# 5G: state of standardization and normalization

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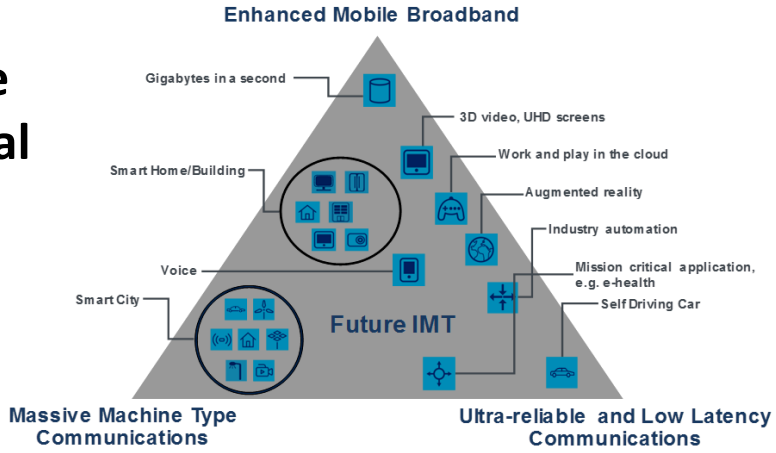
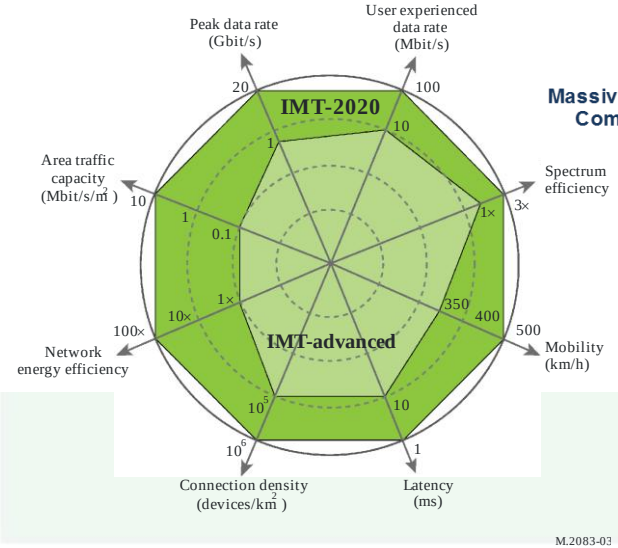
Chief SGD/TSB/ITU
March 2018

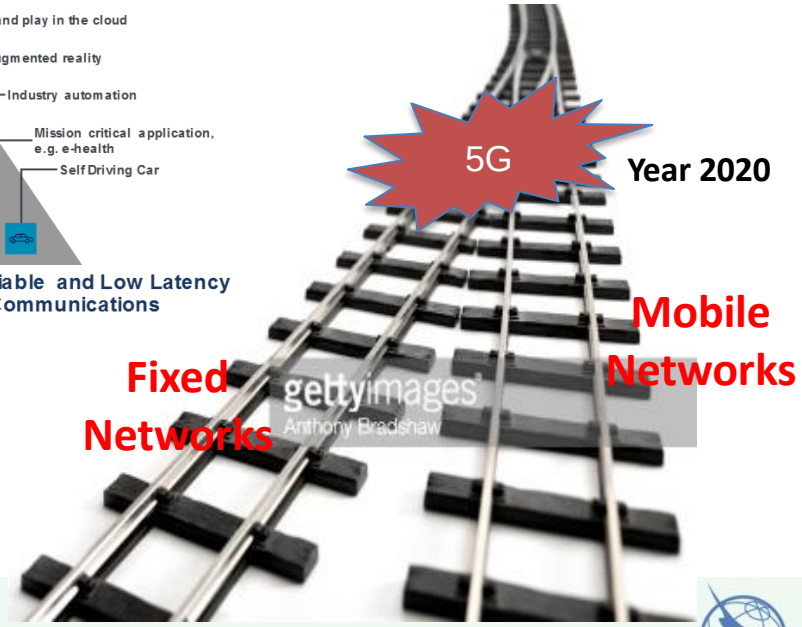
# 5G is much more than a new radio interface

