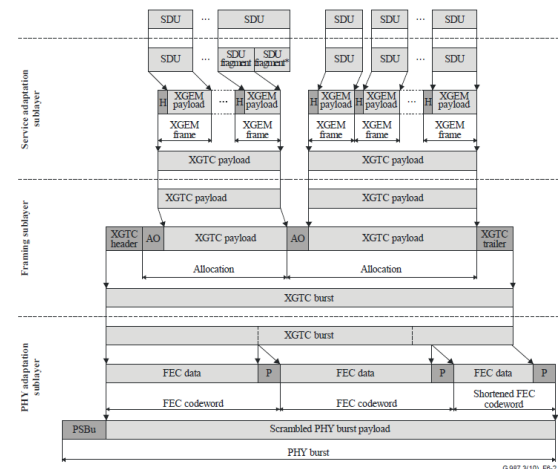
User data frames + OMCI traffic

GTC payload

GTC frame

PHY frame (bitstream)

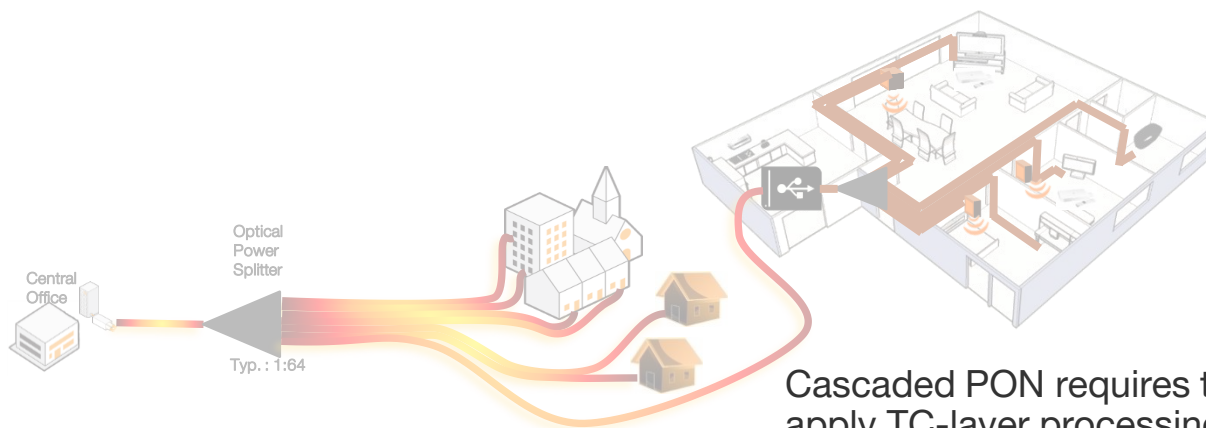
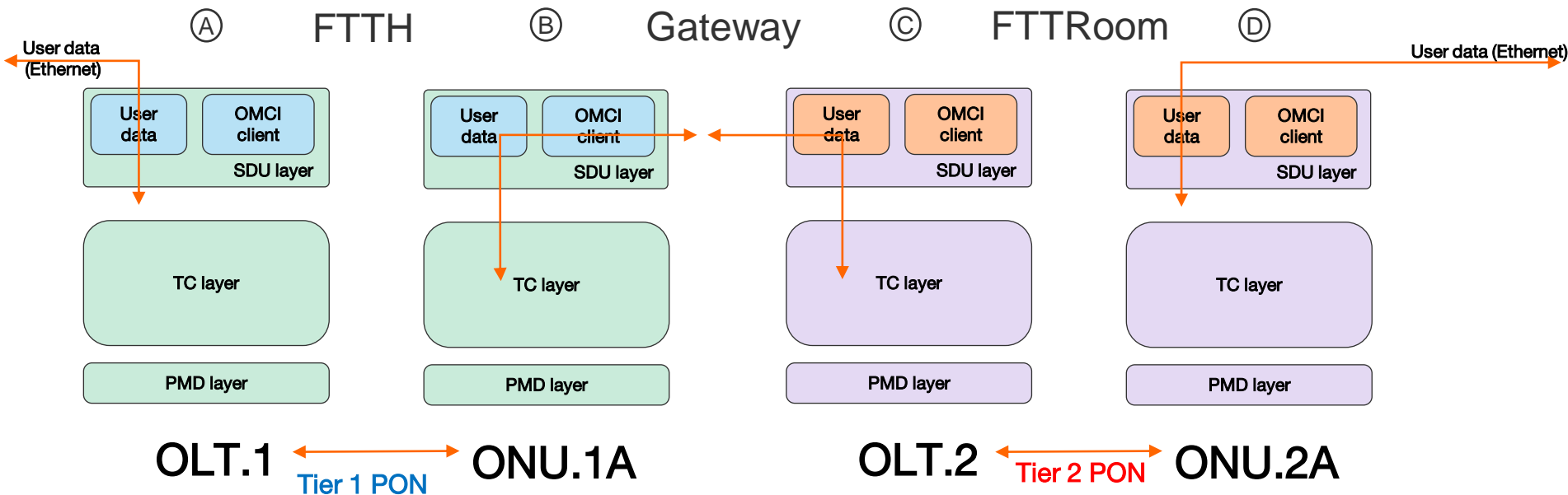
Analog signal



