# *IMT2020/ 5G Standardization In ITU-T Study Group 13*


Hans (Hyungsoo) KIM
Vice-chairman ITU-T SG13

1956 2016
CCITT / ITU-T

ITU

# ITU-T SG13 & IMT2020/ 5G


- **Lead study group on future networks such as IMT-2020 networks (non-radio related parts)**
- Lead study group on mobility management
- Lead study group on cloud computing
- Lead study group on trusted network infrastructures

1956 2016
CCITT / ITU-T

# SG13 IMT2020/ 5G Working Parties

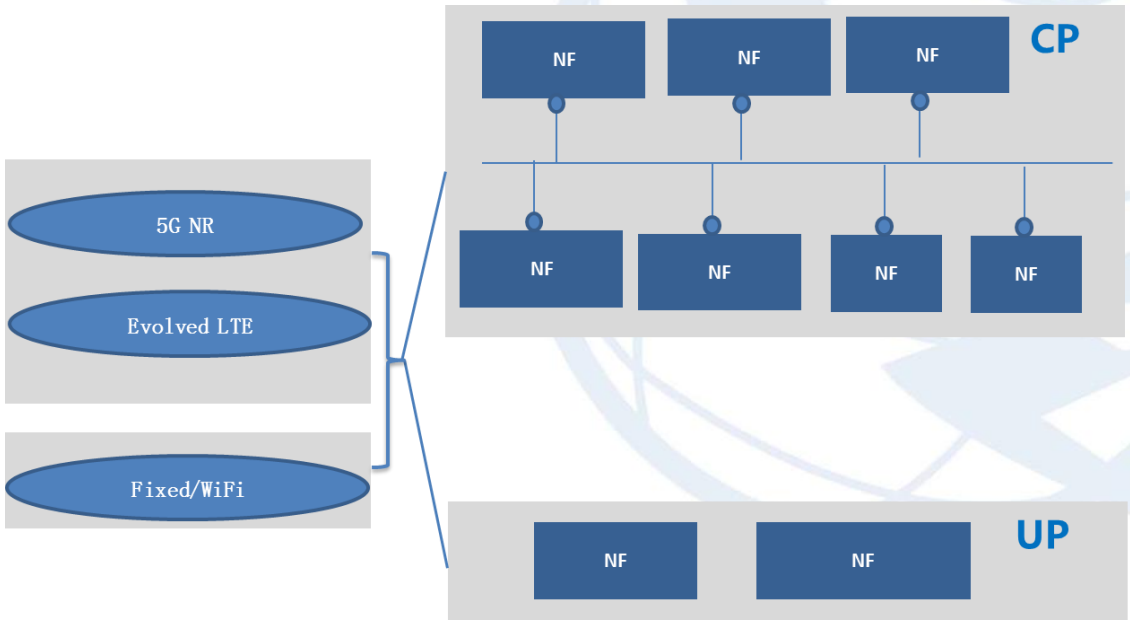
| WP | Title | Questions |
|---|---|---|
| 1 | IMT-2020 Networks & Systems | **Q.6:** Quality of service (QoS) aspects including IMT-2020 networks |
| | | **Q.20:** IMT-2020: Network requirements and functional architecture |
| | | **Q.21:** Network softwarization including software-defined networking, network slicing and orchestration |
| | | **Q.22:** Upcoming network technologies for IMT-2020 and future networks |
| | | **Q.23:** Fixed-mobile convergence including IMT-2020 |

# IMT2020/5G Vision


1956 2016
CCITT / ITU-T

# IMT2020/ 5G - Concept

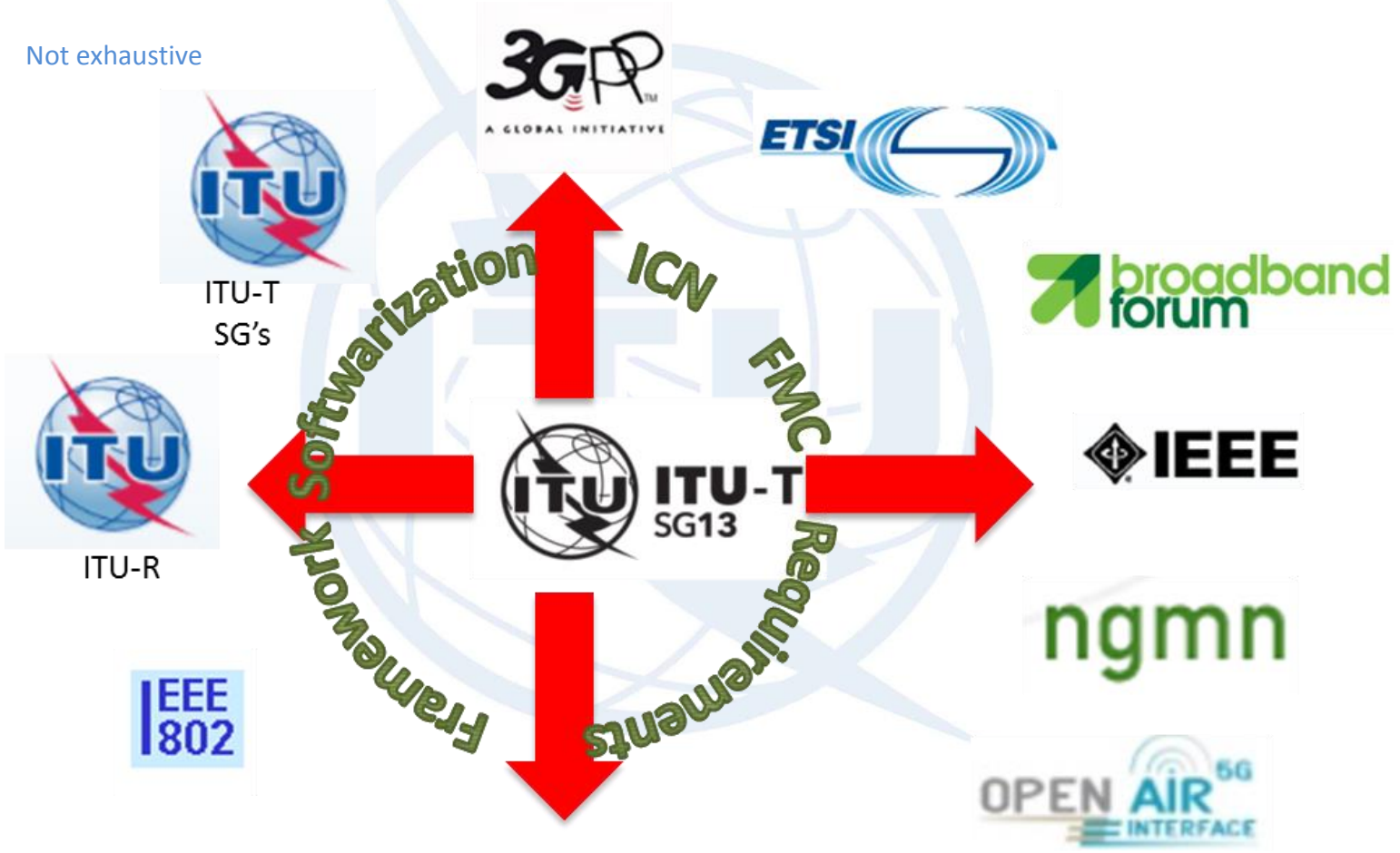
**Most of the innovation to realize 5G needs to happen in the fixed network**




