ETSI ISG F5G perspective - FTTR

Dr. Olivier Ferveur

Chair, ETSI ISG F5G

FTTR Workshop on July 2024

- ◉ Overview of the ISG

- ◉ Uses Cases Related to FTTR
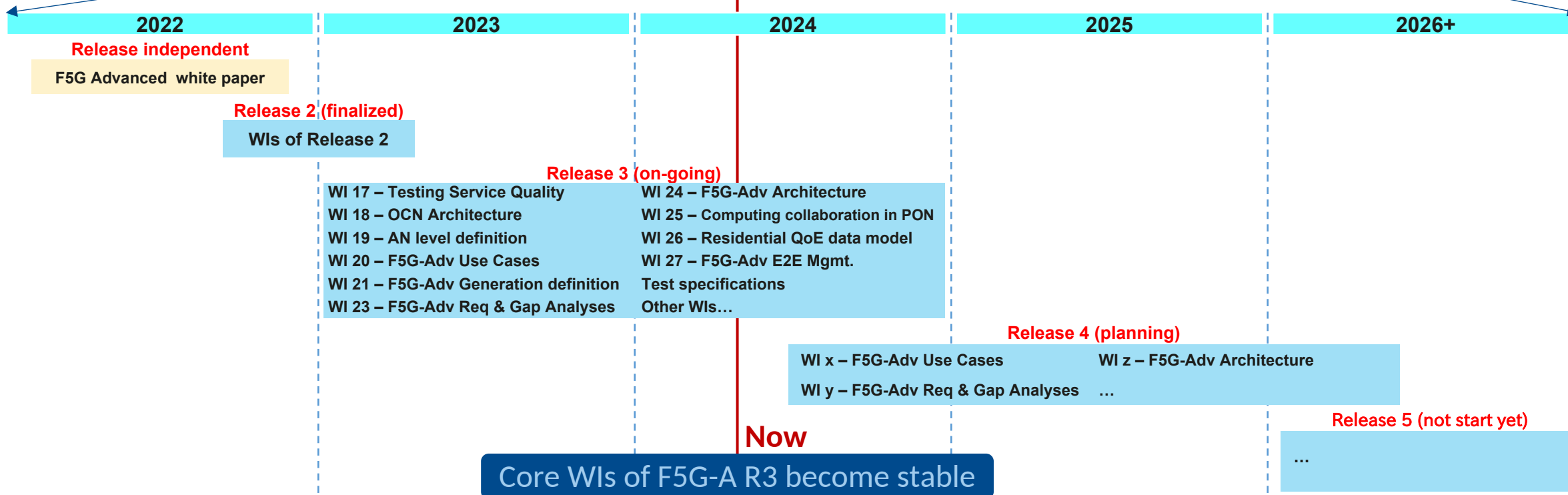
- ◉ ISG Next Step

Overview of the ETSI ISG F5G

Plan for ISG F5G (1) – Releases and Evolution Roadmap

> ➤ **ISG F5G planned to finished F5G Advanced in three release and then move to F6G in 2027**

ISG F5G Created	Release 1 F5G	Release 2 • F5G • F5G-A Vision	Release 3 • F5G Advanced	Release 4 • F5G Advanced	Release 5 • F5G Advanced • F6G Vision	Release 6 • F5G-Advanced • F6G	Release 7
2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030

2022	2023	2024	2025	2026+

Release independent

F5G Advanced white paper

Release 2 (finalized)

WIs of Release 2

Release 3 (on-going)

WI 17 – Testing Service Quality	WI 24 – F5G-Adv Architecture
WI 18 – OCN Architecture	WI 25 – Computing collaboration in PON
WI 19 – AN level definition	WI 26 – Residential QoE data model
WI 20 – F5G-Adv Use Cases	WI 27 – F5G-Adv E2E Mgmt.
WI 21 – F5G-Adv Generation definition	Test specifications
WI 23 – F5G-Adv Req & Gap Analyses	Other WIs…

Release 4 (planning)

WI x – F5G-Adv Use Cases	WI z – F5G-Adv Architecture
WI y – F5G-Adv Req & Gap Analyses	…

Release 5 (not start yet)

…

Now

Core WIs of F5G-A R3 become stable

1) Standard Contribution: 30 WIs Created (20 Published)

Release 1 – F5G

Release 2 – F5G

Release 3 – F5G-A

General

001 F5G definition		

002 F5G UC v1	008 F5G UC v2	021 F5G-A definition
003 F5G TL v1	013 F5G TL v2	020 F5G-A UC
004 F5G arch. v1	014 F5G arch. v2	023 F5G-A R-GA
006 F5G E2E mgmt		024 F5G-A arch.

019 F5G AN Levels | 027 F5G-A mgmt

QoE

005 QoE definition | 015 Home QoE evaluation / 015 v1.2.1 | 017 Home QoE measuremer | 028 SME QoE

026 Home QoE monitoring

Industry

007 Industry PON - GR | 022 Industry PON - GS

Access

011 AN Telemetry frame. | 025 Computing in PON

016 AN Telemetry model

Transport

018 OCN arch

Security

010 Security analysis

012 Security arch

Test spec

029 FTTR testing

PoC

009 PoC | #1 Industrial PON | #2 Telemetry | #3 Optical Service | #4 Visual Inspection | #5 AGV | #6 E2E Service mgmt

Whitepaper

2020: F5G: Bringing Fibre to Everywhere and Everything	2021: F5G Impact & Benefits: Fibre Development Index	2022: F5G Advanced and Beyond	2023: All-fibre network facilitates the Carbon Shift

Legend: Published | Stable/final draft | Early draft | Whitepaper

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> **Till now:**
> - **Weekly** conference call
> - **19** WIs published
> - **2** stable / final drafts
> - **9** early draft under dev.
> - **4** Whitepapers published
> - **6** PoCs created, **5** finished

