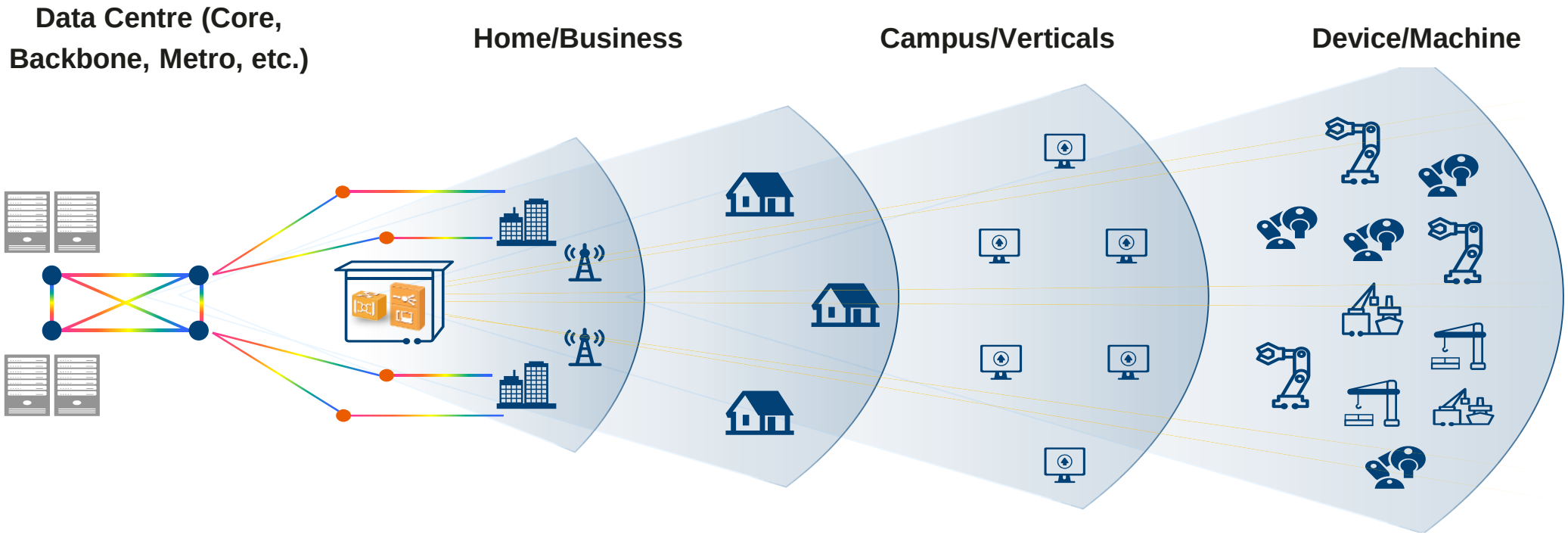
Enhancing the experience of FTTR –ETSI ISG F5G perspective

Luca Pesando

Chair, ETSI ISG F5G

4-party FTTR Workshop on June 23

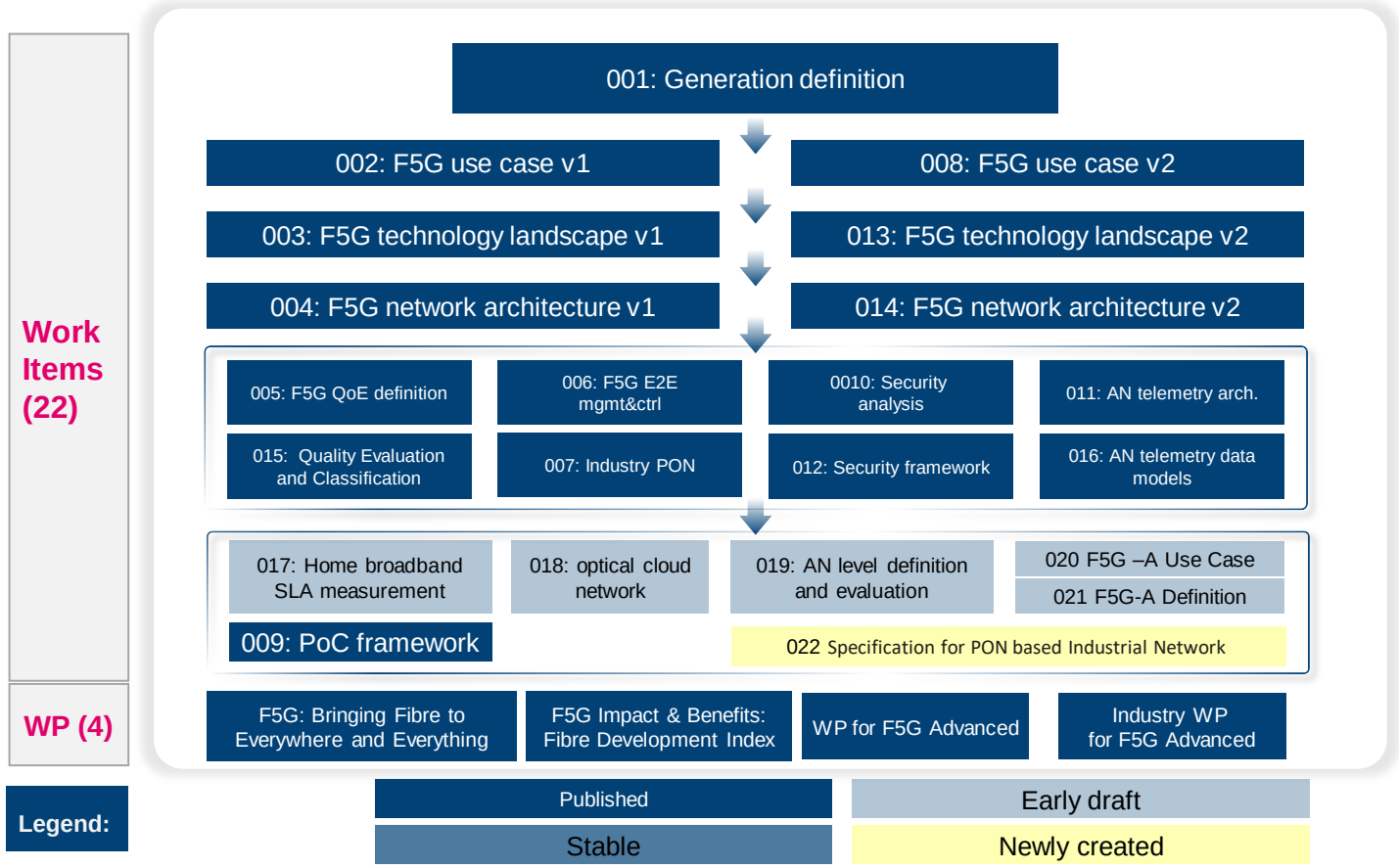
F5G Vision: Fiber to Everywhere & Everything

