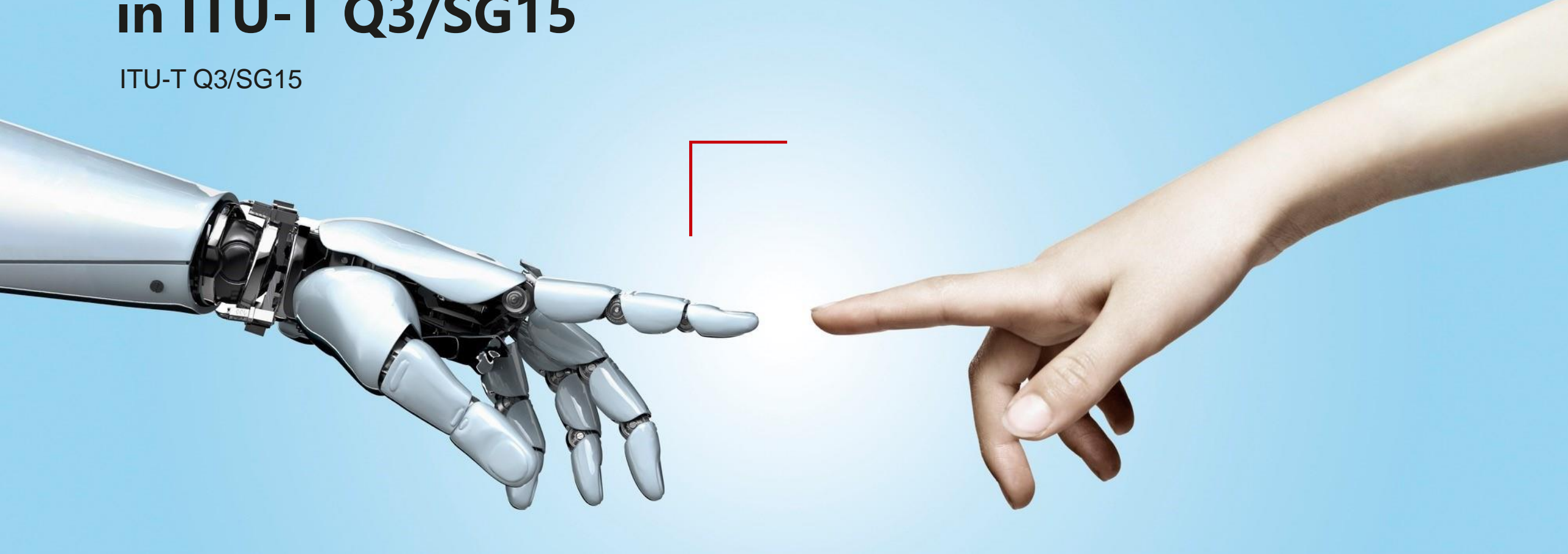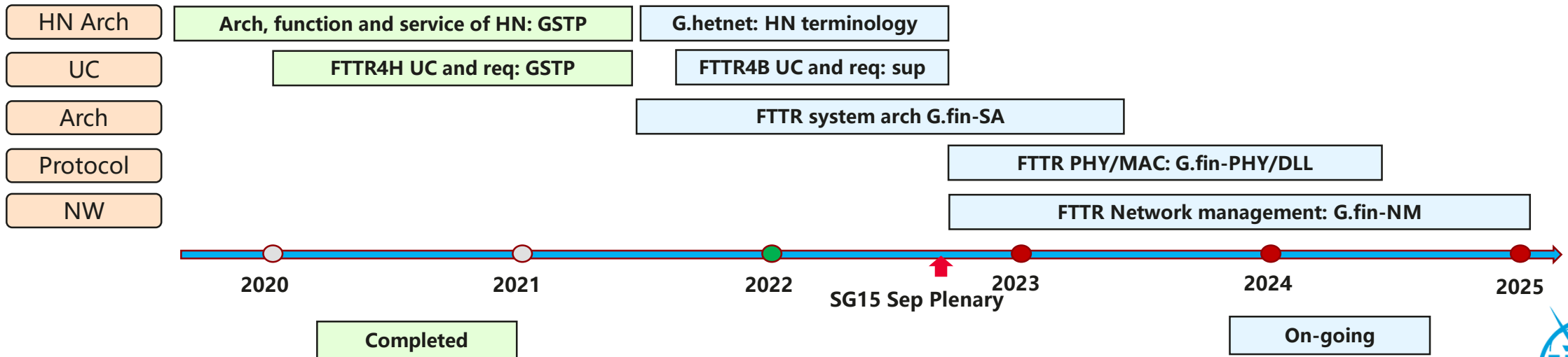# Fibre-to-The-Room (FTTR) STD development in ITU-T Q3/SG15