## 5G Service & Technical Features

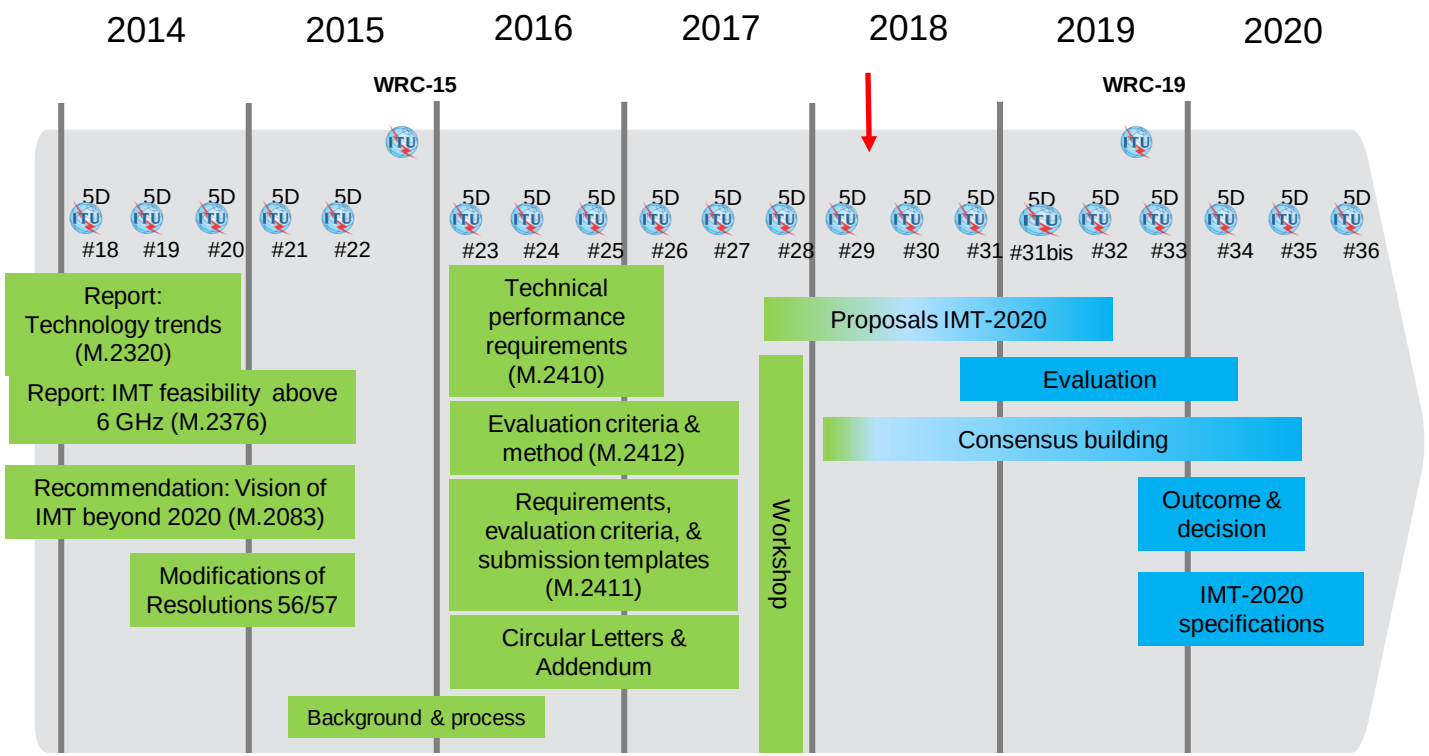


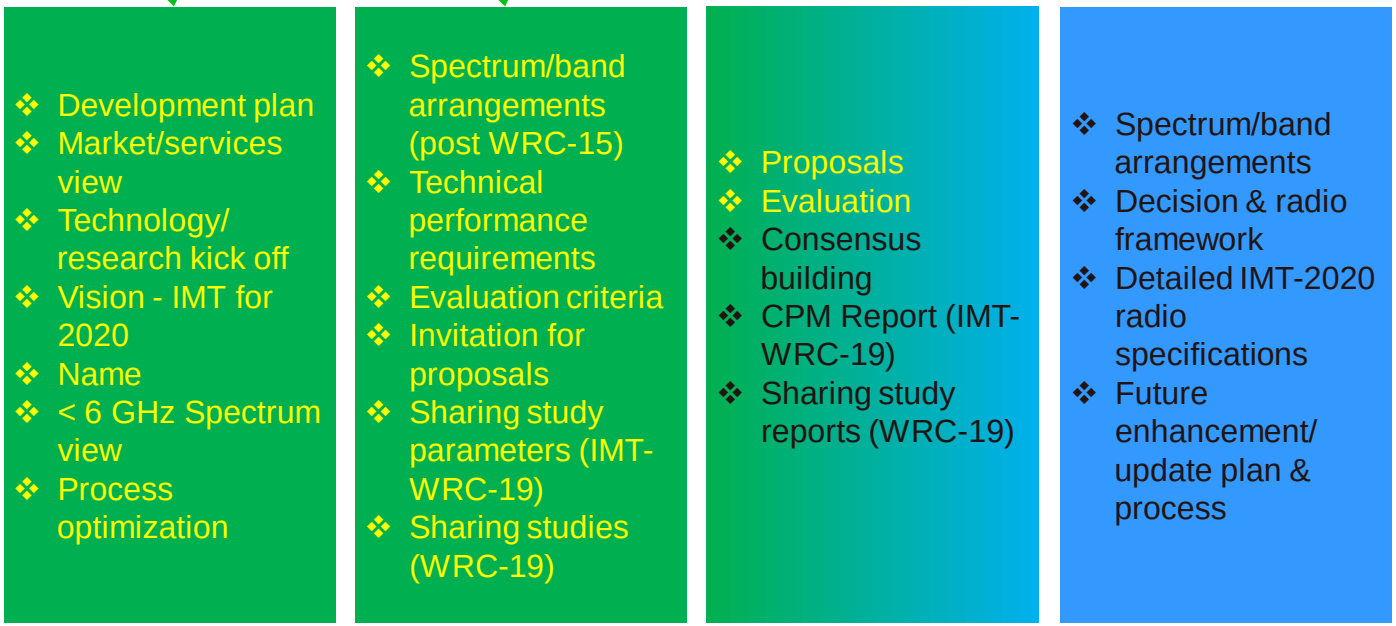

## Fixed-Mobile Hybrid Networks



# ITU-R WP 5D timeline for IMT-2020
# Detailed specifications for the terrestrial radio interfaces



# IMT-2020 standardization process



# IMT-2020 early trials of candidate technologies

- There will now be a number of early technical trials, market trials and deployments of 5G technologies based on the foreseen developments for IMT-2020.
- These technologies may not provide the full set of capabilities envisaged for IMT-2020, but the results of these early activities will flow forward into and assist the development of the final complete detailed specifications for IMT-2020.
- The scope of IMT-2020 is much broader than previous generations of mobile broadband communication systems
- ITU-R Working Party 5D is well on schedule to produce technical specifications for 5G in early 2020.