- Service-based Architecture (Network Functions, NF)
- Control Plane (CP)/User Plane (UP) separation (CUPS)
- Softwarization
- Fixed/ Mobile Convergence
- Flexibility

# Relationships for IMT2020/ 5G

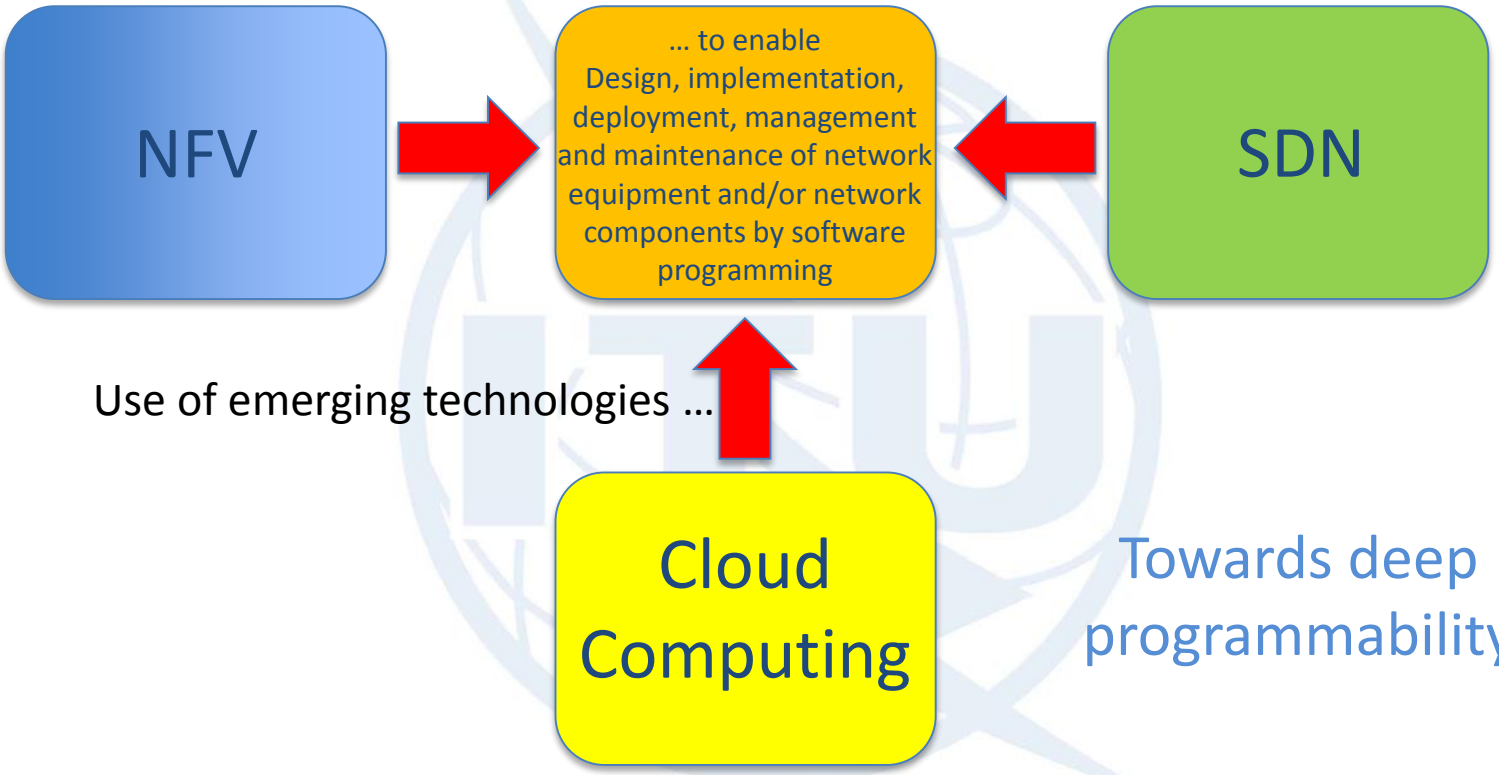
Not exhaustive



# ITU-T SG13 specifications related to IMT-2020

| Domain | Approved Recommendations |
|---|---|
| General | **Y.3100: Terms and definitions for IMT-2020 network** |
| Services, Architecture and Management | Y.3011: Framework of network virtualization for future networks<br>Y.3012: Requirements of network virtualization for future networks<br>Y.3300: Framework of software-defined networking<br>Y.3320: Requirements for applying formal methods to software-defined networking<br>Y.3321: Requirements and capability framework for NICE implementation making use of software-defined networking technologies<br>Y.3322: Functional Architecture for NICE implementation making use of software-defined networking technologies<br>**Y.3101: Requirements of the IMT-2020 network**<br>**Y.3102: Framework of the IMT-2020 network**<br>**Y.3110: IMT-2020 Network Management and Orchestration Requirements**<br>**Y.3111: IMT-2020 Network Management and Orchestration Framework**<br>**Y.3112: Framework for the support of Multiple Network Slicing**<br>**Y.3130: Requirements of IMT-2020 fixed- mobile convergence**<br>**Y.3150: High level technical characteristic of network softwarization for IMT-2020**<br>**Y.3100-series Supplement 44: Standardization and open source activities related to network softwarization of IMT-2020** |
| Data | Y.3031: Identification framework for future networks<br>Y.3032: Configuration of node IDs and their mapping with locators in future networks<br>Y.3033: Framework of data aware networking<br>Y.3034: Architecture for interworking of heterogeneous component networks in FNs<br>**Y.3071: Data Aware Networking (Information Centric Networking) – Requirements and Capabilities**<br>**Y.3070-series Supplement 47: Information-Centric Networking – Overview, Standardization Gaps and Proof-of-Concept** |
| Environmental aspects | Y.3021: Framework of energy saving for future networks<br>Y.3022: Measuring energy in networks |
| Socio-Economic aspects | Y.3013: Socio-economic assessment of future networks by tussle analysis<br>Y.3035: Service universalization in future networks |
| Smart Ubiquitous Networks | Y.3041, Y.3042,Y.3043,Y.3044,Y.3045 |

