ETSI The Standards People

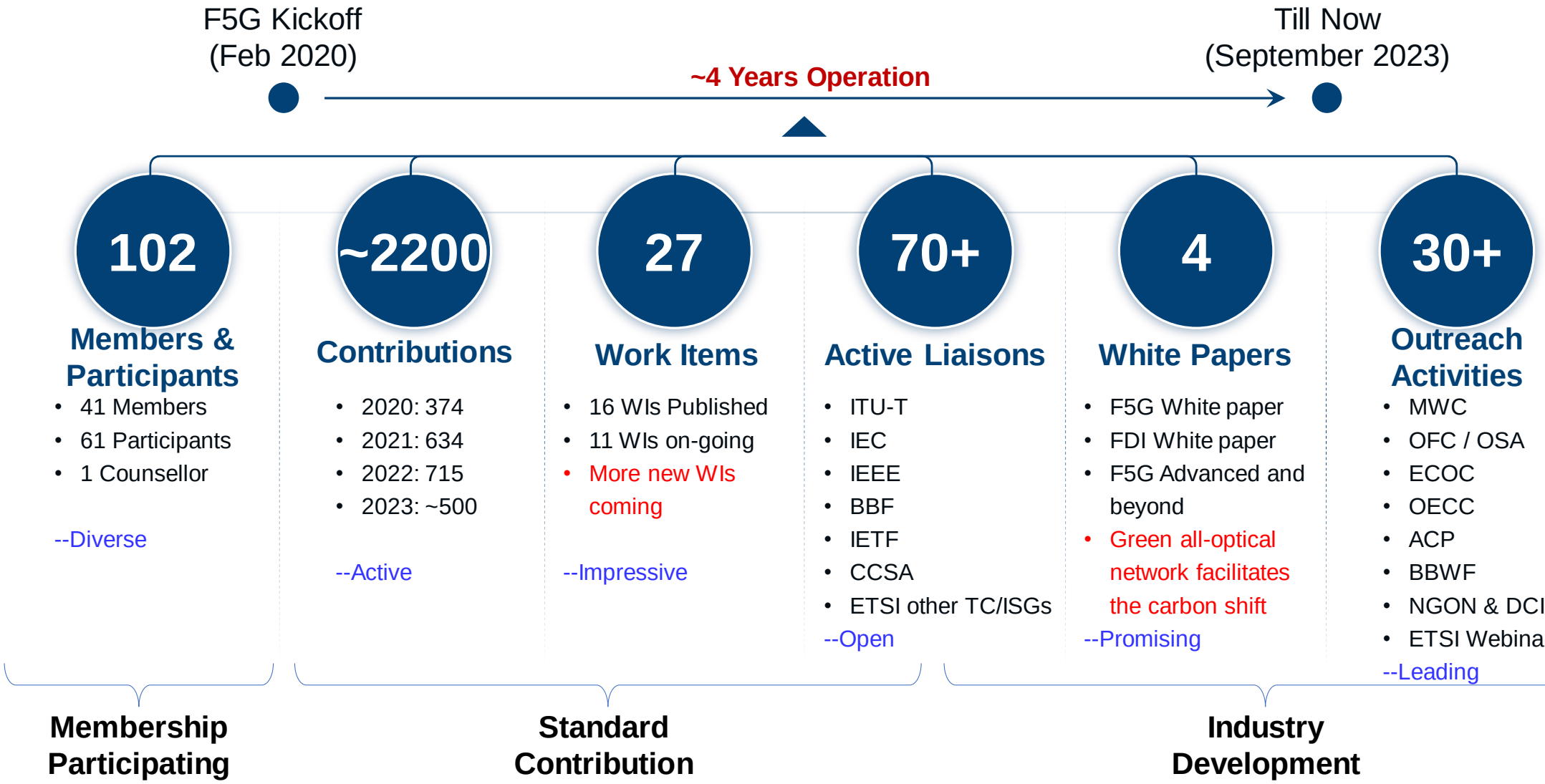
F5G Green and Digital Transformation

ETSI ISG F5G Update at ECOC2023

Presented by: **Marcus Brunner, ETSI ISG F5G Liaison Officer**

ECOC 2023, Glasgow, UK, 1 October 2023

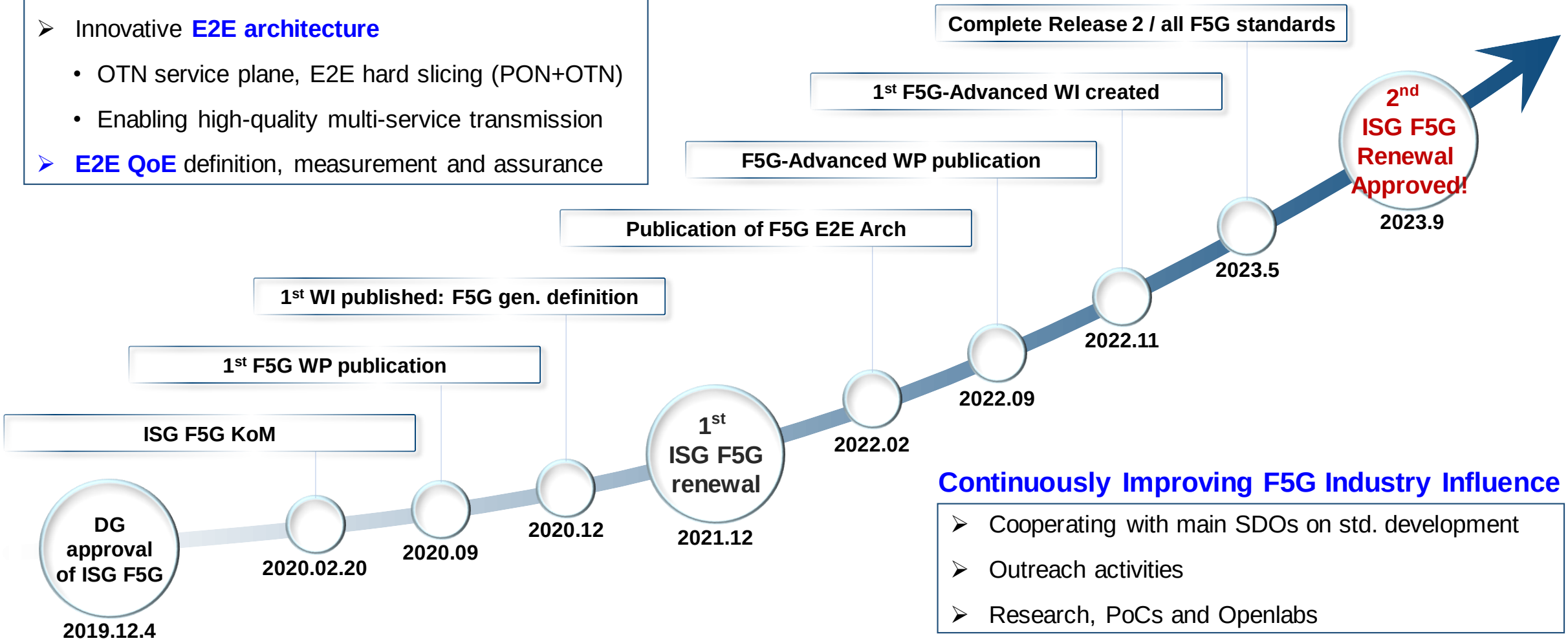
Key Figures of ISG F5G