\* The remaining fragment of the SDU is transmitted in the subsequent allocation with the same Alloc-ID.  
 H XGEM frame header  
 AO Allocation overhead  
 P FEC parity

Figure 6-2 – Upstream SDU mapping

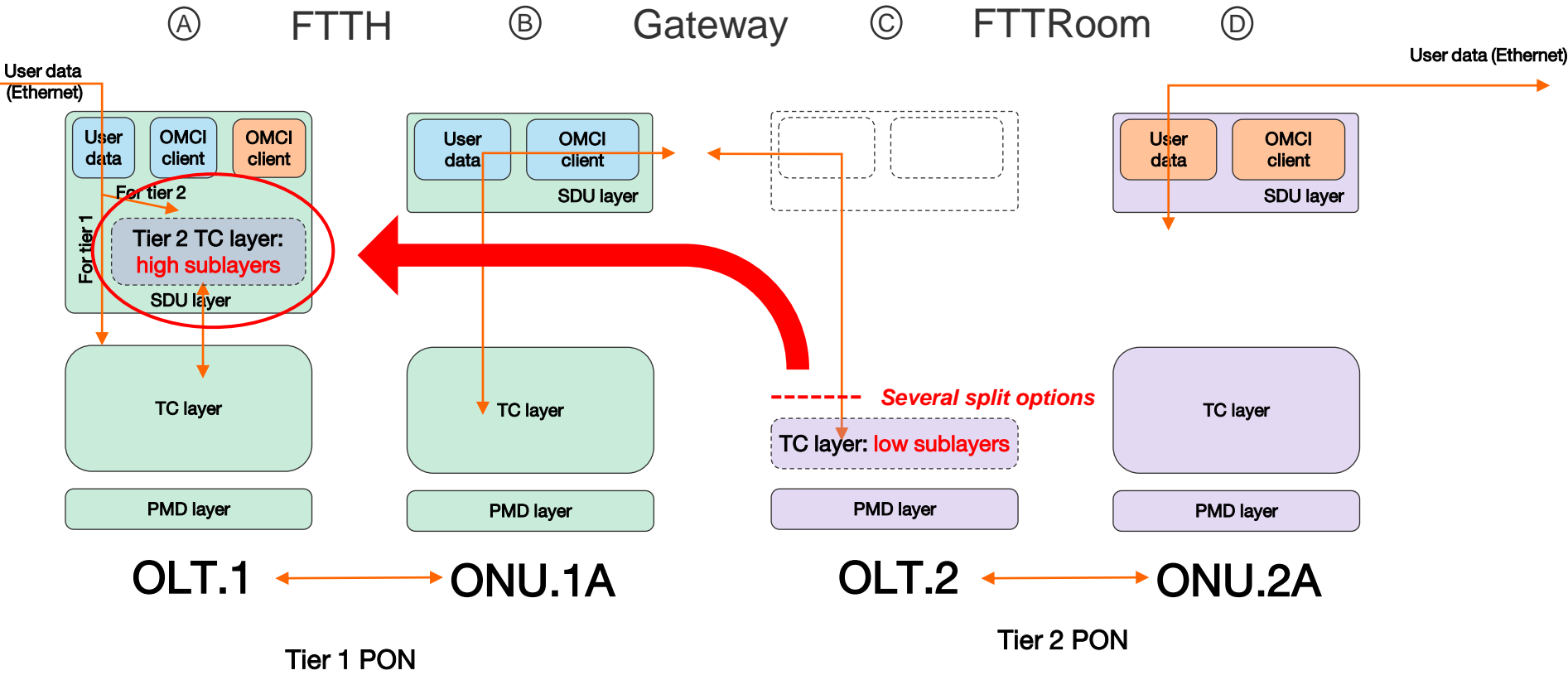
# Cascaded PON with today's technologies