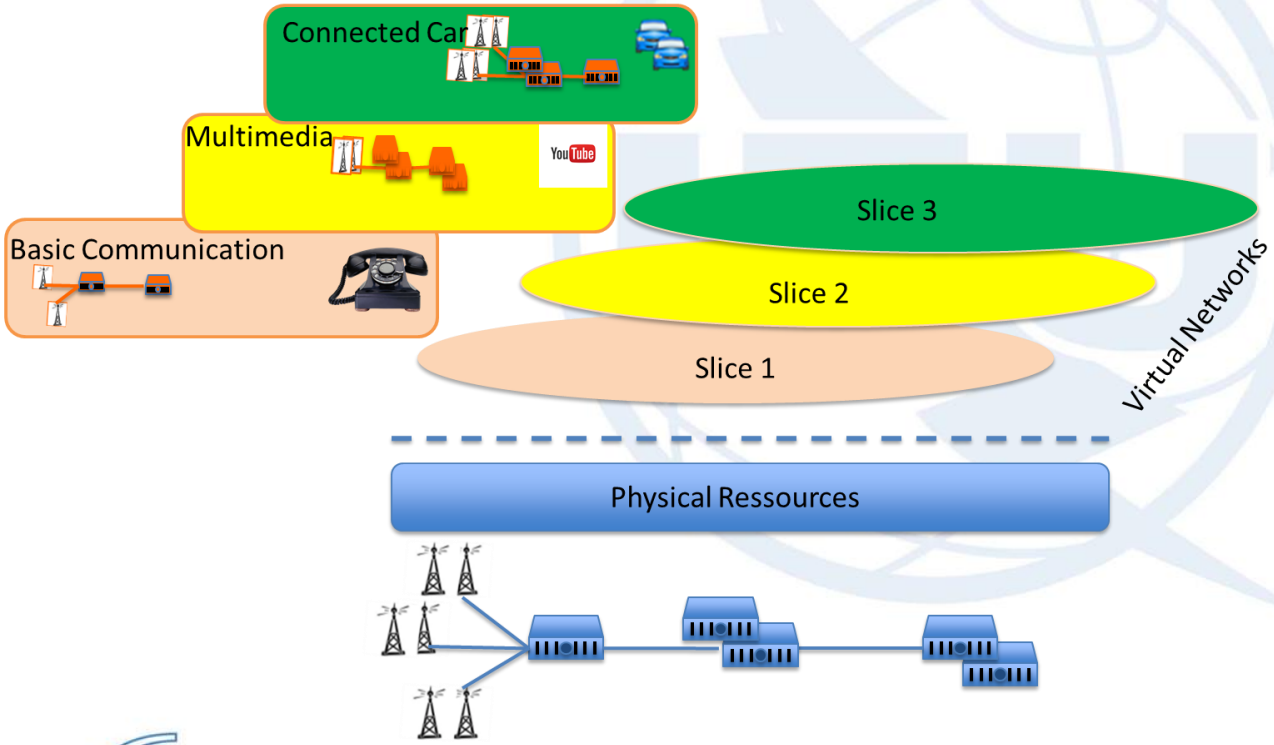
# Network Softwarization




Terms & Definitions: ITU-T Y.3100

# Network Slicing General Principles

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

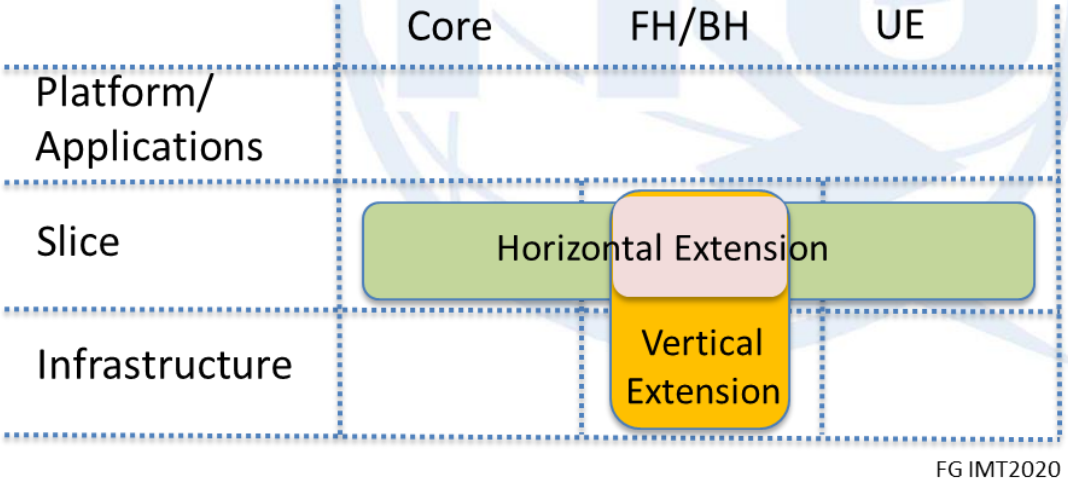


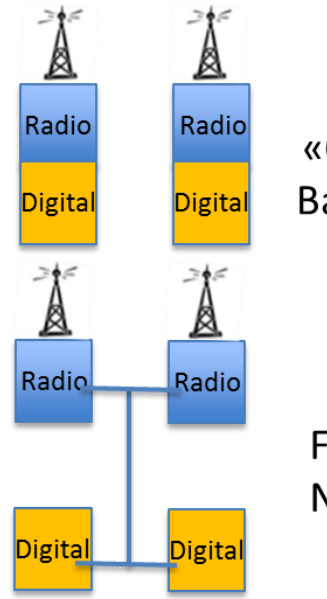

- **eMBB** (enhanced Mobile Broadband)
- **URLLC** (Ultra reliable Low Latency Communication)
- **mMTC** (massive Machine Type Communication)

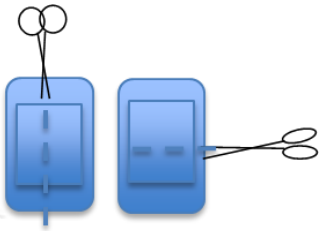
# Horizontal/ Vertical Slicing

High-level technical characteristics of Network Softwarization [ITU-T Y.3150]:

- Vertical aspects; ranging from physical infrastructure, virtualized resources, virtualized network functions etc.)
- Horizontal aspects; ranging from mobile FH, BH and core infrastructure.