# Most of the innovation to deliver 5G needs to happen in the fixed network


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

# ITU-T Standards to support non-radio aspects of 5G

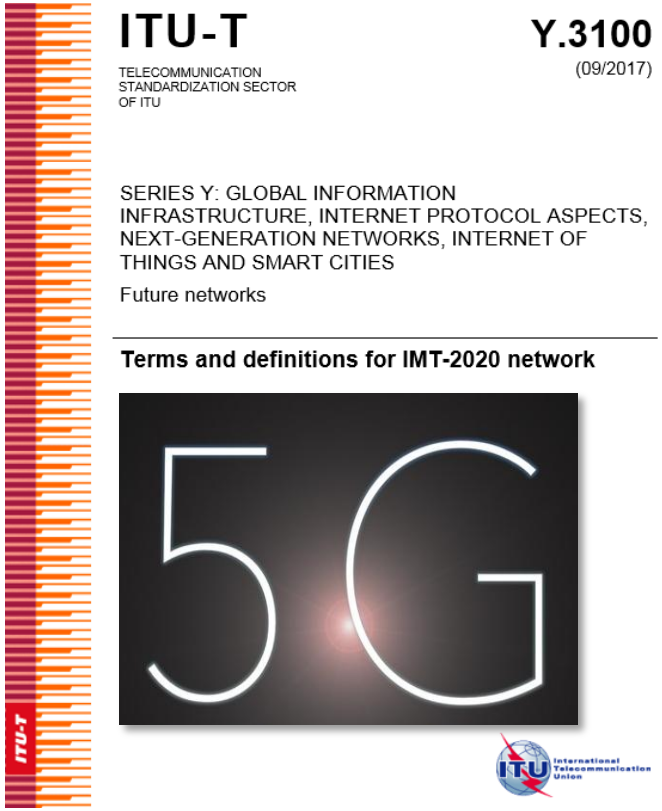
| Area | Full title of document | Status (Nov.) | Approved/ Planned |
|---|---|---|---|
| Terms & definitions | Y.3100, "Terms and definitions for IMT-2020 network" | Published | 13 September 2017 |
| Management framework | Y.3111, "IMT-2020 Network Management Framework" | Published | 13 September 2017 |
| Management requirements | Y.3110, "IMT-2020 Network Management Requirements" | Published | 13 September 2017 |
| Activity report – NW SWarisation Supplement | Y.3100-series Supplement 44, "Standardization and open source activities related to network softwarization of IMT-2020" | Published | 14 July 2017 |
| Requirements | Y.3101, "Requirements of IMT-2020 network" | Consented | 17 Nov-2017 |
| Potential directions | Y.3150, "High level technical characteristic of network softwarization for IMT-2020" | Consented | 17 Nov-2017 |
| Requirements for FMC | Y.3130, "Requirements of IMT-2020 fixed- mobile convergence" | Consented | 17 Nov-2017 |
| Data Aware Networking | Y.3071, "Data Aware Networking (Information Centric Networking) - Requirements and Capabilities" | Published | 29 March 2017 |

