ITU Regional Forum on “Internet of Things, Telecommunication Networks and Big Data as basic infrastructure for Digital Economy”
Saint-Petersburg, Russian Federation, 4-6 June 2018

Progress of 5G studies in ITU-T: overview of SG13 standardization activities

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Outline

- Introduction to the 5G/IMT-2020 studies of ITU-T SG13
- Distinguishing features and high level requirements of 5G/IMT-2020 networks
  - along with key SG13 achievements and ongoing work items
- Conclusions

Introduction to the 5G/IMT-2020 studies of ITU-T SG13

The pre-standardization work of ITU-T FG IMT2020

- ITU-T Focus Group on IMT-2020 scope: pre-standardization activities on fixed access/transport and core network aspects of 5G, including management and control
- FG IMT2020 concluded its activities in Dec 2016
- Nine output documents delivered to ITU-T SG13 *("Future networks, with focus on IMT-2020, cloud computing and trusted network infrastructures")* as a basis for 5G standards production
- Various ITU-T SGs are now involved in 5G (IMT-2020) studies: SG11, SG13, SG15, SG17 (SG16, SG20)

FG IMT2020 figures

20 months of activity

8 f2f meetings with 55-88 participants

> 85 conference calls

The FG IMT2020 documents delivered to ITU-T SG13

FG deliverable title
FG IMT-2020 Chairman's report
TR: Terms and definitions for IMT-2020 in ITU-T
TR: Application of network softwarization to IMT-2020
Requirements of IMT-2020 from network perspective
Framework for IMT-2020 network architecture
Requirements of IMT-2020 fixed mobile convergence
TR: Unified network integrated cloud for fixed mobile convergence
IMT-2020 network management requirements
Network management framework for IMT-2020
TR: Application of information centric networking to IMT-2020

ITU-T SG13 and 5G/IMT-2020

- 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

Three Working Parties in SG13:

IMT-2020 Networks & Systems

Cloud Computing & Big Data

Network Evolution &Trust

SG13 has a Regional Group for Africa
SG13 is parent SG of FG on Machine Learning for Future Networks including 5G (FG-ML5G)
SG13 supervises the Joint Coordination Activity on IMT2020 (JCA-IMT2020)

ITU-T SG13 Working Party 1 (IMT-2020 Networks & Systems)

Question	Scope
Q6	**Quality of service (QoS) aspects including IMT-2020 networks**
	Continuation of Q.6/13 from the last study period
Q20	**IMT-2020: Network requirements and functional architecture**
	Transformation from Architecture WG of FG IMT-2020
Q21	**Network softwarization including software-defined networking, network slicing and orchestration**
	Continuation of Q. 14/13 and 12/13 from the last study period *Transformation from Softwarization WG and Network Management WG of FG IMT-2020*
Q22	**Upcoming network technologies for IMT-2020 and Future Networks**
	Continuation of Q. 13/13 and 15/13 from the last study period *Transformation from ICN WG of FG IMT-2020*
Q23	**Fixed-Mobile Convergence including IMT-2020**
	Continuation of Q. 4/13, 9/13 and 10/13 from the last study period *Transformation from FMC WG of FG IMT-2020*

SG13 WP1 has ensured a smooth continuation of the FG IMT2020 activities and efficient exploitation of its results (in the context of SG13 mandate)

SG13 ongoing approach on the organization of the deliverables for greater benefits to the market

Synchronisation of Recs and TRs according to technological areas (Softwarization, FMC, ICN, QoS, …)

Prioritisation of the most important areas

Joining forces among different questions and work together as needed

Joint meetings among Questions and cross - fertilisation

Technology packages (*)

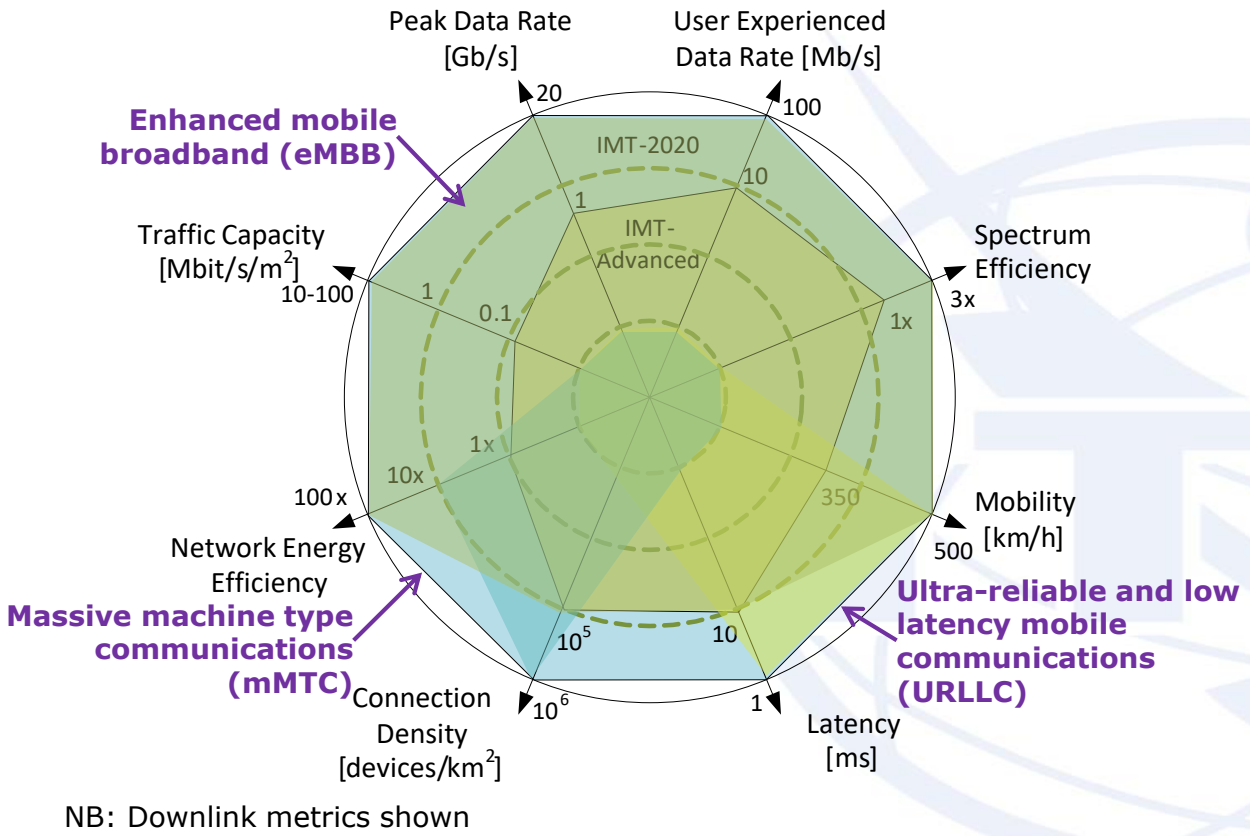
(*) Technology packages currently identified: Softwarization, FMC, ICN, (QoS)

Example of technology package: “Softwarization”

Area	Full title of document	Status (29 May 2018)	Approved/ Planned
Terms & definitions	Y.3100, “Terms and definitions for IMT-2020 network”	Published	13 Sept 2017
Management	Y.3111, “IMT-2020 Network Management Framework”	Published	13 Sept 2017
Management	Y.3110, “IMT-2020 Network Management Requirements”	Published	13 Sept 2017
Network Softwarization specifics	Y.3100-series Supplement 44, “Standardization and open source activities related to network softwarization of IMT-2020”	Published	14 July 2017
Network Softwarization specifics	Y.3150, “High level technical characteristics of network softwarization for IMT-2020	Published	13 Jan 2018
Requirements	Y.3101, “Requirements of the IMT-2020 network”	Published	13 Jan 2018
Frameworks	Y.3102, “Framework of the IMT-2020 network”	Approved	28 May 2018
Architecture	Y.IMT2020-arch, “Architecture of IMT-2020 network”	Ongoing	Oct 2018
Multiple slice support	Y.3112, “Framework for the support of Multiple Network Slicing”	Approved	28 May 2018
Orchestration for slices	Y.NSOM, “Network slicing orchestration and management:”	Ongoing	July 2018
Autonomic Management and Control	Y.AMC, ”Requirements and Architectural Framework for Autonomic Management and Control of IMT-2020 Networks”	Ongoing	July 2018
Network capability exposure	Y.IMT2020-CE-Req, “Requirements of network capability exposure in IMT-2020 networks”	Ongoing	Oct 2018
Network capability exposure	Y.IMT2020-CEF, “Network capability exposure function in IMT-2020 networks”	Ongoing	Q1 2019
Programmability	Y.IMT2020-ADDP, “Advanced Data Plane Programmability for IMT-2020”	Ongoing	Q1 2019
Business roles and models	Y.IMT2020-BM, “Business role-based models in IMT-2020”	Ongoing	July 2018