Milestones Progress for ISG F5G

ISG F5G Key Standard Innovations

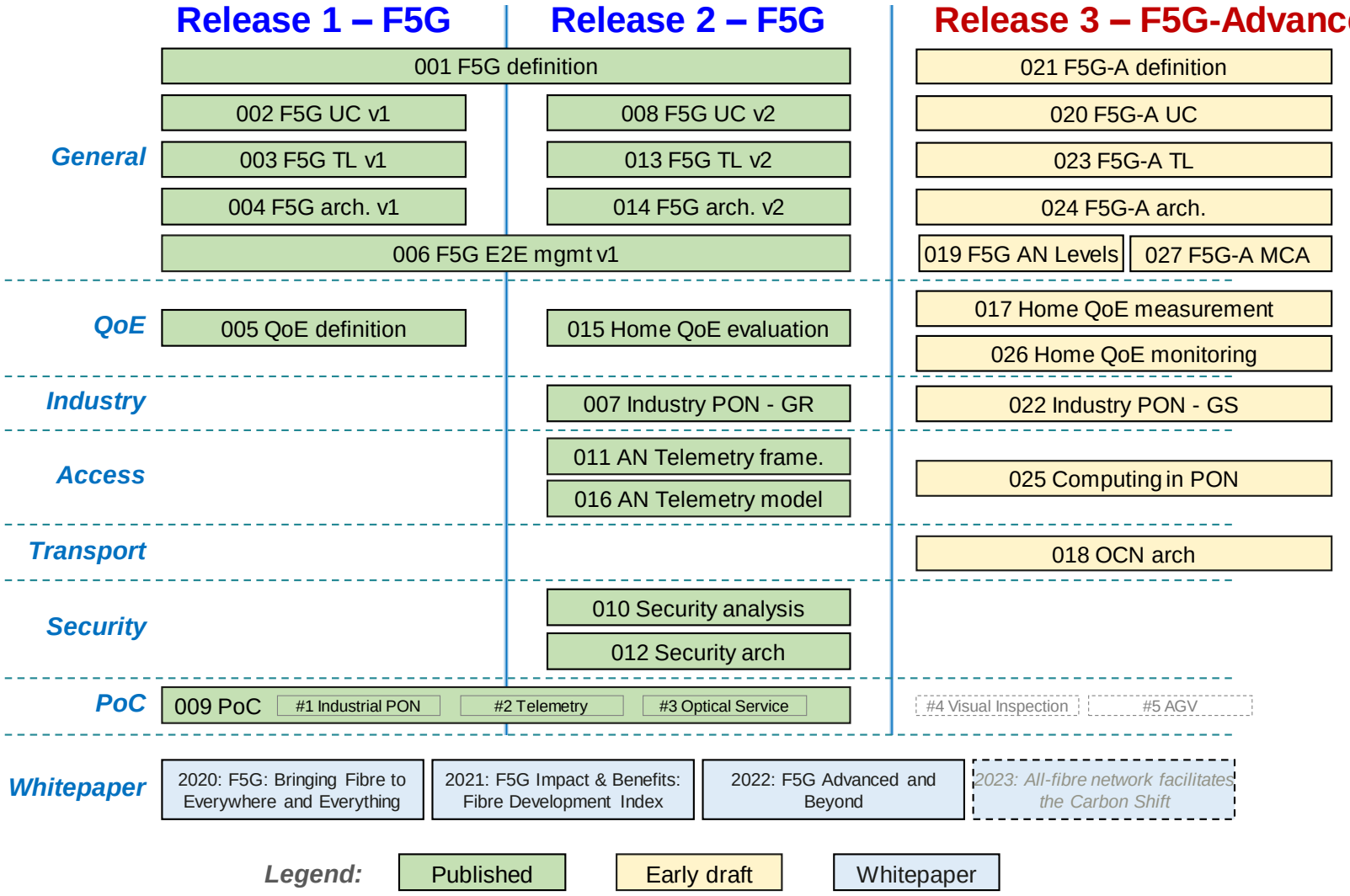
- Origination and promotion of **FTTR**
- Innovative **E2E architecture**
  - OTN service plane, E2E hard slicing (PON+OTN)
  - Enabling high-quality multi-service transmission
- **E2E QoE** definition, measurement and assurance