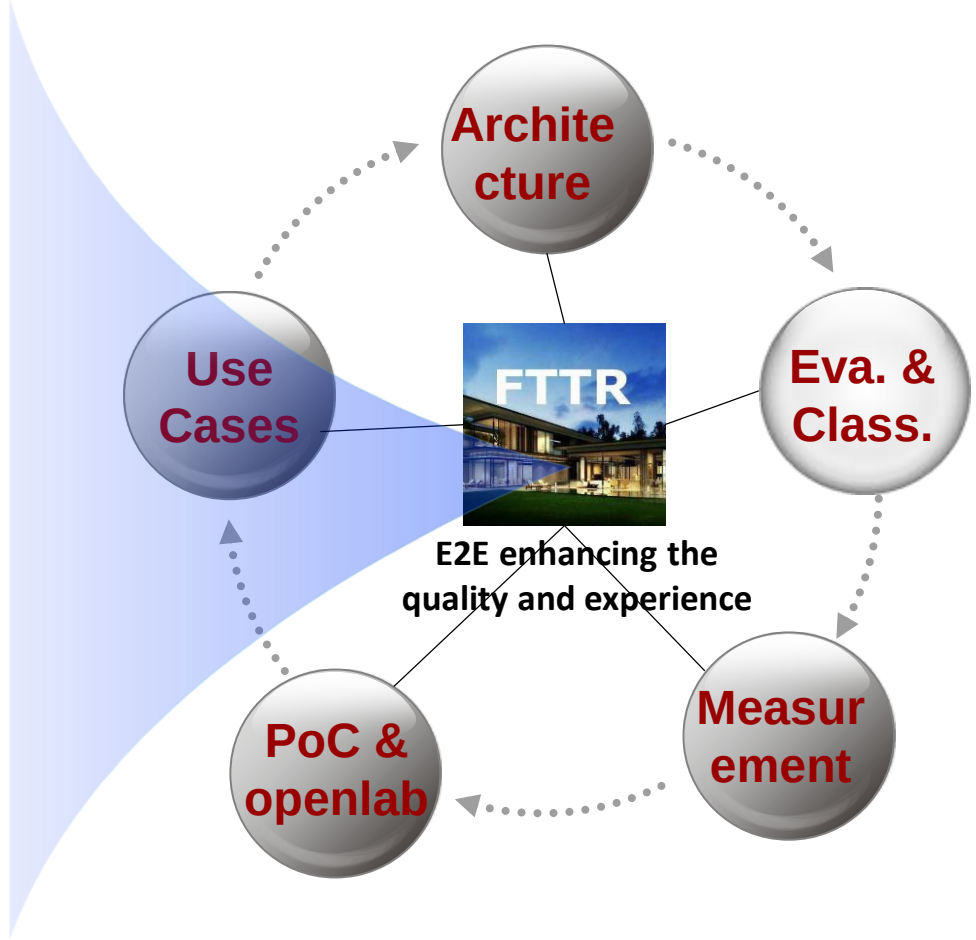


- ✓ Fiber to Everywhere to make fixed access future proof
- ✓ Extending to more end-user : 2Home, 2Room, 2Business, 2Comsumer, 2Mobile, 2Device, 2Machine, etc.
- ✓ Reducing everywhere the fiber-to-end user distance: Km -> 100m -> 10m -> 1m
- ✓ Number of connections expanding: X3 (Room), X10 (Desk), X30 (Machine), X100 (Smart city)

F5G Standards Framework and FTTR Efforts

Till now, 16 standard and 4 white paper were published.