Distinguishing features and high level requirements of 5G/IMT-2020 networks

Gaps and challenges towards 5G/IMT-2020



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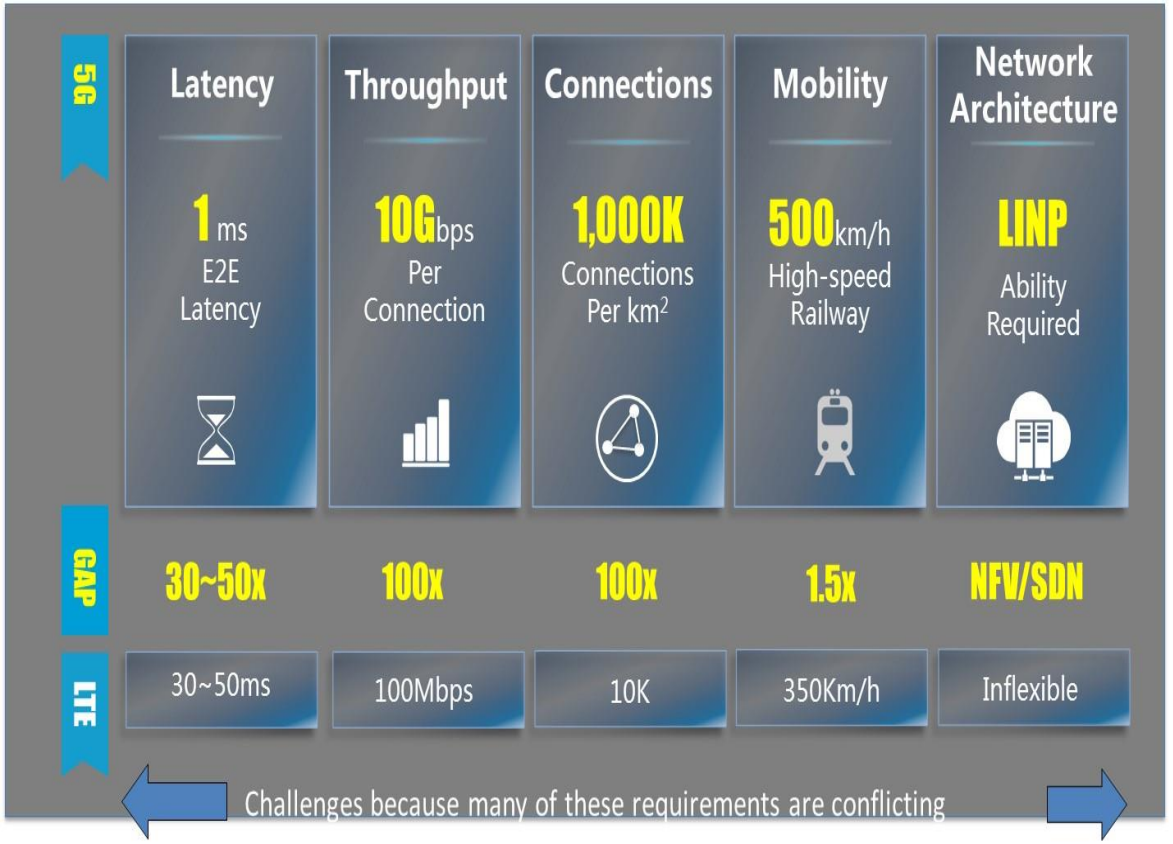


Source: NGMN 5G White Paper

Other network dimensions with gaps for 5G/IMT-2020 expectations:

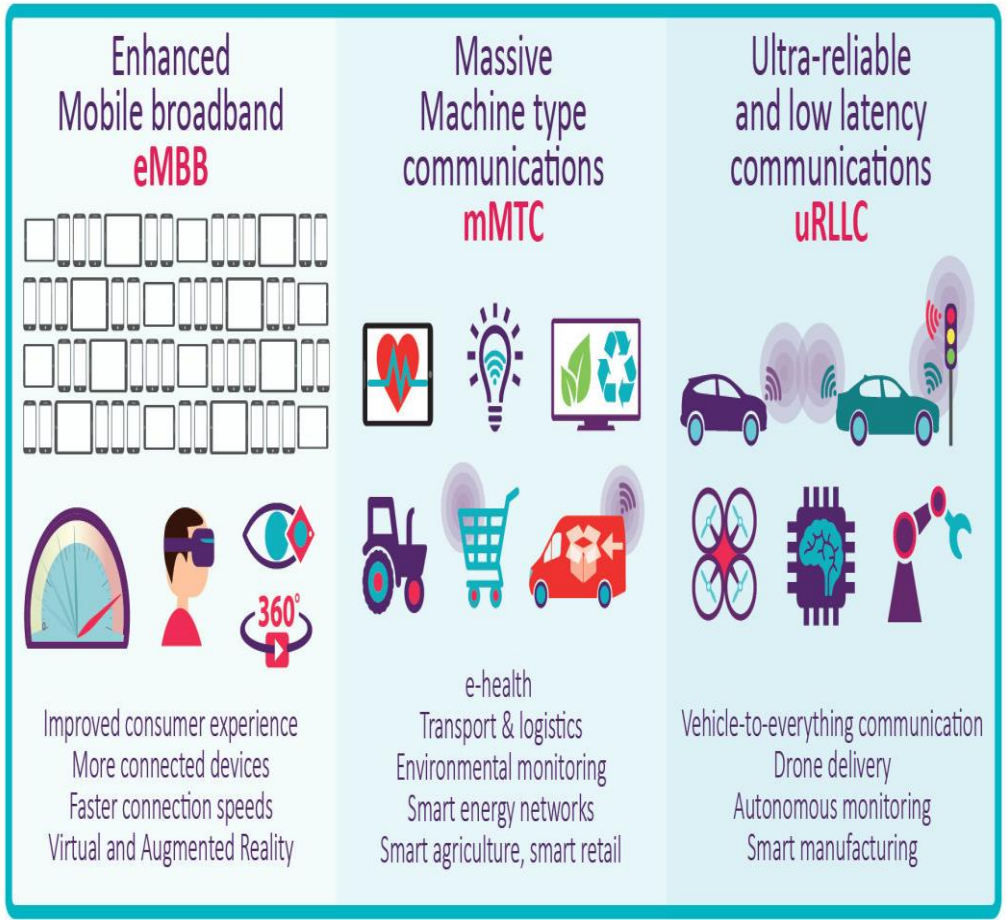
- business agility (diversity of services and business models)
- operational sustainability (end-to-end management and deployment, flexibility, scalability, energy efficiency)

5G/IMT-2020 gap analysis: examples of concerns from an architectural perspective

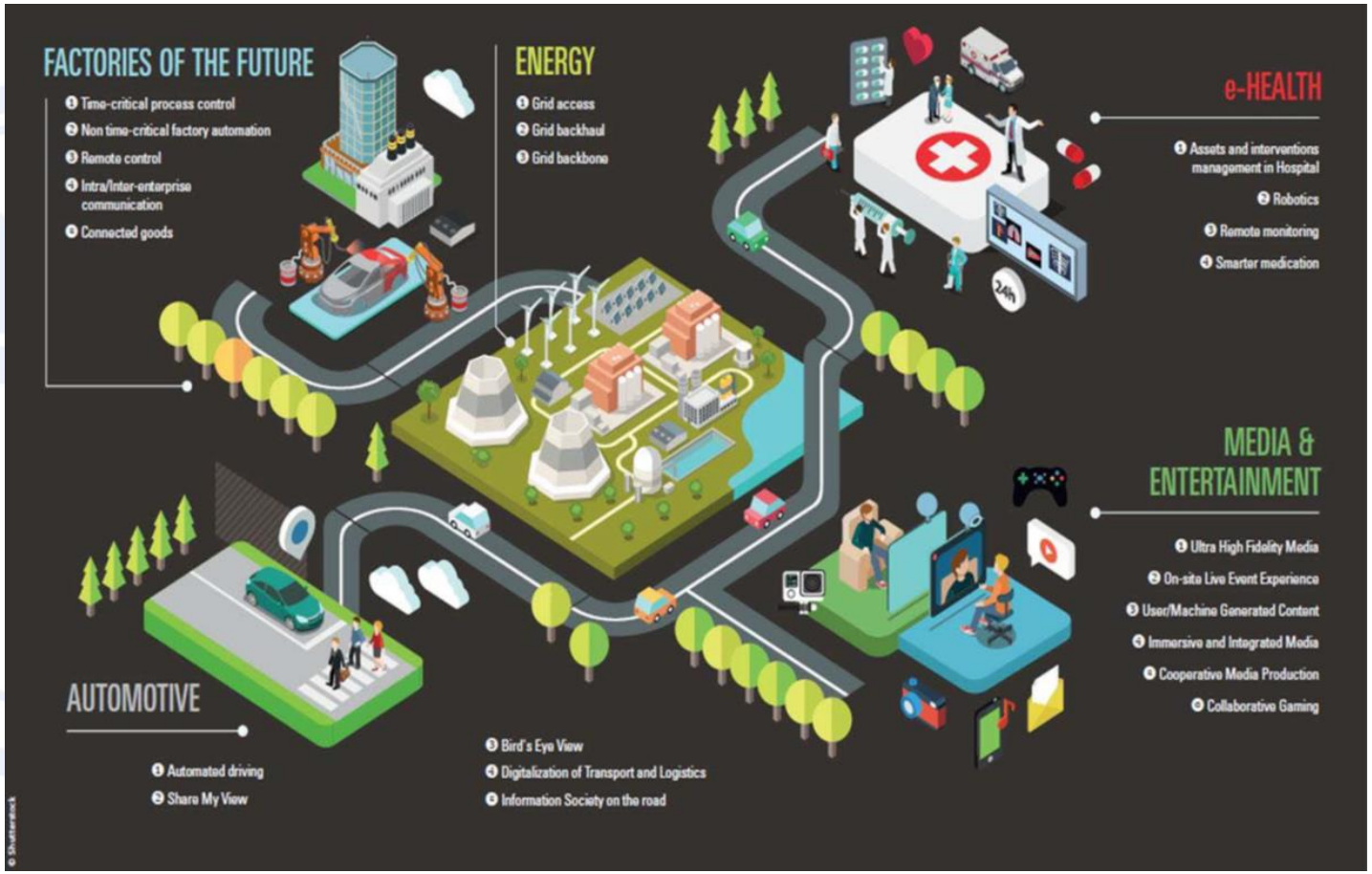
- Diverse bandwidth/data rate demands
- Complex connectivity model
- Application-aware and distributed network architecture (access agnostic common core with unified control functions)
- Mobile network optimized software architecture
- Data plane programmability
- Signalling complexity in massive MTC
- Signalling to reduce end-to-end complexity
- Energy efficiency
- Increasing service availability
- End-to-end network latency model
- End-to-end QoS framework
- Enhancement of privacy and security (and inclusion of «TRUST» as design principle)
- Enhanced identity management
- Multi-Radio Access Technology connectivity
- Fixed mobile convergence
- Flexible mobility
- Mobility management for distributed flat network
- End-to-end network management in a multi-domain environment
- OAM protocols

