Consideration on Demand of FTTR Deployment in Giga-Era

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Big data and technical roadmap of PON development of China Mobile

Gigabit era has reached，200+Mbps has become mainstream bandwidth

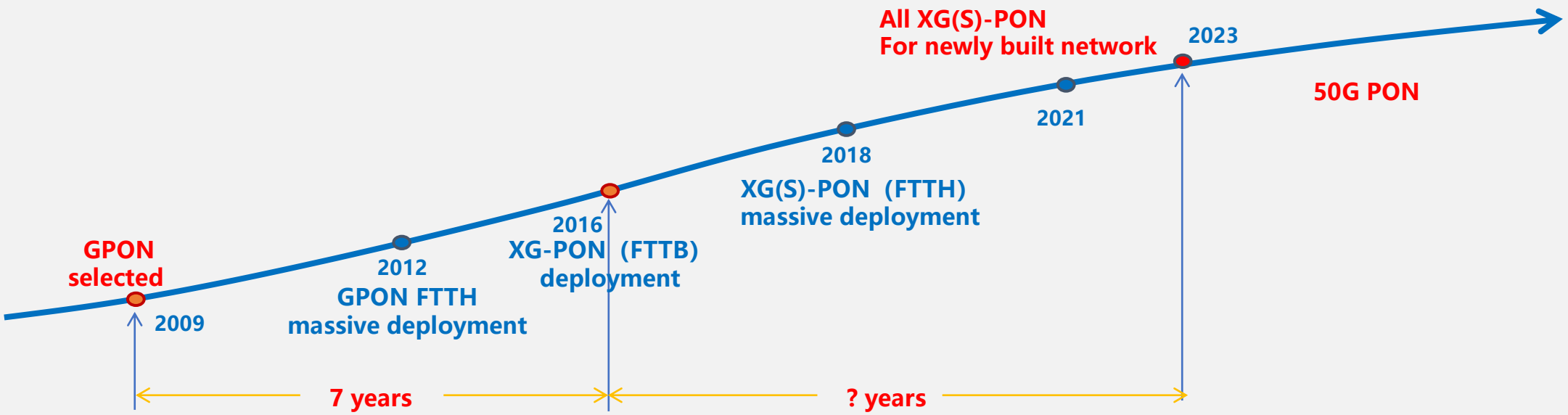
240 million users

Fixed broadband user scale
By Dec.2021

200+ Mbps

User access bandwidth

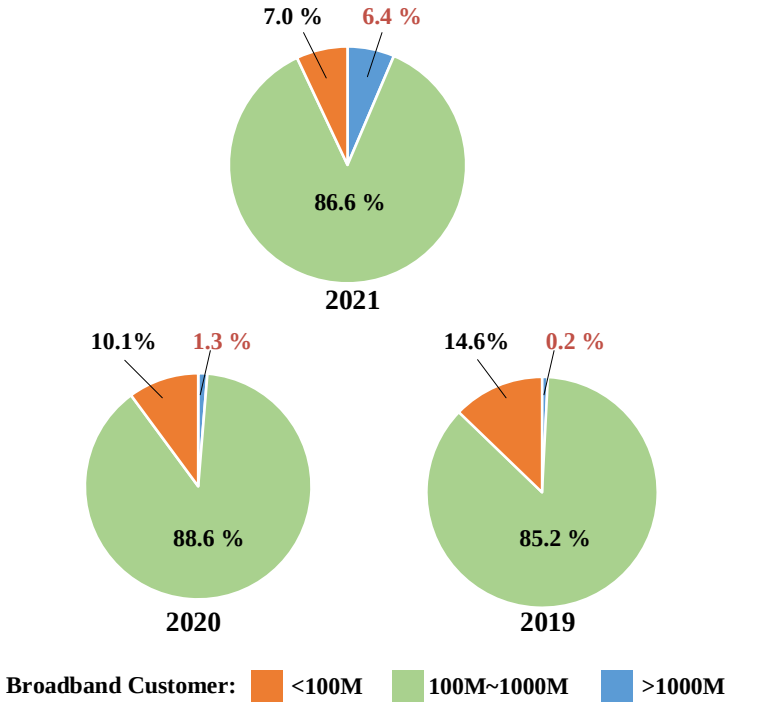
Period between adjacent PON massive deployment is usually about 7 years. Next generation PON is expected to be introduced after 2023



Services development trend and requirements

- By 2021, the ratio of broadband customer with 100+Mbps is 93%，in which the ratio of 1000Mbps is 6.4%
- New services (remote working/5G small cell backhaul) require high bandwidth and low latency performance