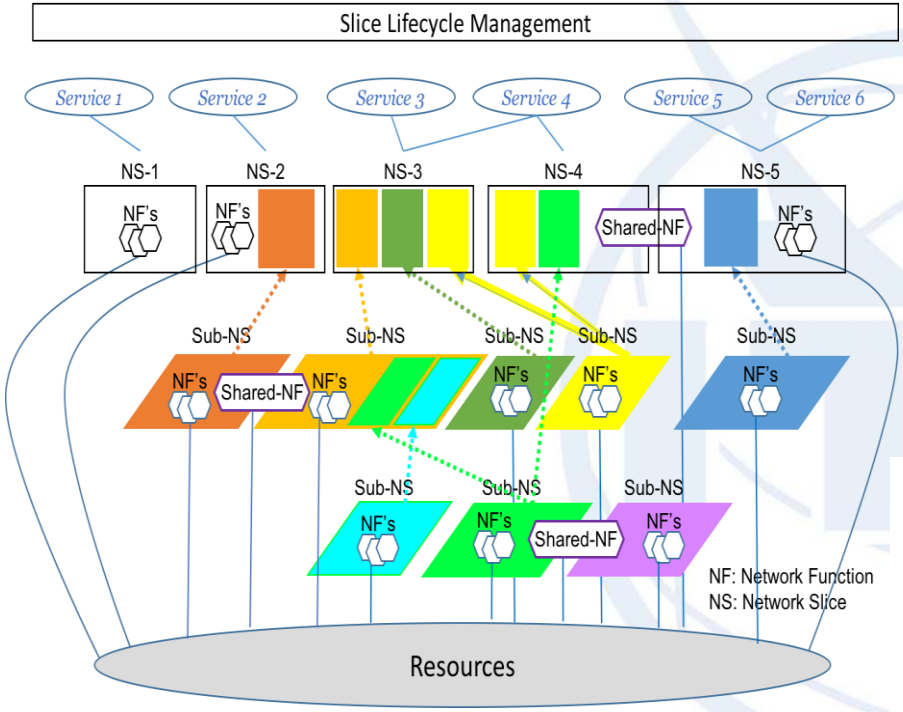



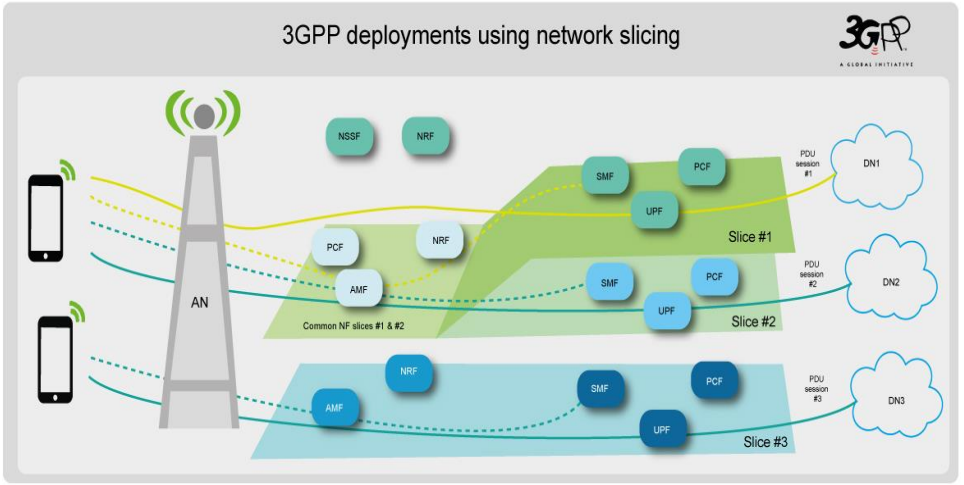
UE-Slicing Horizontal or Vertical

# Network Slicing and Network Functions

## Conceptual View (ITU-T Y.3102, Framework of the IMT-2020 network)




## Example: 3GPP network from network slicing perspective

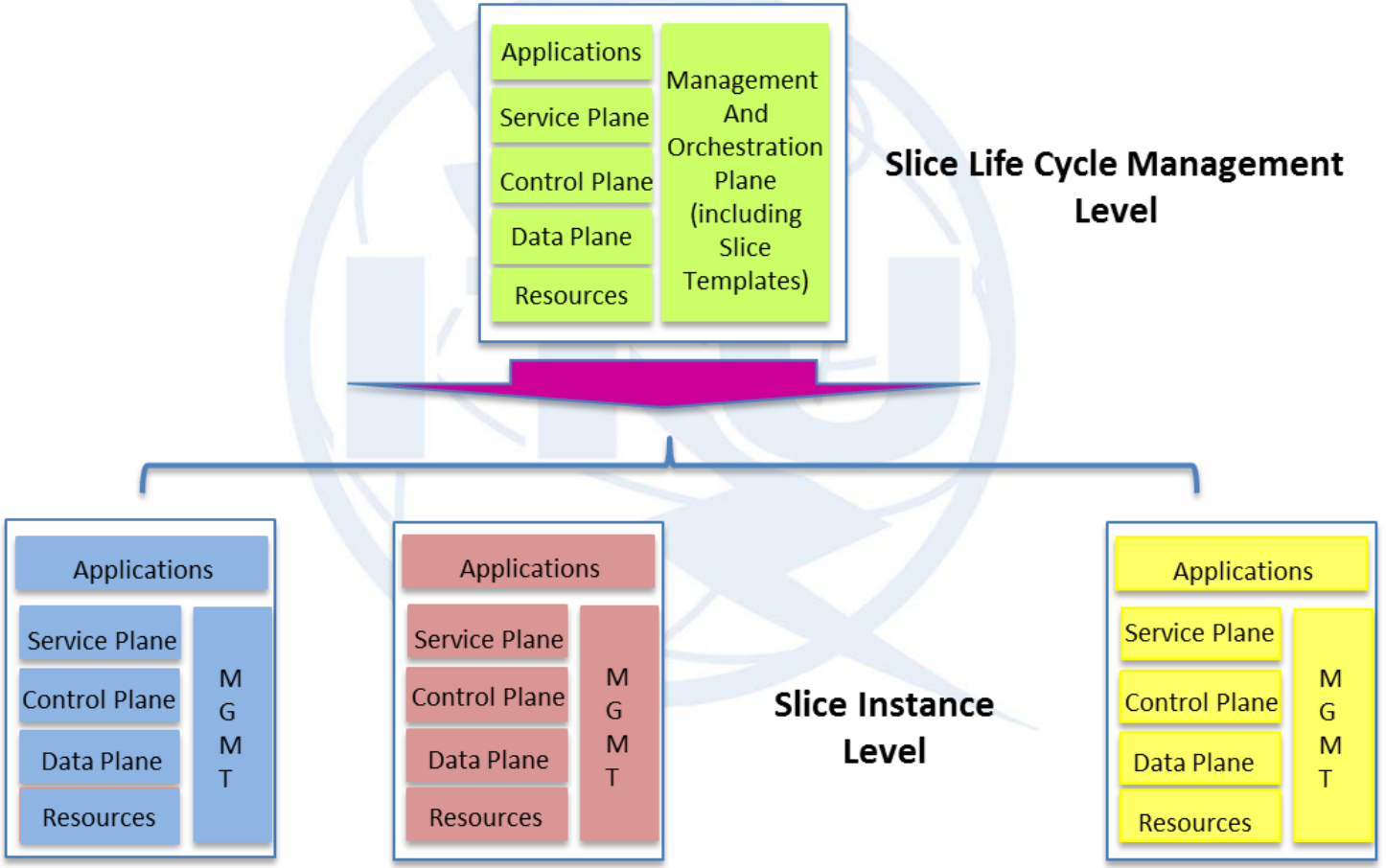



Source: 3GPP

1956 2016 CCITT / ITU-T

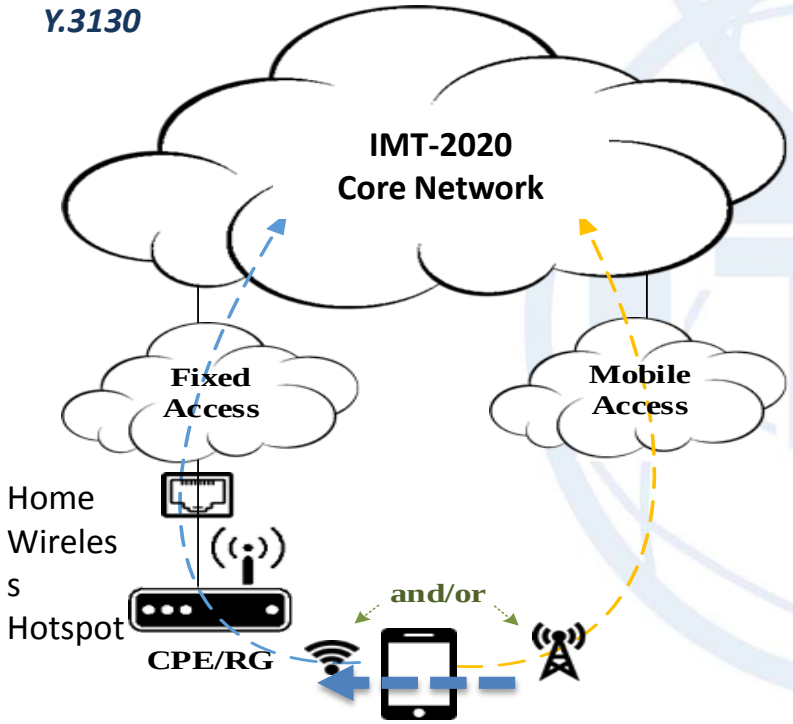
# Network management/orchestration

**ITU-T Y.3110, IMT-2020 network management and orchestration requirements**
**ITU-T Y.3111, IMT-2020 network management and orchestration framework**



# 5G/IMT2020 Fixed Mobile Convergence (FMC)

Example scenario of mobile broadband service via fixed and/or mobile ANs ***Source: ITU-T Y.3130***