> **R1 & R2 published**

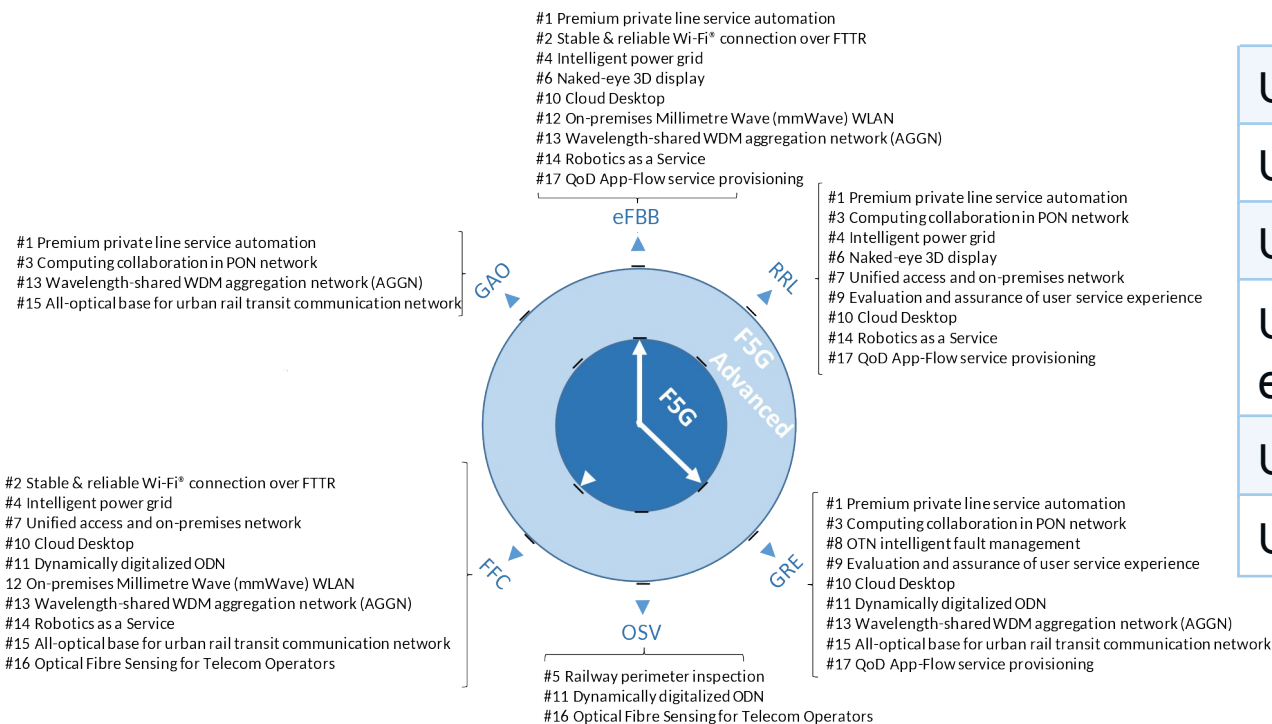> **Now working on F5G-A (R3)**
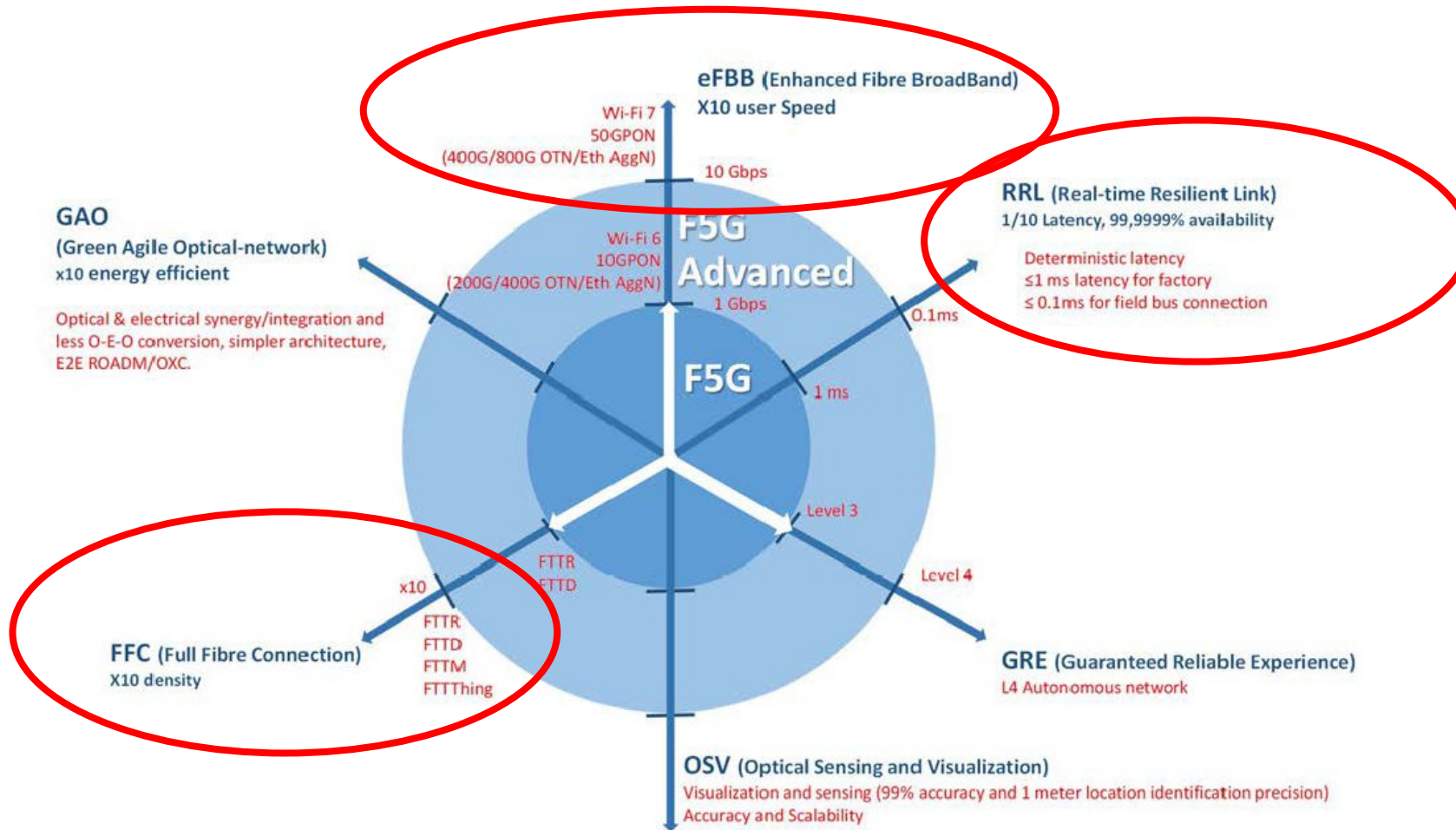
ETSI GR F5G 020: F5G Advanced Use Cases

➤ describe use cases for the F5G Advanced network.

➤ address use cases not included in F5G so far. Use cases will be aimed to introduce new technical requirements for the F5G Advance Network along various characteristic dimensions

➤ be used as input for gap analysis and technology landscape activities to extract technical requirements

#1 Premium private line service automation
#2 Stable & reliable Wi-Fi® connection over FTTR
#4 Intelligent power grid
#6 Naked-eye 3D display
#10 Cloud Desktop
#12 On-premises Millimetre Wave (mmWave) WLAN
#13 Wavelength-shared WDM aggregation network (AGGN)
#14 Robotics as a Service
#17 QoD App-Flow service provisioning

eFBB

#1 Premium private line service automation
#3 Computing collaboration in PON network
#13 Wavelength-shared WDM aggregation network (AGGN)
#15 All-optical base for urban rail transit communication network

#1 Premium private line service automation
#3 Computing collaboration in PON network
#4 Intelligent power grid
#6 Naked-eye 3D display
#7 Unified access and on-premises network
#9 Evaluation and assurance of user service experience
#10 Cloud Desktop
#14 Robotics as a Service
#17 QoD App-Flow service provisioning

GAO RRL

F5G Advanced

F5G

#2 Stable & reliable Wi-Fi® connection over FTTR
#4 Intelligent power grid
#7 Unified access and on-premises network
#10 Cloud Desktop
#11 Dynamically digitalized ODN
12 On-premises Millimetre Wave (mmWave) WLAN
#13 Wavelength-shared WDM aggregation network (AGGN)
#14 Robotics as a Service
#15 All-optical base for urban rail transit communication network
#16 Optical Fibre Sensing for Telecom Operators