Cascaded PON requires to apply TC-layer processing between OLT.2 and ONU1.A



# Proposition: 2<sup>nd</sup> tier TC layer encapsulation



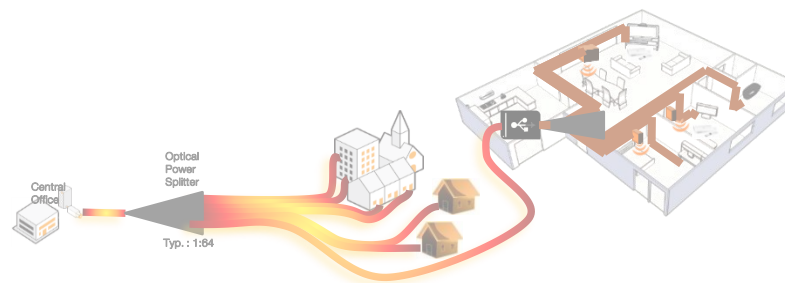
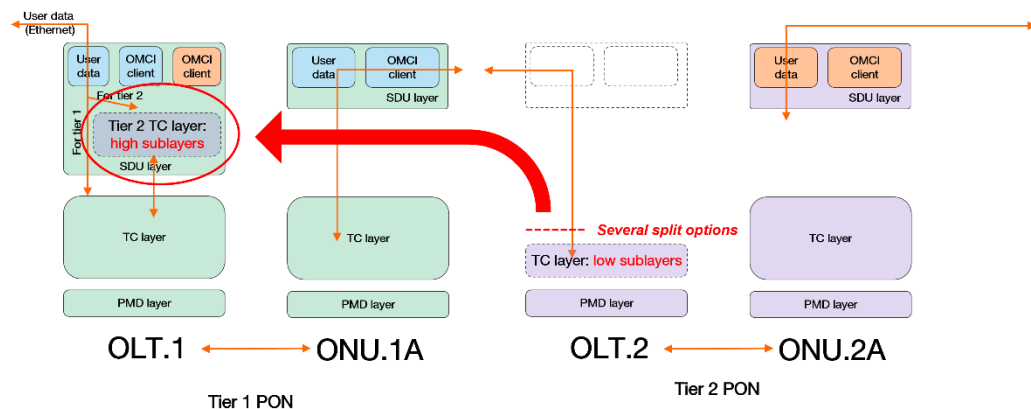
*The TC layer of the tier2 PON can run at the OLT.1*

# 2<sup>nd</sup> tier encapsulation: C-FAN

## Centralised-FAN (Fixed Access Network)

- Opportunities:

- OLT2 FTTRoom (customers' premises) is lighter
  - Lower energy consumption
  - Smaller form-factor
  - Easier network management from operator perspective
- OLT1 FTTH (at central office)
  - Centralizes tier 2 TC layer functions
- A flavor of « Simplified / Centralized / even Cloud » Fixed Access Network
  - => « **C-FAN** »



# Conclusion

## 4 key points

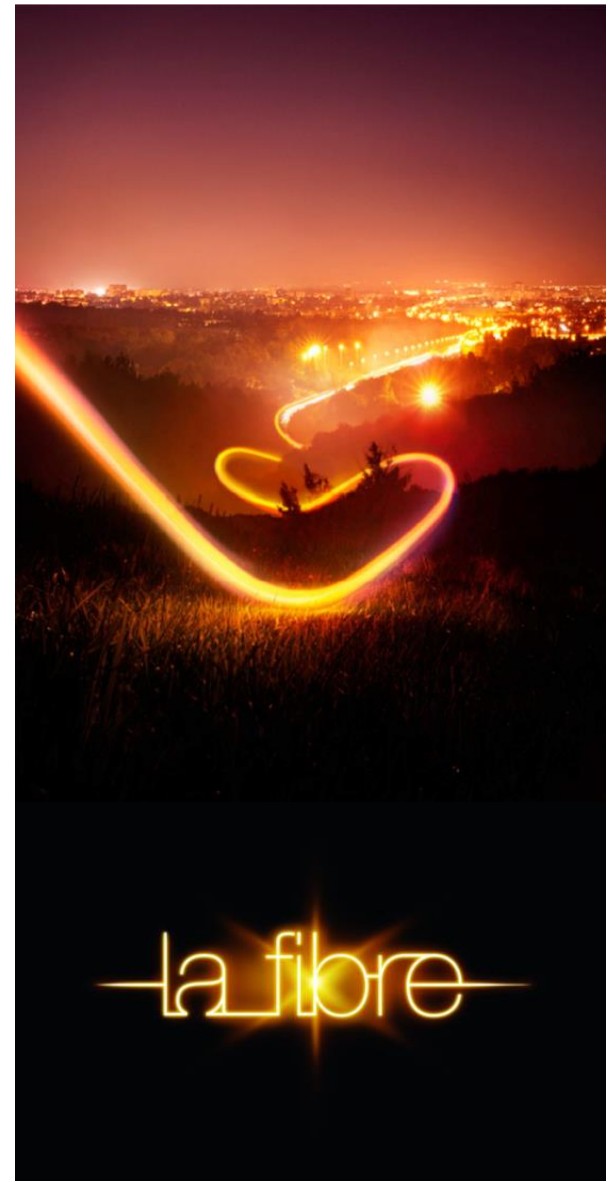
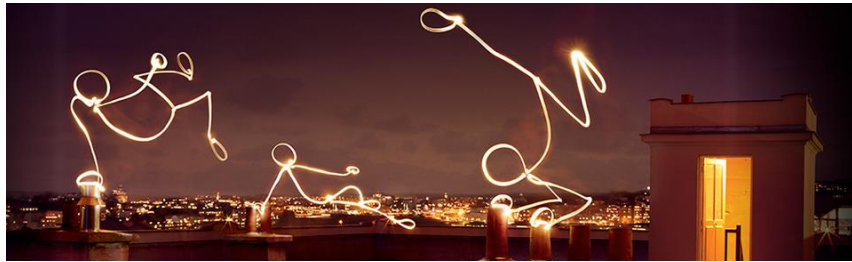
1 The three companions  
FTTH, FTTRoom, WiFi