Gigabit customers increasing rapidly



Source：MIIT of China

Higher quality of broadband access requirement

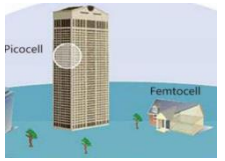
New requirement on bandwidth, latency and jitter

To H → **Extension** → **To B and 5G**

surfing the Internet

Remote working

Industry PON



5G small cell backhaul

- Requirement of home services tend to be similar with business services
- High-value services require the capability of network slicing

Key Technologies

1 PON

2 Gateway

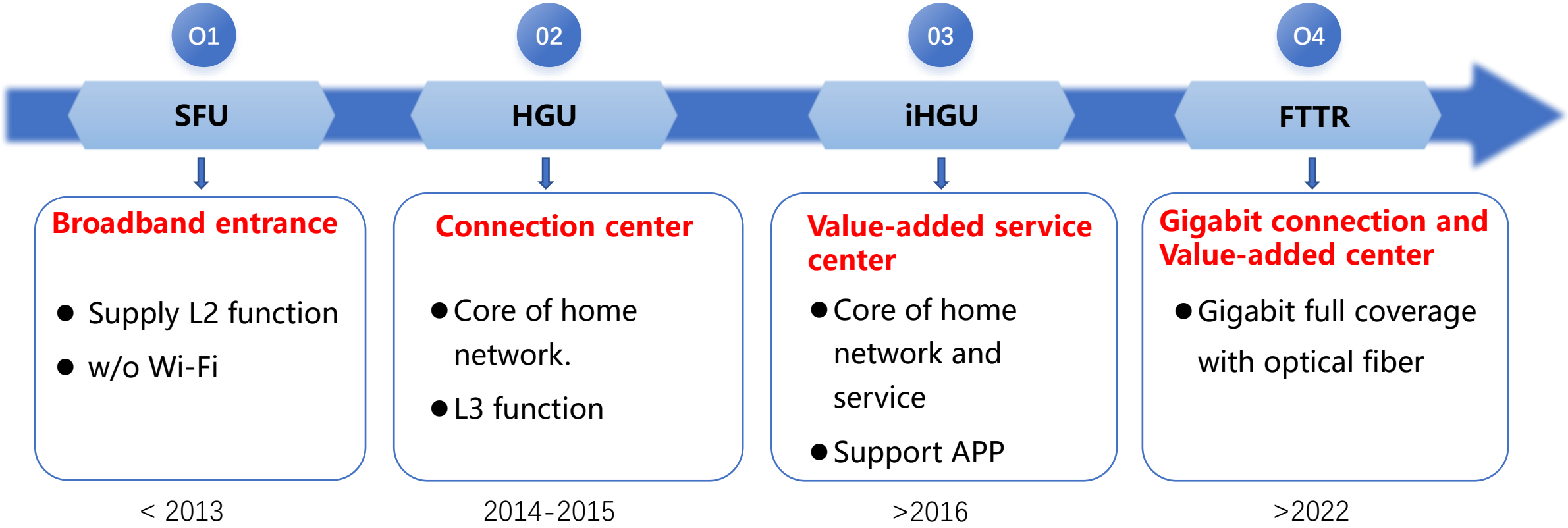
3 Wi-Fi

Home gateway evolution

02 ☐ Terminal number increased: 1 —> 10+

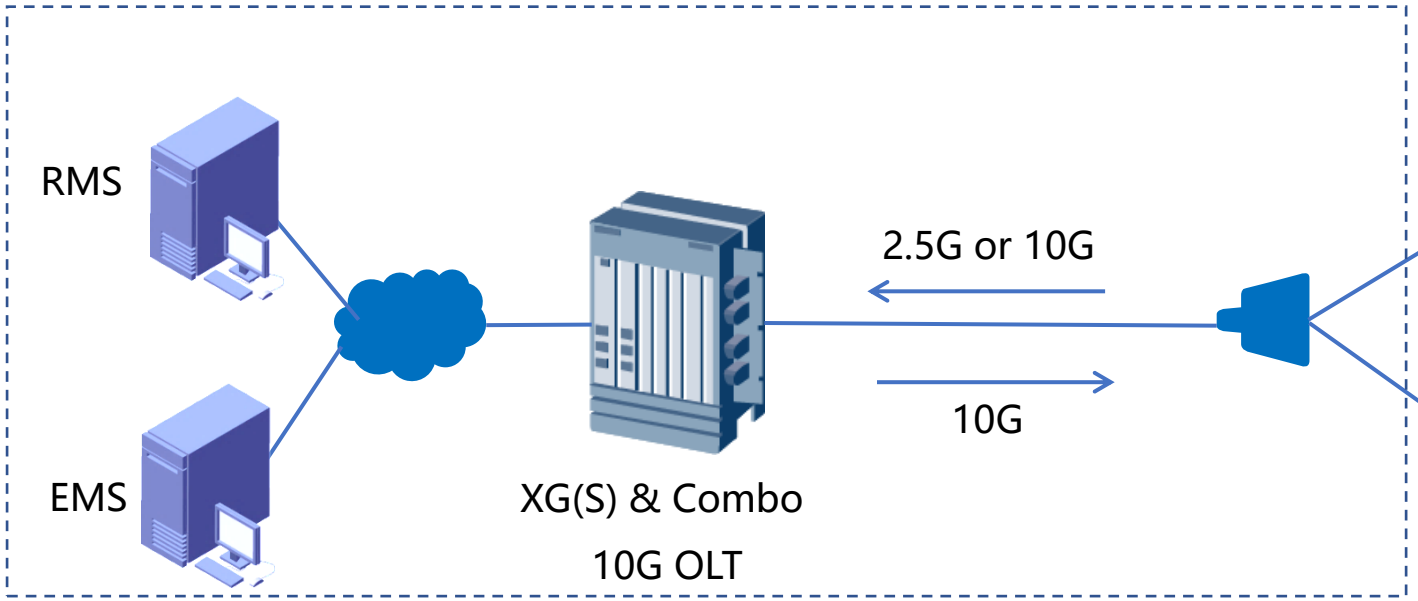
03 ☐ Service types increased: Internet, HD/4K, Cloud VR， and diverse services

04 ☐ Full coverage of Gigabit: Extreme experience guarantee