Continuously Improving F5G Industry Influence

- Cooperating with main SDOs on std. development
- Outreach activities
- Research, PoCs and Openlabs

Standards Contribution: 27 WIs Created (16 of them Published)



- **Till now:**
  - **Weekly** conference call
  - **16** WIs published
  - **11** WIs under development
  - **3** Whitepapers published *(2023 WP will be published soon)*
  - **5** PoCs created, **3** of whom finished
- **Release 1 & 2 were done and all set published**
- **Now working on F5G-Advanced (Release 3)**

Industry synergy (1) – Cooperation with Other SDOs

SDO Cooperation | **Industry Outreach Activities** | **Academia Activities**

➢ Multi-SDO (ETSI, ITU, CCSA, BBF) Joint FTTR workshops, promoting FTTR

1st WS (2021.6)
- Share UCs
- Identify tech. gaps

2nd WS (2022.6)
- Align tech. direction
- Common sense in data rate

3rd WS (2023.6)
- Sync up arch. & tech. spec.
- Discuss future evolution

ISG F5G put forward FTTR, initiated the WS and takes the lead in multi-SDO cooperation, greatly promoting ISG F5G

➢ Cooperation between ETSI and BBF

Extra efforts based on previous year (cooperation in the name of ETSI, not just in ISG F5G)

Jun. 2021
Multi-SDO FTTR workshop

+

Oct. 2022
Joint workshop in BBWF2022

+

Sep. 2023
Joint BASe Technical Summit

More and more consensus based on F5G

➢ Cooperation between ETSI and CCSA

- **ETSI-CCSA CA** signed
- **Joint F5G workshop** on 2022.11.09
- Luis (ETSI DG) & Wen Ku (CCSA DG) attended the WS

Industry synergy (2) – Cooperation with Ecosystem Players

SDO Cooperation | **Industry Outreach Activities** | **Academia Activities**

- **10+** outreach activities per year
- Participants: **Top experts** from Tier-1 operators, mainstream vendors (including Nokia, Infinera, Ciena) etc.

Domains	Event	Theme & Way of Work	Date & Venue
Industry	MWC 2023	F5G workshop	Feb 27 ~ March 02, Barcelona
Academia	OFC 2023	F5G workshop (online + onsite)	March 05~09, San Diego, USA
Industry	FTTH Council 2023	F5G presentation	April 18~20, Madrid
Industry	NGON & 5G Transport	F5G Workshop	May 30, Mandelieu-La Napoule
Standard	3rd FTTR 4-party joint FTTR Workshop	ITU, together with ETSI and CCSA & BBF	June 23
Standard	ETSI Webinar	F5G Architecture introduction	July, 2023
Technical	BASe	Broadband Technical Summit (UFBB)	September 27~28, Den Haag –deferred 1Q24
Academia	ECOC 2023	F5G and Evolution towards F6G	Oct 01~05, Glasgow
Application	BBWF 2023	F5G Workshop	Oct. 24~26, Paris
Standard	2nd ETSI & CCSA joint F5G Workshop	2nd ETSI & CCSA joint F5G Workshop	November 2023 (planned)
Academia	ACP 2023	F5G Workshop	Nov 05~08, Wuhan