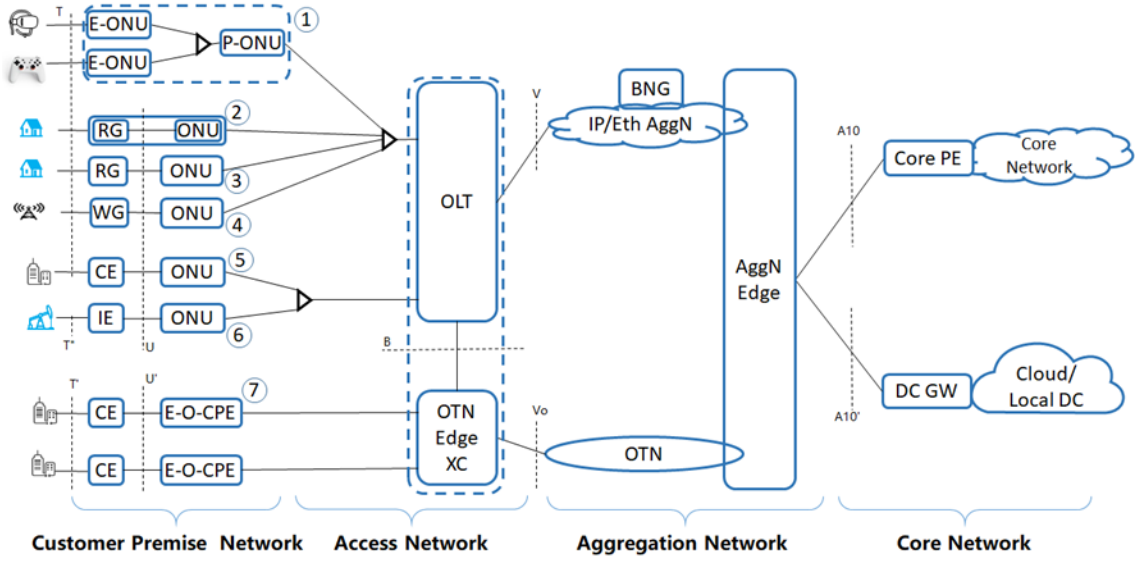


Last update: 4 new WIs and 1 new WP were approved in #14 plenary meeting

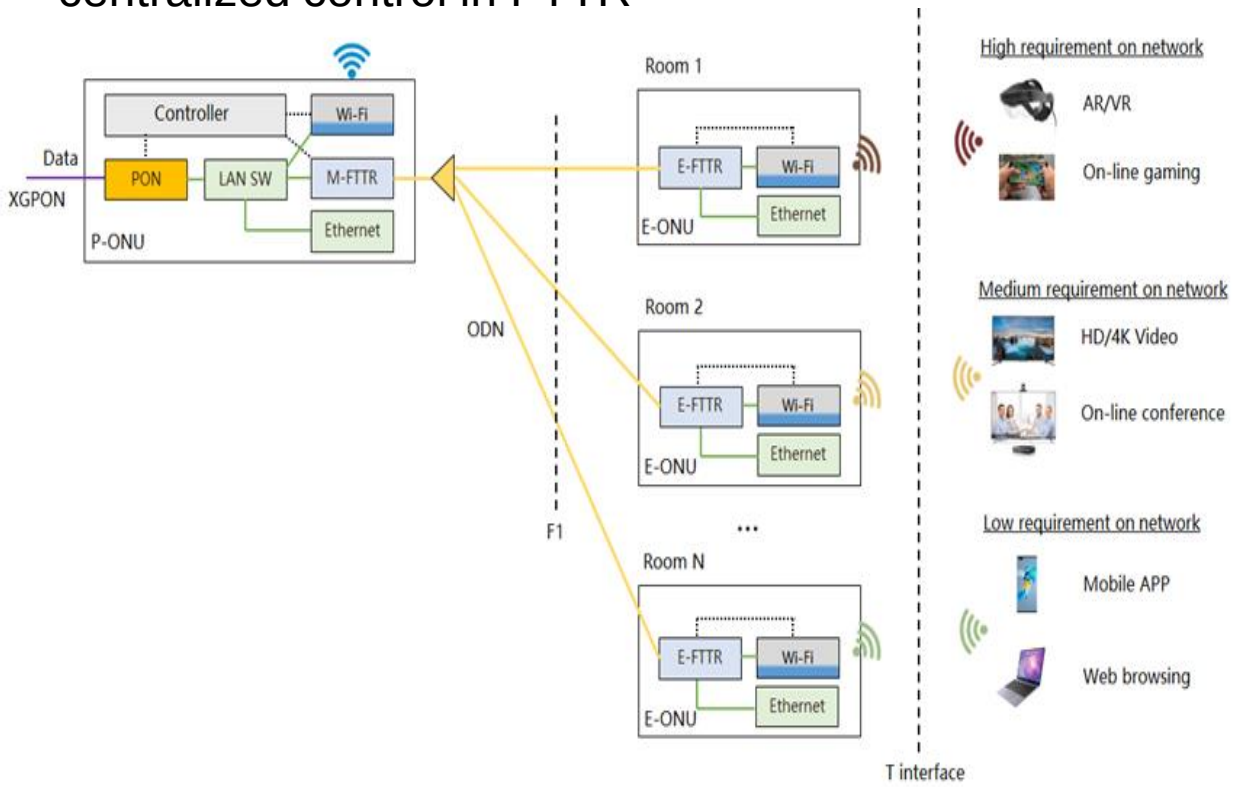
WI 23: F5G Advanced Architecture (Release 3)
WI 24: Technology Requirements and Gap Analyses (Release 3)
WI 25: Architecture of computing collaboration in PON network
WI 26: Architecture and data models for residential service quality monitoring

R2 F5G Architecture - FTTR Detail

Specifies the end to end network architecture, features and related network devices/elements' requirements for F5G, including on-premises, Access, IP and Transport Networks, and defines new features and enhance existing ones

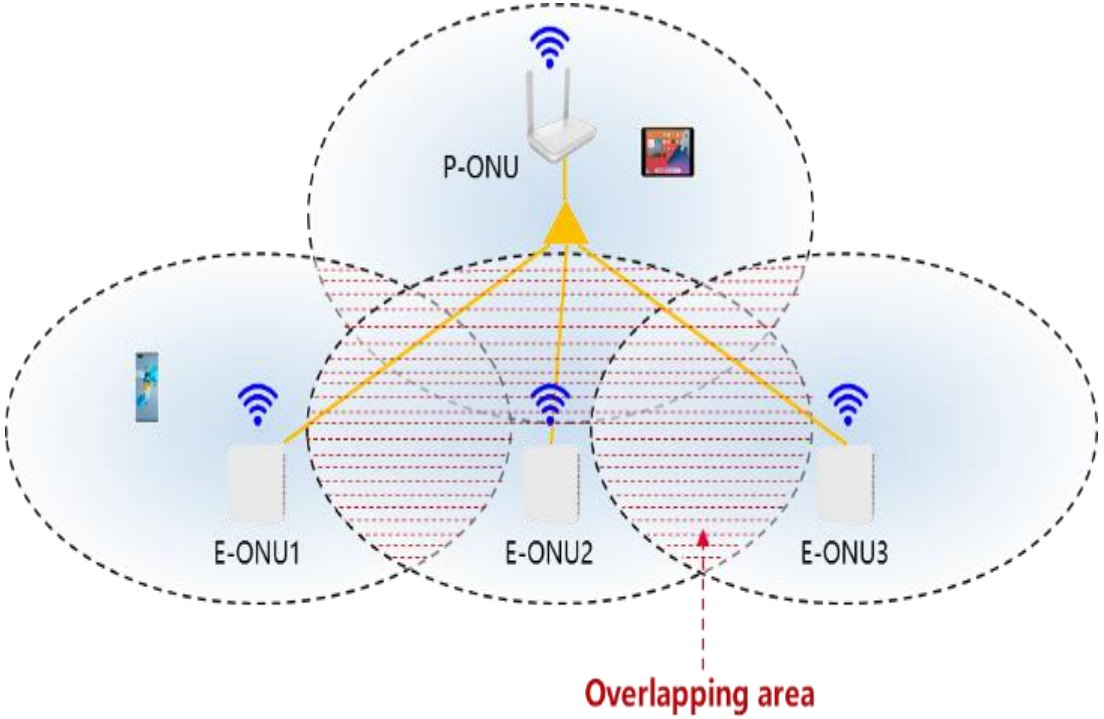


Centralized Wi-Fi access network architecture through centralized control in FTTR