***Service continuity and guaranteed QoS for voice call network switching from mobile to fixed access***

## Motivations for FMC

Service perspective (seamless experience and ubiquitous service availability)

- Unified user identity
- Unified charging
- Service continuity and guaranteed QoS

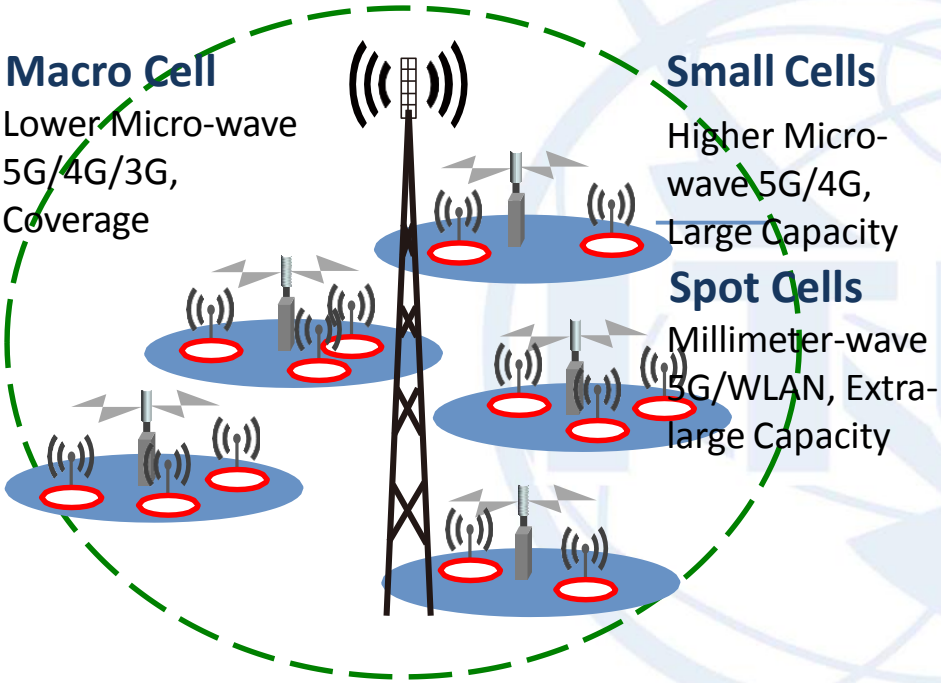
Network perspective (mutual coordination and evolution)

- Simplified network architecture (converged functions, flexible operation via AN coordination, resource sharing)
- OPEX & CAPEX reduction (common functions, common user profile data)

## Requirements [ITU-T Y.3130]

- Traffic switching, splitting and steering between fixed AN and mobile AN on network side
- Traffic switching, splitting and steering on user side
- Other requirements …