HHI F5G Openlab @ MWC


HHI F5G Openlab @ Hannover

F5G Green All-Optical Forum @ MWC

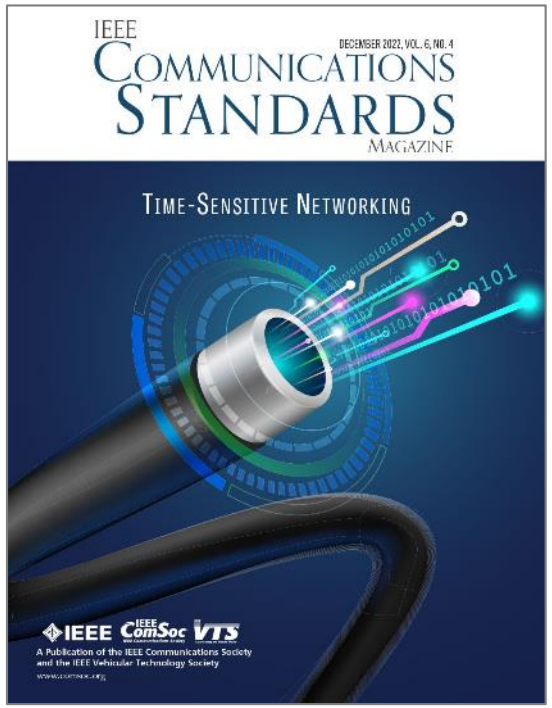

F5G workshop @ NGON

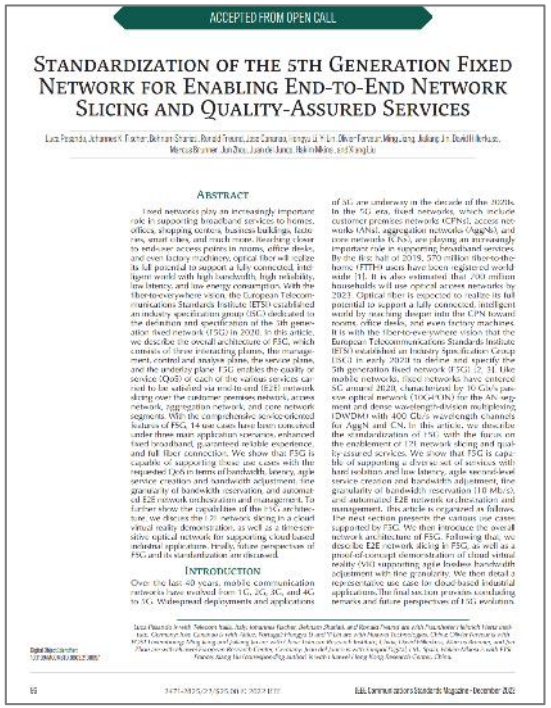

WBBA workshop @ Network X

Industry synergy (3) – Cooperation with Academia

SDO Cooperation | **Industry Outreach Activities** | **Academia Activities**

IEEE Paper




ACCEPTED FROM OPEN CALL

STANDARDIZATION OF THE 5TH GENERATION FIXED NETWORK FOR ENABLING END-TO-END NETWORK SLICING AND QUALITY-ASSURED SERVICES

ABSTRACT

INTRODUCTION

- Author: 16 main contributors of ISG F5G
- "**Standardization of the 5th Generation Fixed Network for Enabling End-to-End Network Slicing and Quality-Assured Services**"
- IEEE Communications Standards Magazine, Volume 6, Issue 4, 2022.12

FRONT-EDGE (Academic Salon)

Workshop on Broadband Access and Edge Networking

Co-organized with the **FRONT-EDGE** Salon:
FutuRe Optical Networking Salon (FRONT): The EDGE

- 2021: Barcelona (at UPC)
- 2022: Porto (with CSNDSP)
- 2022: Bucharest (in ICTON)

ACCESS I Chair: Josep Prat / Josep Segarra	ACCESS II Chair: Ivan Cano	ACCESS & PhotoMAN Chair: Michela Svaluto
Tu.C1.1 The 6th generation fixed network (F6G): Vision and directions *M. Brunner* **Tu.C1.2** Multi-RAT fiber-wireless technologies towards 6G networks *C. Vagionas, R. Maximidis, K. Kanta, P. Toumasis, G. Giannoulis, D. Apostolopoulos, G. Kalfas, M. Gatzianas, A. Mesodiakaki, H. Avramopoulos, A. Miliou, and N. Pleros* **Tu.C1.3** F5G OpenLab: Enabling twin transition through ubiquitous fiber connectivity *M. Balanici, B. Shariati, P. Safari, P. Chojecki, M. Chemnitz, D. Przewozny, J. K. Fische, and R. Freund* **Tu.C1.4** FDMA in point-to-multipoint fibre access systems for non-residential applications *I. N. Cano, G. Caruso, Jinlong Wei, G. Talli, C. Bluemm, S. Calabro, H. von Kirchbauer, U. Wuensche, P. Leyva, H. Rongfang, Kuo Zhang, and Zhicheng Ye* **Tu.C1.5** Digital subcarrier based point-to-multipoint coherent transceivers for bidirectional transmission *A. Napoli*	**Tu.D1.1** SOA-based optical networks with sub-microsecond control plane for low-latency applications *H. Santana, A. Mefleh, and N. Calabretta* **Tu.D1.2** Band evaluation of coherent udWDM-PON with paired lasers *J. Segarra, V. Sales, and J. Prat* **Tu.D1.3** PIC-based transceiver for access networks: Package and functionalities verification towards a commercial solution *F. Rodrigues, J. Santos, C. Rodrigues, H. Neto, and A. Teixeira* **Tu.D1.4** Optical DACs for ultra-high-speed green photonic interconnects *M. Nazarathy and I. Tomkos*	**We.A1.1** ML-based optimization of geometric constellation shaping for unamplified coherent optical systems *B. M. Oliveira, M. S. Neves, F. P. Guiomar, M. C. R. Medeiros, and P. P. Monteiro* **We.A1.2** Performance evaluation of high data rate transmission and optically powered IoT ecosystem over SI-POF for smart home applications *F. M. A. Al-Zubaidi, D. S. Montero, P. J. Pinzón, and C. Vázquez* **We.A1.3** Experimental demonstration of a 400 Gb/s full coherent transmission in an in-field metro-access scenario *M. Casasco, G. Rizzelli, A. Pagano, R. Mercinelli, M. Valvo, V. Ferrero, and R. Gaudino* **We.A1.4** Investigation of mid-term migration scenarios to multi-band solutions in metropolitan networks *J. P. Fernández-Palacios, F. Arpanaei, J. M. Rivas-Moscoso, J. A. Hernández, and D. Larrabeiti*

3-year program for F5G academic salon (2021, 2022 & 2023)

- Cutting edge application use cases
- DSP & transmission in edge/access
- Enabling technologies

Evolving F5G to F5G Advanced for 10Gbps Everywhere

Gigabit Society

10Gbps Everywhere

F5G → F5G Advanced → F6G

2020 — 2025 — 2030

Extension (existing scenarios)

Expansion (new scenarios)