2 Interoperability FTTRoom

3 Push perennial Home LAN  
infrastructure capable to  
support next generation  
PON

4 C-FAN with C for  
Cascaded  
Centralised  
Cloud

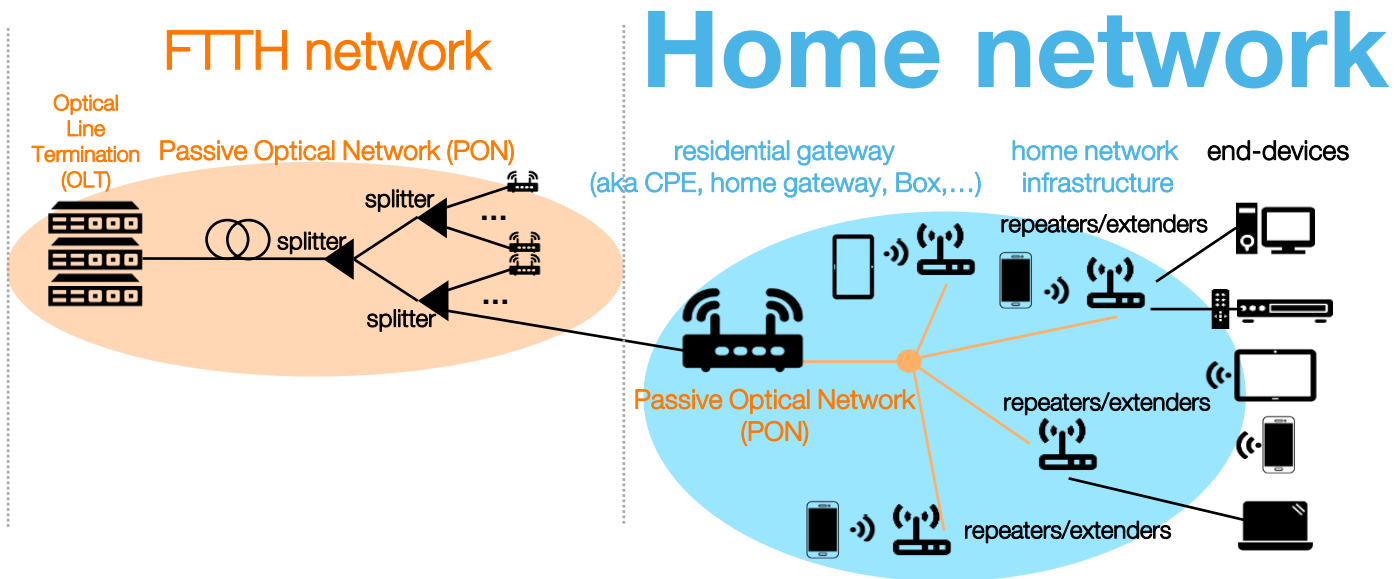
Thank You.







# What role does the FTTRoom have in telco strategy



FTTH	FTTRoom	Wireless LAN
G-PON	No	WiFi 5 / 6 / 6E / 7?
	« G-PON » like	WiFi 6 / 6E / 7?
XGS-PON	No	WiFi 6 / 6E / 7?
	« G-PON » like	WiFi 6 / 6E / 7?
	« XGS-PON » like	WiFi 6E / 7?