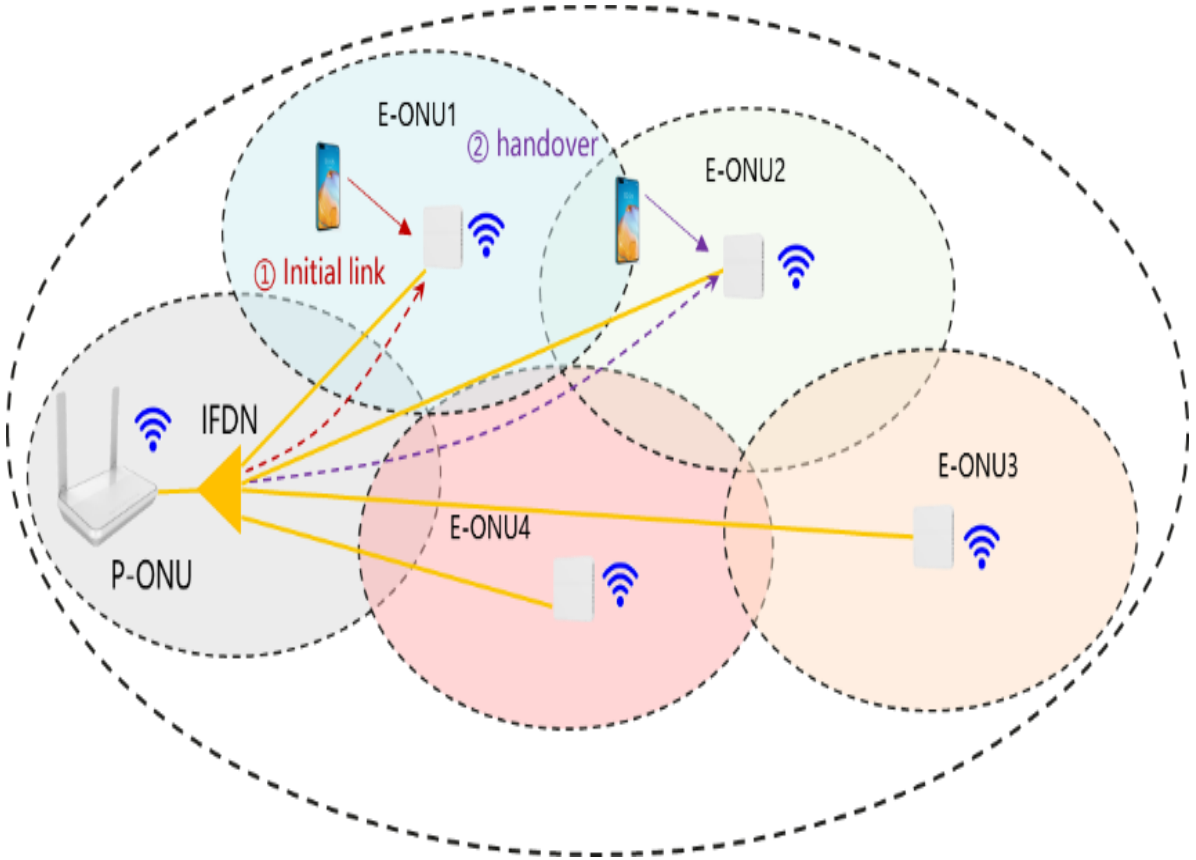


F5G-A Use Case – Stable & Reliable Wi-Fi® Connection over FTTR

Allow an increase of individual Wi-Fi subnets' performance and that of handover to guarantee service stability and performance

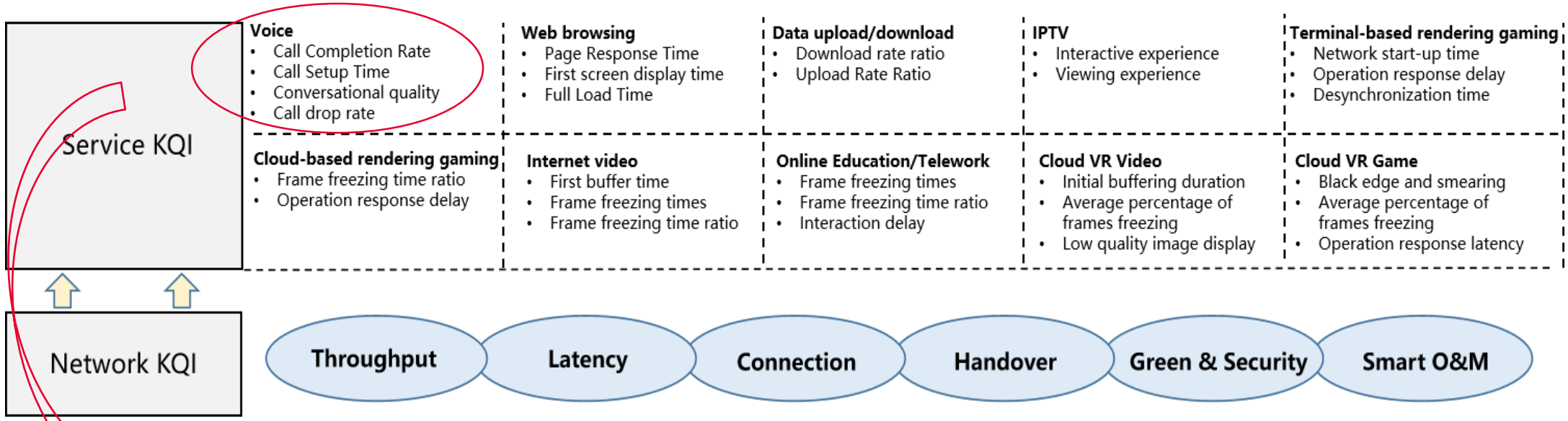


Distribution of Wi-Fi signal in FTTR scenario



Schematic of seamless hand-over

FTTR Residential Services Quality Classification and Evaluation (1/2)



Evaluation procedure

CCR

$$MOS_{CCR} = \begin{cases} 5 & CCR \geq 99\% \\ 0.0872 * e^{3.9869 * CCR} & CCR > 0 \\ 0 & CCR = 0 \\ 0 & Test\ failure \end{cases}$$

CST

$$MOS_{CST} = \begin{cases} 5 & CST \leq 3 \\ -0.5682 * CST + 6.5795 & 3 < CST < 11 \\ 0 & CST \geq 11 \\ 0 & Test\ failure \end{cases}$$

CQ

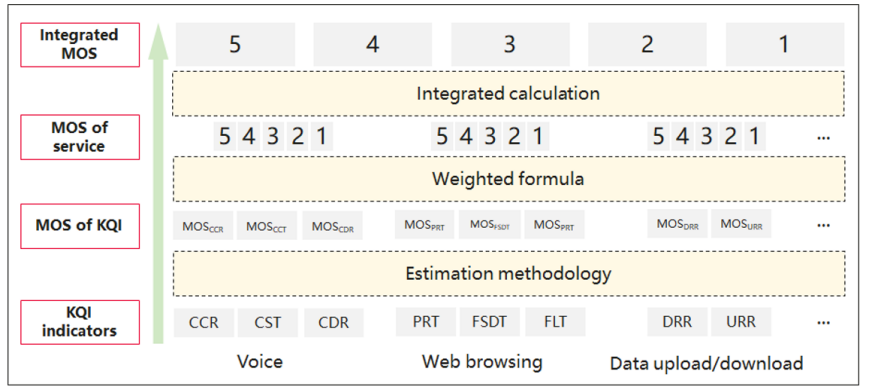
$$\mathrm{MOS}_{VQ} = \begin{cases} 1 & R < 0 \\ 1 + (0.035 * \mathrm{R}) + \mathrm{R} * (\mathrm{R} - 60) * (100 - \mathrm{R}) * 7 * 10^{-6}) & 0 \leq R \leq 100 \\ 4.5 & R > 100 \end{cases}$$