Source: Gap analysis deliverable of ITU-T FG IMT2020

5G/IMT-2020 as key driver for industrial and societal changes: enabler of a large variety of applications



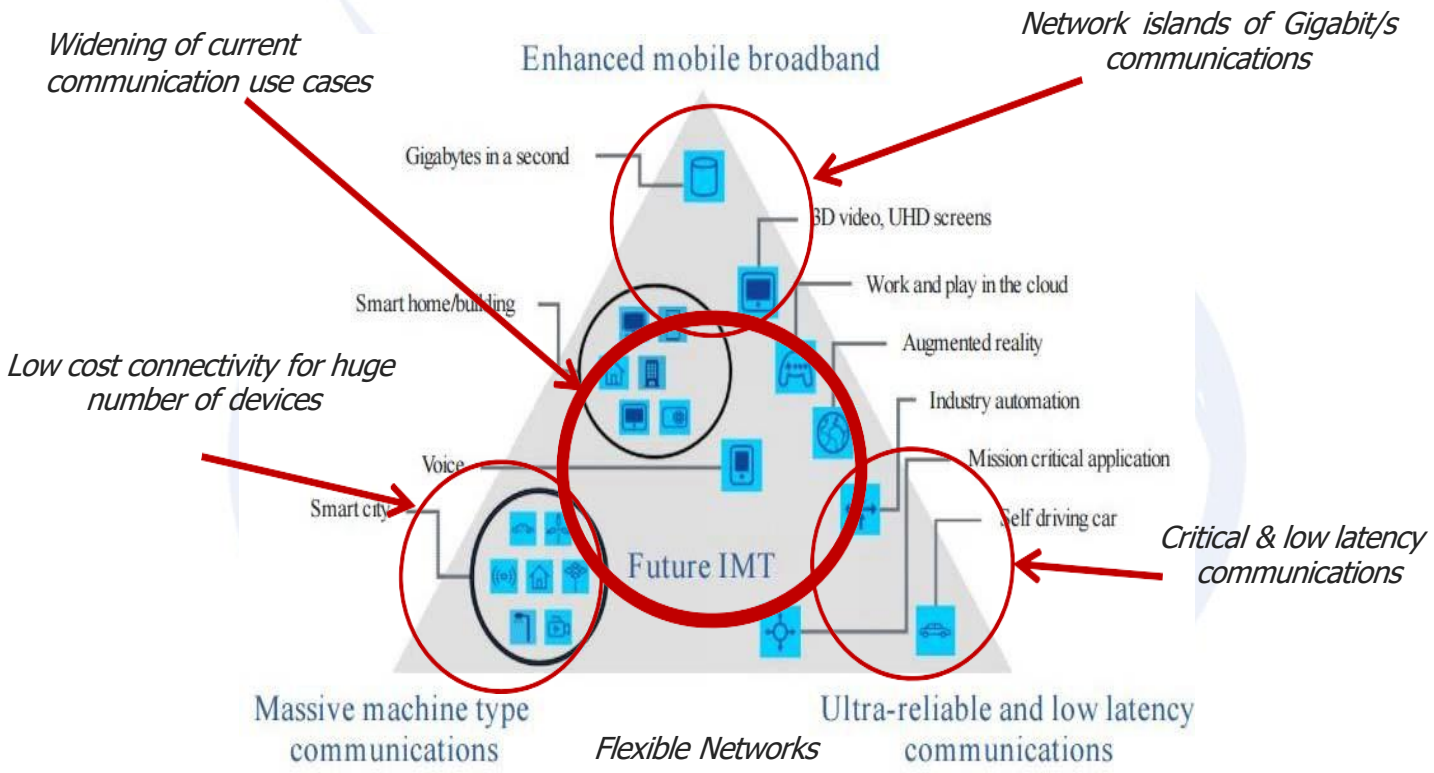
Source: Ofcom



Source: 5G Infrastructure Association, 5G Empowering vertical industries, White Paper

- ***Optimization and/or expansion of existing applications*** *(extended coverage, enhanced features)*
- ***New applications*** *(verticals and advanced applications enabled by technology integration)*

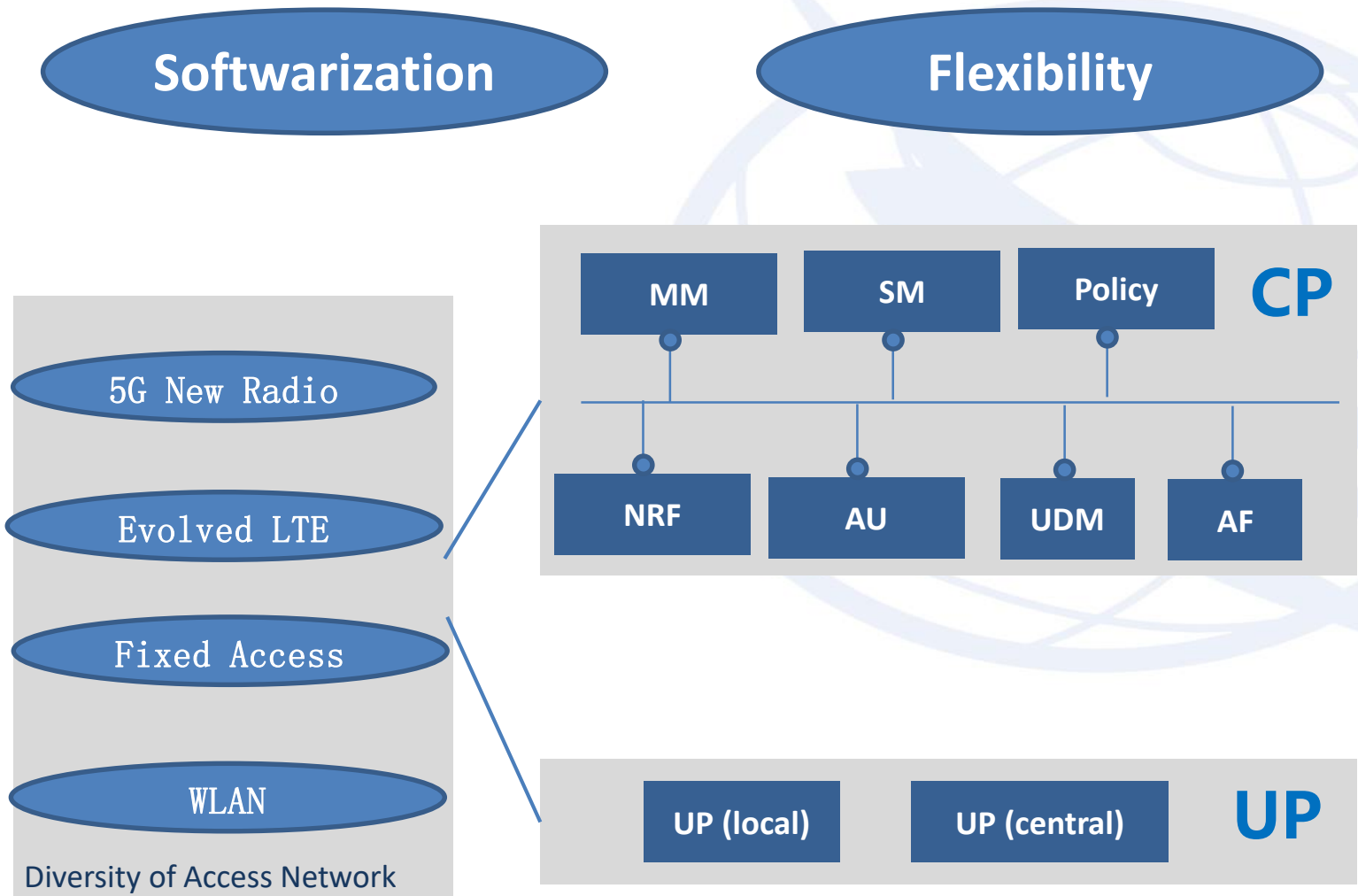
Diverse application-specific requirements to be supported



Source: ITU-R Rec. M.2083

5G/IMT-2020 objective:
to ensure flexibility and adaptation to diverse (and changing) requirements of applications
with maximum reusability of (common) network infrastructure capabilities
and efficient but open integration between application and 5G/IMT-2020 ecosystem (business models diversity)

