



5G: state of standardization

*ITU Regional Forum for Europe on 5G strategies
policies and implementation*

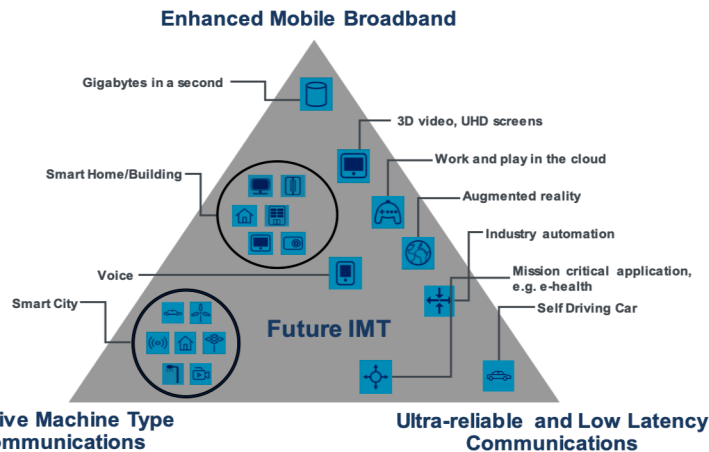
22-23 October 2020

Dr. Bilel Jamoussi
Chief SGD/TSB/ITU
October 2020



5G is much more than a new radio interface

5G Service & Technical Features

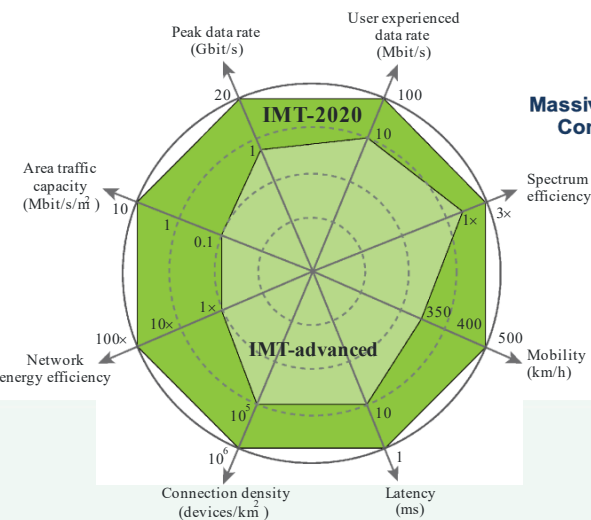


Fixed-Mobile Hybrid Networks



Fixed Networks

Mobile Networks



M.2083-03

Fixed network Innovation to deliver 5G



ITU-T's workshops and demos on network aspects of IMT-2020 (5G) – Geneva, December 2016 & July 2017

Softwarization, Slicing, and FMC



ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

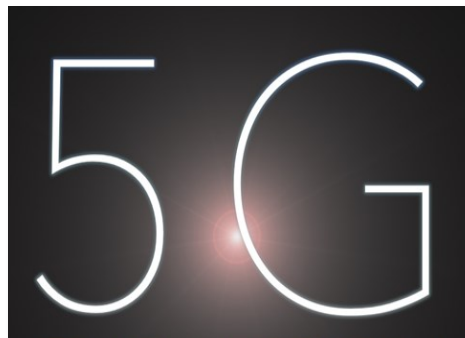
Y.3100

(09/2017)

SERIES Y: GLOBAL INFORMATION
INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS,
NEXT-GENERATION NETWORKS, INTERNET OF
THINGS AND SMART CITIES