**ITU-T Focus Group: ML for 5G**

**How to design** (network architectures, interfaces, protocols, algorithms, data format)

**to make best use of ML?**

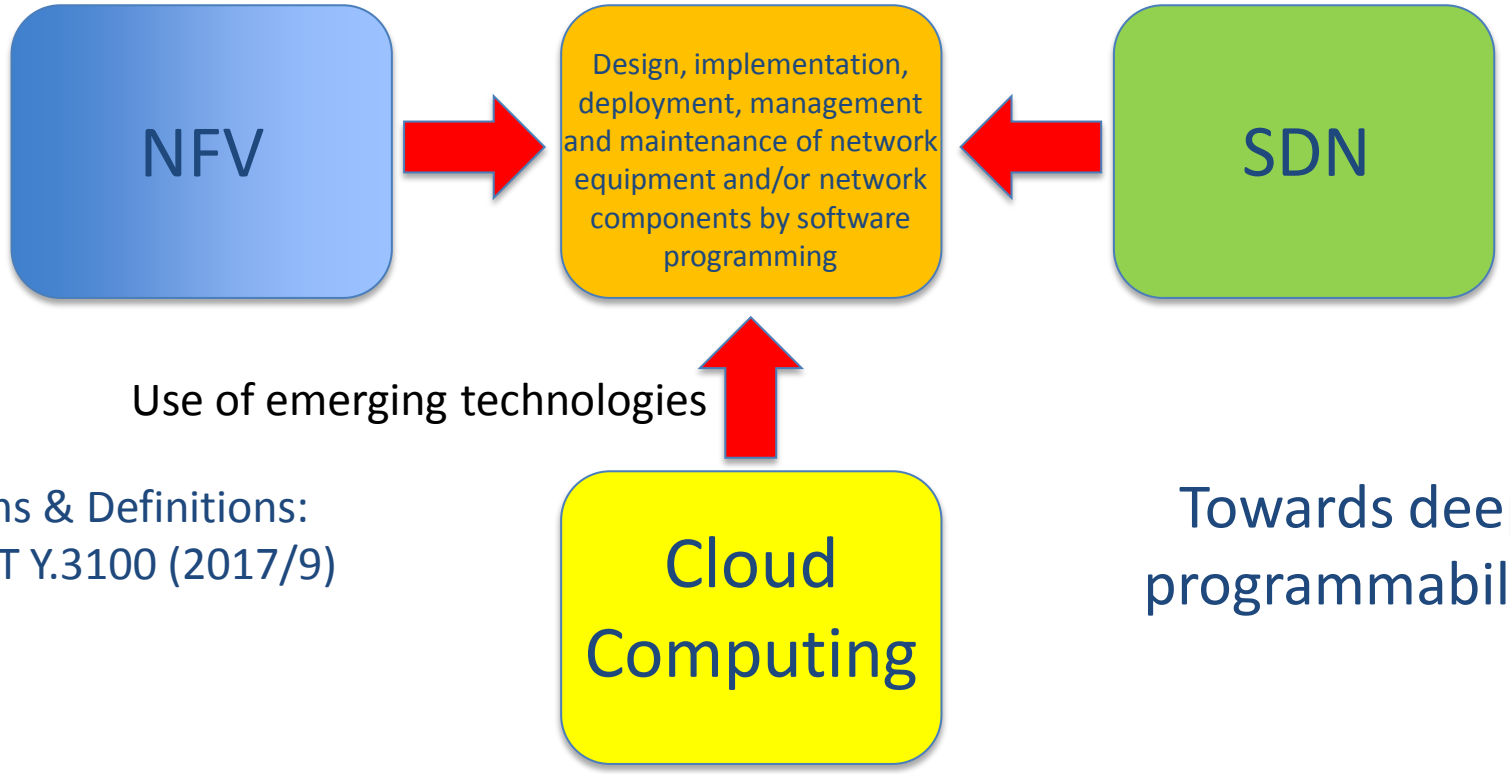
# Softwarization, Slicing, and FMC




- **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

# Network softwarization

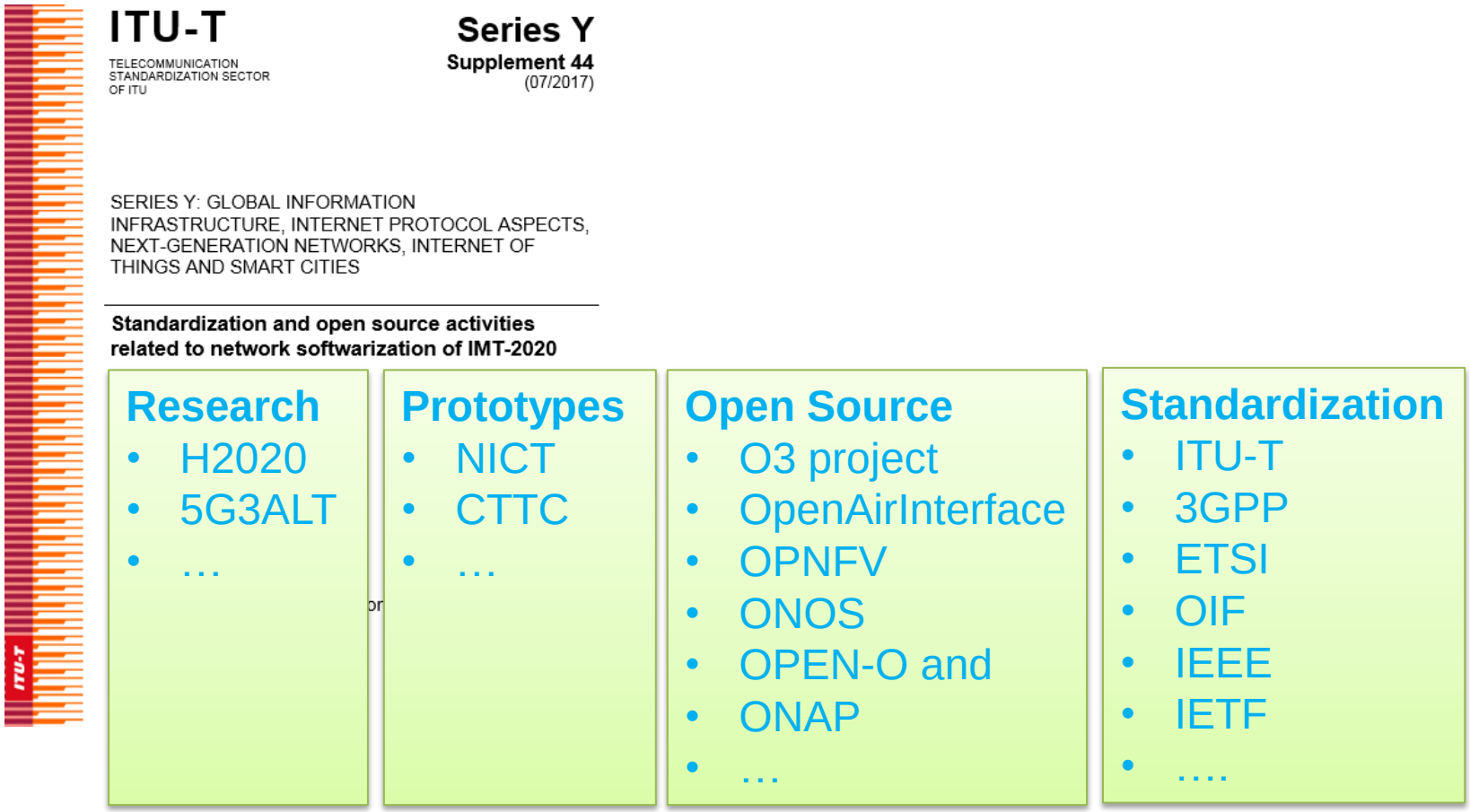
Enabling the (re-)design of network and services architectures, optimizing costs and processes, enabling self-management.