ITU-T Q3/SG15
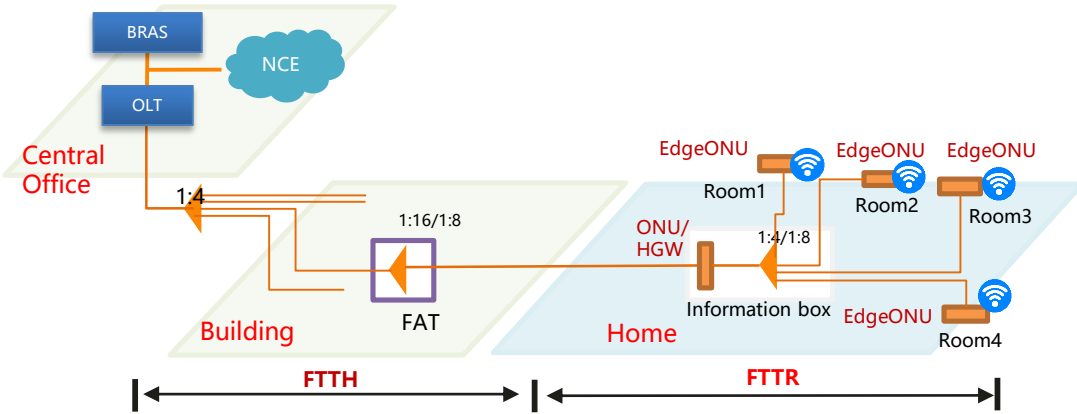
# SG15 Q3: in-premises networking and related access applications

- **Rename: "Q18" -> "Q3" in new SG15 Study Period of 2022-2024**

- **FTTR Project streams G.fin (High speed fibre-based in-premises transceivers)**
  1. **Use case & requirement:** TP of FTTR4H (published), supplement of FTTR4B (stable)
  2. **System Architecture (SA):** priority of P2MP, centralized fibre & wireless coordination
  3. **Physical layer (PHY) and datalink layer (DLL):** initial discussion of power budget
  4. **Network management (NM):** on-going
  5. **Extended application:** FSO (for further study)

| | |
|---|---|
| **HN Arch** | **Arch, function and service of HN: GSTP** / **G.hetnet: HN terminology** |
| **UC** | **FTTR4H UC and req: GSTP** / **FTTR4B UC and req: sup** |
| **Arch** | **FTTR system arch G.fin-SA** |
| **Protocol** | **FTTR PHY/MAC: G.fin-PHY/DLL** |
| **NW** | **FTTR Network management: G.fin-NM** |