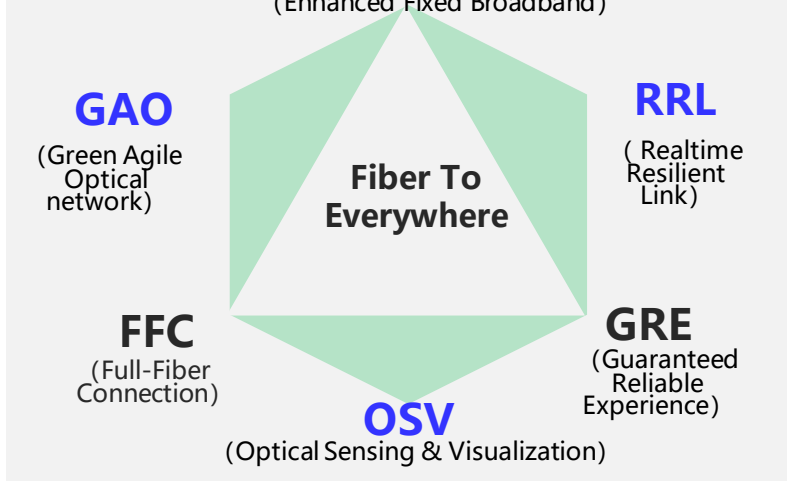
Published by ETSI in 2020

eFBB
Bandwidth, speed

FFC
Connections, density

GRE
Latency, QoS

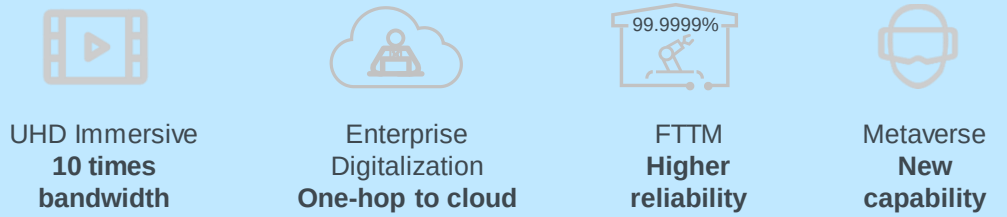
F5G Advanced defining NOW!



Key drivers and enabling technologies for F5G Advanced Evolution

Drivers

Digitalization & cloudification of applications



UHD Immersive **10 times bandwidth**

Enterprise Digitalization **One-hop to cloud**

FTTM **Higher reliability**

Metaverse **New capability**

+

Network Infrastructure

Enabling technologies

Network

- 800G OTN
- OSU
- 50G-PON
- Wi-Fi 6e/7

Fiber to everywhere

- FTTRoom
- FTTOffice
- FTTMachine

Latency control

- Deterministic networking
- End to end slicing

Distributed computing

- Elastic resource scaling
- Latency aware process dispatching
- Network and processing optimization

Energy efficiency

- Energy aware switching/routing
- Power saving equipment modes
- Dynamic load shifting

Autonomous network

- Intent-based service modelling
- Knowledge graph for fault management
- Improved network information gathering

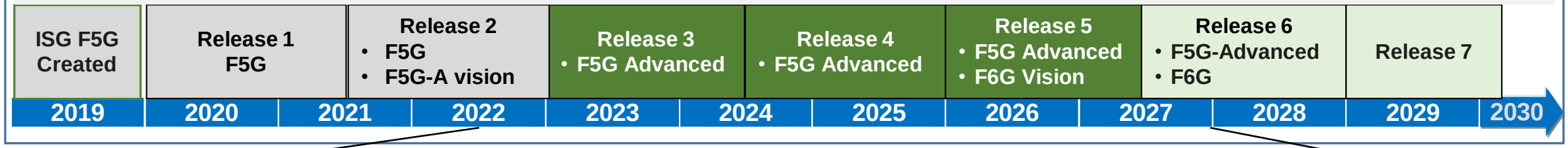
Network-based sensing

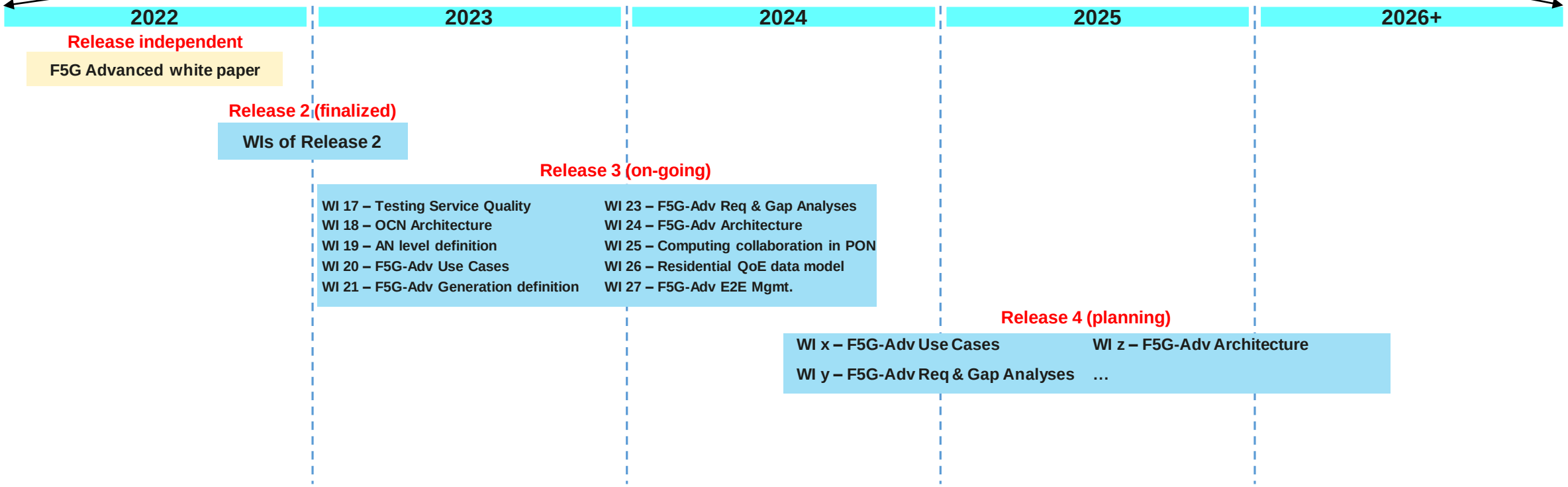
- Fiber cable digitization
- Distributed optical fiber sensing
- Wi-Fi sensing