Terms & Definitions:
ITU-T Y.3100 (2017/9)

Towards deep programmability

# IMT-2020 Softwarization Ecosystem



ITU-T

TELECOMMUNICATION STANDARDIZATION SECTOR OF ITU

Series Y

Supplement 44

(07/2017)

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

**Standardization and open source activities related to network softwarization of IMT-2020**

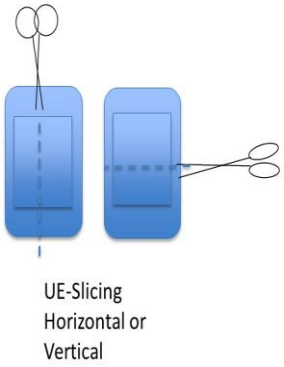
**Research**
- H2020
- 5G3ALT
- …

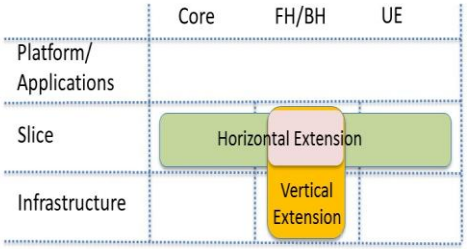
**Prototypes**
- NICT
- CTTC
- …

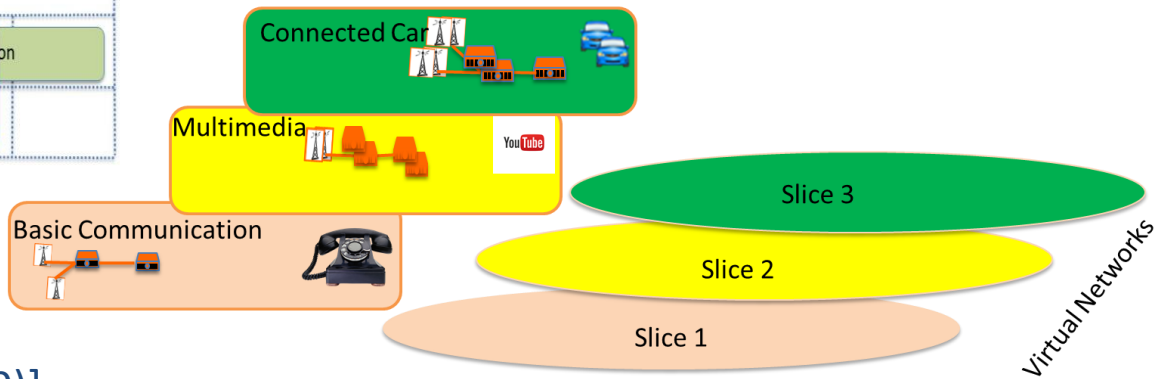
**Open Source**
- O3 project
- OpenAirInterface
- OPNFV
- ONOS
- OPEN-O and
- ONAP
- …

**Standardization**
- ITU-T
- 3GPP
- ETSI
- OIF
- IEEE
- IETF
- ….

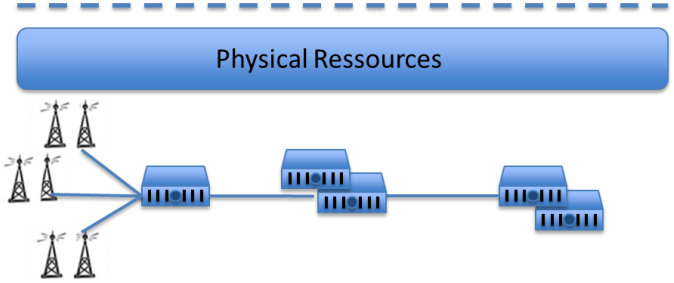
# Network slicing general principles




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



# 5G Network Slice

ITU-T

TELECOMMUNICATION STANDARDIZATION SECTOR OF ITU

Y.3111

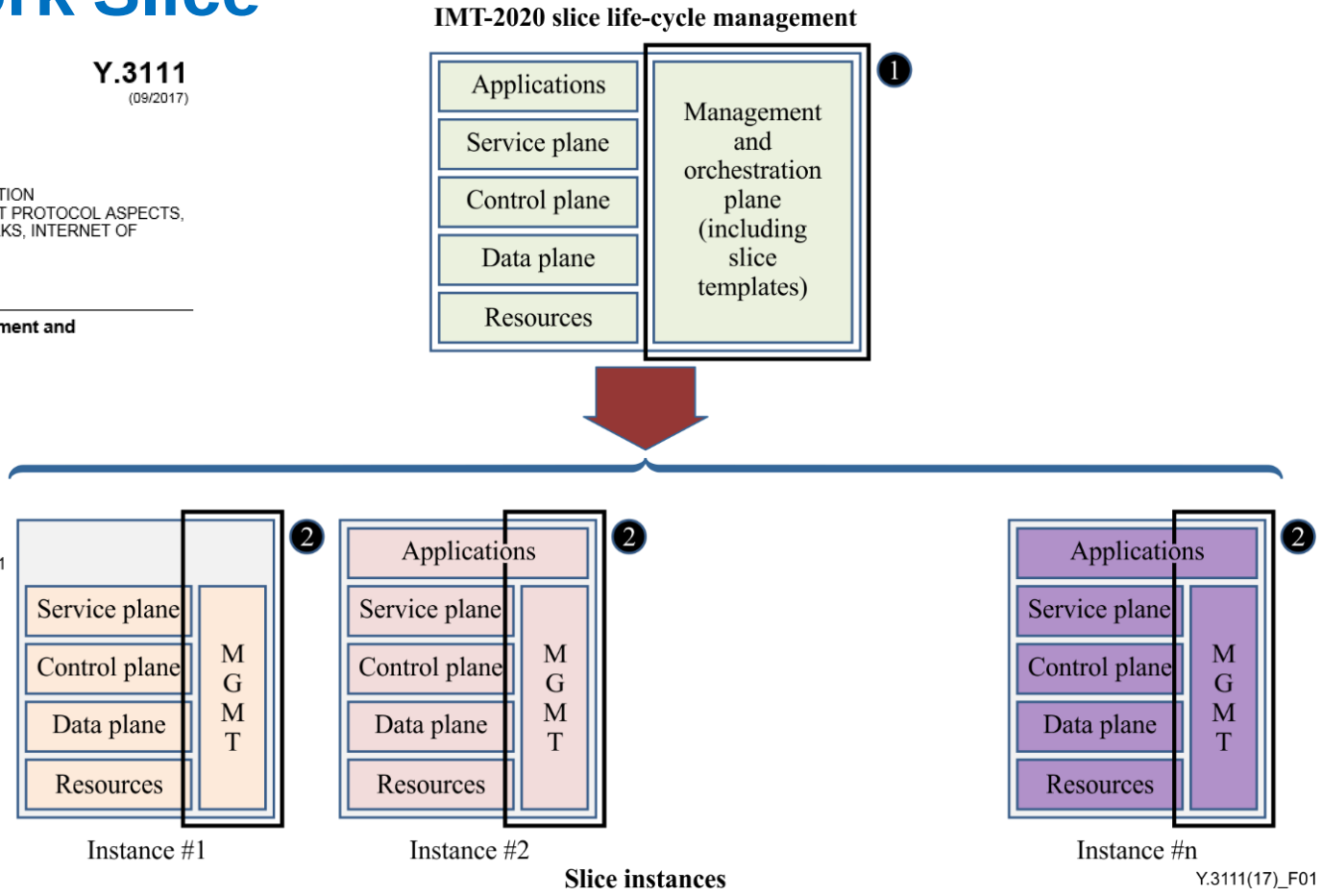
(09/2017)