2020   2021   2022   SG15 Sep Plenary   2023   2024   2025

**Completed**   **On-going**

# FTTR application in home area

## Network: From Access to Home



## Connection: Service oriented
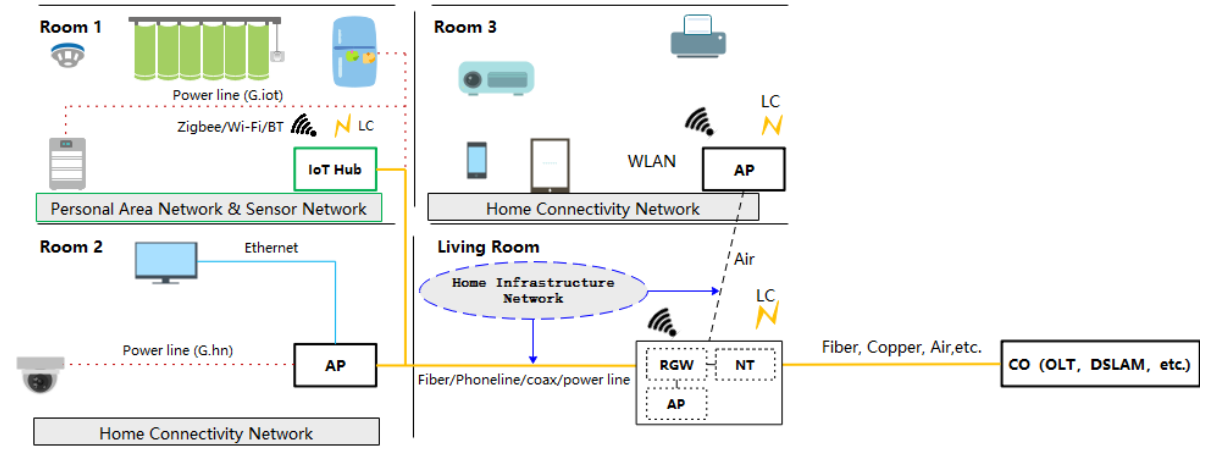


**Change**

1. **Small Loop length** (50-100m, 20-30dB channel gain)，Transmission latency <0.1us@30m
2. Less nodes with **QoS requirements for nodes**: VR/Video/IoT

1. **Close to service**：Guaranteed QoE, from enough throughput to enough latency and packet loss rate
2. **Close to device:** Various device types and tech generations

**New**

1. **P2MP networking**：South-North streaming to East-West streaming: New opportunities on system design and protocol

1. **Low power devices：** IoT center-control low power mode
2. **One single network：** Optimized FTTR + Wi-Fi network

**Use cases**

① High Quality Wi-Fi Backhualing (Throughput 1-10G, Roaming 1-10 ms)

② Support of Extremely low latency (<1ms, jitter negligible )

③ Low Complexity and Easy ODN (Pre-conectorized fibre, engineering tool)

④ FTTR Slicing (FTTR + Wi-Fi coordination)

⑤ East-West Streaming (Support East-West direction)

⑥ Support Various Device Types (STB、IoT hub、RGW、etc.)

⑦ Enable Smart Home Connections (low power mode)

⑧ FTTR Applications in Business (other applications)

**Source**：GSTP-FTTR - Use cases and requirements of fibre-to-the-room,2021

# FTTR application in SME

**FTTR4B**

**FTTR4H**

**Smart office**

**Campus/Classroom/**

**Small building**

**Shops**
(restaurant、
chain store, etc.)

**Hospital**

**Small flat  (2~3 Rooms)**

**Large flat  (3~5 Rooms)**

**Independent house  (>5 Rooms)**

# FTTR4B：Use case & requirement

- Small and medium sized enterprises (SME)

| Company category | Staff headcount | Turnover | Balance sheet total |
|---|---|---|---|
| Medium-sized | < 250 | ≤ €50 million | ≤ €43 million |
| Small | < 50 | ≤ €10 million | ≤ €10 million |
| Micro | < 10 | ≤ €2 million | ≤ €2 million |

- Ethernet LAN switching technology



- Issues of Ethernet switch based technology:

1) **High complexity of cable** to support higher data rate: leading to increment of cable weight and size

2) **Large size of the head end**: due to P2P connection, increasing number of connection will require increasing number of ports in the head end

3) **Short communication length**: channel quality decrease significantly in the copper wire; the typical Ethernet cable

4) **Additional access controller** to dynamically adjust the data streams and Wi-Fi configuration

- Value of the FTTR here in the business:

1) **Light-weight and long-distance communication for optical fibre**:

2) **Various multiplexing methodologies**： WDM, SDM, ect. To increase the data throughput