FFC GRE

OSV

#1 Premium private line service automation
#3 Computing collaboration in PON network
#8 OTN intelligent fault management
#9 Evaluation and assurance of user service experience
#10 Cloud Desktop
#11 Dynamically digitalized ODN
#13 Wavelength-shared WDM aggregation network (AGGN)
#15 All-optical base for urban rail transit communication network
#17 QoD App-Flow service provisioning

#5 Railway perimeter inspection
#11 Dynamically digitalized ODN
#16 Optical Fibre Sensing for Telecom Operators
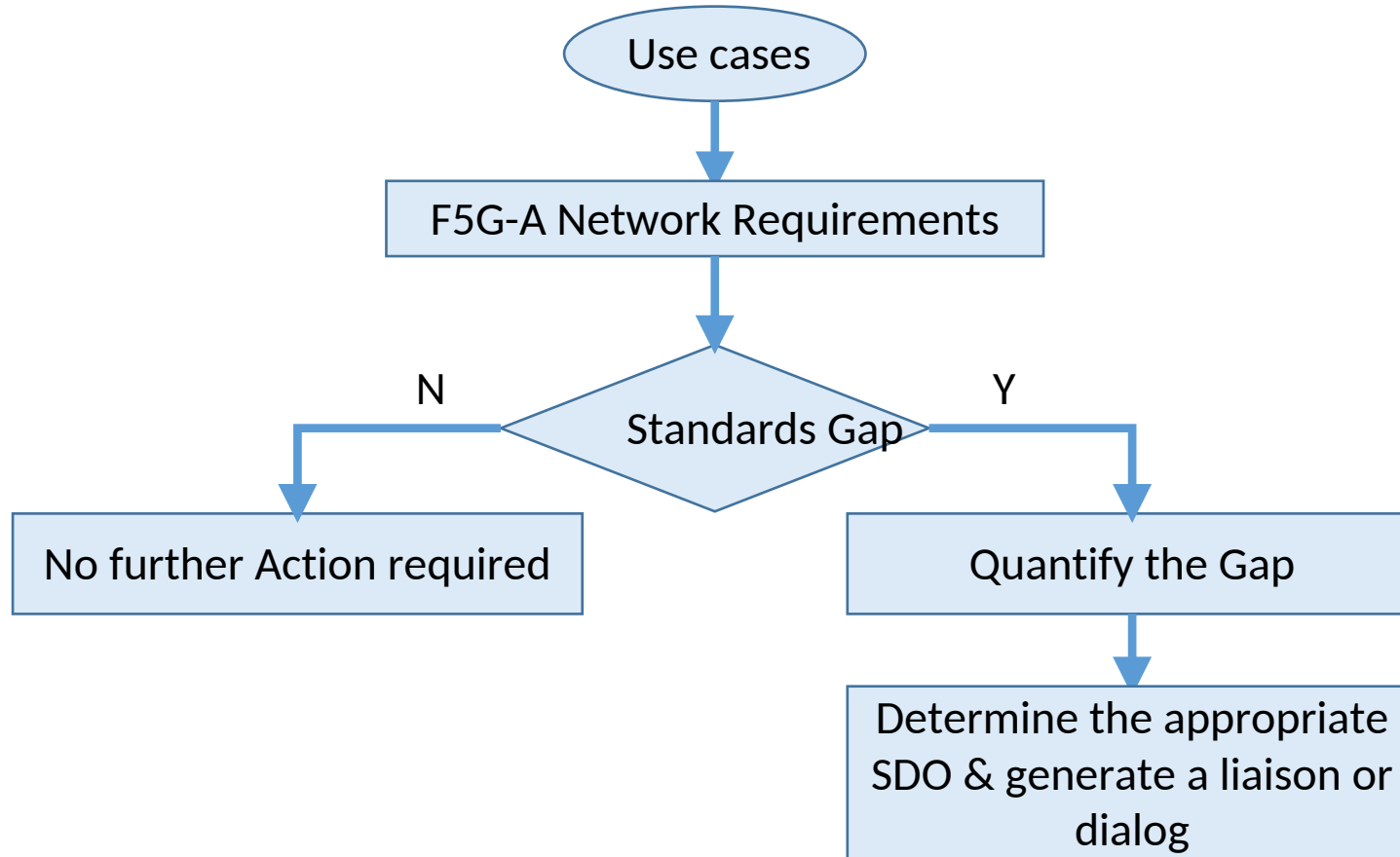
Use Case Related to FTTR

UC #2 Stable & reliable Wi-Fi® connection over FTTR
UC #3 : Computing collaboration in PON network
UC #7 :Unified access and on-premises network
UC #9 :Evaluation and assurance of user service experience
UC#12 : On-premises Millimetre Wave (mmWave) WLAN
UC #17 :QoD App-Flow service provisioning

WI-023: F5G-A Technology Requirements and Gap Analyses R3

F5G-A Requirements and Gaps flow

Use cases

↓

F5G-A Network Requirements

↓

Standards Gap

N → No further Action required

Y → Quantify the Gap

↓

Determine the appropriate SDO & generate a liaison or dialog

Main scope of this WI

- ➤ This Work item specifies the technology requirements for F5G-A use cases release 3 and explores existing technologies from related SDOs

- ➤ It performs gap analyses between the technologies required by the use cases and those that are available.

- ➤ The identifies the relevant SDOs based on their existing projects.

Use Cases Related to FTTR

UC #3 : Computing collaboration in PON network
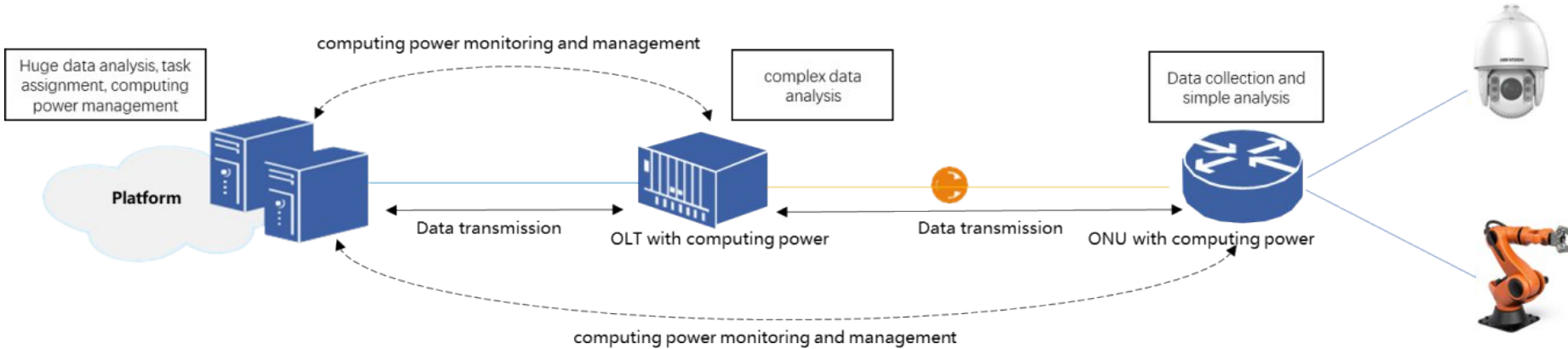
GR F5G 20 : MOTIVATION

- Breaks the computing power barrier between the ONU, the OLT and the cloud platform in the PON access network.
- Achieves coordination and integration of computing power in the PON access network.
- Controls the computing power operation of the entire PON access network in real time and make dynamic adjustments.