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

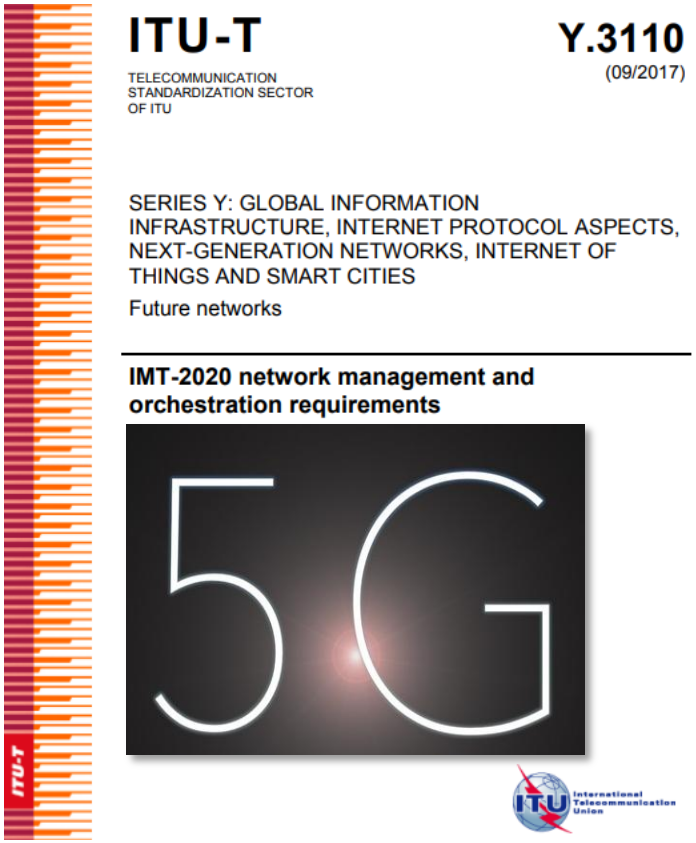
Future networks

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

Recommendation ITU-T Y.3111



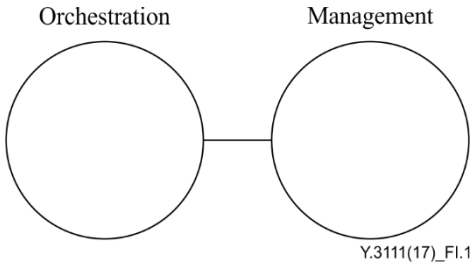
# 5G Network Management and Orchestration



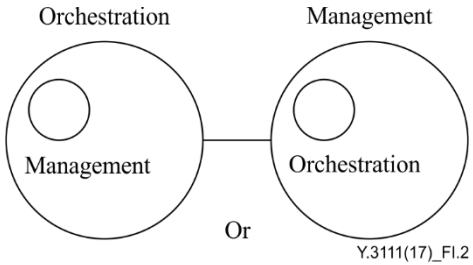

- **management:** In the context of IMT-2020, the processes aiming at fulfilment, assurance, and billing of services, network functions, and resources in both physical and virtual infrastructure including compute, storage, and network resources.

- **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.

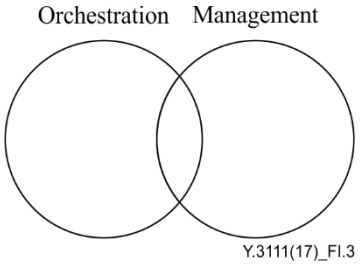
# 5G Network Orchestration vs Management