5G/IMT-2020 vision - functional view



Source: China Mobile

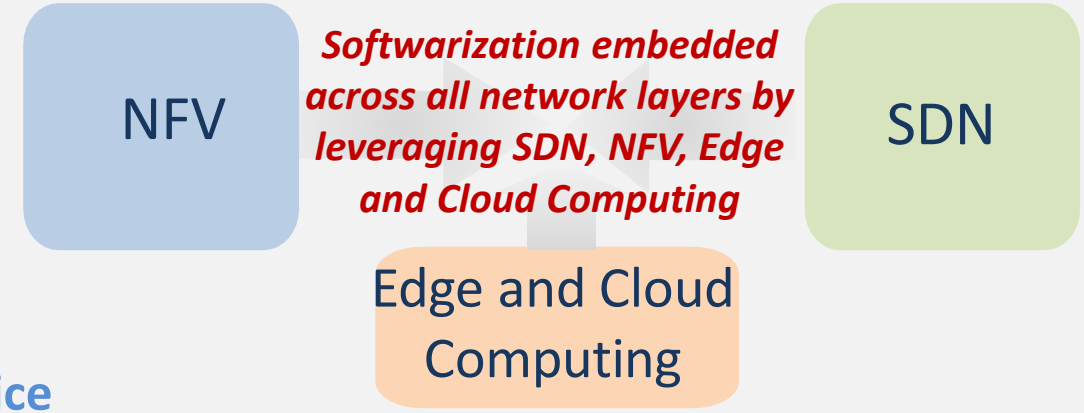
- Service-based architecture and functions interaction
- Modularization of functions
- Separation between Control Plane (CP) and User Plane (UP)
- Network Slicing
- Flexible User Plane
- Fixed Mobile Convergence (through converged Control Plane and simplified User Plane)

Network softwarization

Network softwarization [Y.3100]: ***Overall approach for designing, implementing, deploying, managing and maintaining network equipment and/or network components by software programming***

Key drivers of Network softwarization

- pervasive diffusion of ultra-broadband (fixed and mobile)
- increase of performance of HW at lowering costs
- growing availability of Open Source SW
- more and more powerful terminals and smart things
- actionable Big Data and AI/ML advances



Network softwarization is paving the way towards **X-as-a-Service**

- SDN Controllers, Virtual Network Functions and end users' applications all considered as "services"

Network functions become flexible

- New components can be instantiated on demand (e.g. dedicated network dynamic setup)
- Components may change location or size (e.g. deployment at edge nodes, resource reallocation)
- Communication paths may change (e.g. service aware networking, chained user plane functions)

Enablement of network/service architectures (re-)design, cost and process optimization, self-management

Network programmability but also **increased complexity** [network management impact]

See also ITU-T Y.3150

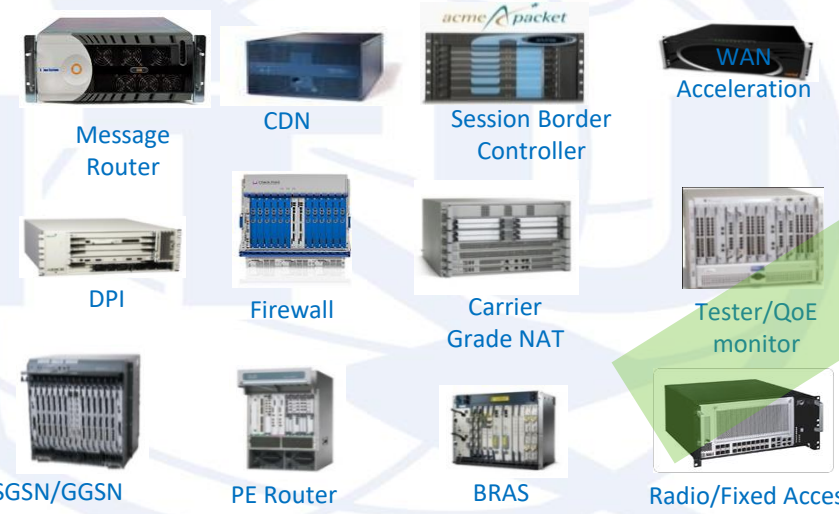
Network Functions Virtualization (NFV): ICT ecosystem disruption

NFV is about implementing network functions in software (programs) running on top of industry-standard hardware (instead of dedicated hardware)

NFV benefits

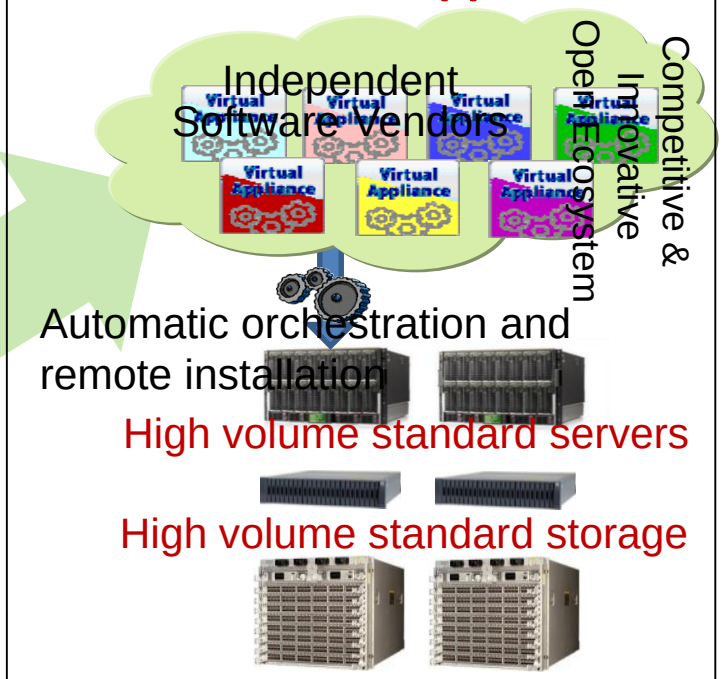
- **Reduced CAPEX and OPEX** (e.g. power consumption)
- **Increased efficiency** (several tenants on same infrastructure)
- **Flexibility** to scale up/down resources
- **Agility** (improved time-to-market to deploy new network services)
- **Lower dependency** on network vendors

Classical Network Appliance Approach



- Fragmented, purpose-built hardware
- Physical install per appliance per site
- Hardware development: large barrier to entry for new vendors, constraining innovation & competition

Network Functions Virtualisation Approach

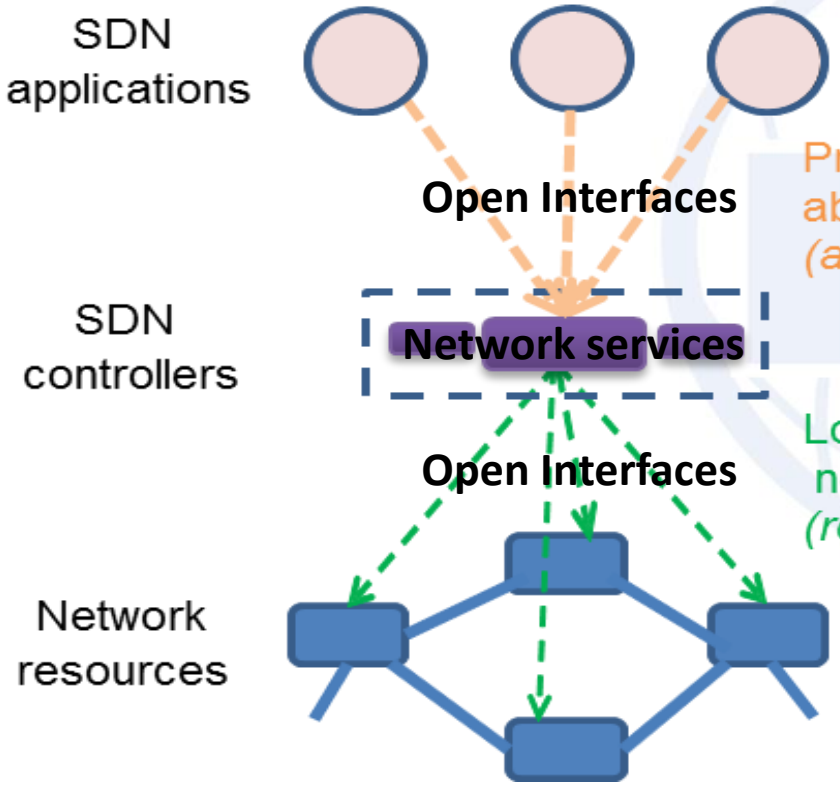


Some issues to be fully addressed, incl.

performance, co-existence, resilience, scalability, vendor integration

Software Defined Networking (SDN)

SDN is a set of techniques enabling to directly program, control and manage network resources, which facilitates design, delivery and operation of network services in a dynamic and scalable manner.