CDR

$$\mathrm{MOS}_{CDR} = \begin{cases} 2291.6 * (\mathrm{CDR})^2 - 184.1 * CDR + 5 & CDR < 10\% \\ 0 & CDR \geq 10\% \\ 0 & Test\ failure \end{cases}$$

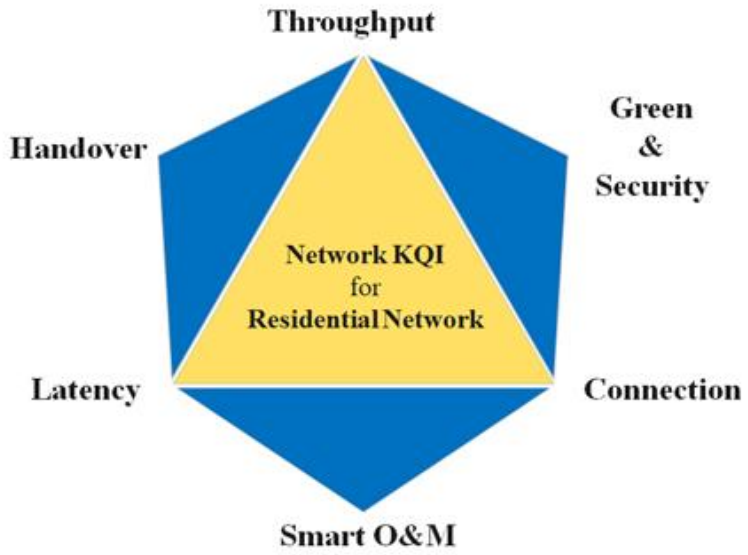
Comprehensive MOS value

$$\mathrm{MOS}_{voice} = \mathrm{a} * \mathrm{MOS}_{CCR} + \mathrm{b} * \mathrm{MOS}_{CST} + \mathrm{c} * \mathrm{MOS}_{VQ} + \mathrm{d} * \mathrm{MOS}_{CDR}$$



FTTR Residential Services Quality Classification and Evaluation (2/2)

- The six-dimensional evaluation matrix for network KQI



- Service classification based on the evolution supported by network development

Level / Dimension	L0	L1	L2
Service	Voice Web browsing SD&HD video Upload/download	Terminal-based online game 4K video On-line education/office	Cloud VR 8K video Cloud-based online game

Detailed network evaluation of residential services

Level	Service	Network KQI						
		Throughput	Latency	Connection	Handover	Green	Security	Smart O&M
L0	Voice Web Browsing Upload Download SD&HD video	⩾100Mbps	⩽35ms	connected: 64	⩽100ms	⩽45 mW/Mbit	Hardware supports secure boot, firmware package encryption, system encryption, anti-reverse analysis. The system must have the active/standby capability. When an exception occurs, the system can be switched to the standby area.	Device self-management, fault self-identification and offline self-optimization
L1	4K video Terminal-based online game Online education/office	⩾1000Mbps	⩽19ms	connected: 128, 16 active with 50M each	⩽50ms	⩽30 mW/Mbit	The firewall support protect against DDoS attacks with at least 3000 attack packets per second. The system needs to be scanned by security tools without known vulnerabilities.	Automatic network provisioning, Fault self-diagnosis and Scenario self-optimization
L2	8K video Cloud-based online game Cloud VR	⩾2000Mbps	⩽7ms	connected: 256, 16 active with 100M each	⩽10ms	⩽20 mW/Mbit	The firewall should support protect against DDoS attacks with at least 10000 attack packets per second. The system can record logs for common attacks, prevent brute force cracking and check the security of key files.	Service continuity under upgrade, fault self-recovery and collaborative self-optimization.

Basic network evaluation of residential service

Level	Throughput	Latency of residential network	Handover
L0	≥100Mbps	≤100ms	≤100ms
L1	≥1000Mbps	≤50ms	≤50ms
L2	≥2000Mbps	≤20ms	≤10ms

Measurement Specification for FTTR KQI

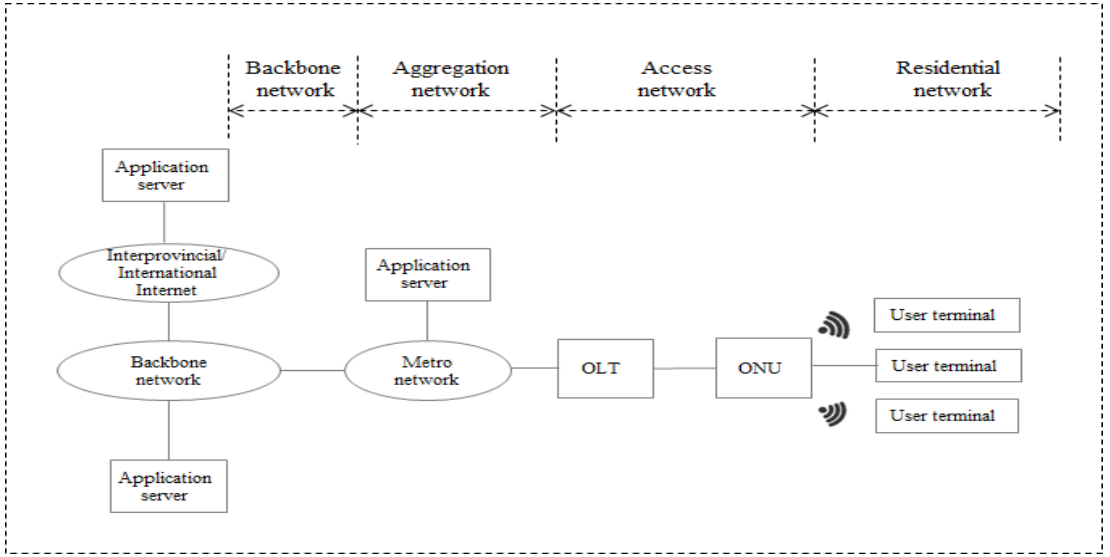
- F5G GS-017 F5G Residential Services Quality Evaluation and Classification