WI-23 : GAP ANALYSIS

- Heterogeneous computing capability
- Identification of service flow & corresponding demand
- Dynamic collaboration between the PON network elements and the computing elements
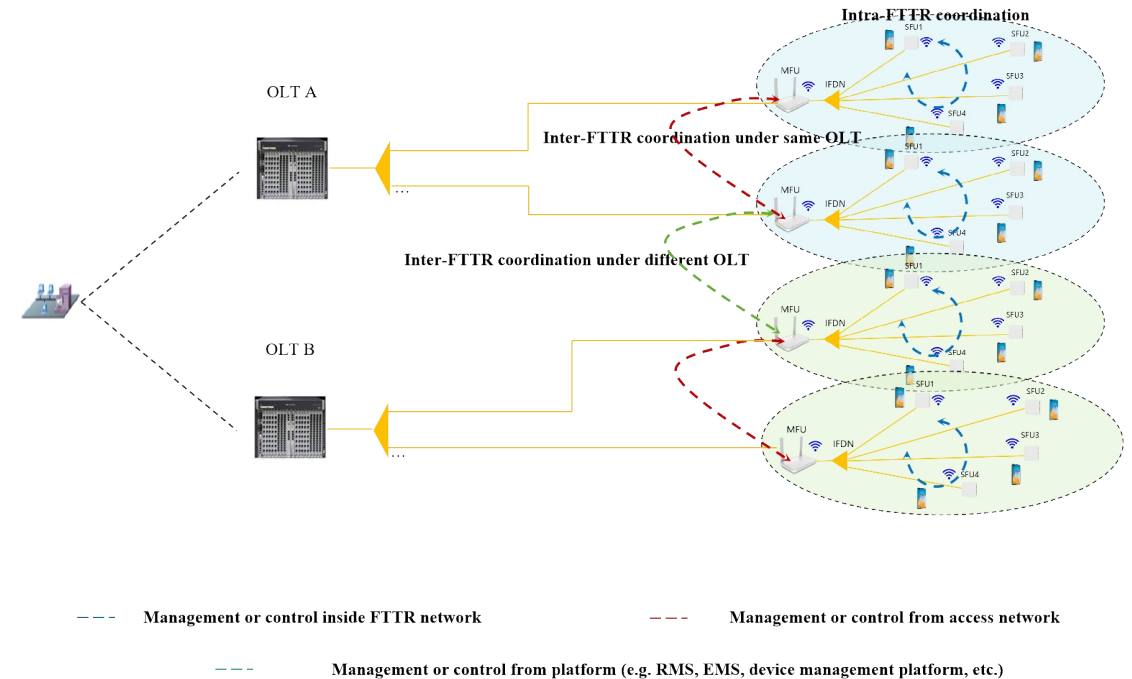
UC #17 :QoD App-Flow service provisioning
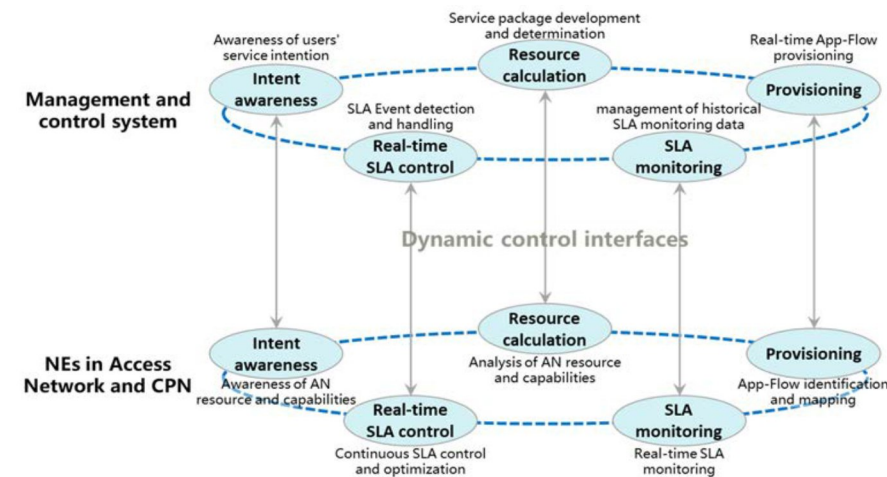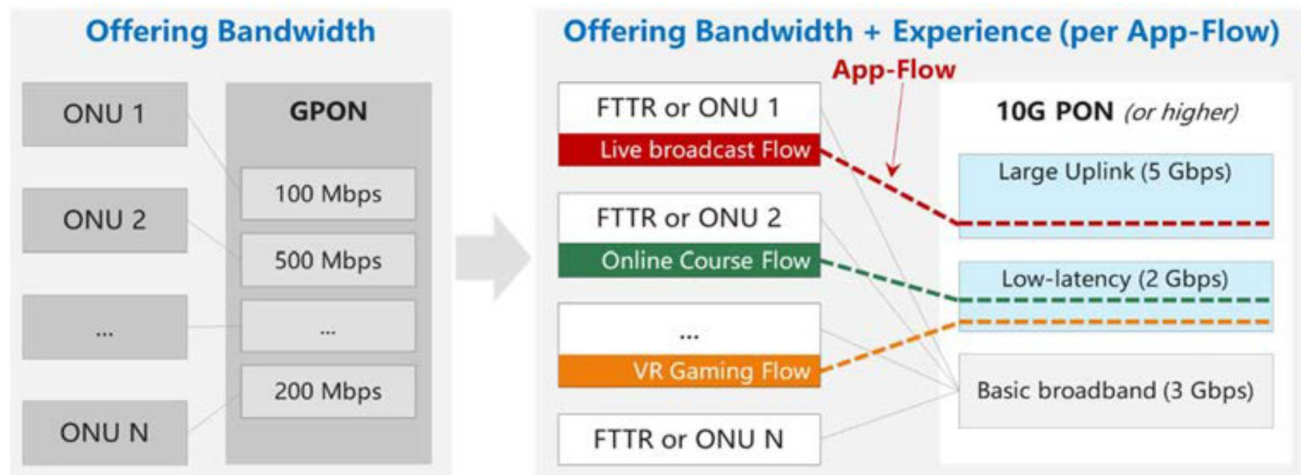
- Dynamically create, delete, modify, and query an App-Flow in seconds.
- Identify different App-Flows and map the specific application data into their corresponding App-Flows.