Programmatic control of abstracted network resources *(application-control interface)*

Logically centralized control of network resources *(resource-control interface)*

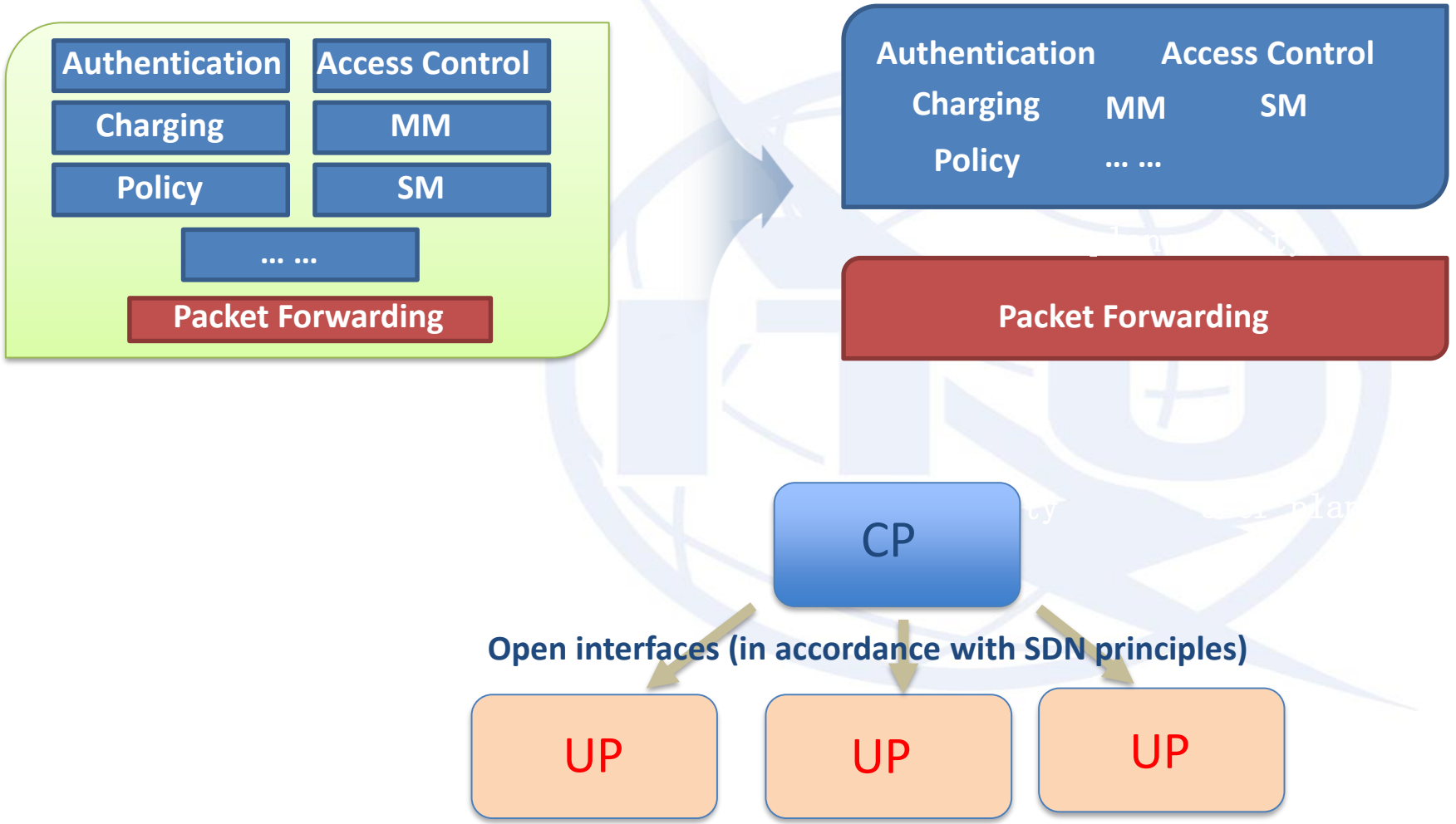
Concept of SDN

Source: ITU-T Y.3300

SDN benefits

- **Faster network business cycle**
- Acceleration of innovation and rapid adaptation to demand
- Increase in resource availability and efficiency of use
- **Customization of network resources** including **service-aware networking**

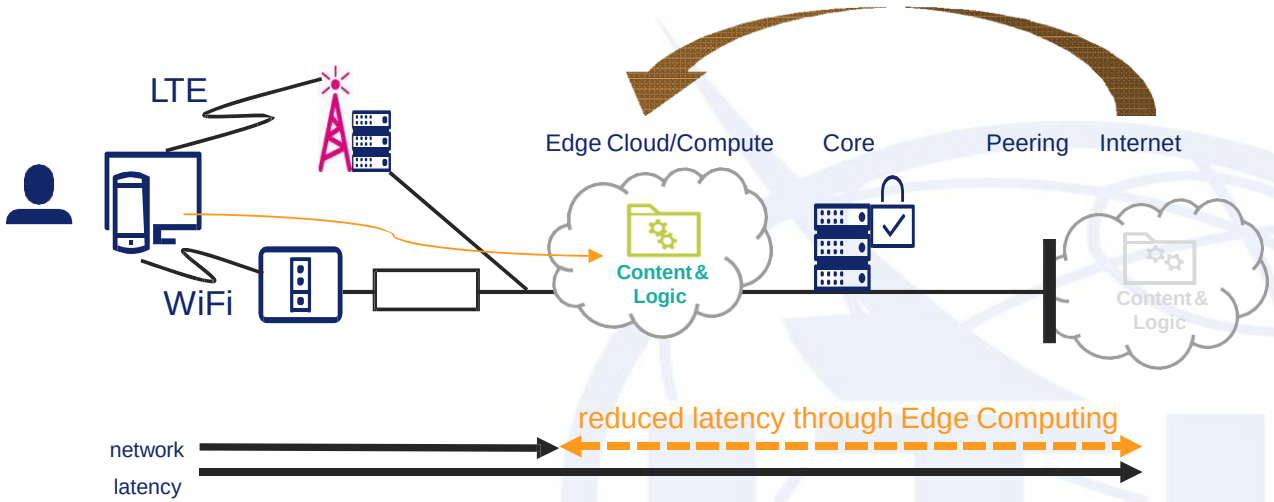
Separation between Control Plane and User Plane



- Scalability
- Independent evolution of both planes
- Flexible network function deployment

Different User Planes under control of a unified Control Plane

Edge Computing: computing and storage resources next to the user



Low latency applications

- Drones
- Self-Driving Cars
- Robotics

- Interactive Environments
- Virtual Reality
- Augmented Reality

- Voice Control
- Motion Control
- Eye-Tracking

[Ultra-low Latency < 20 ms]

Edge Computing benefits

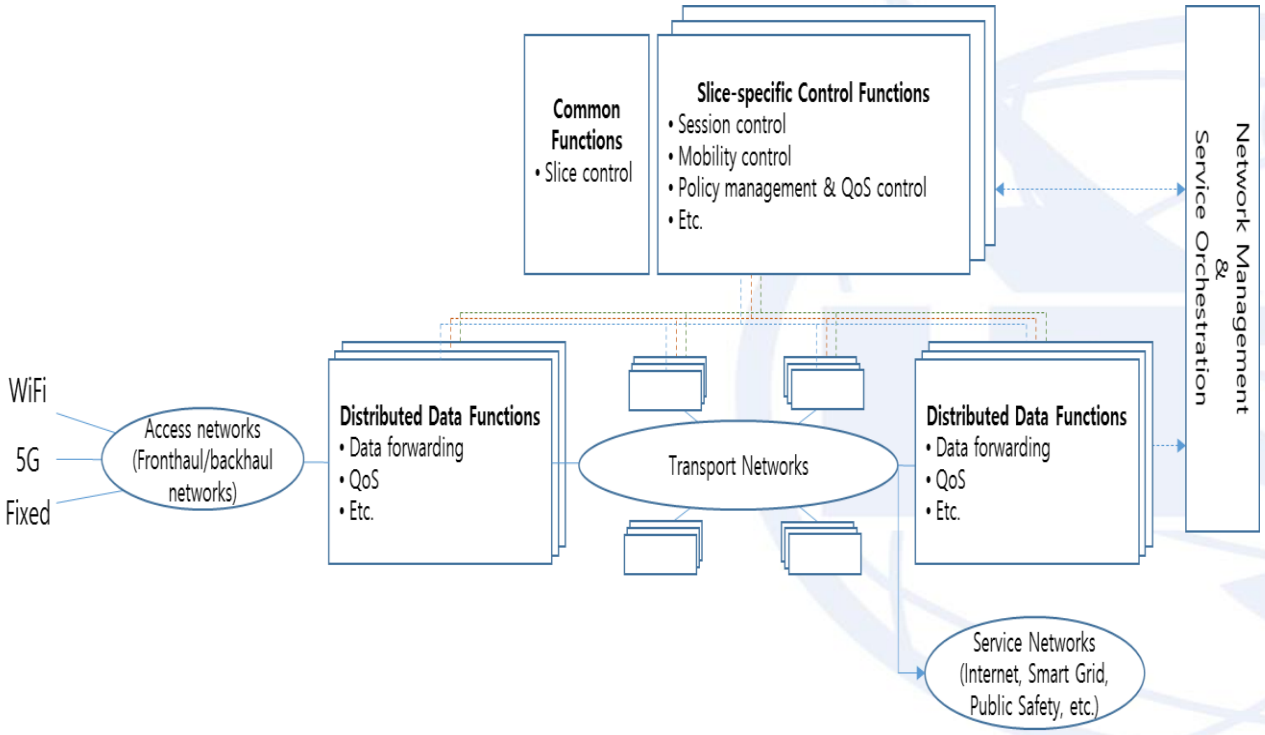
- **(Ultra-)low latency**: disruptive improvement of customer experience
- **Reduction of backhaul/core network traffic**: cloud services (e.g., big data) near to user
- **In-network data processing**

Some issues to be fully addressed

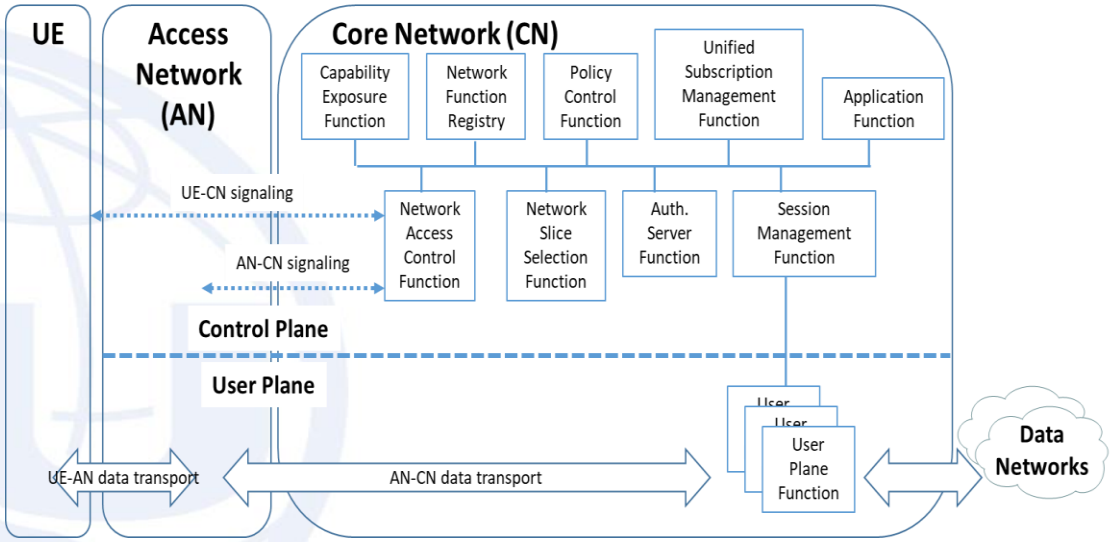
Resource limitation, more complexity, service continuity and mobility, …