Network KQI → Support → **Service KQI** → Evaluate → **MOS**

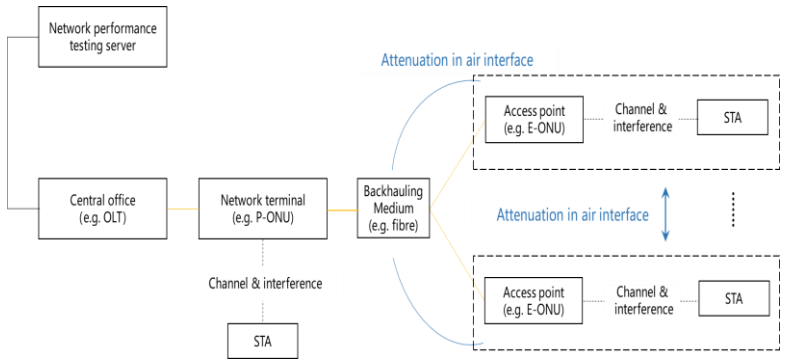
① Network KQI measurement

② Service KQI measurement

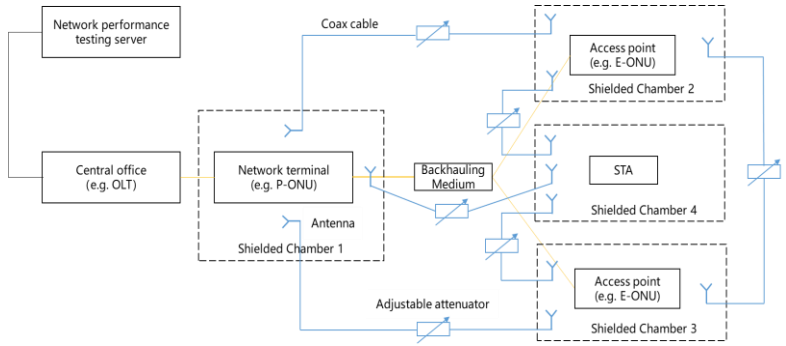
- WI-017 Measurement Specification for Residential Services Quality Evaluation