Key technical solution—End-to-end Gigabit network

- All newly built OLTs must have 10G GPON capability, and combo mode module is adopted to cover GPON ONT
- 10G GPON + Gigabit iHGU + Wi-Fi6 for end-to-end Gigabit



Full Gigabit access network

- OLT with 10G GPON capability
- 2 and 3-mode Combo

10G iHGU

- **Home customer**: mainly asymmetric
- **Business customer**: symmetric

Full Gigabit Wi-Fi

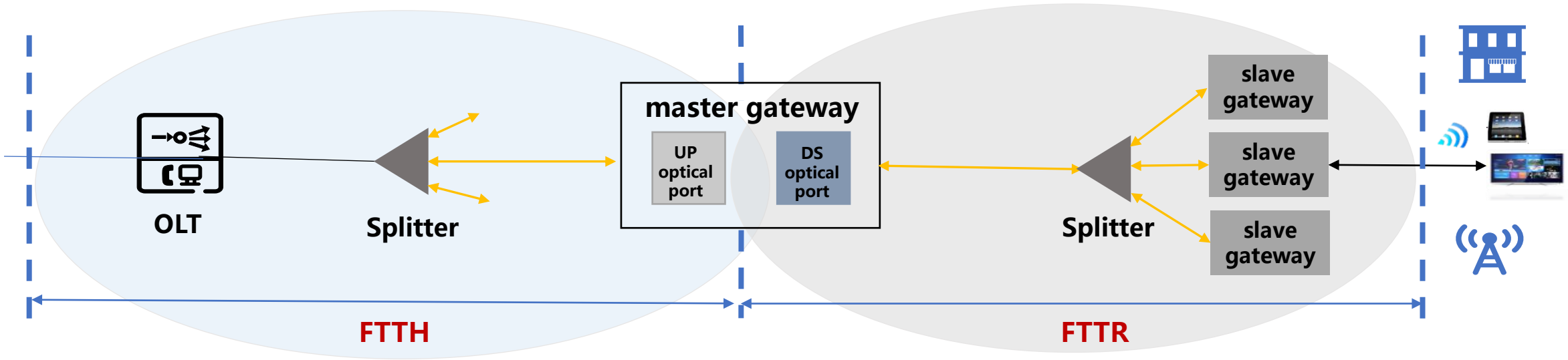
- Wi-Fi6 for Gigabit access
- 80MHz/160MHz

Deployment Policy

- **10G GPON**: 2 and 3-mode 10G GPON coexist in near future, and will evolve with service.
- **iHGU:** For home customer, asymmetric 10G iHGU is preferred, while for ordinary business customers, symmetric 10G iHGU is mainstream.