Edge Computing … and more: Fog/Device Computing

A distributed functional architecture



Example of distribution of network functions

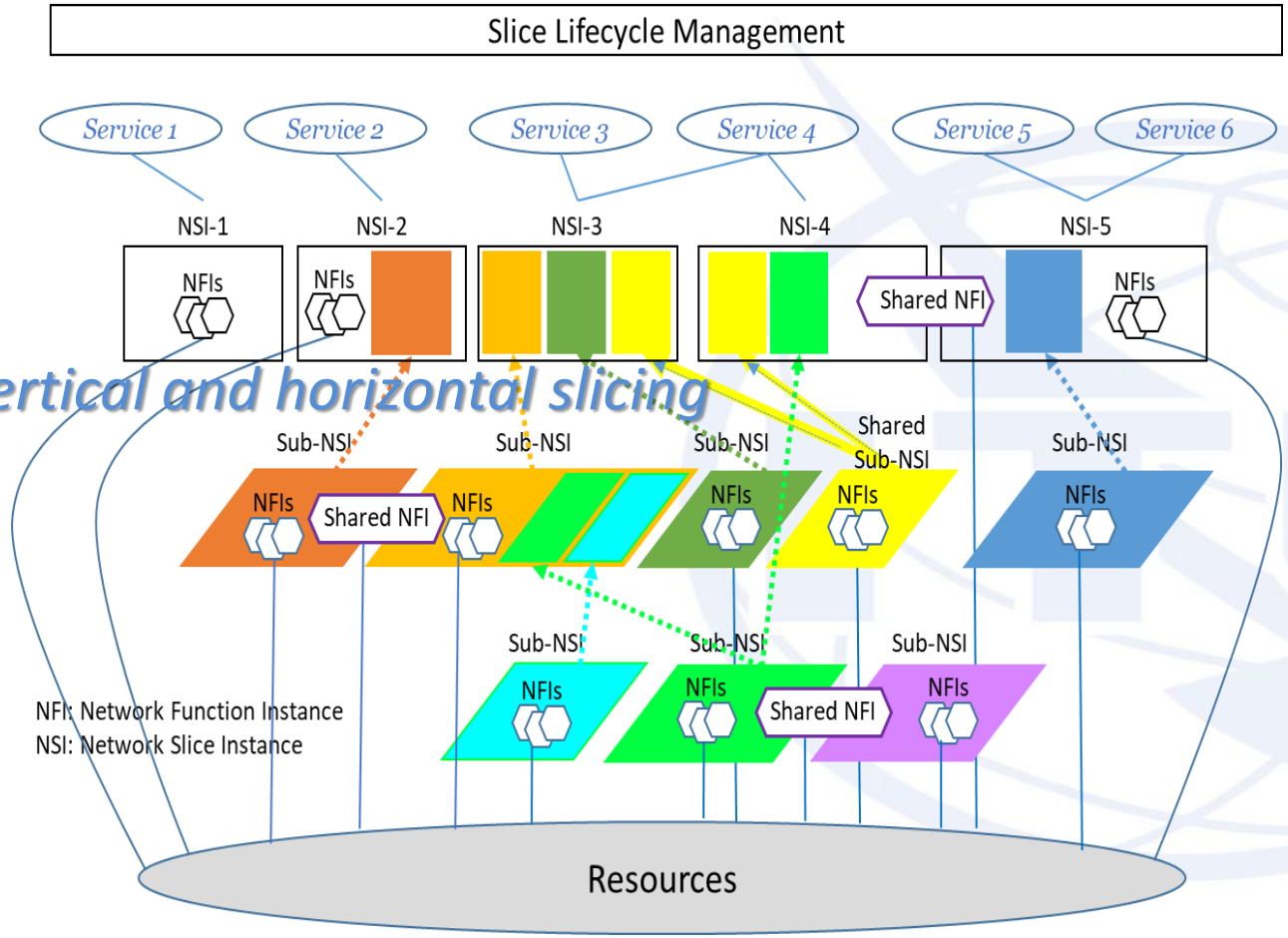


Framework of IMT-2020 network

Source: Y.3102

Provisioning of diverse network services by using network functions instantiated at the right place and right time

Network slicing: customized support of applications via dedicated logical networks over single infrastructure



Network Slicing conceptual overview

Slicing versus limitations of classical approaches
(« All-in-One » too complex, « Multiple networks » too costly)

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

Various dimensions of network slicing:

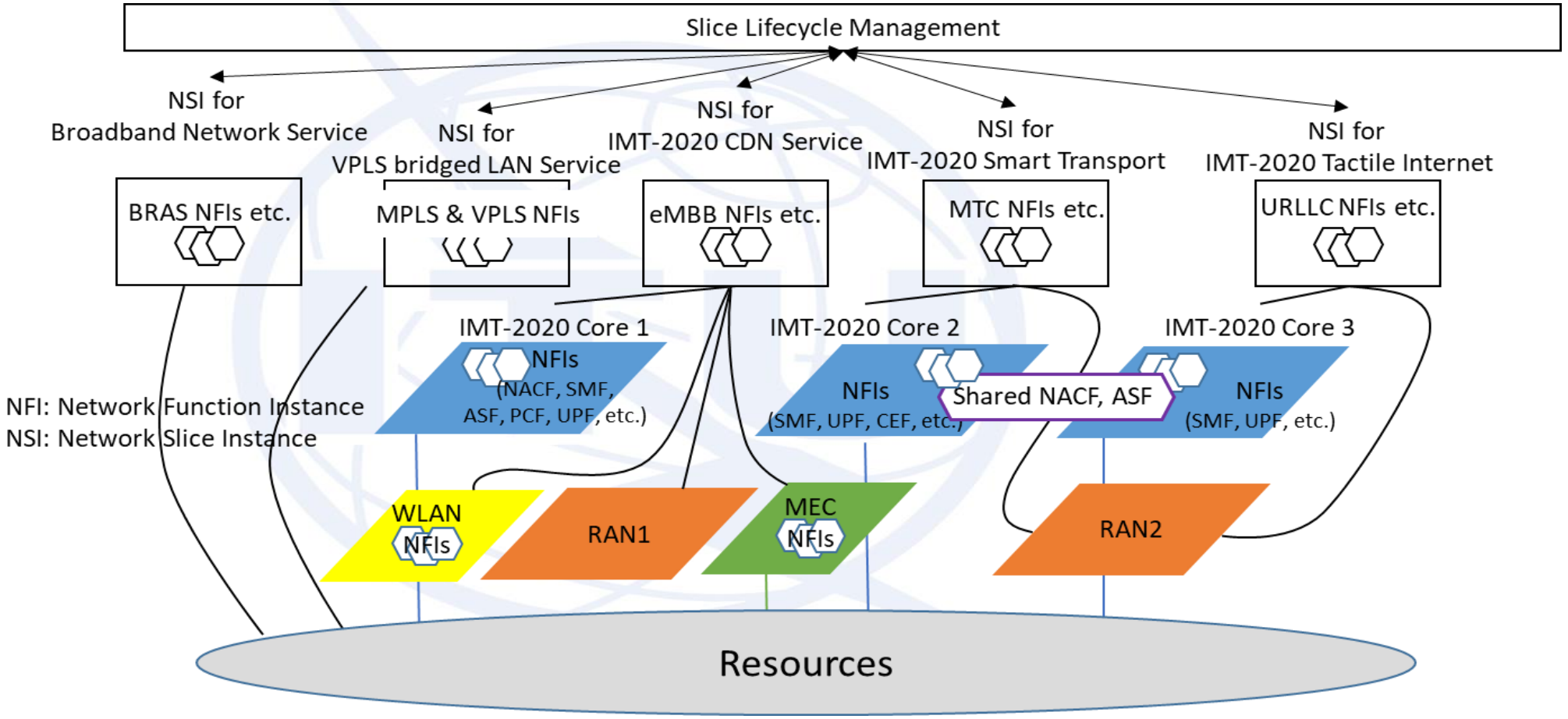
- slice types and blueprint (template)
- blueprint information (incl. service requirements, priority, resource isolation level, etc.)
- static versus dynamic slice instantiation
- service assurance and service integration
- recursive slicing (diverse business models)
- end-to-end versus per-domain slice (sub-network slices, incl. radio slicing), inter-domain slice federation
- per-slice network function chaining
- slice-specific and shared network functions
- slice lifecyle mgt (within globally optimal network mgt)
- UE-slice interaction (flexible slice selection, …)
- slice exposure of end-to-end slices to customers

5G/IMT-2020 network has to support flexible and dynamic management of network slices for various diverse applications, ensuring scalability, high availability and overall resource optimization

