broadband forum

Day 2: Advancements in Managed Connected Users and Services

Standards development update on technologies for in-premises networking and related access applications
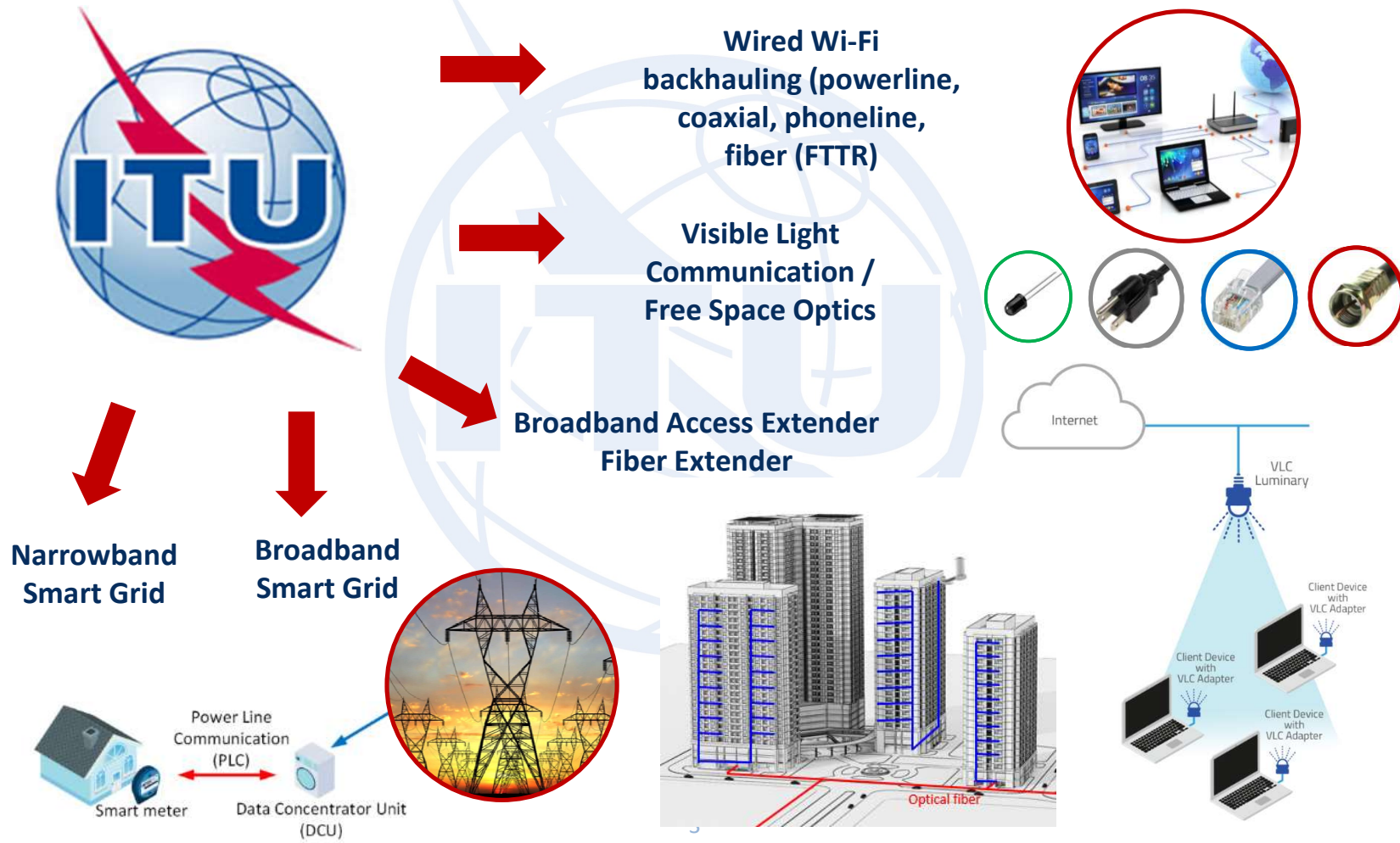
Les Brown,
ITU-T Rapporteur Q3/15

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ITU-T SG15/Q3 experts group (ex Q18)