Key technical solution—FTTR for all-optical Gigabit home network

- Full Gigabit coverage: Fiber extended to the room as new sort of infrastructure
- Orientation: high-value home customers and ordinary business scenarios
- Standardization: ITU-T standards (G.FIN) have been set up



Full Gigabit coverage in home | Gigabit Wi-Fi | FTTR

P2MP

- Splitting ratio: 1:4 , 1:16， even 1:32
- Symmetric line rate better for LAN scenario

Management and control

- Centralized and unified management and control of FTTH and FTTR network

Wi-Fi networking

- Master and slave gateways all supporting Wi-Fi6 with coordinating

FTTR architecture requirement from migration view

2 Extensions

- **Extension of PON EMS management**： optical layer & link management ability extends to FTTR master ONU
- **Extension of RMS management**: services configuring ability extends to FTTR, including master and slave ones.

1 Decoupling

- **EMS/OLT and FTTR decoupling**: decoupling is the basis to support FTTR fast and massively deployment

1 Network

- **Telecom-level integrated network capability:**
  - 1000M seamless coverage
  - Low-latency
  - Fast roaming
  - Network Telemetry

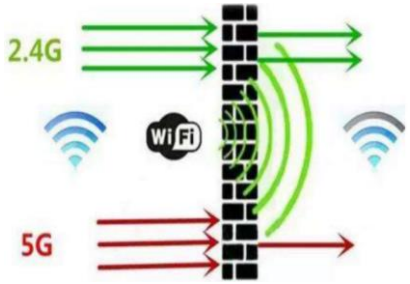
FTTR must be compatible with legacy fixed broadband network system, and it is essential to establish new network capabilities compared to traditional HGU and home network

Consideration on capability requirement of FTTR

Gigabit coverage in home network demand Gigabit link capability from Wi-Fi to backhaul

Wi-Fi perspective: To guarantee Gigabit Wi-Fi by using 5G frequency spectrum and deep optimization

2.4GHz->5GHz • 2*2 mimo with 80MHz/160MHz



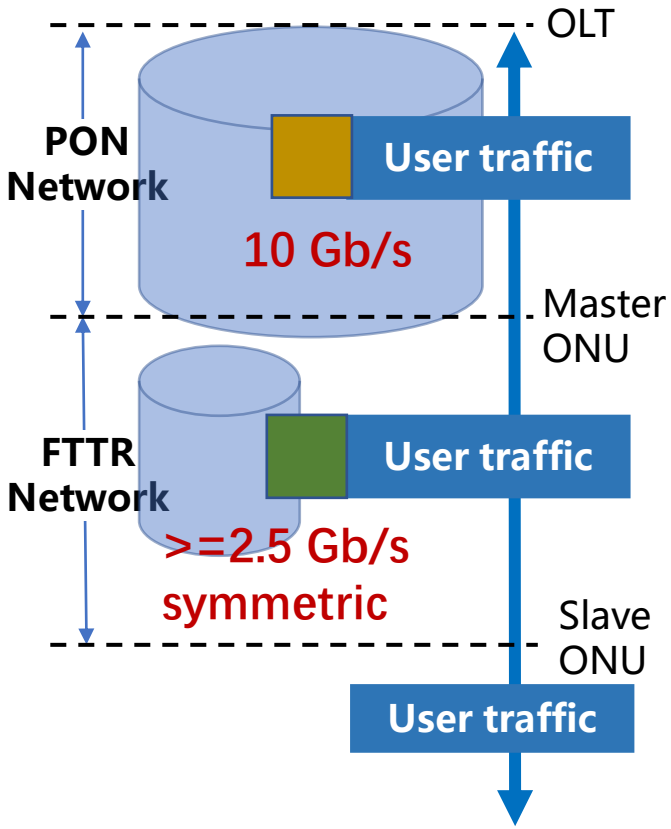
Bandwidth

Stability

Wi-Fi OTA > 1 Gb/s

- **Single node Wi-Fi OTA optimization:** Channel/power optimization to avoid or optimize interference
- **Single node traffic scheduling optimization:** optimize WMM and OFDMA coordination on traffic, to improve throughput and latency

Network perspective : home network demands optical backbone for local and internet data transmission