**1. Independent orchestration and management**




**2. Management/orchestration includes the other**



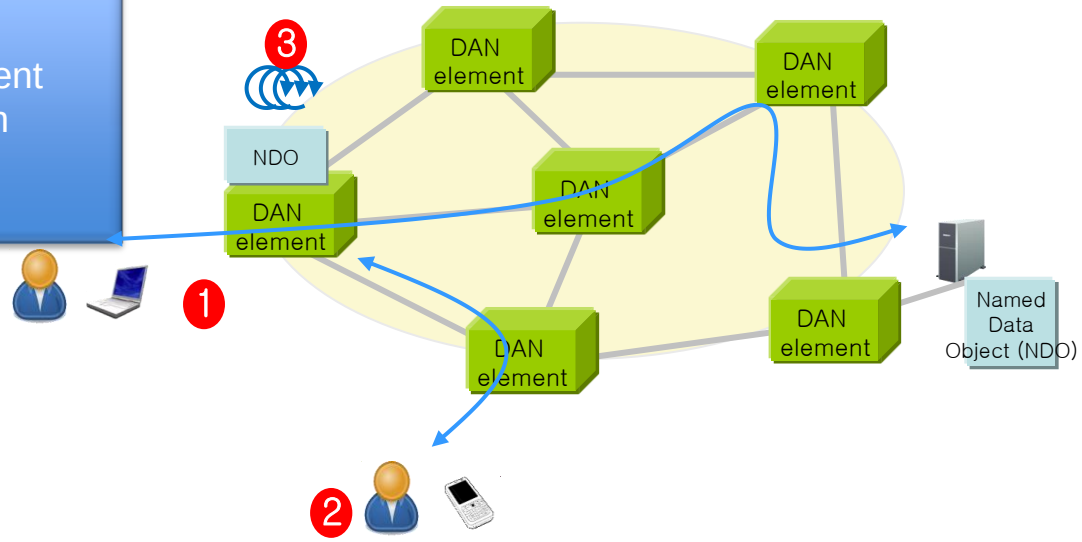

**3. Orchestration and management with an intersection**

| | Orchestration | Management |
|---|---|---|
| **Monitoring purpose** | Availability | Healthiness |
| **Action purpose** | Provisioning | Maintaining |
| **Representative actions** | Control/Configuration<br>Create/Destroy/Move | Monitor/Alarm for event<br>Detection/Isolation/Resolve for fault |
| **Target resources** | Dissimilar devices | Similar devices |

# New networking technology: Data Aware Networking (DAN) (aka Information Centric Networking (ICN))

**ICN capabilities**

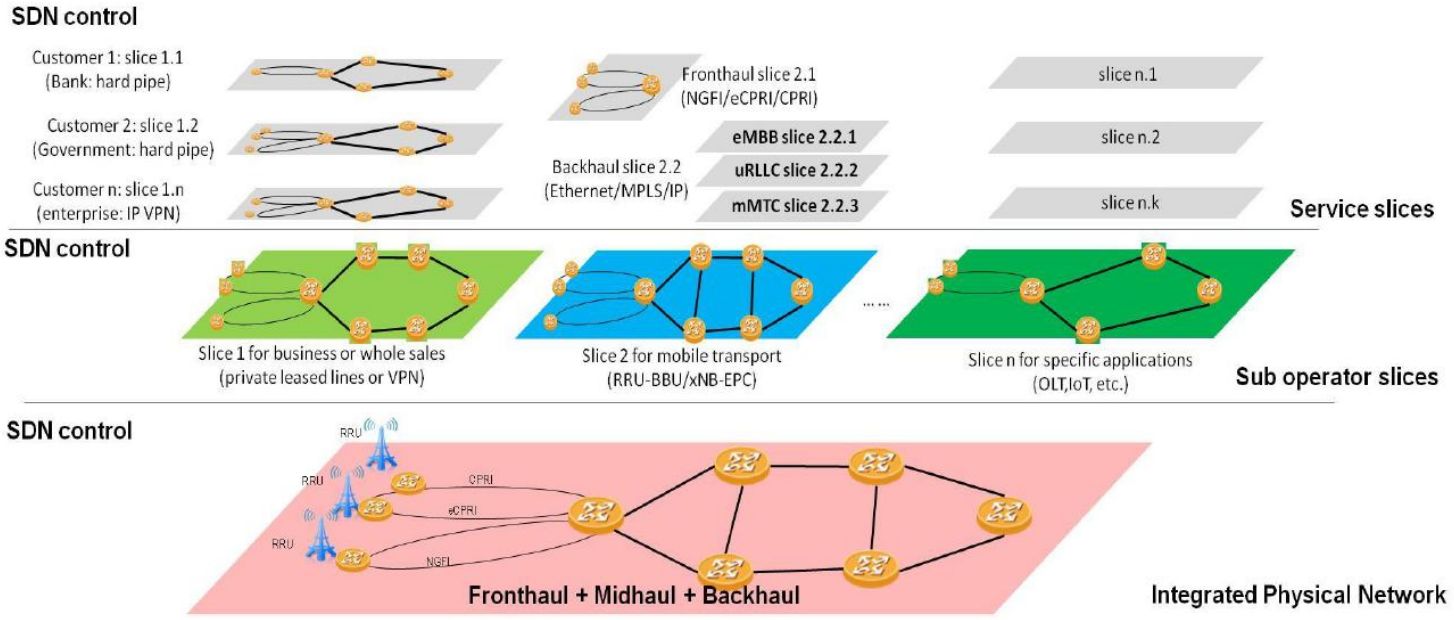
- Data
- Control
- Security
- Management
- Application (network service)




ITU-T Y.3071 on requirements and capabilities of ICN (2017/3)