(https://www.etsi.org/media-library/white-papers)

F5G Advanced: Release and Evolution Roadmap

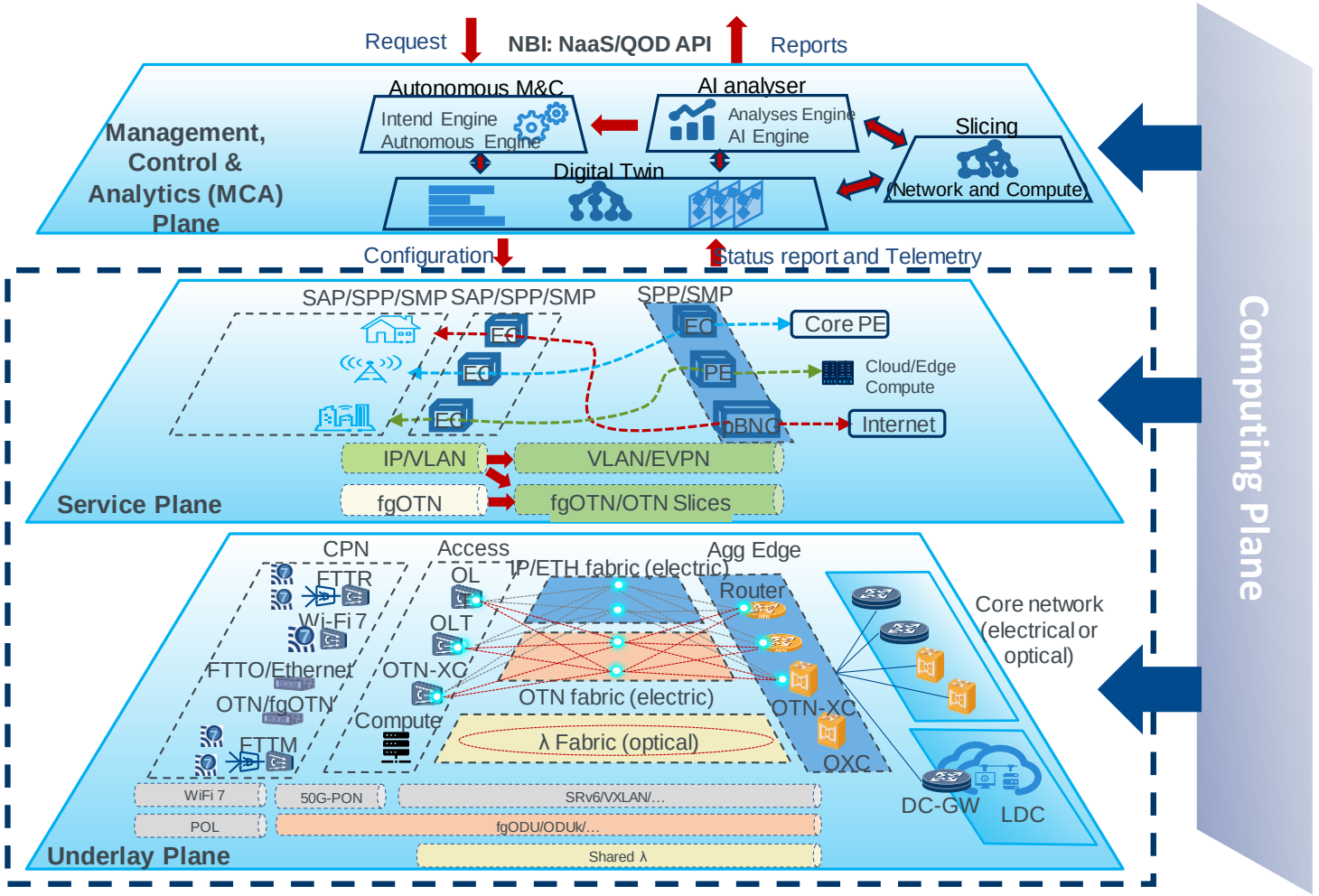
- **ISG F5G planned to finished F5G Advanced in three release and then move to F6G in 2027**





Based on ETSI ISG F5G Release Documentation
https://docbox.etsi.org/ISG/F5G/Open/Release_Documentation

F5G Advanced Architecture (in progress)