Future networks

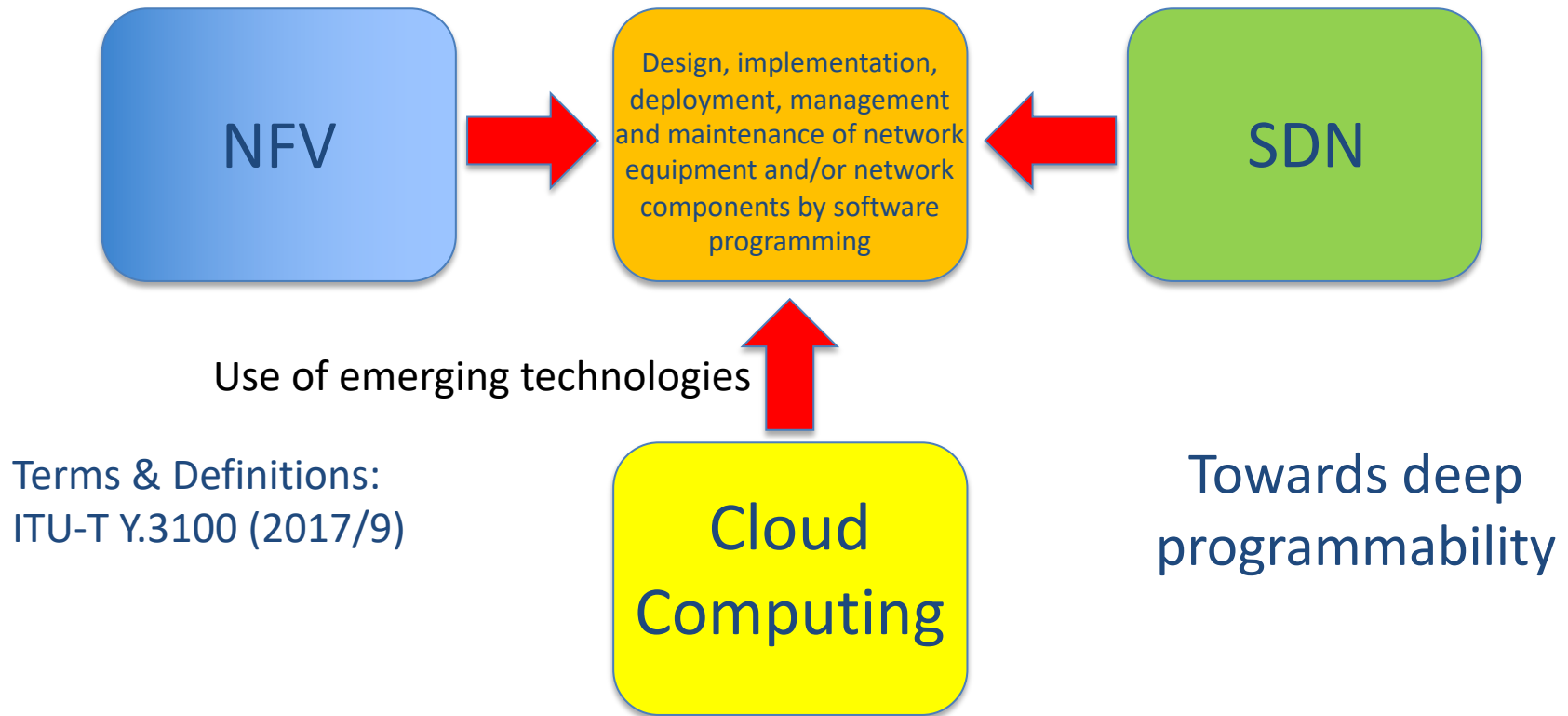
Terms and definitions for IMT-2020 network



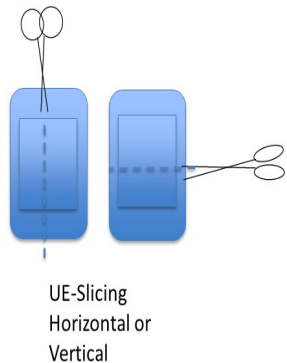
- **Softwarization:** Designing, implementing, deploying, managing and maintaining networks using software
- **Slicing, e.g. separate slices for**
 - voice communications
 - automated driving
 - wide range of other use cases
- **Fixed Mobile Convergence:** Network architecture to support fixed / mobile convergence, with seamless user experience

Convergence of compute and telecom industries to deliver 5G

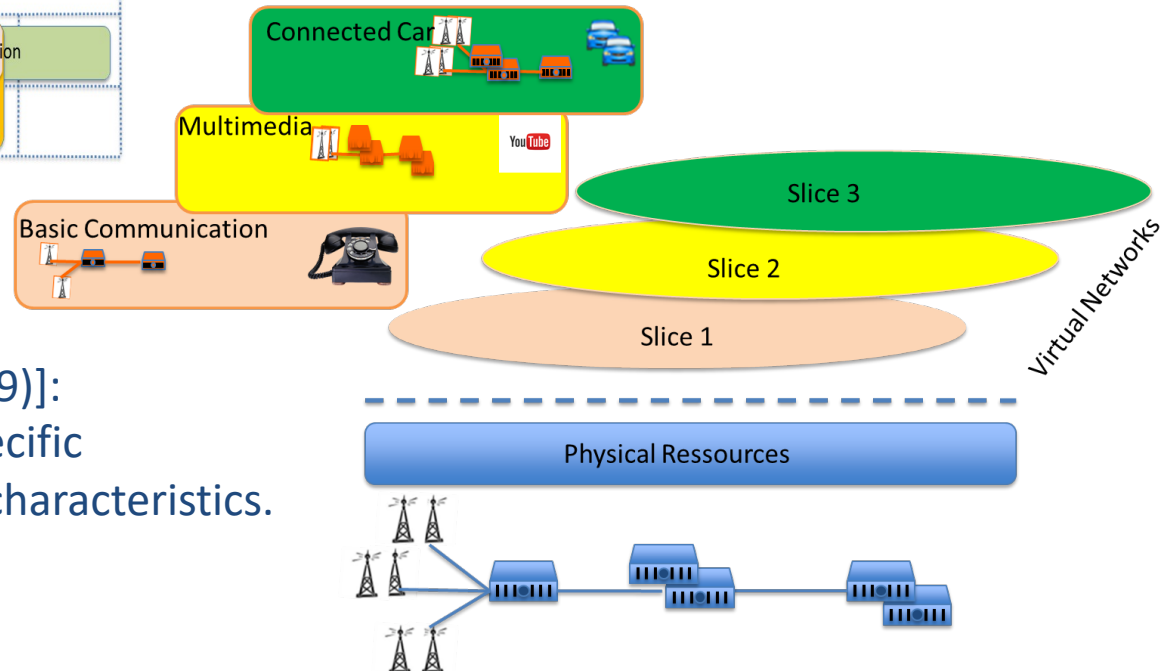
Enabling the (re-)design of network and services architectures, optimizing costs and processes, enabling self-management.