WI-23 : GAP ANALYSIS

- Quality On Demands API
- App-flows provisioning
- Real-time Qos Management system for Access and CPN
- …

UC #7 :Unified access and on-premises network
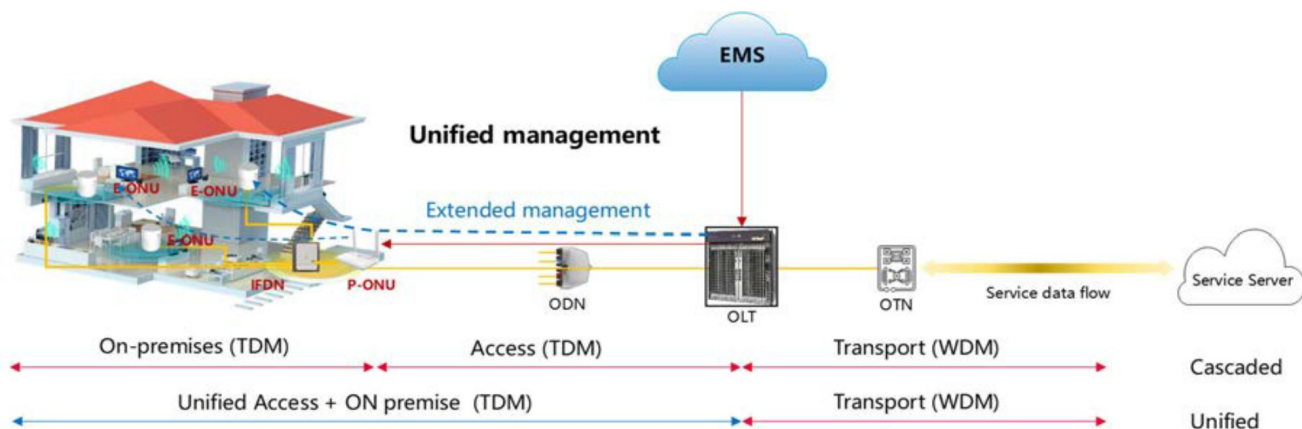
WI-23 GAP ANALYSIS

- Provide unified control of data transmission
- Provide unified management of data transmission

-> based on OMCI extension, IP based protocol, etc.

GR-20 : MOTIVATION

- A global view of packet scheduling can be performed to reduce the E2E transmission latency, optimize the data buffer size, etc. This is beneficial for the end user's QoE.
- To make use of the computing power of the device in the central office (OLT) to provide a more accurate data transmission strategy.
- Cooperative management provides global mapping of device status to improve network resource utilization (time/spatial/spectrum) and provide network asset monitoring.

UC #9 :Evaluation and assurance of user service experience

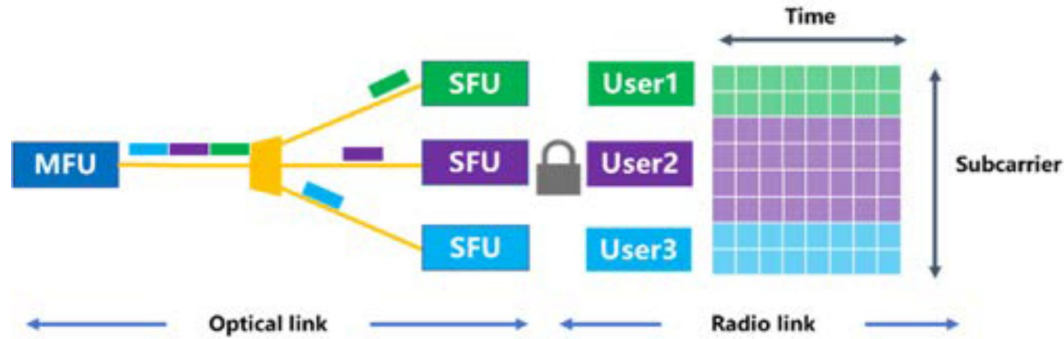| Key capabilities | Realtime evaluation of user's service experience | Precise demarcation and root cause analysis of poor-QoE problems | Automatic rectification and audit of poor-QoE problems |
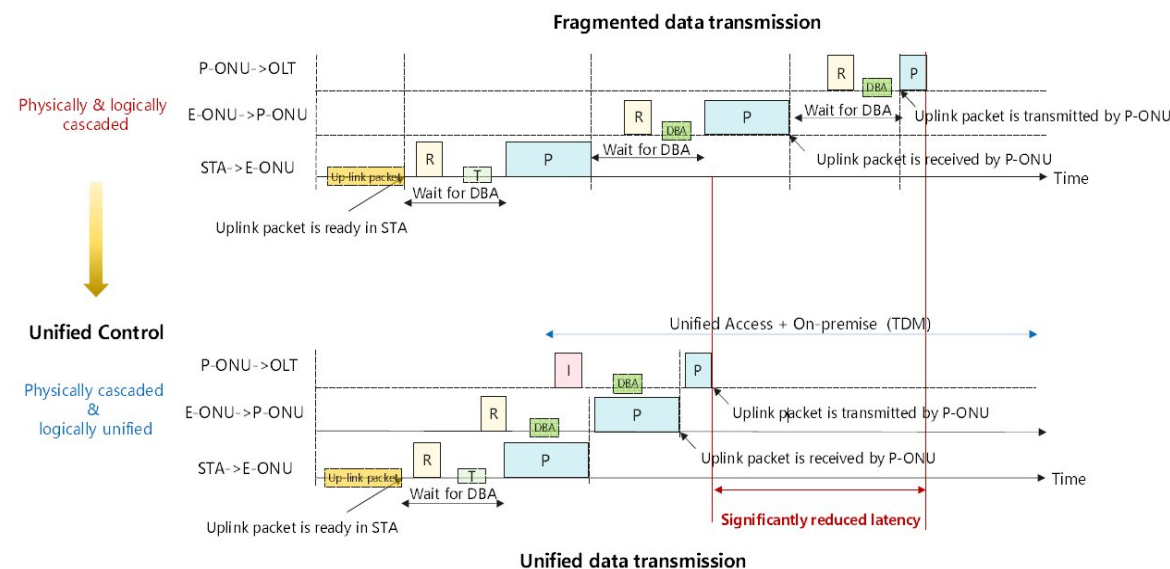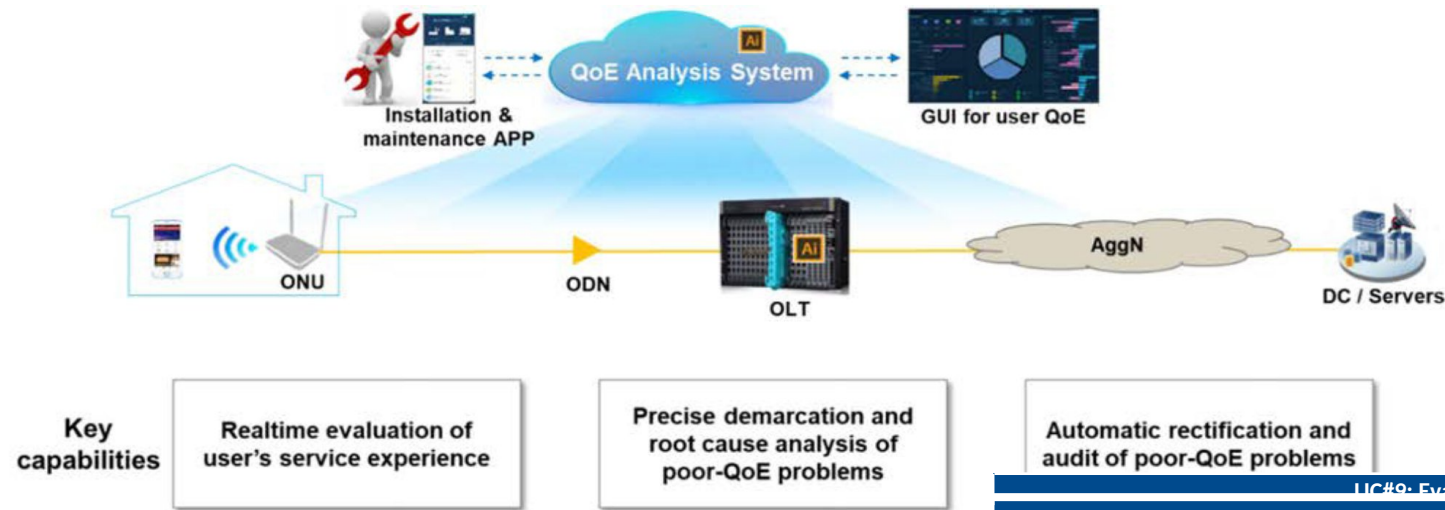
GR F5G 20 : MOTIVATION
- Pro-active Network operation.
- Avoid On-site intervention
- Improve User Experience