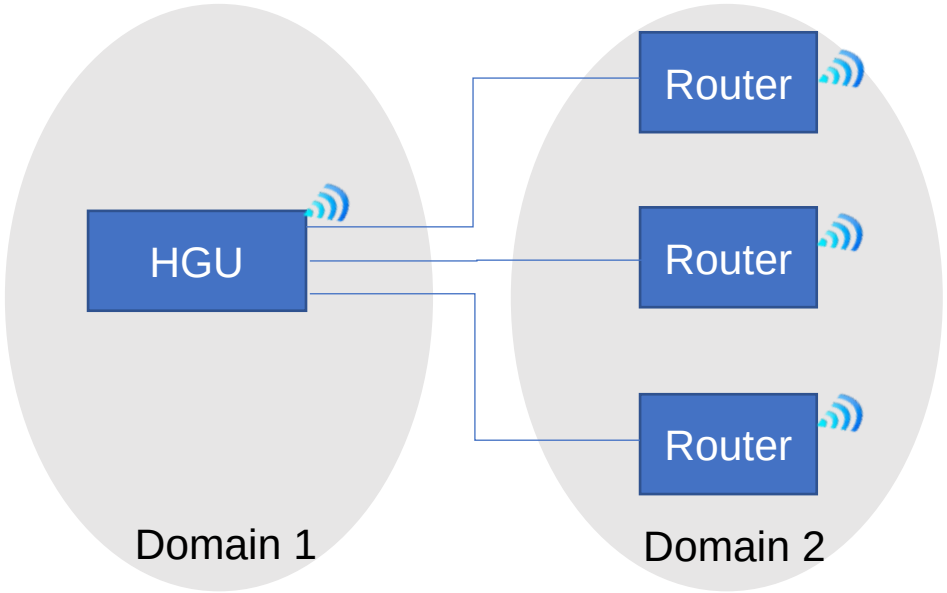


- 1:4 splitter ratio could be enough for most home scenario in China
- Symmetric 2.5 Gb/s line rate seems better for simultaneous carrying local and internet data transmission in home

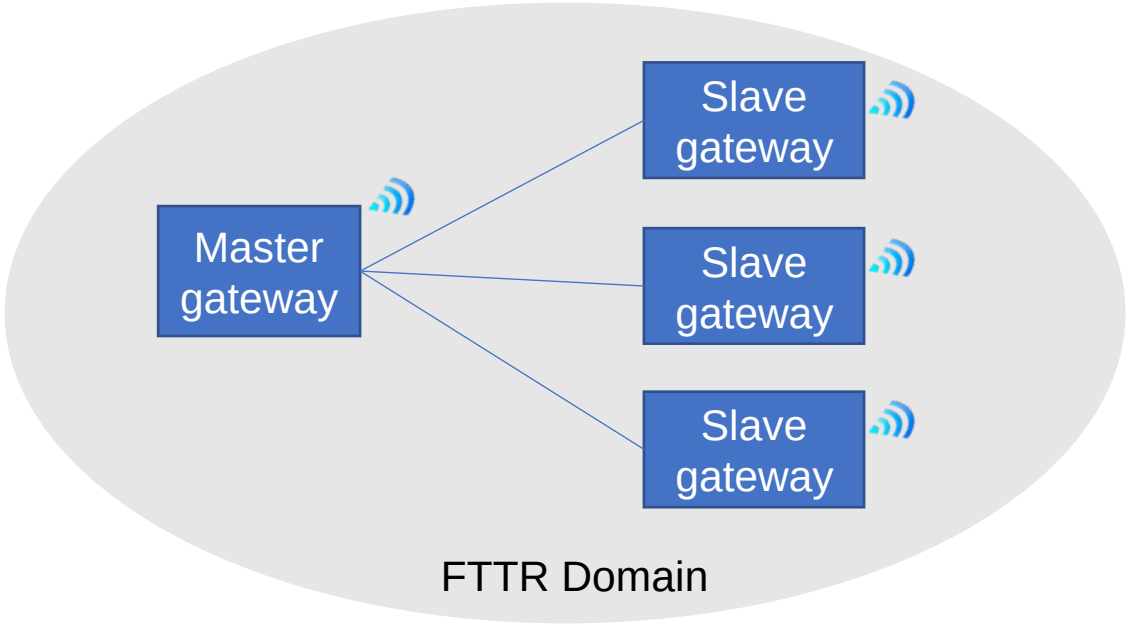
Consideration on capability requirement of FTTR

Gigabit seamless coverage in home network demand a unified domain centrally controlled to guarantee multi-APs with a high performance

As Is



To Be



Hard to sufficiently coordinate:

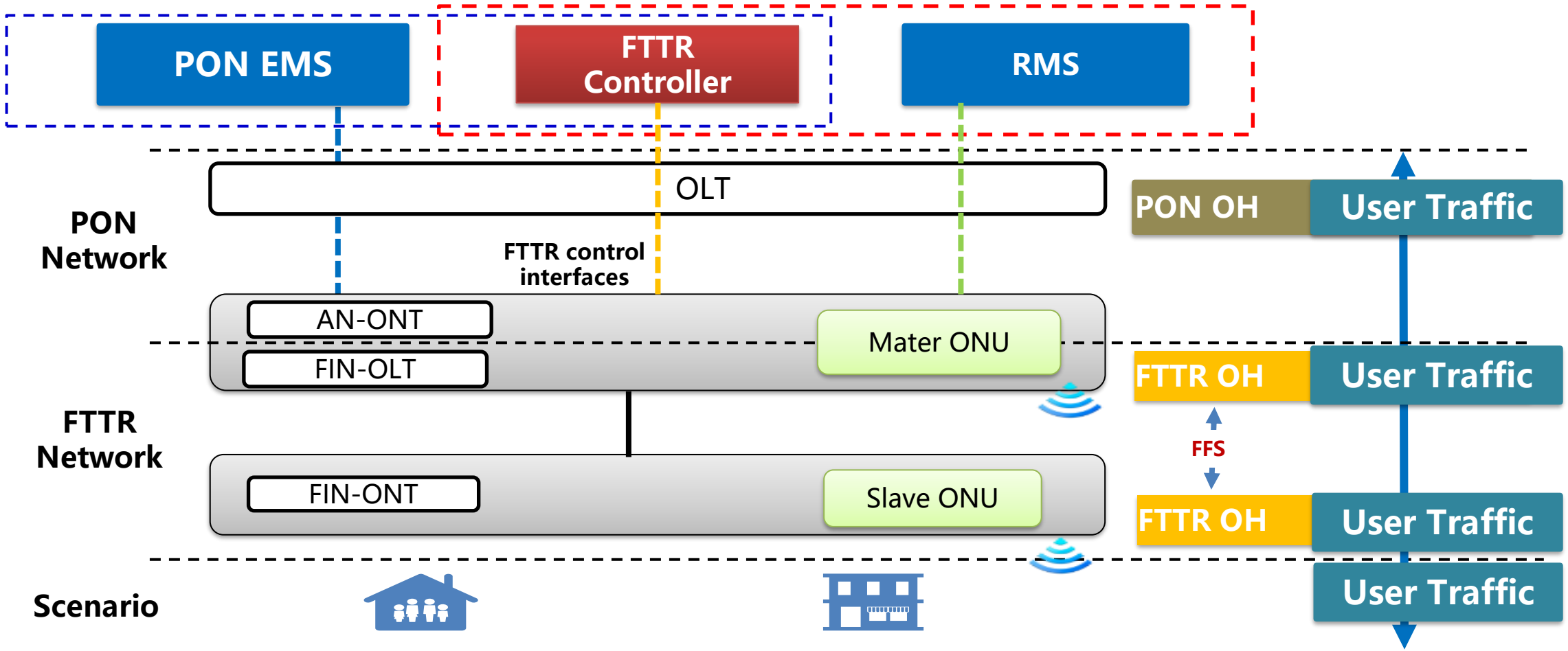
- Lack of sufficient coordination to literally form a unified multi-APs network between HGU Wi-Fi and Router Wi-Fi
- Due to the sharing channel with CSMA mechanism, room for multi-APs performance improvement

Unified domain to guarantee 1000M coverage:

- FTTR should provide a multi-APs network as a unified domain, involving Master ONU and slave ONU
- To ensure multi-APs work with coordination by some sorts of centrally controlled scheme, so as to guarantee 1000M seamless coverage with low latency

Consideration of FTTR architecture

- FTTR controller: charge of remote management and control over unified FTTR domain
- Deployment: FTTR controller more like a module, could deployed with either EMS or RMS
- Legacy systems: PON EMS manage ONT part of Master ONU, and no big change for RMS



Summary

- Adopting XG(S)-PON + Gigabit iHGU + Wi-Fi6 to construct end-to-end Gigabit broadband access networks, and pushing forward FTTR development to guarantee full coverage with Gigabit access ability
- Gigabit seamless coverage of FTTR demand a unified and centrally controlled domain to guarantee multi-APs with a high performance, involving high speed and low latency

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Thanks!