Network slicing general principles



| | Core | FH/BH | UE |
|---------------------------|----------------------|--------------------|----|
| Platform/ Applications | | | |
| Slice | Horizontal Extension | | |
| Infrastructure | | Vertical Extension | |



Network slice [ITU-T Y.3100 (2017/9)]:
A logical network that provides specific network capabilities and network characteristics.

5G Network Management and Orchestration

ITU-T

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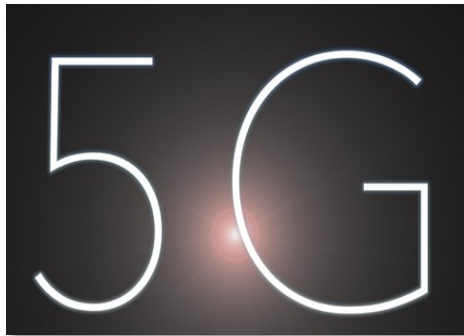
Y.3110

(09/2017)

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THINGS AND SMART CITIES

Future networks

**IMT-2020 network management and
orchestration requirements**



- **management:** In the context of IMT-2020, the processes aiming at fulfilment, assurance, and billing of services, network functions, and resources in both physical and virtual infrastructure including compute, storage, and network resources.
- **orchestration:** In the context of IMT-2020, the processes aiming at the automated arrangement, coordination, instantiation and use of network functions and resources for both physical and virtual infrastructure by optimization criteria.