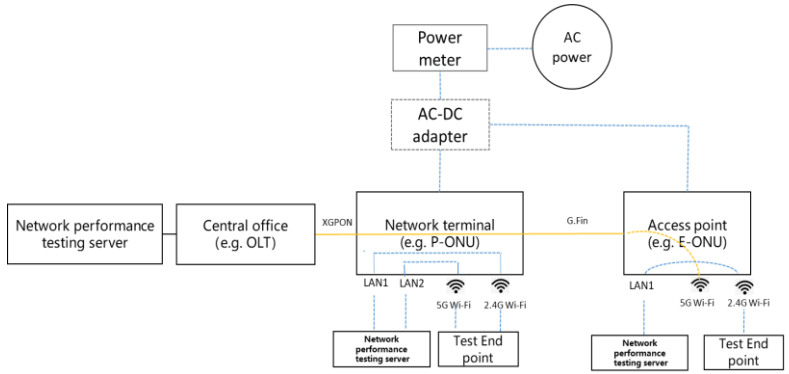
① E2E measurement setup for service KQI



Throughput



Handover

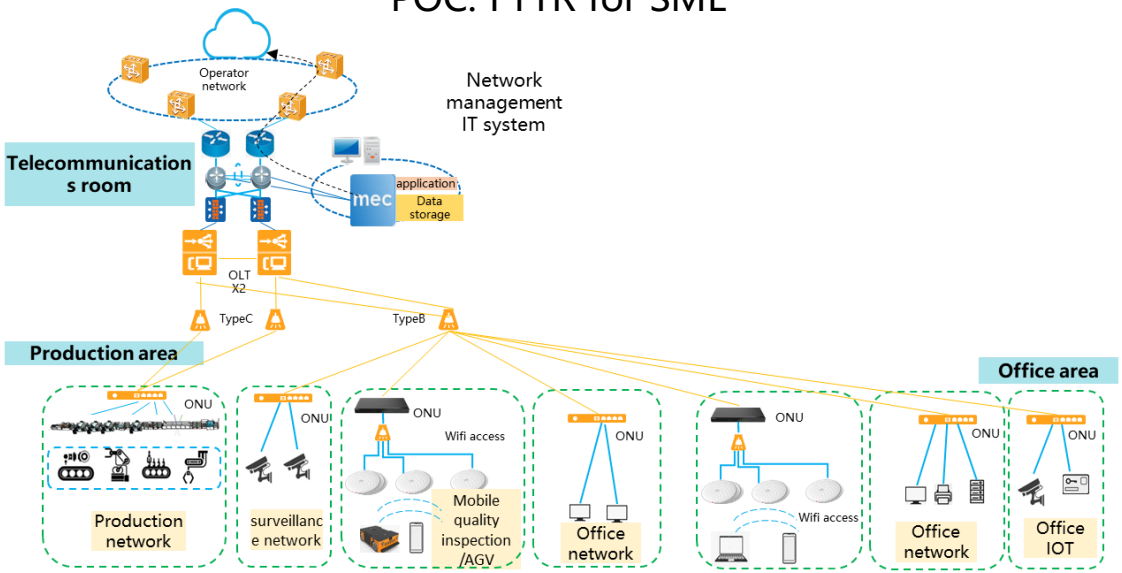


Power consumption

② Measurement approaches for network KQI

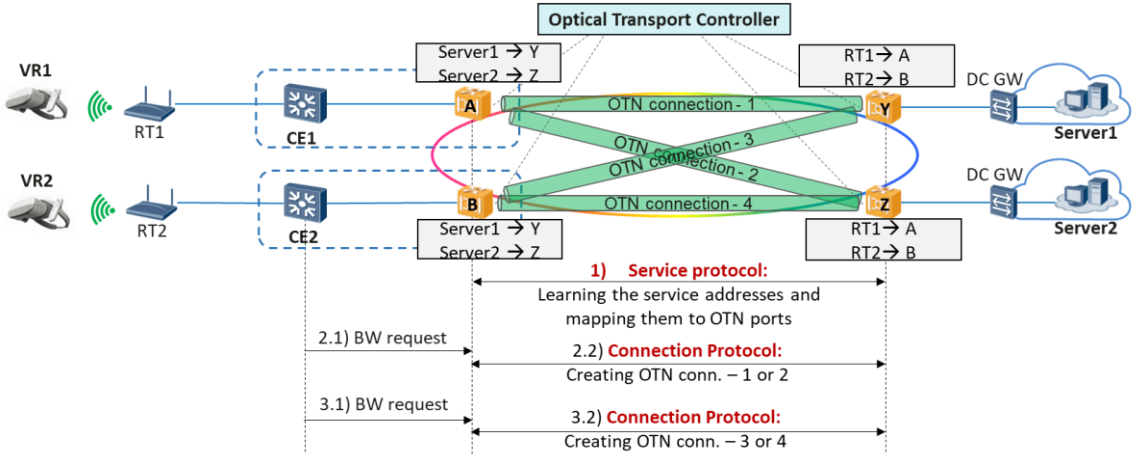
5. PoC for FTTR

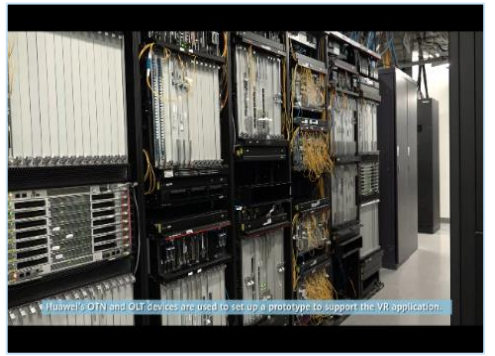
POC: FTTR for SME

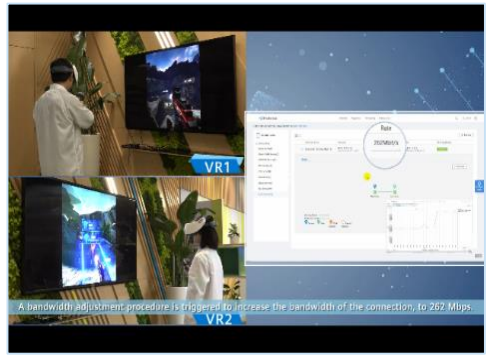


POC participants: CAICT、CTC、CX PRECISION FABRICATION CO.,LTD submitted in 2022 for F5G ISG

POC： FTTR for Residential (Cloud VR Services into Multiple Clouds)







POC participants: China mobile, BUPT in 2022 for F5G ISG

Outlook for Evolution

Digitization and Cloudification of Applications

UHD immersive experience services

Enterprise digitization and cloudification

Industry going fiber

Metaverse as a Driver

Network Infrastructure Improvements

Digitization of network operations

Optical fiber infrastructure

Smart Infrastructures

The green challenge

ETSI-WP-50-F5G-Advanced-and-Beyond, September 2022

Experience is King to Facilitate the Evolution to 10Gbps

gigabit society

10Gbps everywhere

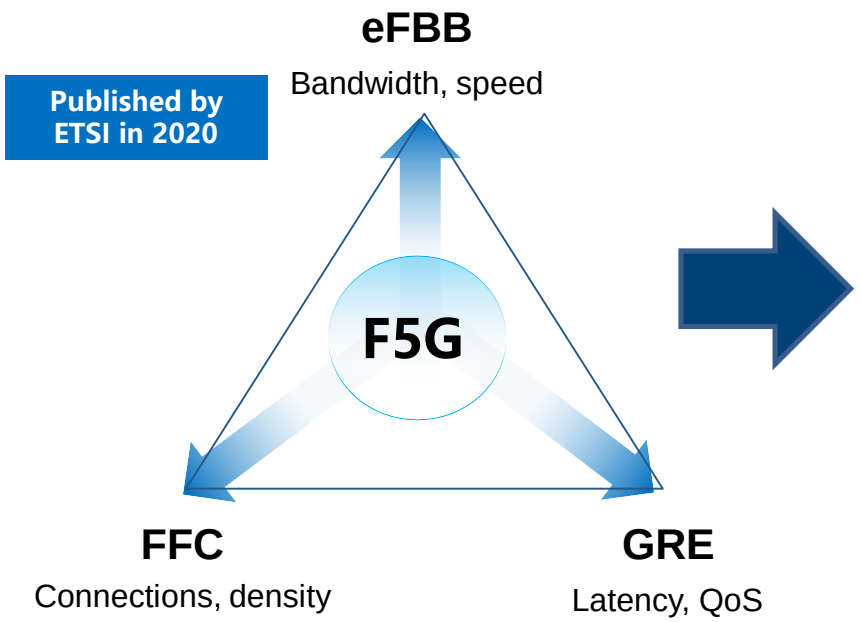
F5G | F5G Advanced | F6G

2020 | 2025 | 2030

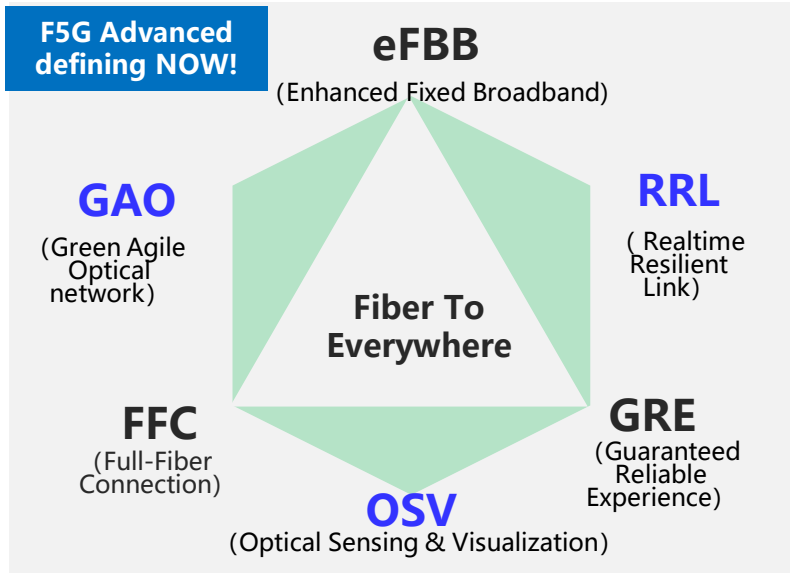
Extension (existing scenarios)

Expansion (new scenarios)