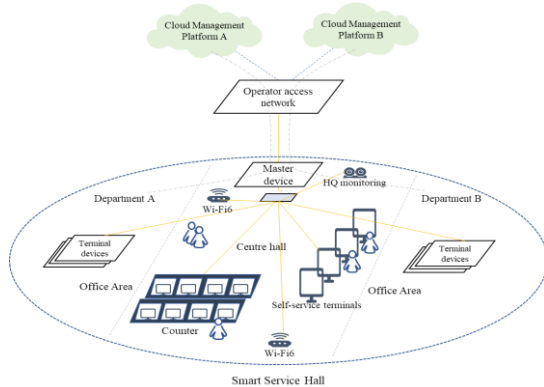3) **Integrated functions in single system**: Layer 2 can include access control function

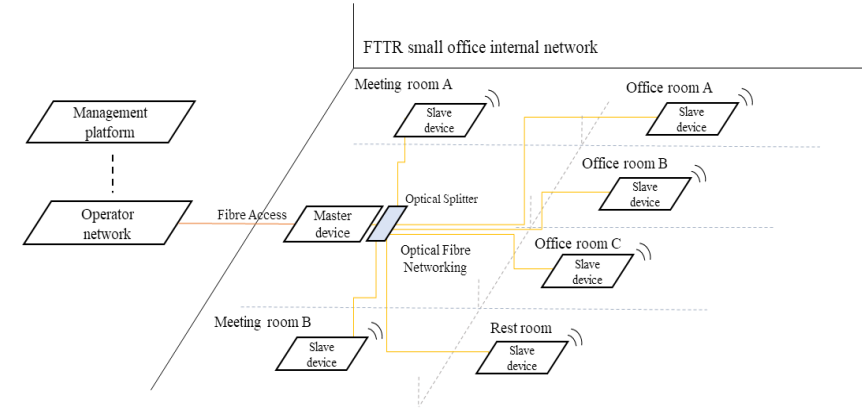# FTTR4B： Use case & requirement

## ● Use case 1: Live application
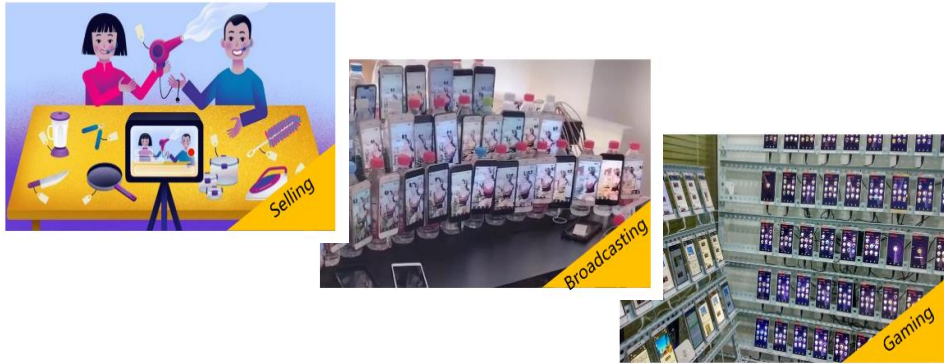


- Service: DL/UL real-time 4K/8K video with dense link
- Req: 10-20 ms E2E latency/Stable data rate @Gbps

## ● Use case 2: Live application



- Service: maintain various link connection in office
- Req: 32-128 link, 1-2km length, 2.5-10G, OEHC

## ● Use case 3: Service hall



- Service: provide network for business blocks
- Req: isolated network, network slicing

## ● Use case 4: School scenario



- Service: link for education of school
- Req: distinct authentication, dense connection