# Heterogenous Access Networks and common Core Network

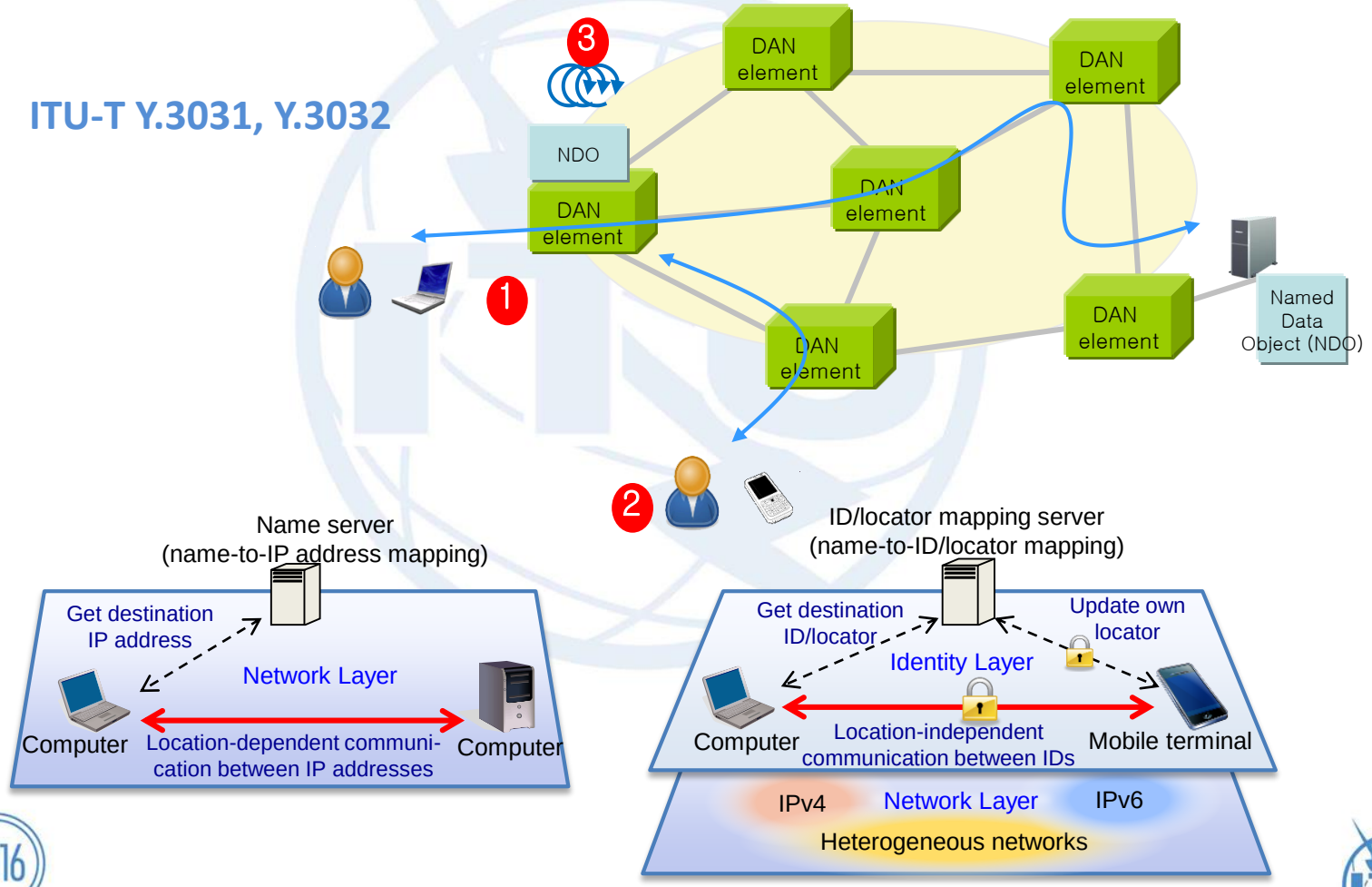



- **Integration of existing and new Access Networks (ANs)** (new RATs as well as evolved IMT-advanced RATs, Wireless LANs, fixed broadband, satellite)
- ANs for specific verticals may require specific network functions and technologies
- **Minimized AN-CN dependency with access-agnostic common CN** (common AN-CN interface and common control decoupled from AN technologies)
- Expectation of **unified authentication and authorization framework** across different ANs - see also FMC unified user identity

***Source: ITU-T Y.3101***

# New networking technology: Information Centric Networking (ICN))

ITU-T Y.3031, Y.3032



# Support of diverse business models in 5G/IMT-2020 networks

**Support of diverse business models will be critical to the successful deployment of 5G/IMT-2020 networks**

**Investigating key business roles and models of 5G/IMT-2020 ecosystem(s) is beneficial to technical standardization**

- The identification of relevant use cases where business roles can interact in multiple ways enabling diverse business models promotes linkage between concrete deployments and standardization (network requirements, functional architecture, open interfaces)

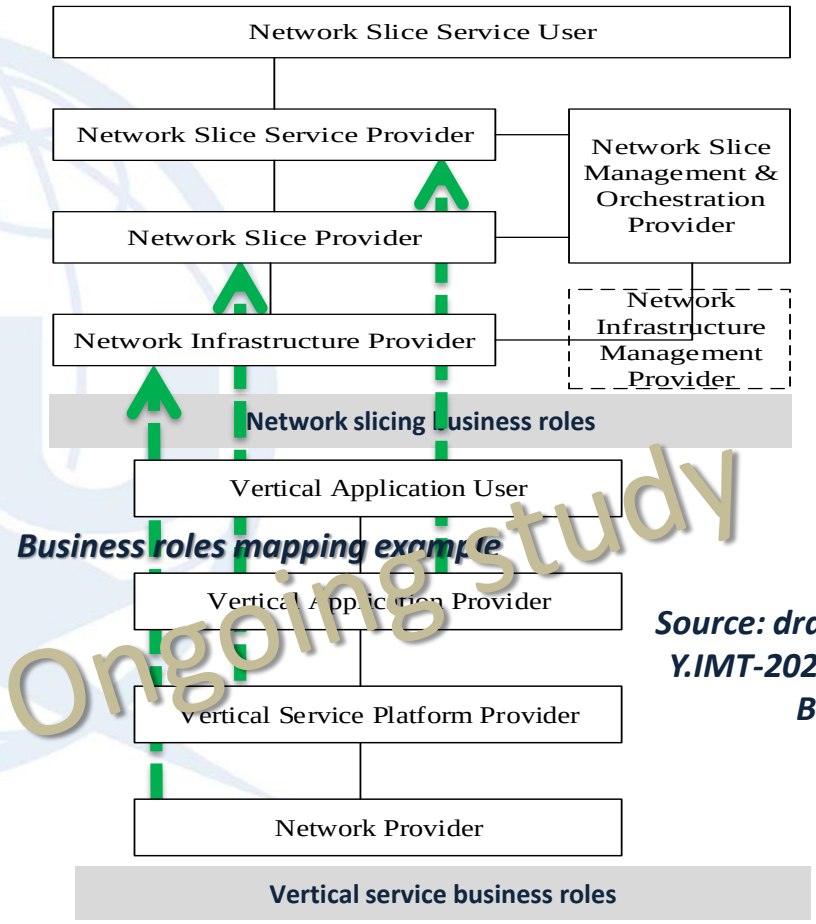
**Ongoing ITU-T draft Rec. Y.IMT2020-BM**