Example of IMT-2020 network from network slicing perspective

Vertical slicing

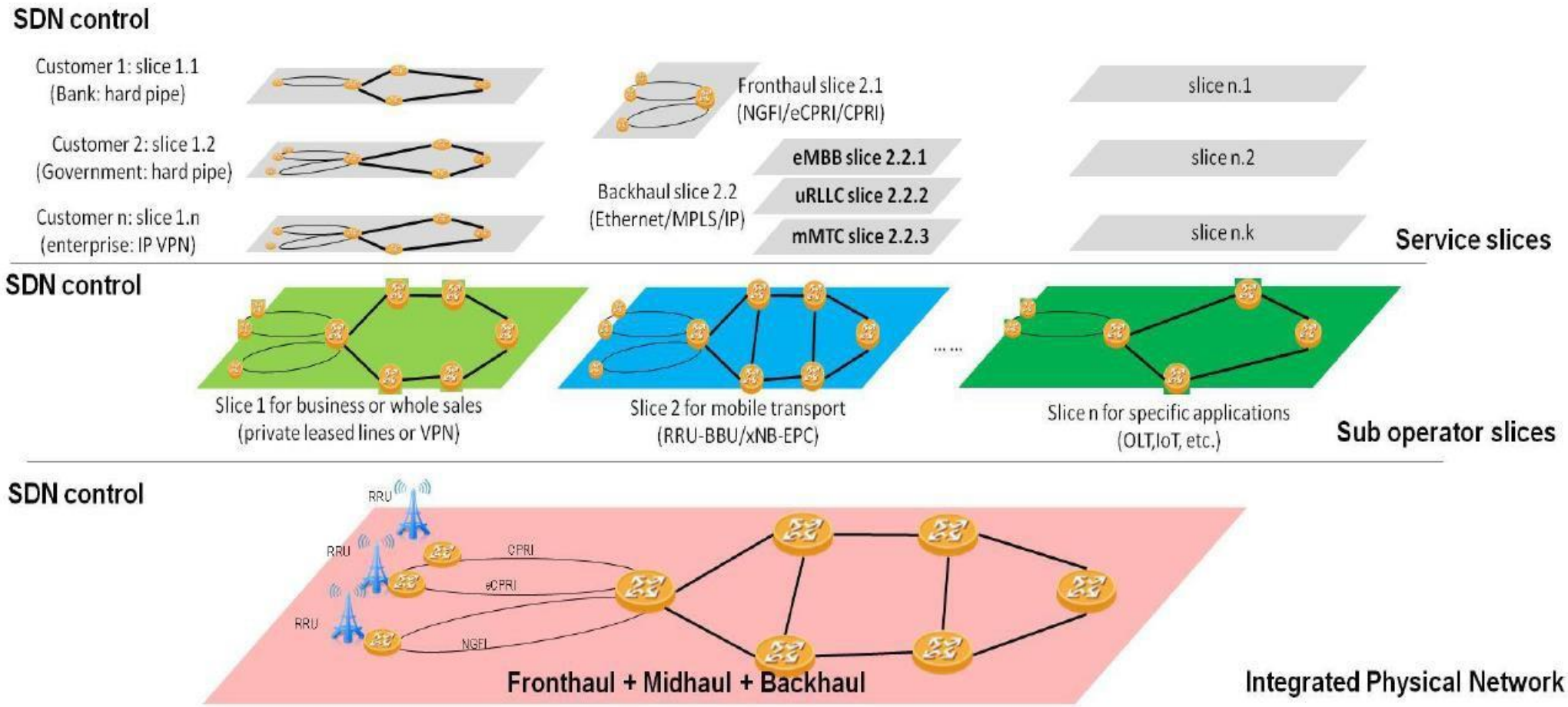
Horizontal slicing [in single slice or across multiple vertical slices]



Source: ITU-T Y.3102

Each slice is architected and optimized for specific application(s)
Each slide can have its own network architecture, engineering mechanisms and network provision

Application of slicing techniques to 5G/IMT-2020 network transport layer - ongoing study in ITU-T SG15



Source: China Mobile

Network management and orchestration

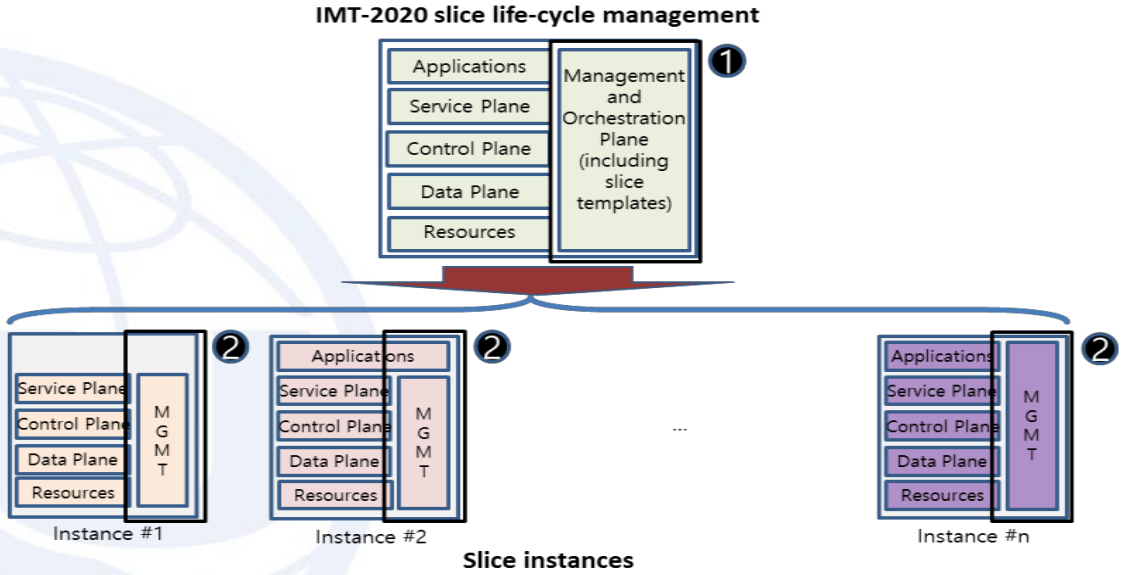
Softwarization impacts network management

- New types of failure (underlying infrastructure, virtualization)
- Dynamic deployment of components
- Increased accounting options
- Adaptation to required performances
- Wider spectrum of attacks (cloud infrastructure, sharing)

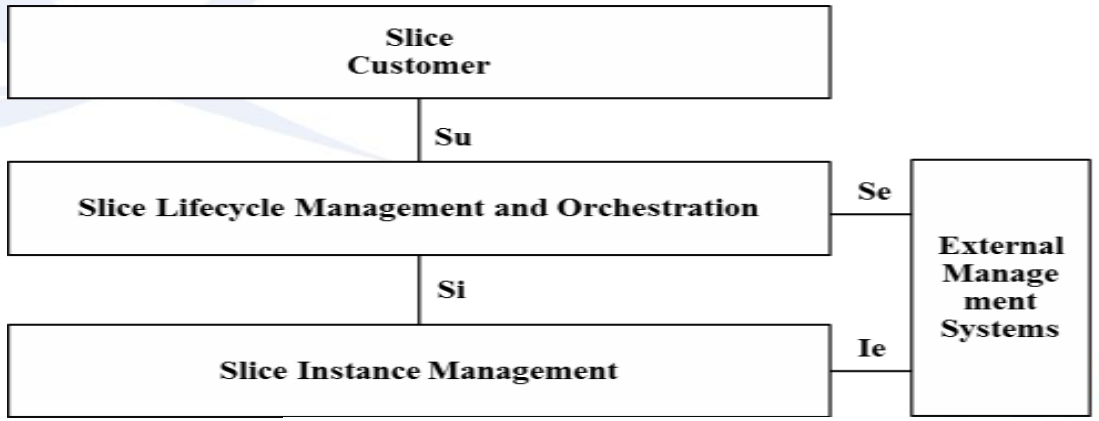
Overall network management and network slice lifecycle management

- Level of isolation between network slices
- Blueprint (Template) based network slices
- Network slice-specific policies and configurations
- Overall orchestration of physical and logical resources
- Integrated management of legacy networks