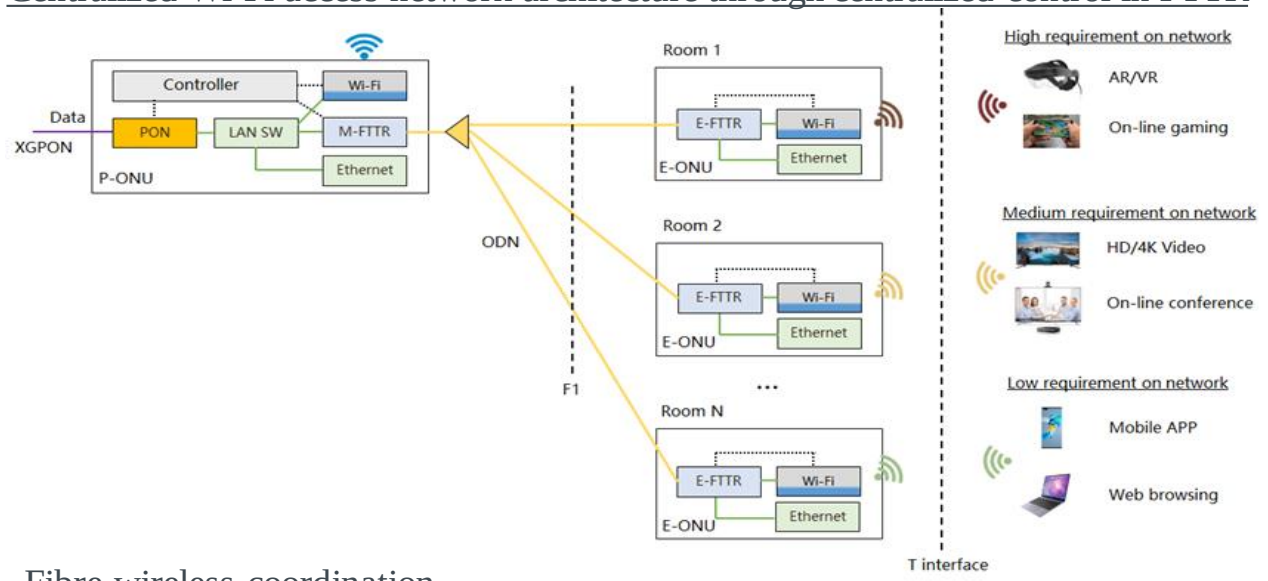


- **Underlay Plane**: OTN + IP/Eth dual plane
- **Service Plane**: decoupled, fgOTN for high-quality cloud services
- **MCA Plane**: AN L4, intelligent network operation
- **Cross-layer computing resources** for:
  - AI analyser & Digital Twin @ MCA Plane
  - Service Processing & Mapping Points @ Service Plane
  - NE-level AI training & inference @ Underlay Plane

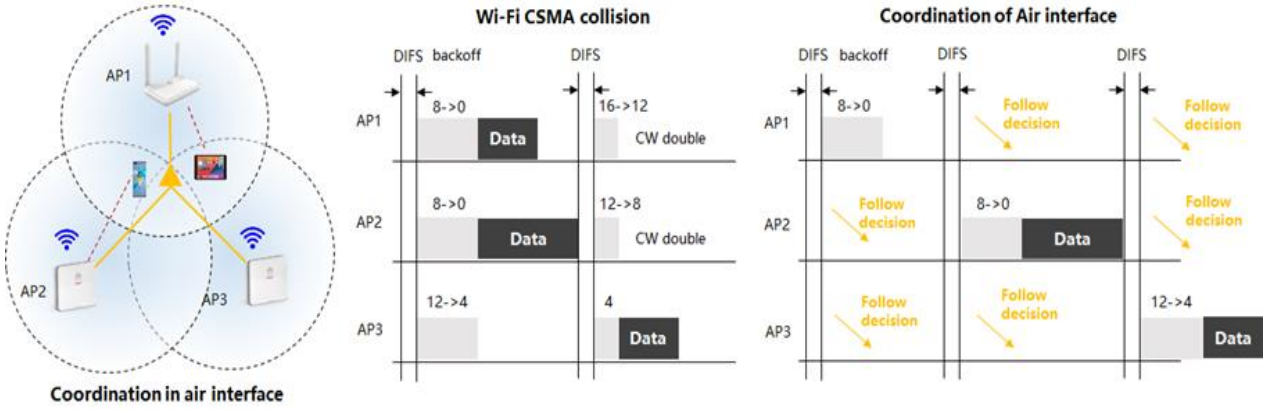
F5G Advanced CPN: Fibre to the Room (FTTR)

- **Enhancing FTTR with coordination**
- **Improved QoE**
- **Application for Residential and SME**