**Source:** ITU-T SG15 Q18, Use case & Requirements of Fibre-to-The-Room (FTTR) in Small Business Application (draft)

# FTTR4B: Use case & requirement
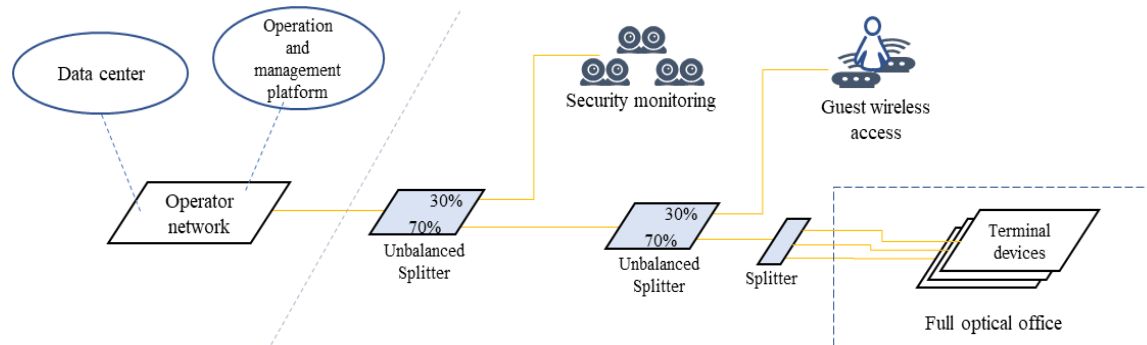
### ● Use case 5: Business building
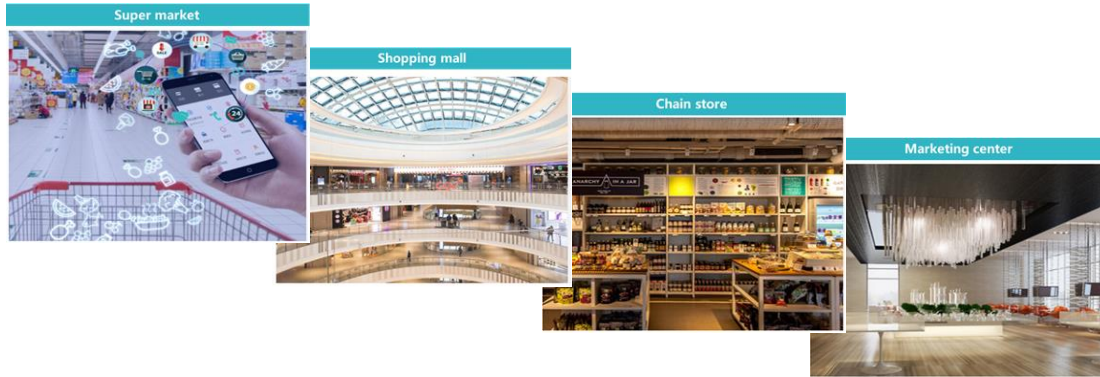


- Service: movable link, dense link
- Req: network isolation, QoS, fast roaming

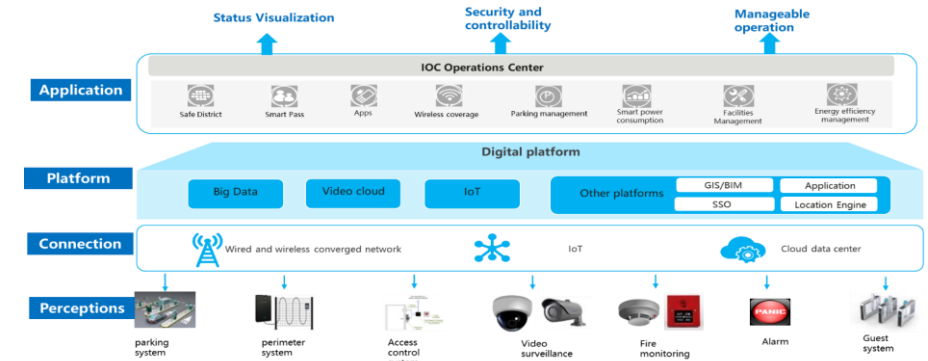### ● Use case 6: Indoor leisure and entertainment