- Study Group 15: Networks, Technologies and Infrastructures for Transport, Access and Home
- Q3: Technologies for in-premises networking and related access applications
- Project areas:
  - **G.hn:** Unified high-speed wire-line based home networking transceivers
    - Operation over coax, twisted pair, powerline and POF
    - Recommendations: PHY layer (G.9960), DLL (G.9961), management layer (G.9962), MIMO (G.9963), Spectrum (G.9964), secure admission (G.9978)
  - **G.vlc:** High speed indoor optical wireless communications
    - Recommendations: G.9991
  - **G.fin:** High speed fiber-based in-premises transceivers – "Fiber to the Room (FTTR)"
  - **G.uvs:** Support of UHD video service over G.hn
    - Recommendations: G.9976
  - **G.IoT:** IoT smart home over PLC
  - **G.hetnet:** Terminology and overview of the architecture of Heterogeneous Home Networks
  - **G.sg:** Narrowband PLC for Smart Grid:
    - Recommendations: G.9901 (PSD), G.9902, G.9903 (G3-PLC), G.9904 (Prime)
- Ecosystem: Chip vendors, system vendors, service providers
- End customers: Telco operators, Power Utilities, Lighting companies, retail channels
- Main liaisons: ITU-R, ETSI TC ATTM, ETSI ISG F5G, CCSA TC6, Broadband Forum, and HomeGrid Forum

ITU-T SG15/Q3 Application Space

Wired Wi-Fi backhauling (powerline, coaxial, phoneline, fiber (FTTR)

Visible Light Communication / Free Space Optics

Broadband Access Extender Fiber Extender

Narrowband Smart Grid

Broadband Smart Grid

Power Line Communication (PLC)

Smart meter

Data Concentrator Unit (DCU)

Internet

VLC Luminary

Client Device with VLC Adapter

Client Device with VLC Adapter

Client Device with VLC Adapter
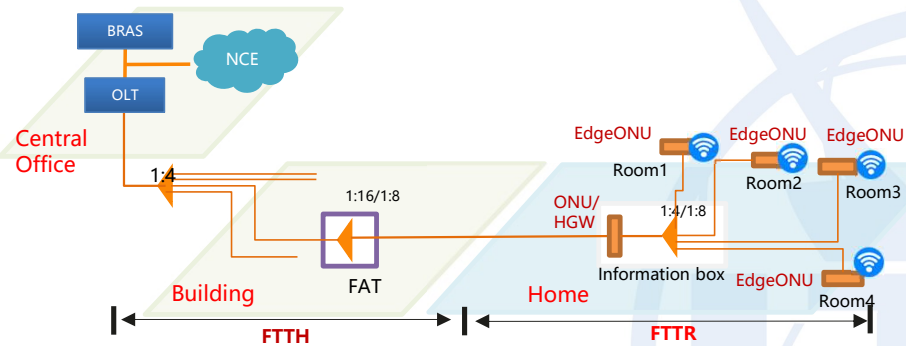
Optical fiber

1956 2016

CCITT / ITU-T

ITU-T SG15/Q3 latest project: Fiber to the Room (FTTR)

- FTTR project started in 2020 and has become a hot topic in Q3/15
  - To provide reliable very high speed low latency communications within premises to guarantee user experience over various in-premises network services.

- Use case study: Recently published a Technical Paper on Use cases and requirements of fibre-to-the-room
  - **For home:** GSTP-FTTR - Use cases and requirements of fibre-to-the-room (FTTR)
  - **For small business:** G.Sup on FTTR for small business applications scheduled for agreement 09/2022

- Technical Recommendations:
  - **G.fin-SA**: System architecture – goal for consent 2023
  - **G.fin-PHY**: Physical layer specification – goal for consent 2024
  - **G.fin-DLL**: Data link specification – goal for consent 2024
  - **G.fin-Magnagment**: Management layer specification – goal for consent 2024

- Standards promotion: coordinating the effort with ITU-T Q2/15, ETSI ISG F5G, CCSA TC6, and Broadband Forum
  - Have held 2 workshops on the topic (2021 and 2022), attracting 300+ participants from 38 counties.
    - Joint ETSI ISG F5G, BBF, CCSA TC6 and ITU-T SG15 Workshop on "FTTR" (Fibre to the room)
    - Second Joint ETSI ISG F5G, BBF, CCSA TC6 and ITU-T SG15 Workshop on "FTTR" (Fibre to the room)