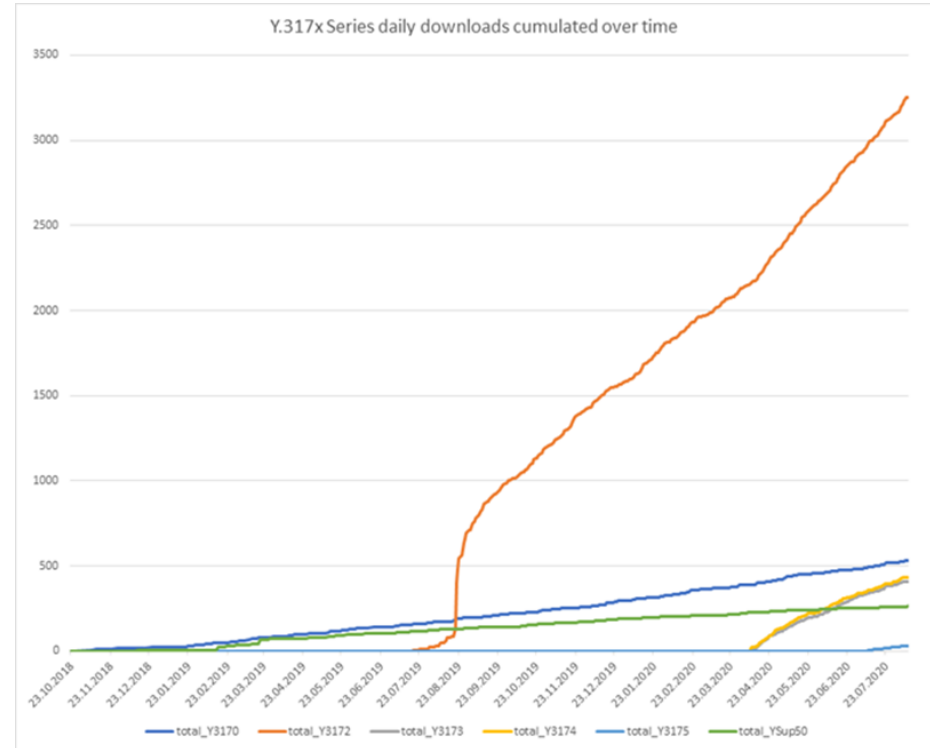
Machine Learning for 5G

How to design

- network architectures,
- interfaces,
- protocols,
- algorithms,
- data format

to make best use of ML

How to synchronize
Standards development
with Open Source
Implementation



ITU-T Y.317x Series
Downloads

ITU's AI/ML in 5G Competition: Hosts of Problem Statements

1. China 

2. Spain 1 

3. Spain 2 

4. Brazil 

5. India 

6. Ireland 

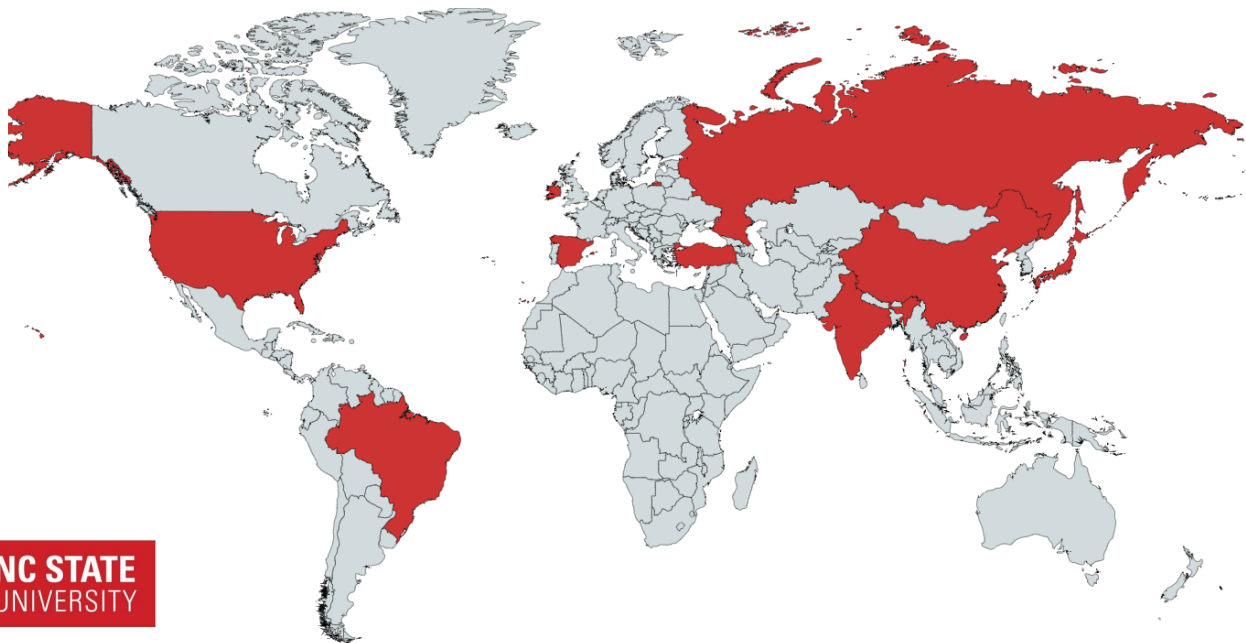
7. United States of America 

8. Japan 

9. Turkey 

10. Adlik/ZTE 

11. Russia 

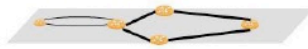


IMT2020/ 5G transport aspects (ITU-T SG15)

Standards related to transport layer of IMT-2020 5G networks including application of slicing techniques in the transport

SDN control

Customer 1: slice 1.1
(Bank: hard pipe)



Customer 2: slice 1.2
(Government: hard pipe)



Customer n: slice 1.n
(enterprise: IP VPN)



Fronthaul slice 2.1
(NGFI/eCPRI/CPRI)

Backhaul slice 2.2
(Ethernet/MPLS/IP)

eMBB slice 2.2.1

uRLLC slice 2.2.2

mMTC slice 2.2.3

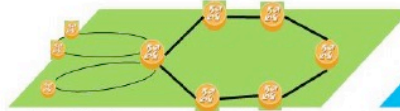
slice n.1

slice n.2

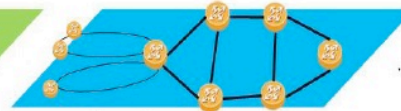
slice n.k

Service slices

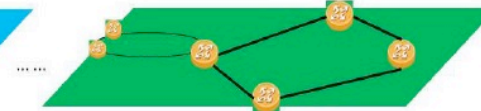
SDN control



Slice 1 for business or whole sales
(private leased lines or VPN)



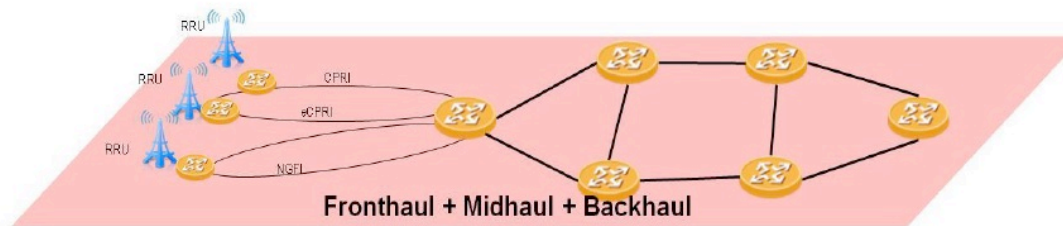
Slice 2 for mobile transport
(RRU-BBU/xNB-EPC)



Slice n for specific applications
(OLT, IoT, etc.)