- Service: dense link, on-line gaming
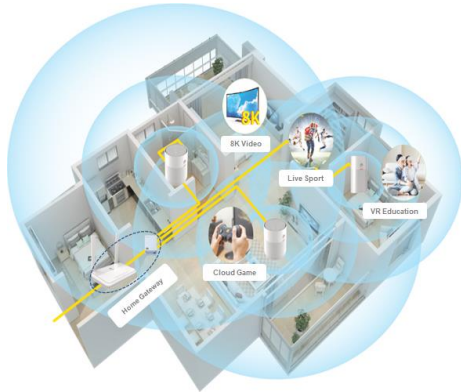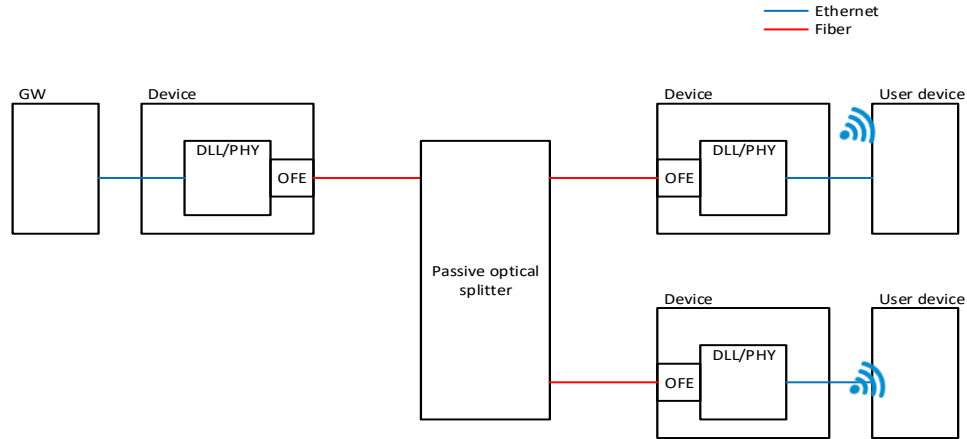- Req: low latency connection, dense link

### ● Use case 7: Workshop



- Service: large area coverage, security monitoring
- Req: unbalanced connection, easy mangement
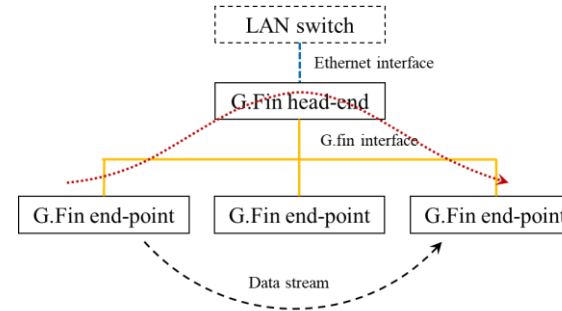
### ● Use case 8: Smart community



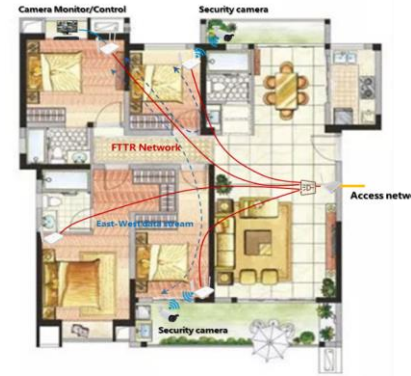- Service: various digital service in community
- Req: High speed for HD surveillance, QoS