Published by ETSI in 2020



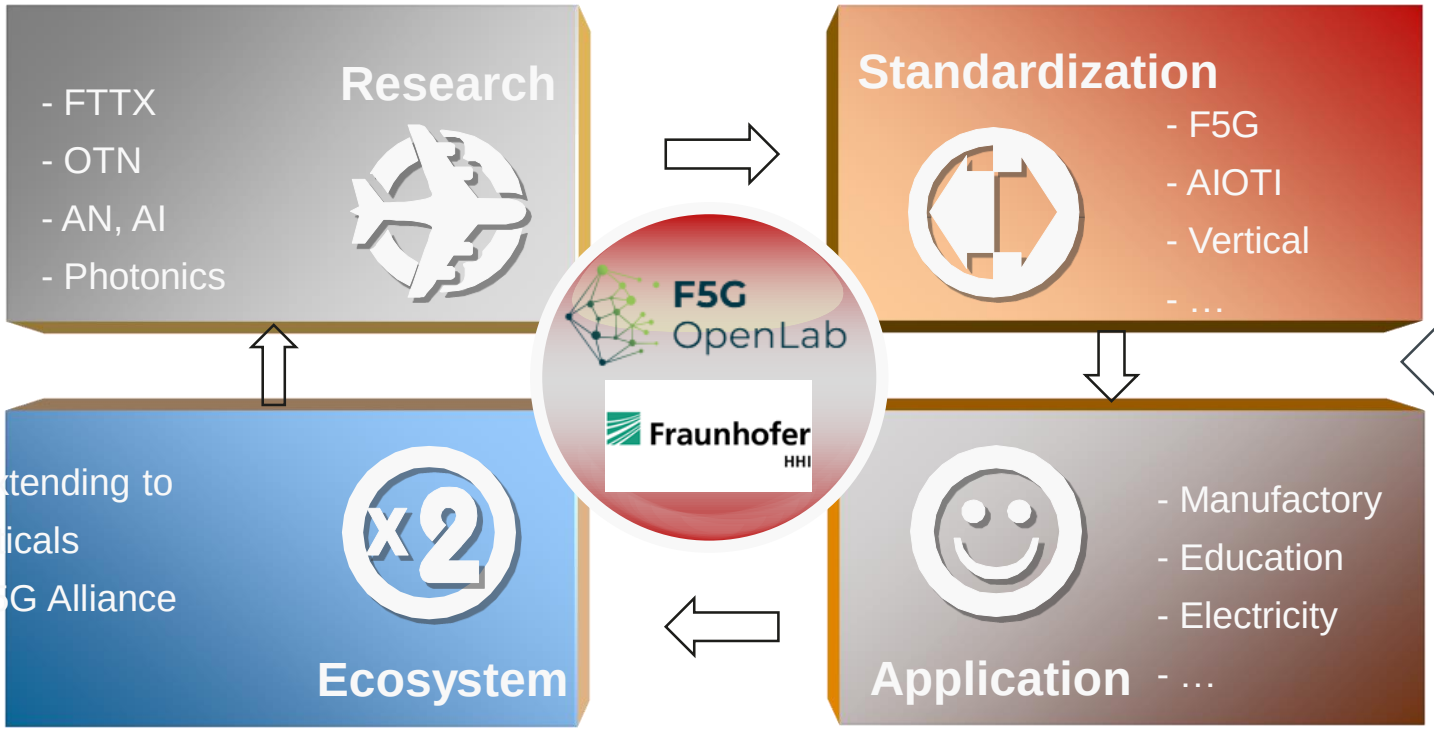
F5G Advanced defining NOW!

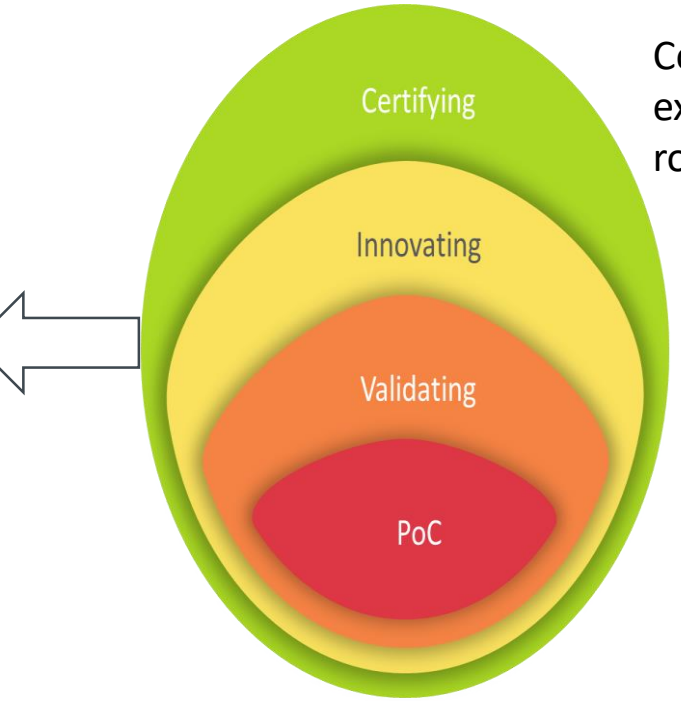


Summary and Main Take-aways

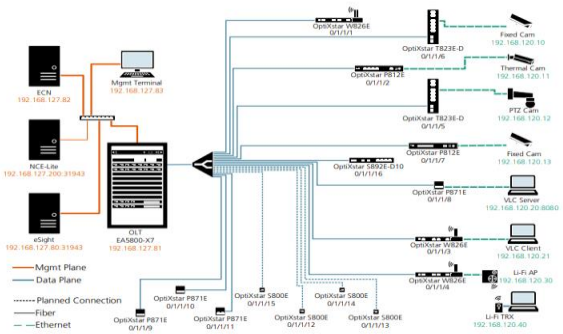
- The vision of ISG F5G is guided by the “Fibre to Everywhere & Everything” concept
- FTTR is one of the trends and real drivers for evolving into gigabit society
- One of the main focuses for ISG F5G is to make FTTR happen and have large diffusion
  - e2e scope for ETSI ISG F5G, developing from cases through technical and architecture innovation, service evolution and classification, measurement and PoC, etc.
- Some standard related with the experience enhancement of FTTR contributed by ETSI ISG F5G are now generally known and recognized
- ETSI ISG F5G is looking forward to the collaboration with other SDOs to deliver FTTR for the dual transition (digital & green)

F5G Openlab –Call for Action!

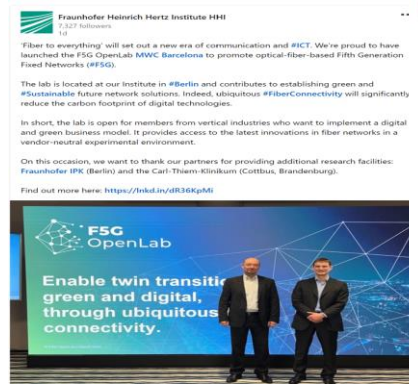




Competency expansion roadmap



Fraunhofer Heinrich Hertz Institute HHI'S Post




Embracing F5G Advanced era and years of light.
Together, we make it happen!