WI-23 : GAP ANALYSIS
- Evaluation of user's service experience
- User experience rectification and audit

UC#9: Evaluation and assurance of user service experience	
[R9-1]: The user experience evaluation model shall be defined.	[Gap9-1]: None.
[R9-2]: The Access Network QoE analysis system shall support the Access Network service and network KQIs collection.	[Gap9-2]: The interface to obtain the Access Network service and the network KQIs is currently not supported.
[R9-3]: A portal to the Access Network QoE analysis system should be provided to report the location and the key factors affecting the users' service experience.	[Gap9-3]: The interface that the Access Network QoE analysis system provides the location and the key factors that affect the users' service experience to the management and control system is currently not supported.
[R9-4]: A portal to the Access Network QoE analysis system should be provided to report the users who are considered to have, or potentially will have service experience problems.	[Gap9-4]: The interface that the Access Network QoE analysis system provides the list of users who are considered to have, or will have service experience problems to the management and control system is currently not supported.
[R9-5]: The Access Network QoE analysis system shall support automatic reconfiguration of the Access Network to resolve software problems that cause service experience problems.	[Gap9-5]: The automatic reconfiguration of the Access Network to resolve software problems that cause service experience problems is currently not supported.
[R9-6]: The Access Network QoE analysis system shall support dispatching the users' service experience problem trouble tickets.	[Gap9-6]: The trouble ticket or maintenance ticket dispatching, when a user's QoE problem or potential problem are detected by the access network QoE analysis system, is currently not supported.

WI F5G 17 F5G Measurement Specification for Residential Services Quality Evaluation
WI F5G 26 Architecture and data models for residential service quality monitoring

# UC#12 : On-premises Millimetre Wave (mmWave) WLAN
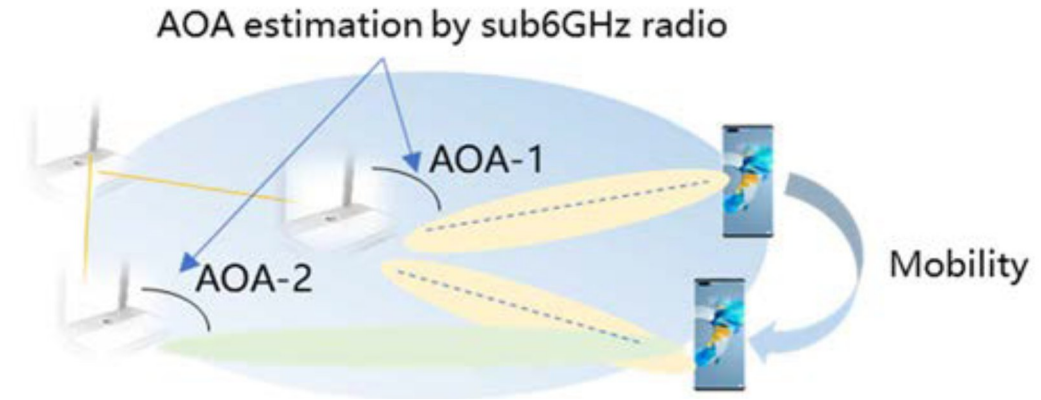
GR-20 : MOTIVATION

- Provides QoS adapted links for various services to support real-time interactive services, like cloud-gaming, remote controlling, etc.
- Supports extremely high throughput (10 Gbps everywhere) for AR/VR/XR, 3D display, etc.
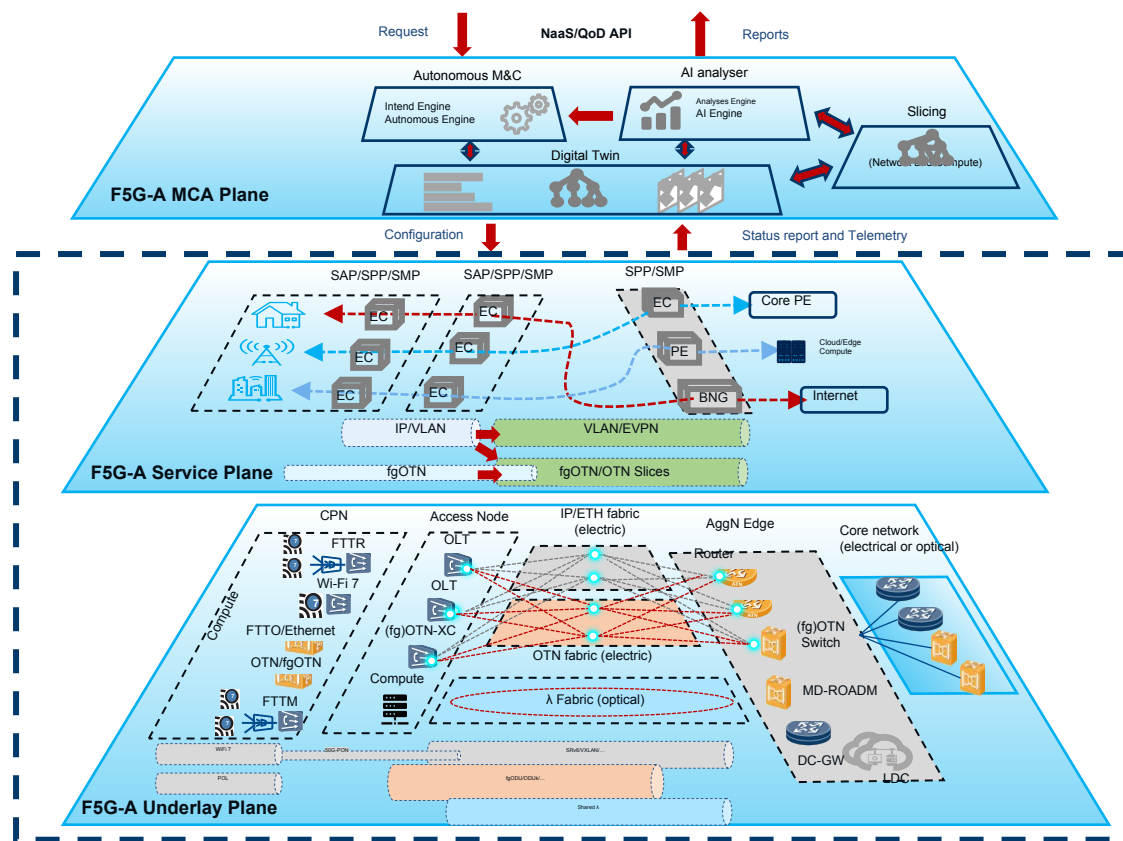- Simplifies protocol/system design due to signal isolation within a room or region.