**Source:** ITU-T SG15 Q18, Use case & Requirements of Fibre-to-The-Room (FTTR) in Small Business Application (draft)

# FTTR P2MP physical topology



Ethernet
Fiber

East-West communication
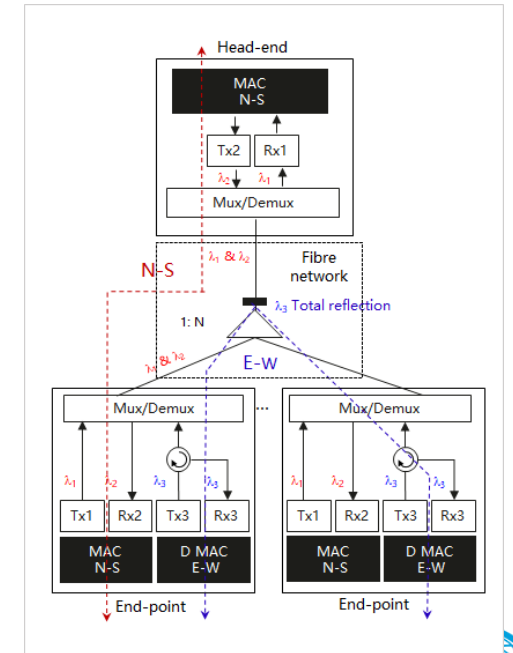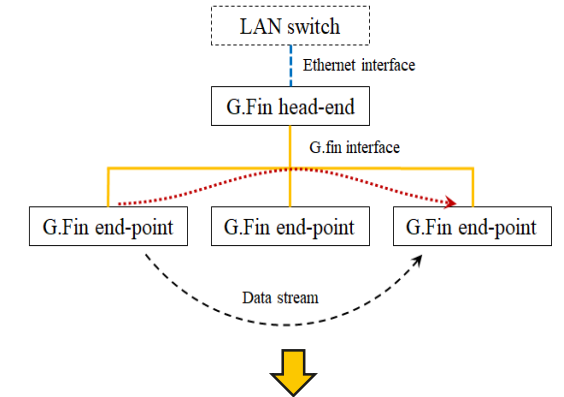


E-W streaming through MAC

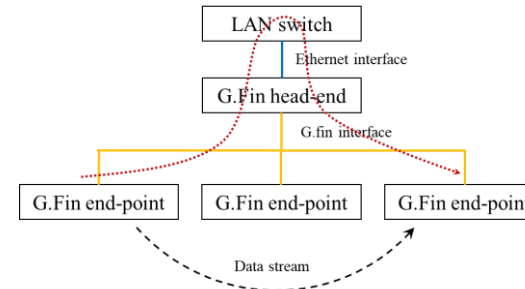E-W streaming through upper layer

- Advantages of P2MP topology：
1. Flexible fibre deployment: less fibre, easy deployment
2. Easy extension: multi-level, additional nodes
3. Low complexity for devices

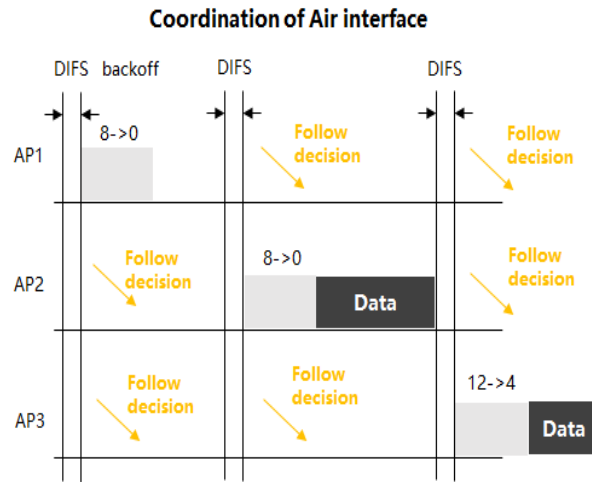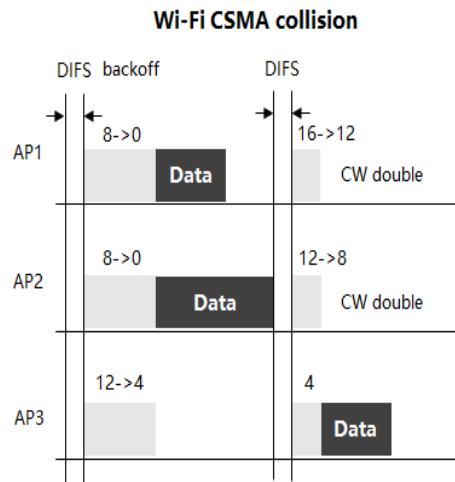# Centralized control architecture for FTTR