Sub operator slices

SDN control

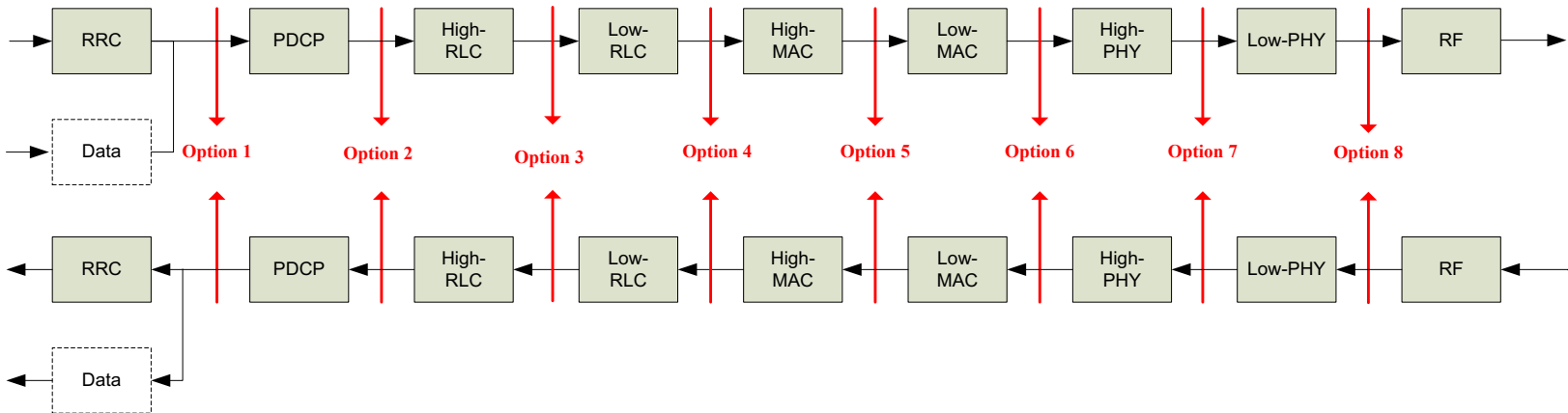


Fronthaul + Midhaul + Backhaul

Integrated Physical Network

Fronthaul

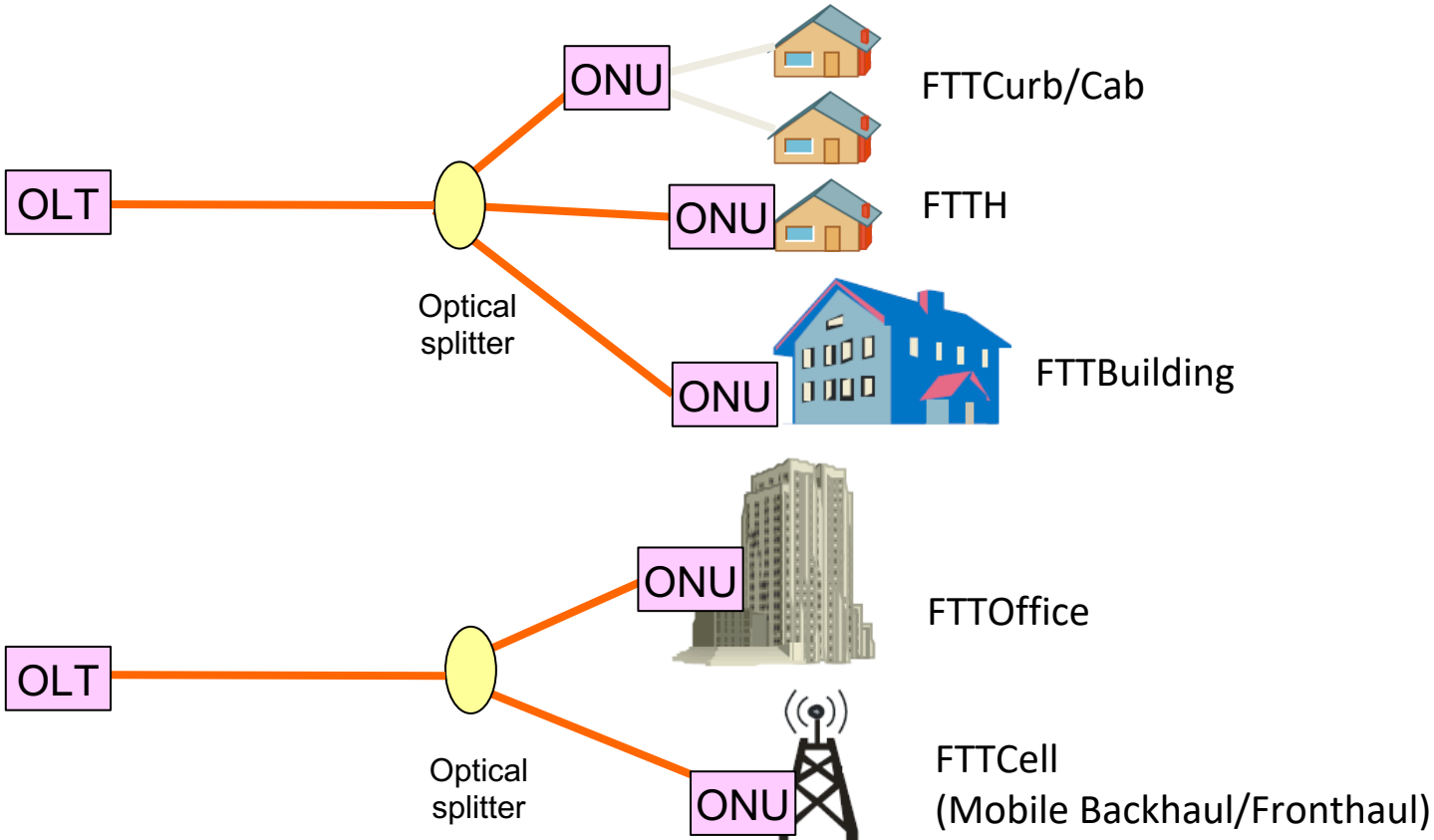
- Conventionally, the fronthaul link is between RF and the remaining L1/L2/L3 functions (Option 8 split point)
- Option 8 centralizes high layer functions but requires stringent latency and high bandwidth
- It is critical to consider trade-offs between throughput, latency, and functional centralization.