- Analyses best practice use cases from different perspectives, building on key features of 5G/IMT-2020 networks
- Identifies key business models and roles (cannot be exhaustive)

**Use cases under investigation**

- network slicing based services
- vertical services (IoT vertical-5G horizontal integration)
- other services - Device to Device, AR/VR, V2X, Edge Computing

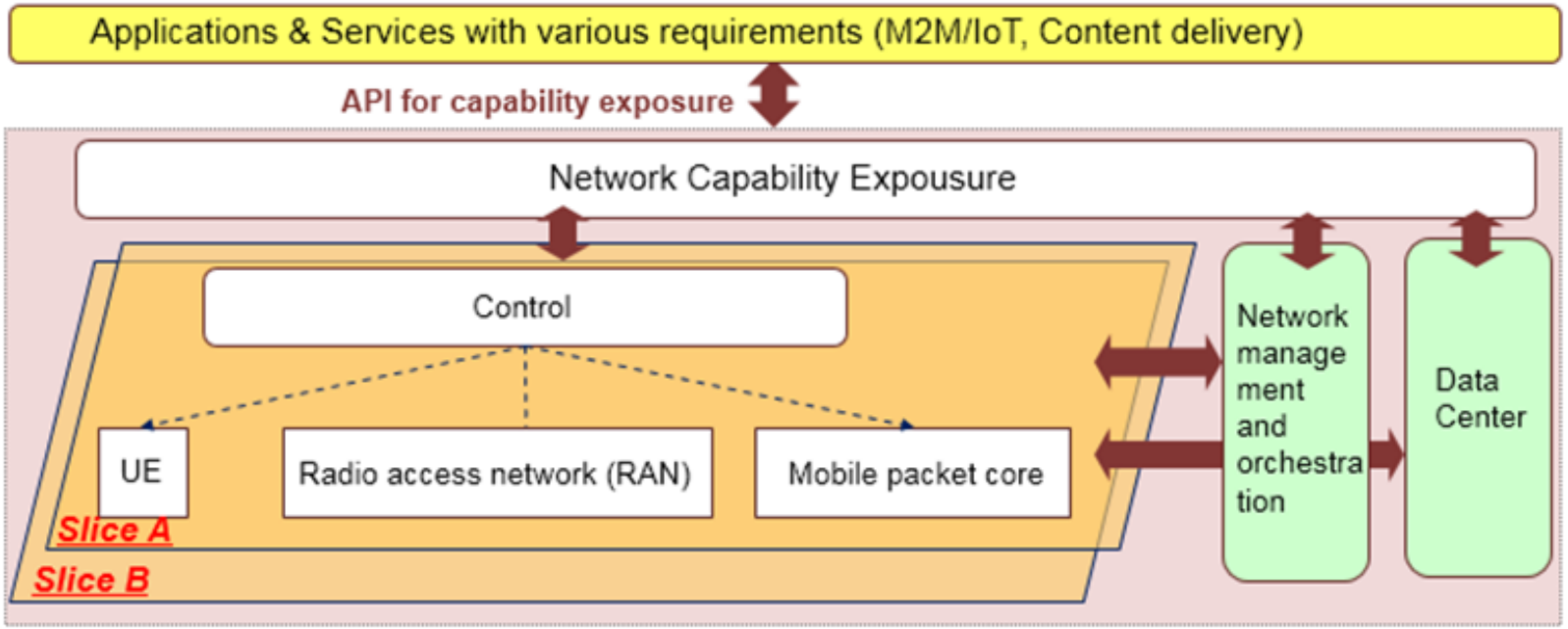
*NOTE – 3GPPP is progressing TR 22.830 "Feasibility Study on Business Role Models for Network Slicing"*