WI-23 : GAP ANALYSIS

- Provide necessary throughput to support F5G-A applications
- Well controlled Wi-Fi® signals to support interference free connection
- Coordination with sub-6G Wi-Fi®
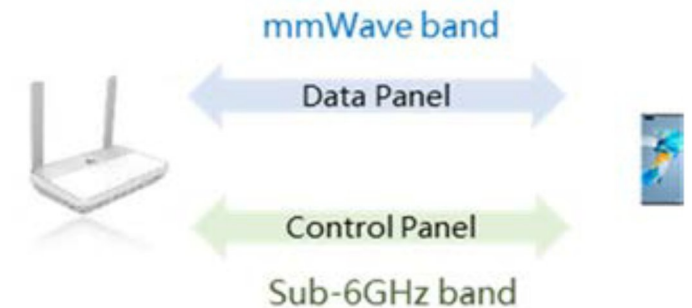
WI-024: F5G-A Network Architecture, Release 3

Brief introduction of the WI

Main scope of this WI

➤ **E2E F5G-A architecture including the following features**

- Quality on Demand
- Autonomous End-to-End Slice Creation and Adaptation
- Large Wi-Fi Networks and Policy Control
- Introduction of additional Residential and Business Service Packages
- Addition of Computing and its interaction with the network
- Optical Layer extension for wavelength sharing
- Fine-Granular Services over Optical Networks

➤ **Evolution from Rel 2**

- F5G-A Underlay Plane have evolved to Wi-Fi® 7, Adv FTTR, 50G-PON, fgOTN and 800G OTN
- Cross-Plane Compute
- all-optical aggregation network with a λ fabric
- Intelligent Slice management
- QoD and NaaS APIs
- Enhanced FTTR

ISG Next Step

- **F5G Advanced Network Topology enhanced by**
1. Underlay plane (such as 50GPON, 10G-FTTR)
2. AggN with fgOTN and B400G OTN
3. Enabled by computing functionalities & collaboration
4. Support network as a Service (NaaS) & Quality on Demand (QoD)
5. Capability to manage & control CPN by operators

- **Near real-time Control Interfaces over FTTR**
1. F1: dynamic coordination between P-ONU and E-ONUs
2. Gc: coordination through OLT for different FTTR(s)
3. Tc: control from the end-devices
4. Cc: control interface between an OLT and the compute functionality
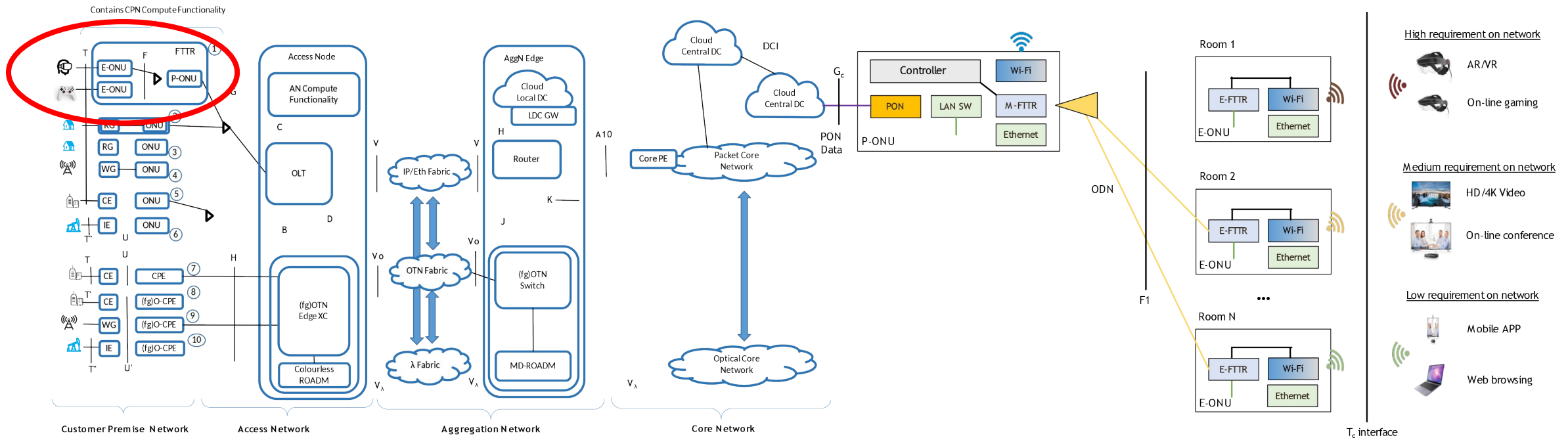
WI-026: Arch. & Data Models for Residential Service Quality Monitoring

The functions of the monitoring system include service KQI monitoring, network KQI monitoring and network KPI monitoring.
Network KQI monitoring can be initiated through a service-oriented monitoring platform or network-oriented monitoring platform