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



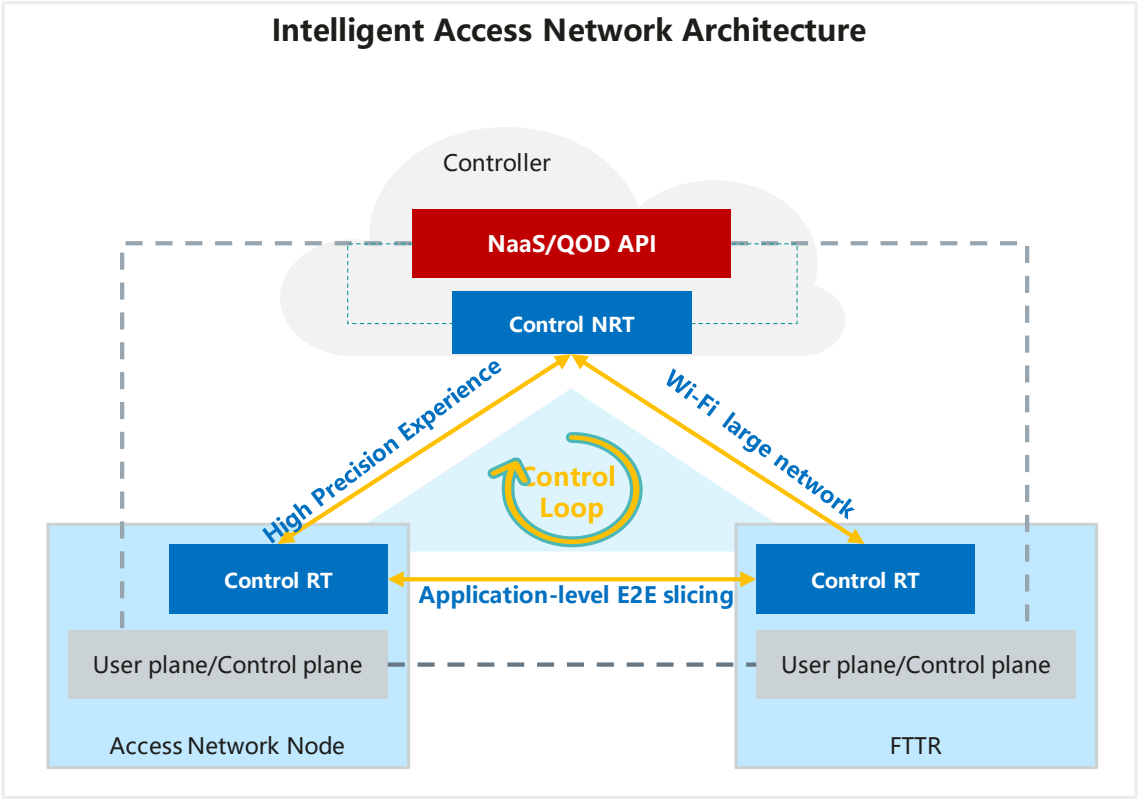
Fibre-wireless coordination



Reference: Dechao Zhang, Jinglong Zhu, Xiang Liu, Xuming Wu, Junwei Li, Yan Zeng, Xiaoshu Si, and Han Li, "Fiber-to-the-room: a key technology for F5G and beyond," J. Opt. Commun. Netw. 15, D1-D9 (2023)

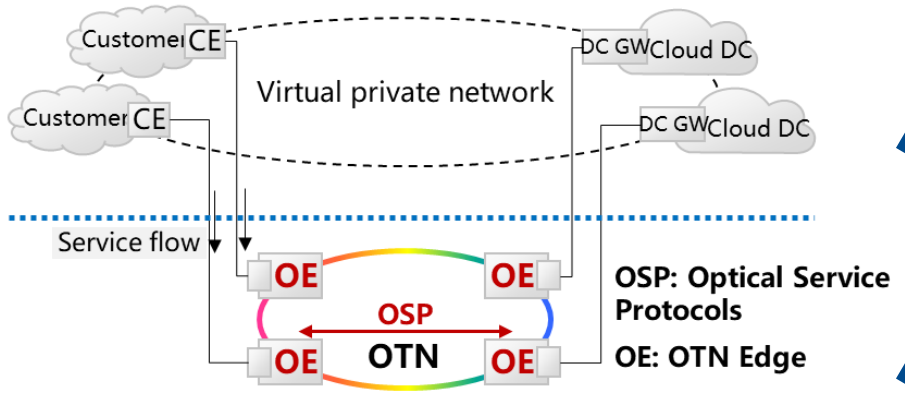
F5G Advanced Intelligent Access Networks

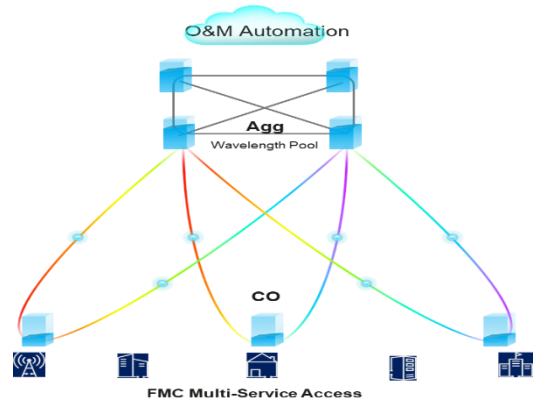
- Network as a Service and Quality on Demand APIs
- Separation of real-time and non-real-time control
- Integration of Access Networks and FTTR
- End-to-end Slicing



F5G Advanced Simplified Optical Transport Network for Cloud Services

Optical Cloud Network (OCN)

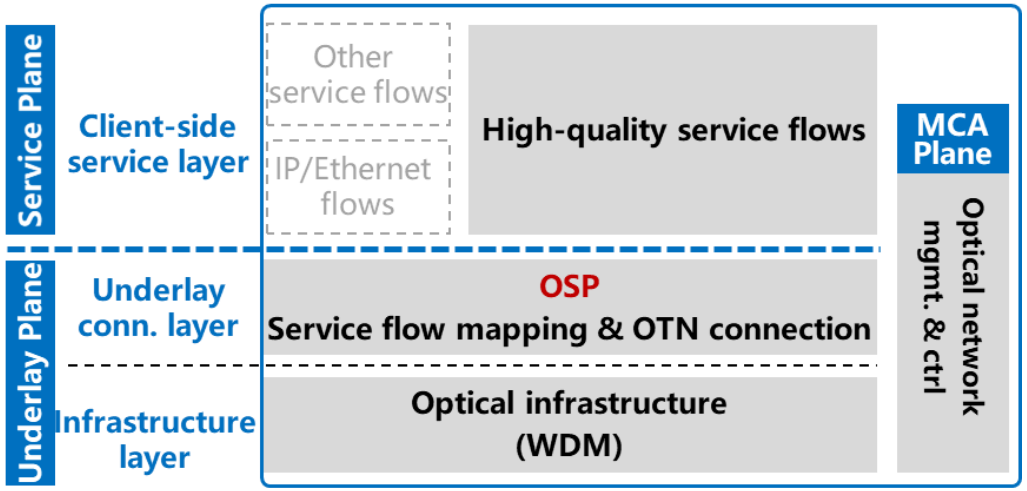




Wavelength-shared WDM

Key enabling technologies:

- Using **fgOTN** for High-quality cloud services
- Innovative **OSP** protocol to enable cloud-service-driven OTN
- **Multi-λ** shared by multi access rings, dynamic re-allocation



Value-added cloud service-oriented Optical Networks

Simplified optical infrastructure with lower CapEx & OpEx

Summary

- Standardization Methodology: Use Cases, Requirements, Gaps, Architecture
- Roadmap-driven Standardization: Generations and Releases
- Release 3 specifying F5G Advanced (in progress)
- End-to-end perspective on optical networks
- F5G Driving the Green and Digital Transformation