- Next: Critical to accelerate the development of these standards since deployments, particularly in China, using proprietary solutions has already started.
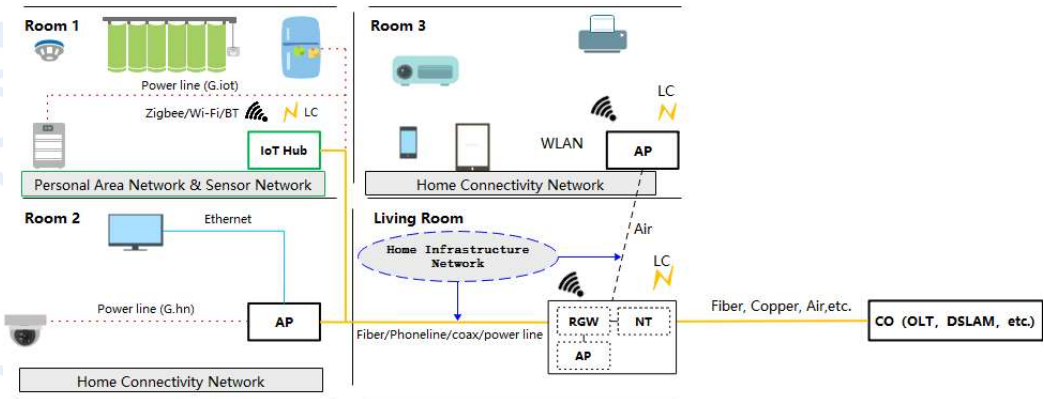 - **If you are interested in this work, please consider participating in the work of ITU-T Q3/15**

ITU-T SG15/Q3 - FTTR 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 small business

FTTR4B

Smart office

Campus/Classroom/

Small building

Hospital

FTTR4H

Small flat (2~3 Rooms)

Large flat (3~5 Rooms)

Independent house (>5 Rooms)

Shops
(restaurant、
chain store, etc.)

FTTR: Driving forces

- FTTR driving forces:
  - Centralized control architecture
    - Coordination with Wi-Fi nodes to allocate the appropriate resources
  - QoS guaranteed in-premises network
    - Guarenteed QoS
    - Low latency exchanging channel for Wi-Fi messages

Centralized control architecture
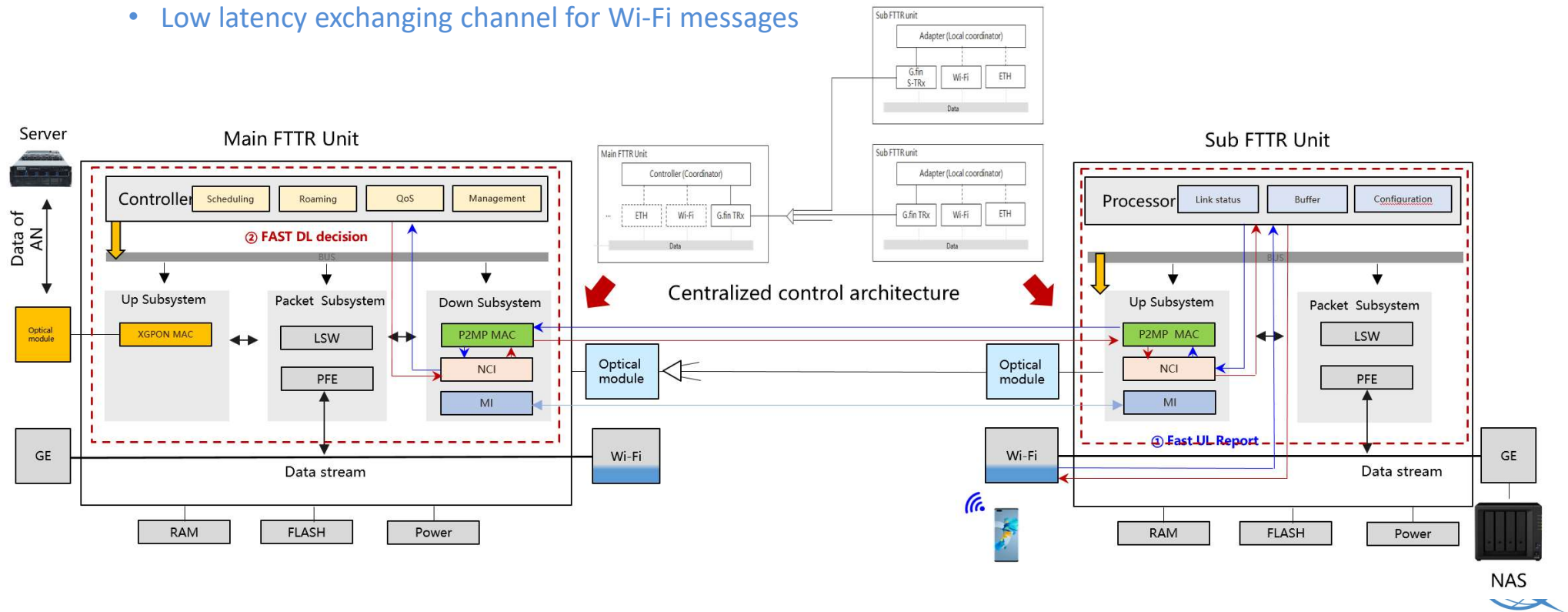
ITU-T SG15/Q3 - Recently approved Recommendations