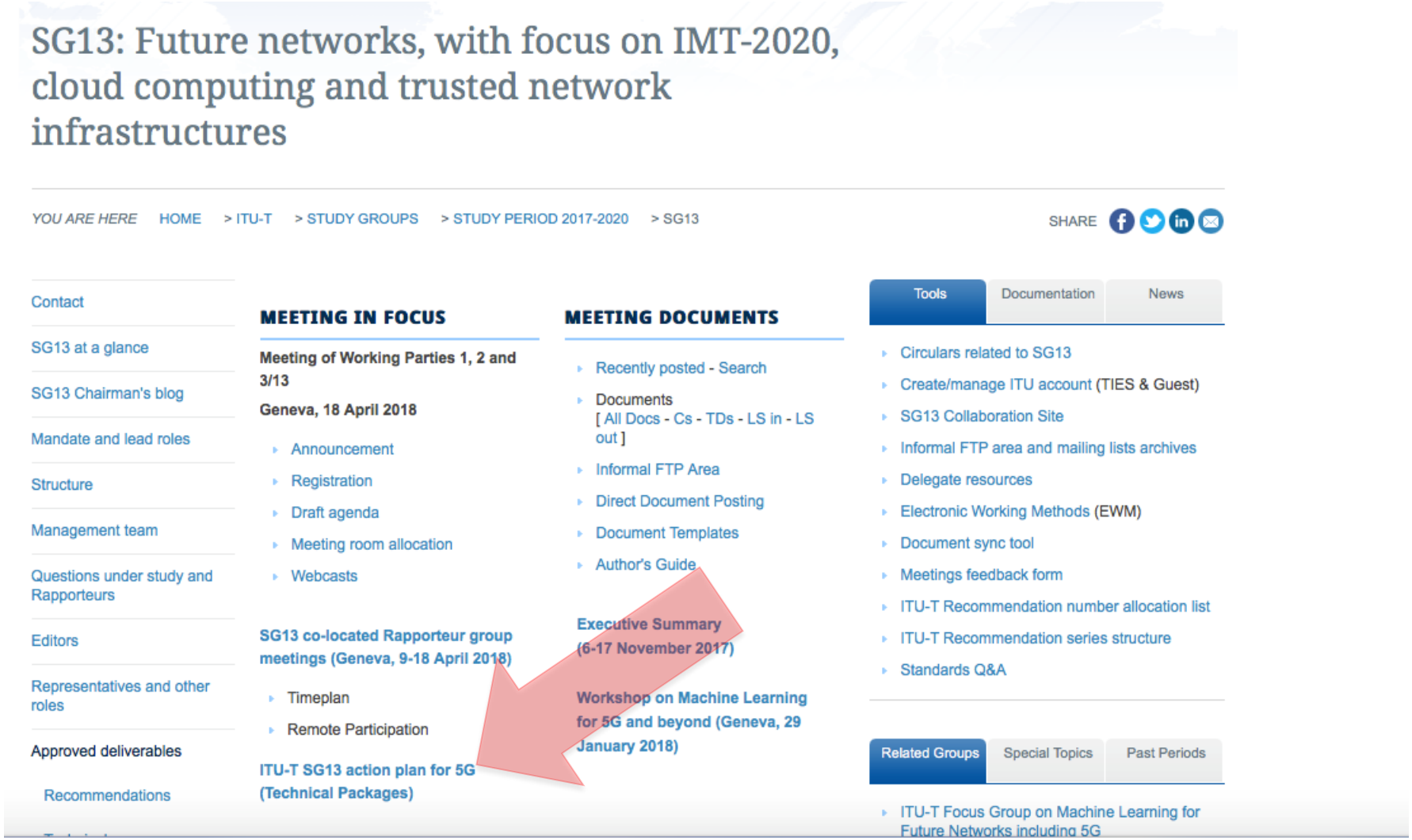

***Source: draft Y.IMT-2020-BM***

# Network Capability Exposure in 5G/IMT-2020 networks

**IMT-2020 networks are expected to bring some new and enhanced capabilities. The opening of IMT-2020 network capabilities will bring new business opportunities to operators, vendors and third parties (e.g., enterprises, OTT players).**



# ITU-T Study Group 13 5G-Action-Plan




1956 2016 CCITT / ITU-T

# Technology Package: Softwarization

| 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 |
| Frameworks | Y.IMT2020-frame, "Framework of IMT-2020 network" | Ongoing | Apr-2018 |
| Requirements | Y.3101, "Requirements of IMT-2020 network" | Consented | 17 Nov-2017 |
| Architecture | Y.IMT2020-arch, "Architecture of IMT-2020 network" | Ongoing | Nov-2018 |
| Orchestration for slices | Y.NSOM, "Network slicing orchestration and management:" | Ongoing | Apr-2018 |
| Framework for multiple slice support | Y.IMT2020-MultiSL, "Framework for the support of Multiple Network Slicing" | Ongoing | Jul-2018 |
| Requirements of network capability exposure | Y.IMT2020-CE-Req, "Requirements of network capability exposure in IMT-2020 networks" | Ongoing | Nov-2018 |
| Potential directions | Y.3150, "High level technical characteristic of network softwarization for IMT-2020" | Consented | 17 Nov-2017 |
| | Y.AMC, "Requirements and Architectural Framework for Autonomic Management and Control of IMT-2020 Networks" | Ongoing | Jul-2018 |
| | Y.IMT2020-ADDP, "Advanced Data Plane Programmability for IMT-2020" | Ongoing | 2019 |
| | Y.IMT2020-CEF, "Network capability exposure function in IMT-2020 networks" | Ongoing | 2019 |
| | Y.IMT2020-BM, "Business models of IMT-2020" | Ongoing | Apr-2018 |

# Technology Package: FMC

| Area | Full title of document | Status (July 17) | Approved/ Planned |
|---|---|---|---|
| Requirements for FMC | Y.3130, "Requirements of IMT-2020 fixed- mobile convergence" | Consented | 17 Nov-2017 |
| Arch for FMC | Y.FMC-ARCH Functional architecture for supporting fixed mobile convergence in IMT-2020 networks | Ongoing | Nov-2018 |
| Mobility management | Y.MM-RN - Mobility management framework over reconfigurable networks | Ongoing | Nov-2018 |
| Mobility management | Y.FMC-MM - Mobility management for fixed mobile convergence in IMT-2020 networks | New WI | 2019 |
| Requirements on mgm | Y.FMC-MO-req, "IMT-2020 FMC functional requirements for management and orchestration" | New WI | Nov-2018 |
| Service scheduling | Y.FMC-SS, "Service scheduling for supporting FMC in IMT-2020 network" | New WI | 2019 |
| Capability exposure | Y.FMC-CE, "Capability exposure enhancement for supporting FMC in IMT-2020 network" | New WI | 2019 |

# Technology Package: ICN

| Area | Full title of document | Status (Nov'17) | Approved/ Planned |
|---|---|---|---|
| Data Aware Networking | Y.3071, "Data Aware Networking (Information Centric Networking) - Requirements and Capabilities" | Published | 29 March 2017 |
| ICN | Y.3070-series supplement "Information-Centric Networking - Overview, Standardization Gaps and Proof-of-Concept | Ongoing | Apr-2018 |
| | Y.ICN-FnChain "Framework for service function chaining in ICN" | Ongoing | Nov-2018 |
| | Y.ICN-ReqN "Requirements of ICN naming and name resolution in IMT- 2020" | Ongoing | Nov-2018 |
| | Y.ICN-DS-framework "Framework for Directory Service for Management of a Huge Number of Heterogeneously Named Objects in IMT-2020" | Ongoing | Nov-2018 |
| | Y.SuppICN-PoC-DaaS "PoC for IoT Data as a Service using ICN in IMT- 2020" | Ongoing | Apr-2018 |

# Technology Package: QoS

| Area | Full title of document | Status (Nov'17) | Approved/ Planned |
|---|---|---|---|
| QoS | IMT-2020 network QoS monitoring architectural framework | Ongoing | Jul-2018 |

# 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

**ETSI Joint SDO/Fora Industry Harmonization Initiative for Unified Standards for AMC, SDN, NFV, E2E Service Orchestration and Big-Data Analytics for AMC**

- Software oriented enablers for 5G
- ITU-T SG13 is engaged

# Conclusions

- IMT2020/5G  is progressing with high pace
- IMT2020/5G includes a number of SDOs, and innumerable forums, alliances, consortia and projects working on it
- ITU-T SG13 position in the IMT2020/5G ecosystem is to contributing with international harmonized Terms & Definitions as well as high level Frameworks, Principles and Requirements. As one of its missions  ITU-T Study Group 13 works to include requirements and interests of the developing countries into the technical IMT2020/5G standardization
- ITU-T SG13 has created new Focus Group «on Machine Learning for Future Networks including 5G» to studying potential application of ML based mechanisms in 5G Telecommunication Networks
- ITU-T Study Group 13's  Joint Coordination Activity on IMT2020 (JCA-IMT2020) is the platform for contributions and information what work is done in all of the different groups dealing with IMT2020/ 5G

# Welcome to raise questions to us

**Dr. Leo Lehmann,**
SG13 Chairman
Leo.Lehmann@bakom.admin.ch

**Tatiana Kurakova**
TSB SG13 Counsellor
Tatiana.Kurakova@itu.int

1956 2016
CCITT / ITU-T