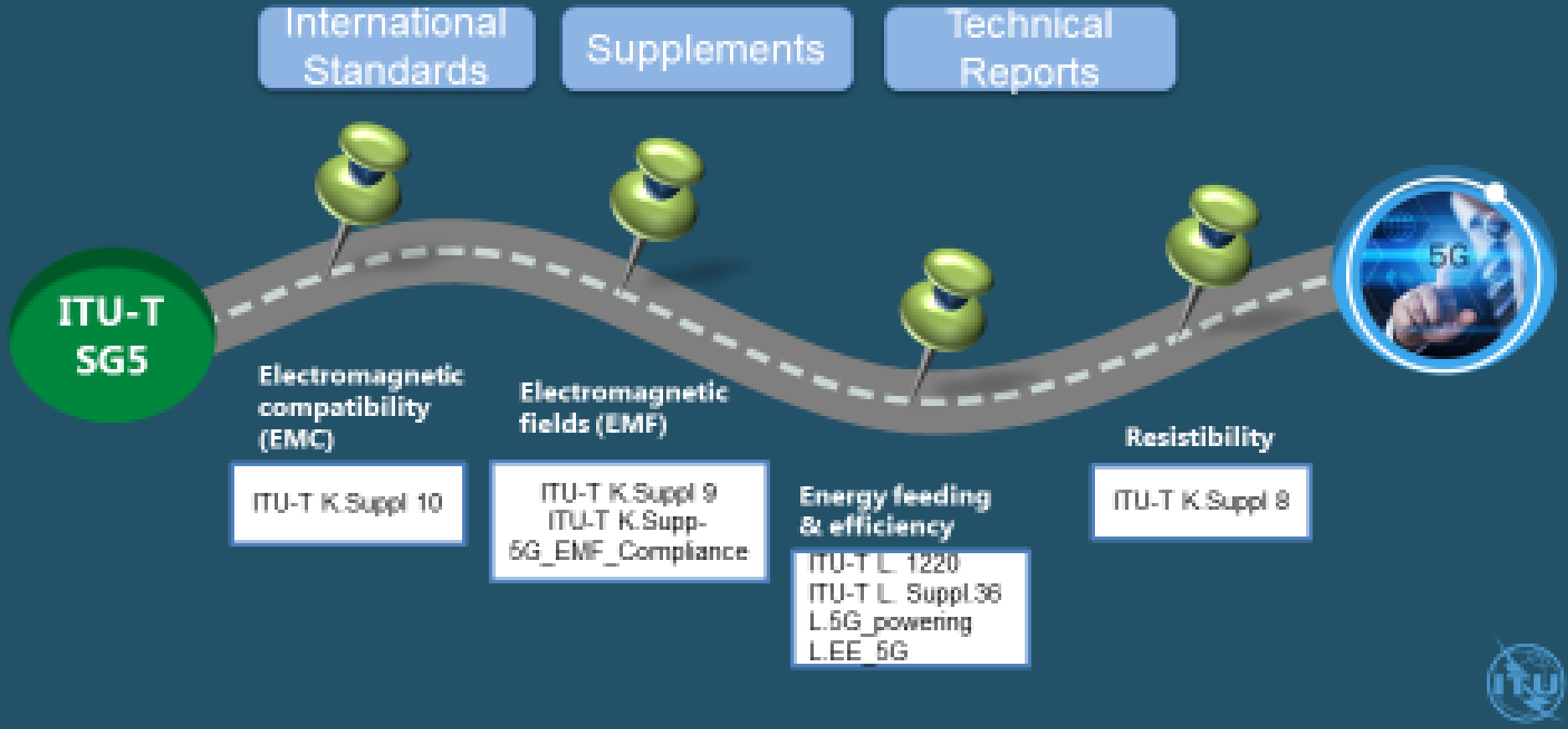
# IMT2020/ 5G transport aspects (ITU-T Study Group 15)

## Studies related to transport layer of IMT20207 5G networks including application of slicing techniques in the transport

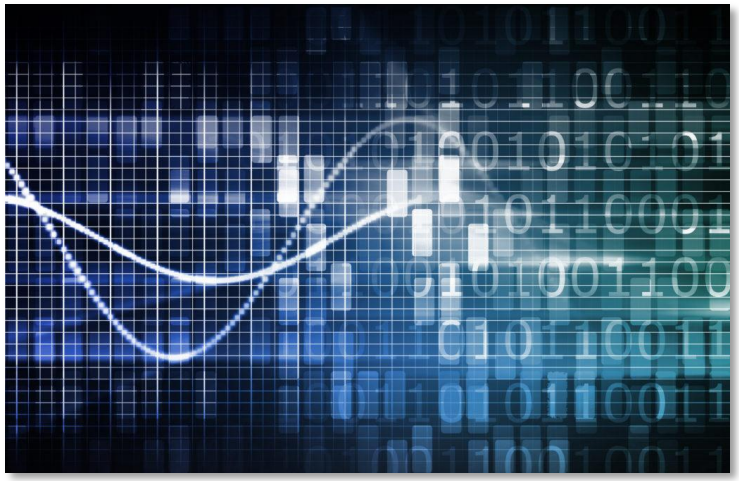



Source: China Mobile

# Setting Environmental Requirements for 5G



# ITU-T assesses the quality and performance of networks, terminals, video, voice and multimedia applications



QoS work on:

- Virtual reality
- Crowdsourcing (P.CROWD)
- Quality measurement frameworks
- Virtual performance measurement systems
- Quality aspects of digital financial services, SIM-boxing, VoLTE and ViLTE (related to consumer protection)

# Machine Learning for 5G

## How to design

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

## to make best use of ML

# 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)

- To promote high-level coordination in IMT2020 standardization
- A global IMT2020 standards roadmap (for non-radio aspects) will be maintained via regular exchanges with relevant external entities. Open to ITU Members and designated representatives of relevant Standards Development Organizations and Forums
- There is a mailing list for discussion and information sharinghttps://www.itu.int/en/ITU-T/jca/imt2020/Pages/subscription.aspx

# References

- ITU-T SG13 Chairman Blog
- IMT-2020 Focus Group Reports
- Machine Learning for 5G

# Thank you