Functional architecture of the residential service quality monitoring
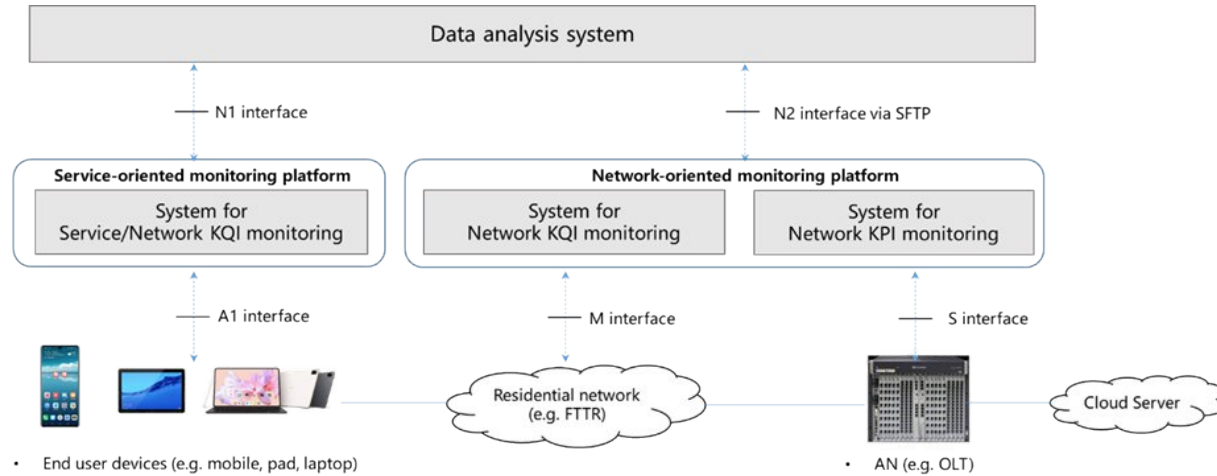
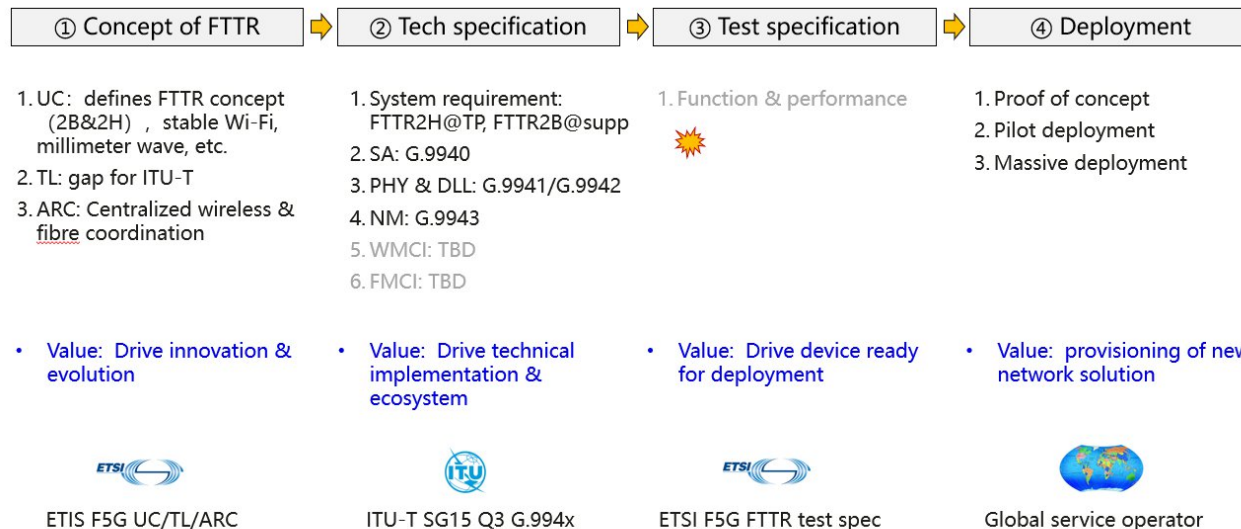**Functional model of service-oriented monitoring platform**
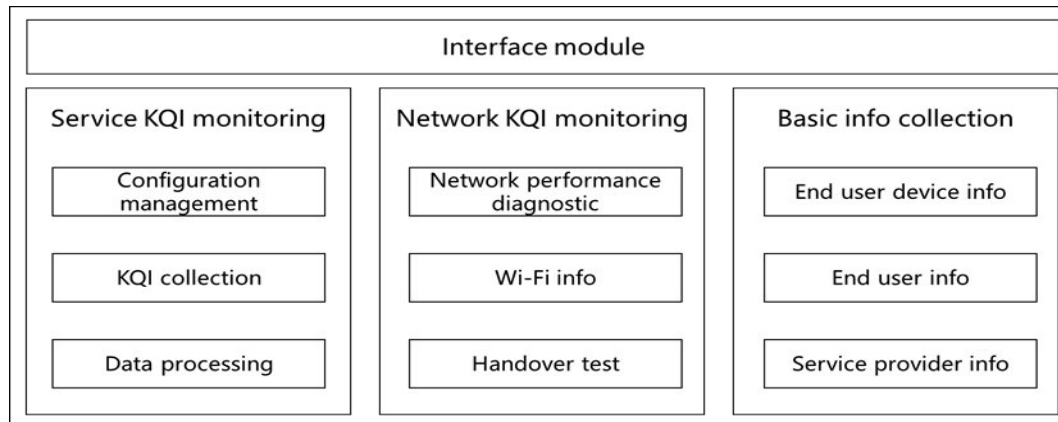
Main scope of this WI

➢ Overview of framework architecture

➢ Interface and data model for monitoring service KQIs
  - A1 Interface & Monitoring protocol
  - Data model
  - Device capability & Management & maintenance

➢ Interface and data model for monitoring network KQIs
  - N2 Interface &Monitoring protocol
  - Data model
  - Data collection cycle requirements
  - Management & maintenance

WI-029: Test Spec. for Residential FTTR Functionality & Performance

This Work Item will specify the test methodology and criteria of the functionality and performance of ITU-T G.fin-based on-premises network. The test specification includes optical interfaces and the coordination with Wi-Fi interfaces in residential scenarios.

① Concept of FTTR ➡ ② Tech specification ➡ ③ Test specification ➡ ④ Deployment

① Concept of FTTR
1. UC: defines FTTR concept (2B&2H), stable Wi-Fi, millimeter wave, etc.
2. TL: gap for ITU-T
3. ARC: Centralized wireless & fibre coordination

- Value: Drive innovation & evolution

ETIS F5G UC/TL/ARC

② Tech specification
1. System requirement: FTTR2H@TP, FTTR2B@supp
2. SA: G.9940
3. PHY & DLL: G.9941/G.9942
4. NM: G.9943
5. WMCI: TBD
6. FMCI: TBD

- Value: Drive technical implementation & ecosystem

ITU-T SG15 Q3 G.994x

③ Test specification
1. Function & performance

- Value: Drive device ready for deployment

ETSI F5G FTTR test spec

④ Deployment
1. Proof of concept
2. Pilot deployment
3. Massive deployment

- Value: provisioning of new network solution

Global service operator

Main scope of this WI

➢ 5.1.1　FTTR-H Test case #1.1: xxxx

➢ 5.1.1.1

Test purpose

➢ 5.1.1.2

Test environment

➢ 5.1.1.3

Test configuration

➢ 5.1.1.4

Test procedure

➢ 5.1.1.5

Expected results

Table 1: Test cases for FTTR-H

Test cases group	Test cases	ITU-T Rec
Service support function & performance		
	Mean signal transfer delay	G.9940 7.2
	Maximum Ethernet packet size	G.9940 7.3
	Synchronization	G.9940 7.4
Physical layer function & performance		
	Bit rates	G.9940 8.1
	Maximum number of connected S-FTRs	G.9940 8.2
	Fibre length	G.9940 8.3
	Optical link budget	G.9940 8.4
	Operating wavelength	G.9940 8.5
	Optical interface parameters of downstream direction	G.9941 7.4.6.2
	Optical interface parameters of upstream direction	G.9941 7.4.6.3
System level function & performance		
	Power saving and energy efficiency	G.9940 9.1 G.9942 12
	Security functions	G.9940 9.2 G.9942 11
	Dynamic time assignment	G.9940 9.3
	Quality of service (QoS)	G.9940 9.4
	Eye safety	G.9940 9.5
Wi-Fi performance		
	IP layer throughput	
	IP layer latency	
	IP layer Roaming switching time	

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ETSI F5G Blog

PROOF OF CONCEPT "VISUAL INSPECTION FOR AUTOMATIC QUALITY ASSESSMENT"

📅 2024-04-12   👤 Posted by Sergii Shykin, ISG F5G Secretary (Huawei)   👁 1496 Hits

REVOLUTIONARY F5G-BASED VR GAMING SERVICE AT MOBILE WORLD CONGRESS 2024

📅 2024-03-25   👤 Posted by Lluis Gifre (CTTC)   👁 2033 Hits

DRIVING F5G ADVANCED AHEAD

📅 2024-03-11   👤 Posted by Yi Lin, ISG F5G Technical Manager   👁 1940 Hits

ETSI HELD A WEBINAR ON "HOW CAN ALL-OPTICAL NETWORKS CONTRIBUTE TO CARBON TRANSITION?"

📅 2024-01-29   👤 Posted by Yi Lin, ISG F5G Technical Manager   👁 1679 Hits

ETSI RELEASED THE F5G ADVANCED GENERATION DEFINITION, PROMOTING THE EVOLUTION OF F5G

📅 2023-12-14   👤 Posted by Yi Lin, ISG F5G Technical Manager   👁 2204 Hits

Snapshots on May 23rd, 2024

Thank you for your attention

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