- **G.hn:**
  - *G.9960 amd1 and G.9961 amd1 (02/2020)*
    - Extended bandwidth over coaxial (10 Gbps) and phoneline mediums (5 Gbps), multi-level coding and RCM schemes
  - *G.9960 amd2, G.9961 amd2, and G.9962 amd1 (07/2020)*
    - Support for smart grid applications, reverse power feeding over coax, IEEE 802.1X port-based network access control, new logical interface between the security controller entity and the domain master management entity
  - *G.9961 amd3 (04/2021)*
    - Enhancements to simplify routing mechanisms in tree topologies
  - *G.9961 amd4 (05/2022)*
    - Additional support for smart grid applications, enhancements to secure admission
  - *G.9978 amd1 (05/2022)*
    - Added external authentication procedures in addition to G.hn native authentication
- **G.vlc:**
  - *G.9991 amd1 (07/2020)*
    - IEEE 802.1X-based authentication in addition to native authentication
  - *G.9991 amd2 (04/2021)*
    - Mechanism to support advanced inter-domain mobility through an external controller ("Handover")

  - All can be found at ITU-T Recommendations

ITU-T SG15/Q3 - Recently approved Technical Papers

- **G.hn:**
  - GSTP-HNSG - Technical paper on the use of G.hn technology for smart grid (2020)
  - GSTP-HNIA: Use of G.hn in Industrial Applications (2020)
  - GSTP-OVHN - Overview of the ITU-T G.hn technology (2021)
  - GSTP-HNAFS - Architecture, functions, and services of home network (2021)
- **G.fin:**
  - GSTP-FTTR - Use cases and requirements of fibre-to-the-room (FTTR) (2021)

  - All can be found at [Technical papers and technical reports (itu.int)](itu.int)

ITU-T SG15/Q3 - Future deliverable timeline

- **G.hn:**
  - G.9962 amd2 – for consent 09/2022
    - Includes G.hn management parameters in YANG format
    - Centralized neighbouring domain interference mitigation (C-NDIM) protocol & mapping into Layer 2 Configuration and Management Protocol (LCMP)
  - Update to the technical paper on using G.hn for access – for agreement 09/2022
- **G.fin:**
  - Supplement on uses cases for FTTR 4B – for agreement 09/2022
- **Narrowband PLC for Smart Grid:**
  - Narrowband orthogonal frequency division multiplexing power line communication transceivers – PSD specification – G.9901 Amd 1 & Corr 1 – for determination 09/2022
  - Narrowband orthogonal frequency division multiplexing power line communication transceivers for G3-PLC networks – G.9903 Amd 2 & Corr 1 – for consent 09/2022

2022 — **2023** — **2024**

- **G.hn:**
  - G.9960/1 PLC update (G.hn2) – for consent
  - Technical paper on the use of ITU-T G.hn technology for in-home networking – for agreement
- **G.fin:**
  - Recommendations: system architecture – for consent
- **G.vlc:**
  - Technical paper on the use of ITU-T Visible Light Communication technology – for agreement - 1 or 2 Technical Papers on use cases and requirements for narrow beam OWC and channel adaptive OWC
- **G.uvs:**
  - Technical requirements of AR/VR/MR service over in-premises networks (G.uvs-XR) – for consent
- **G.IoT:**
  - System architecture, PHY layer and DLL layer for IoT Smart Home over PLC (G.IoT) – for consent
- **G.hetnet:**
  - Terminology and overview of the architecture of a Heterogeneous Home Network – consent 2023

- **G.fin:**
  - Physical layer - for consent
  - Data Link layer - for consent
  - Management layer - for consent

ITU-T SG15/Q3 - Collaboration with Broadband Forum

– Network architecture

- Incorporating Q3/15 technologies (e.g., G.hn, G.fin, Gvlc) into the overall end-user management architectures and requirements (WT-488)
- Development of novel management architectures (e.g. Fiber Access Extension)

– Network management

- Creation/maintenance of technology data models (Yang, TR-181)

– Marketing

- Promote/Showcase Q3/15 technologies for deployment (BASe)