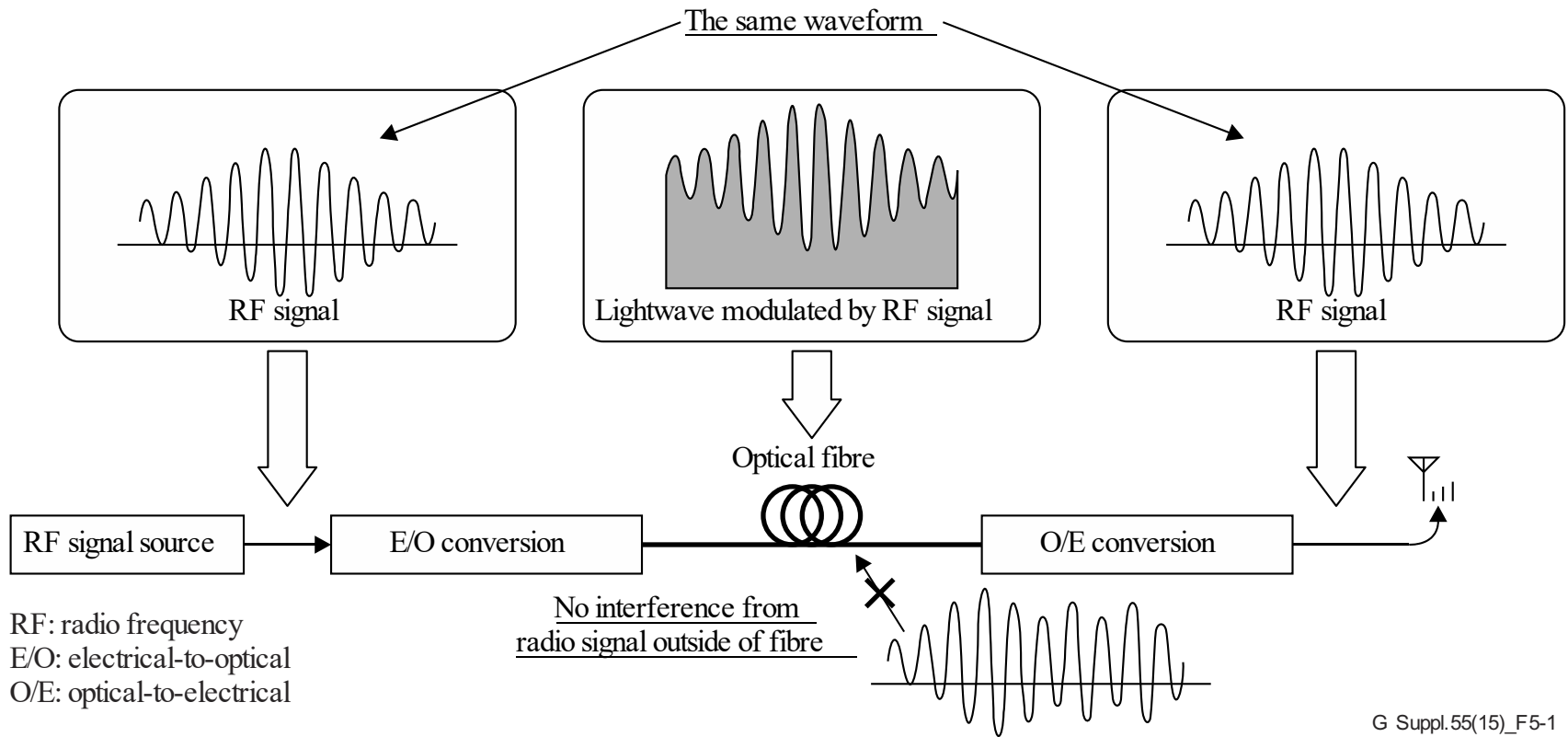
Signal processing chain of 4G and 5G wireless base stations and optional split points

source: 3GPP TR 38.801, “Technical Specification Group Radio Access Network; Study on new radio access technology: Radio access architecture and interfaces”, March 2017