- 80MHz, 160MHz & 320MHz
- High speed
- Dense network
- CSMA case collision
- Impact experience
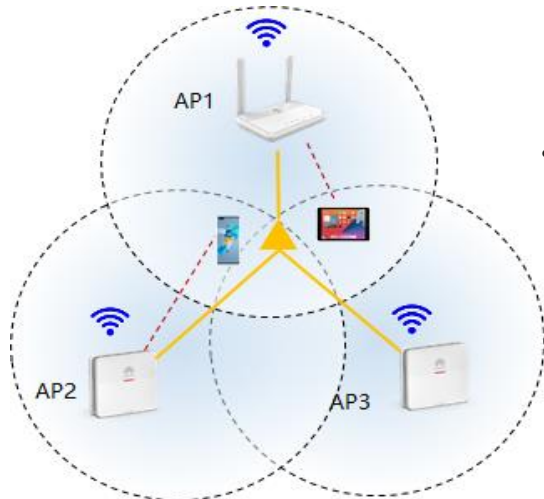
**Coordination in air interface**

**Wi-Fi CSMA collision**

**Coordination of Air interface**



**Coordinated Wireless-Fibre Architecture**
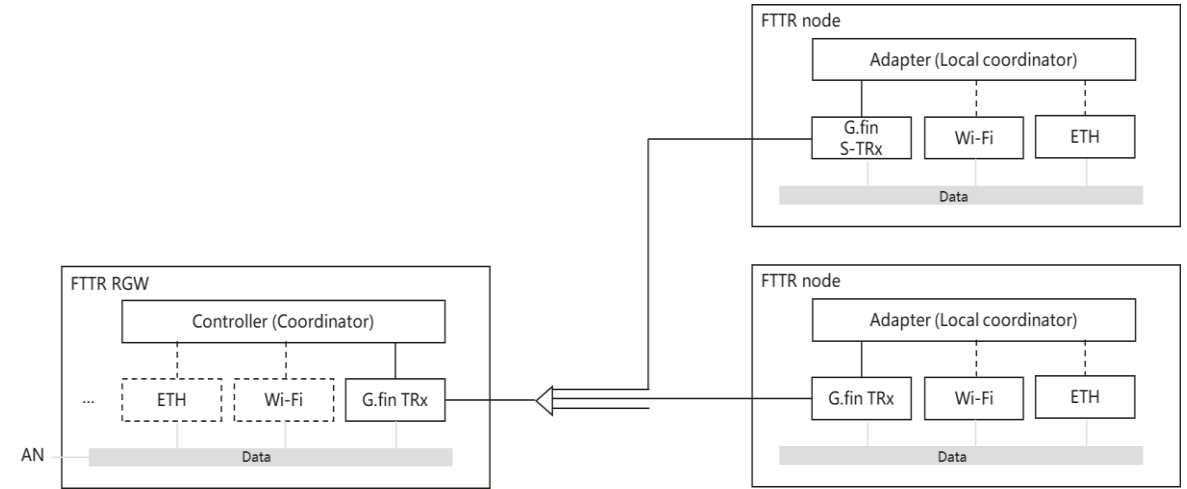


- **Mechanism:**
1. Identify service requirement
2. FTTR RGW dynamically collects the Wi-Fi and network relevant information such as data buffer, link status, etc.
3. The RGW controller does analysis and makes decision
4. The decision is sent to each FTTR node through the fibre network
- **Requirement for protocol:**
1. Design of Wi-Fi relevant message in DLL or PHY level
2. Low latency exchanging channel

# In summary

- **ITU-T focal point in next step:**
    1. To Finalize and publish the supplement of FTTR for SME application
    2. To complete G.fin system architecture specification
- **Continuous joint effort is expected across multiple SDO:**
    1. Regular liaisons, Ad hoc meeting, joint workshops, etc.
    2. Extension of FTTR applications in other areas, light communication, fibre sensing, etc.
- **Welcomed all the ITU-T member to contribute FTTR specification development**

# Thank you.