Fronthaul by PON



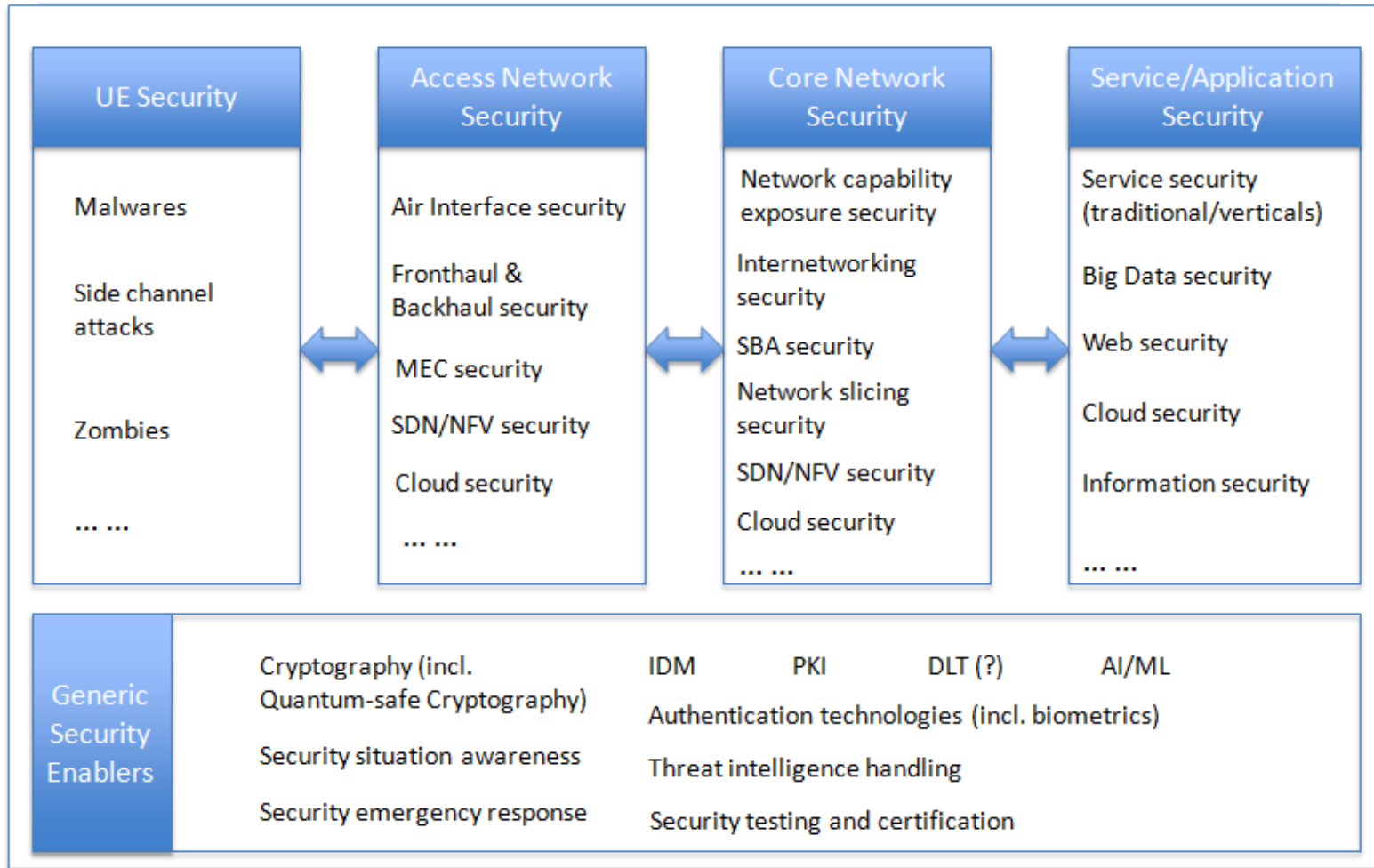
Radio over fiber (analog RoF) for 5G fronthaul



Other work in SG15 to enable 5G

- CPRI over OTN for 5G fronthaul
- Optical transport network (OTN) beyond 100 Gbit/s
- Metro Transport Network (MTN)
- Wavelength division multiplex (WDM) technologies
- Frequency and time synchronization for 5G
- Management & Control of Transport Network supporting IMT-2020/5G

5G end-to-end Security Framework

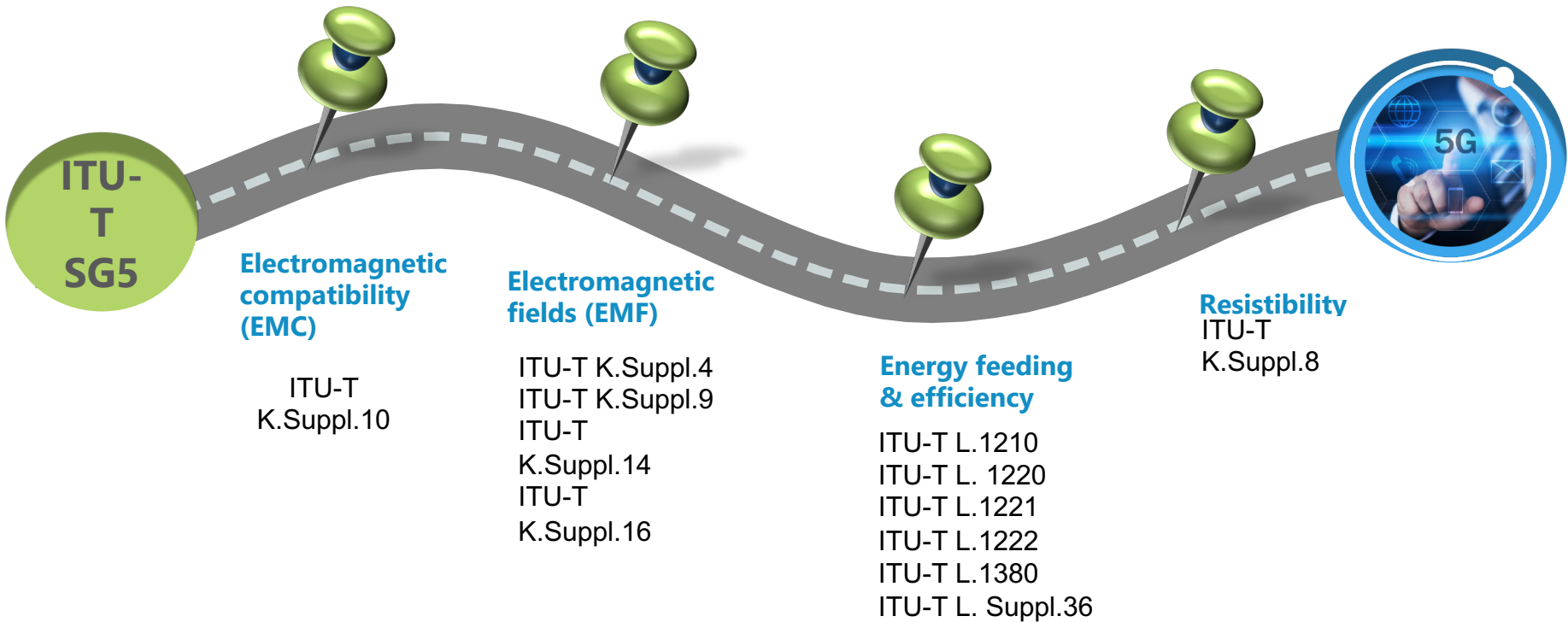


Setting Environmental Requirements for 5G

International Standards

Supplements

Technical Reports



ITU-T standards to assess 5G performance, quality of service and quality of experience

- **Internet performance:** capacity parameters and a reliable method of measurement for the Gigabit Internet age (ITU-T Y.1540)
- Measuring the **performance of virtual network functions** (ITU-T Y.1550)
- **QoE of virtual reality:**
 - Factors influencing QoE for VR services (ITU-T G.1035)
 - Test methods for 360° video on head-mounted displays (ITU-T P.919)
- Crowdsourcing to assess the **QoS of broadband networks** (ITU-T E.812)



Cooperation among standards development organizations

Exchange of information and collaboration among organisations is essential for 5G (given its large spectrum of technologies, services, stakeholders)

ITU-T SG13 “Joint Coordination Activity on IMT2020” (JCA-IMT2020)

- Promotes high-level coordination in IMT2020 standardization
- Is open to ITU Members and designated representatives of relevant Standards Development Organizations and Forums
- Maintains a global IMT2020 standards roadmap (for non-radio aspects) via regular exchanges with relevant external entities:

<https://www.itu.int/net4/ITU-T/roadmap/#?topic=0.130&workgroup=1&searchValue=&page=2&sort=Relevance>

- Roadmap above has pointers to standard location, accessible publicly

What's next

Beyond 5G

- [Focus Group Network 2030](#) set up a [vision](#) for Network 2030 and its [architecture framework](#)
- To complement the work in ITU-R on beyond IMT-2020

References

- ITU-T SG13 Chairman [Blog](#)
- IMT-2020 Focus Group [Reports](#)
- [Machine Learning for 5G](#)
- [5G Basics, 2017, flipbook](#)
- Focus Group ML5G [Technical Standards/Specifications](#)
- Focus Group Network 2030 [Technical Specifications and reports](#)



Thank you