Network slice lifecycle management: conceptual framework

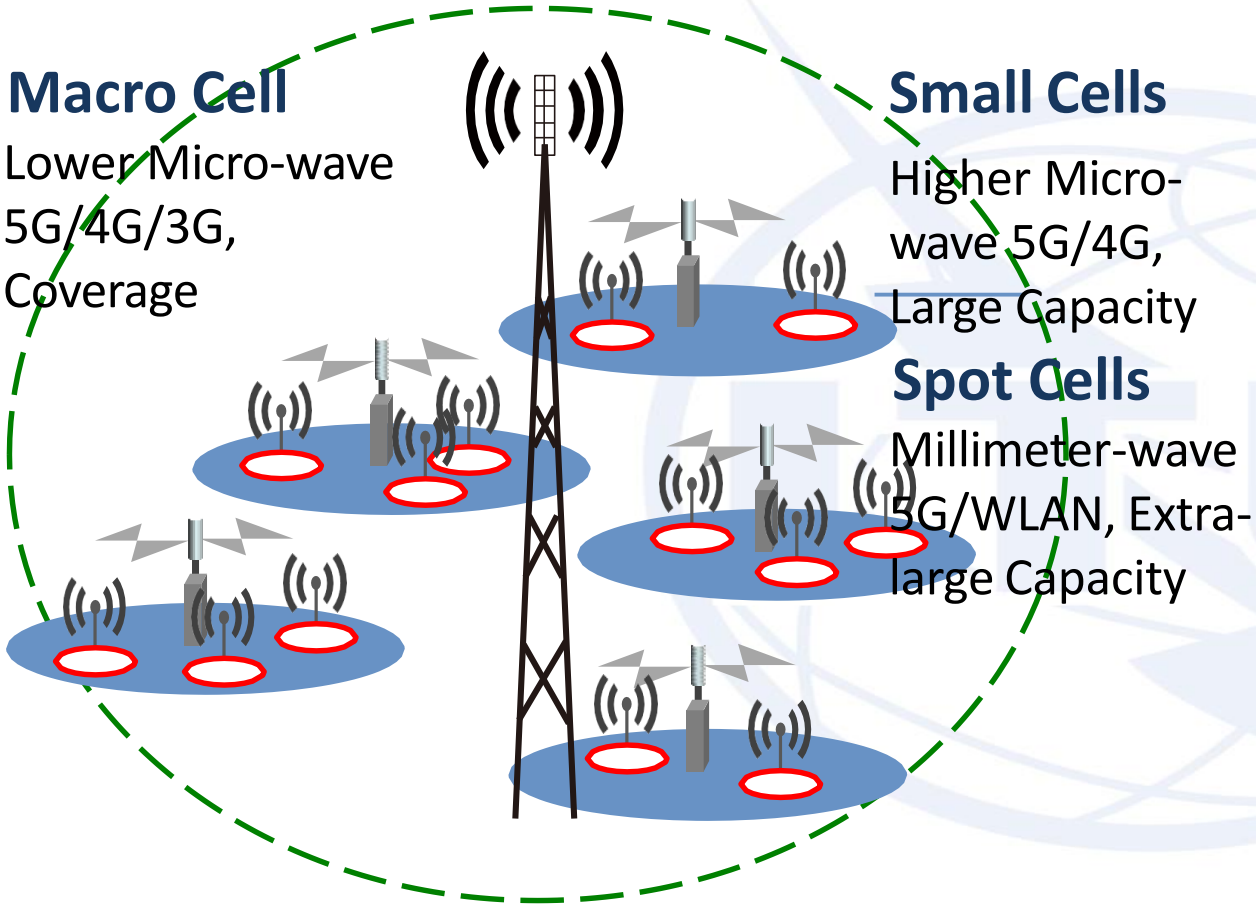


Network slice lifecycle management: functional view



Sources: ITU-T Y.3110, Y.3111

Heterogenous Access Networks and common Core Network

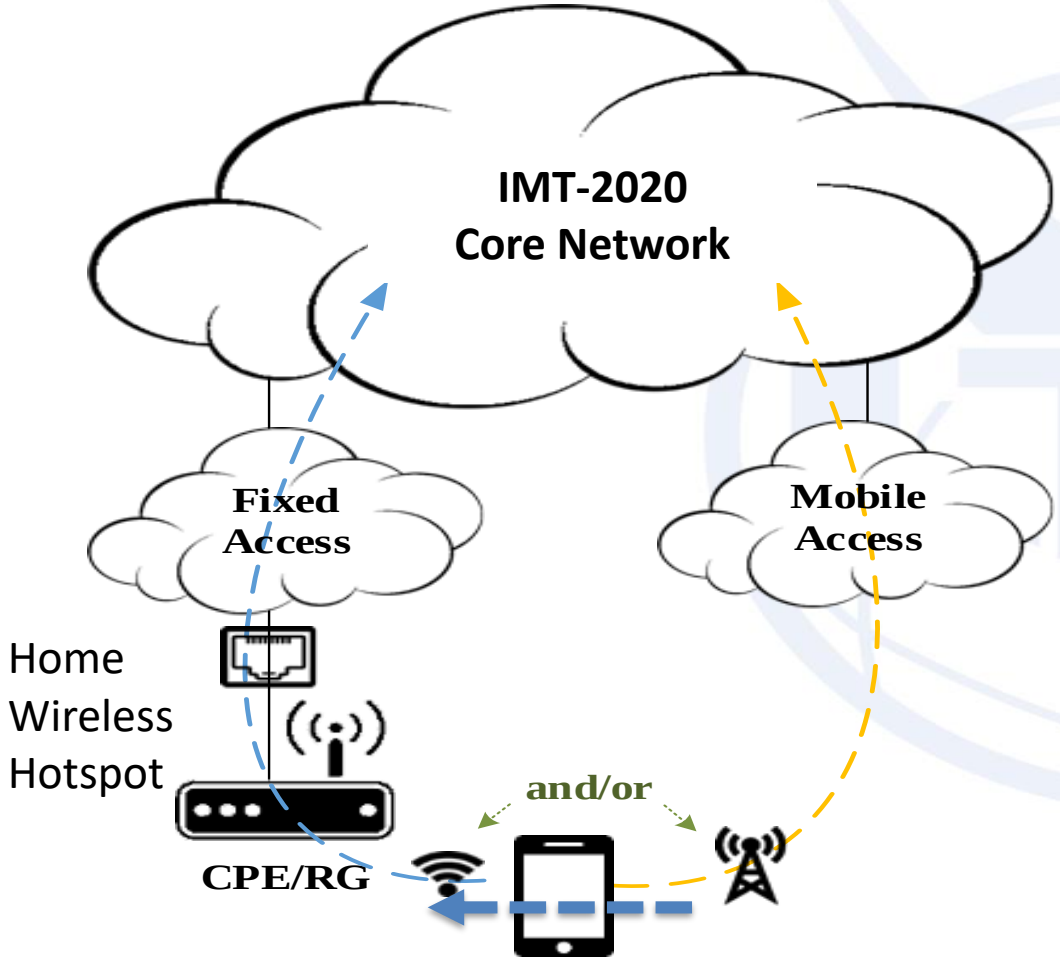


- **Integration of existing and new Access Networks (ANs)** (new RATs as well as evolved IMT-advanced RATs, Wireless LANs, fixed broadband, satellite)
- ANs for specific verticals may require specific network functions and technologies
- **Minimized AN-CN dependency with access-agnostic common CN** (common 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

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]

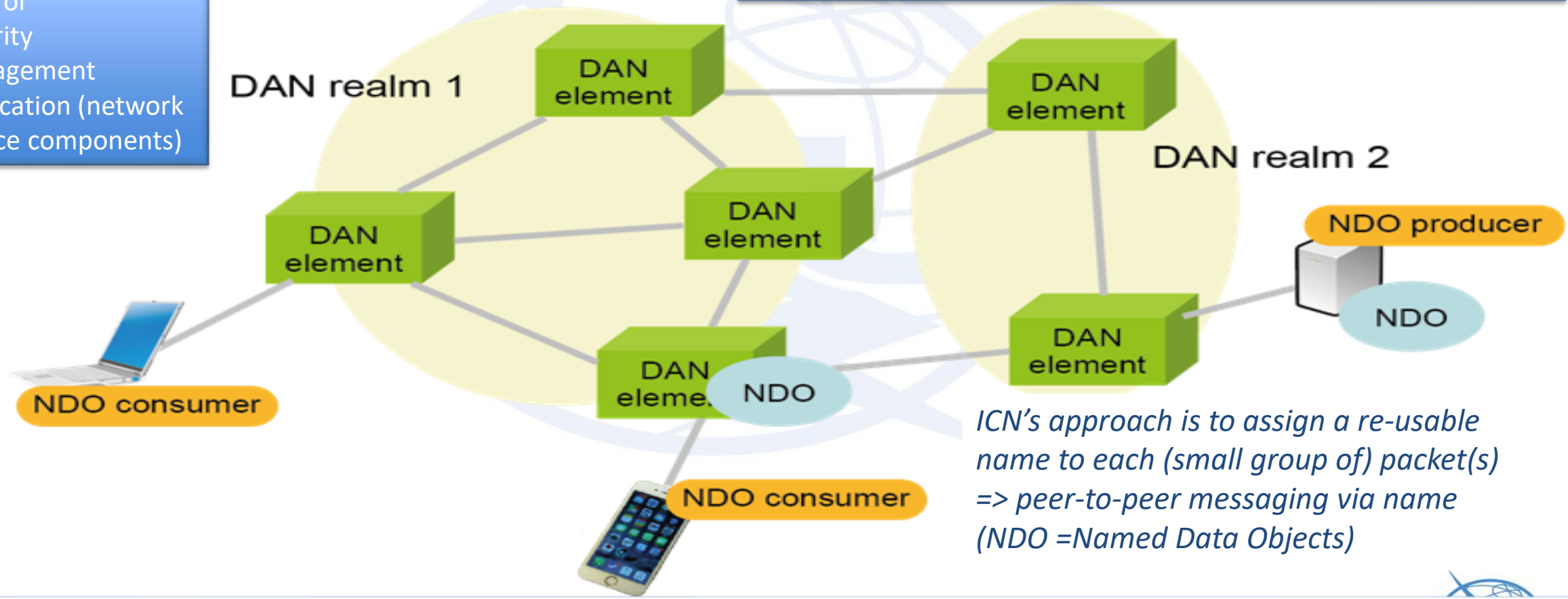
- Traffic switching, splitting and steering between fixed AN and mobile AN on network side
- Traffic switching, splitting and steering on user side
- Other requirements …

User Plane flexibility allows deployment of new networking paradigms: Data Aware Networking (DAN), aka Information Centric Networking (ICN)

ICN capabilities (Y.3071)

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

Novel approach to support ultra-low latency mobile broadband communications



ICN's approach is to assign a re-usable name to each (small group of) packet(s) => peer-to-peer messaging via name (NDO =Named Data Objects)

ITU-T Y.3071 *specifies DAN requirements and related capabilities, and describes functional components*

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)

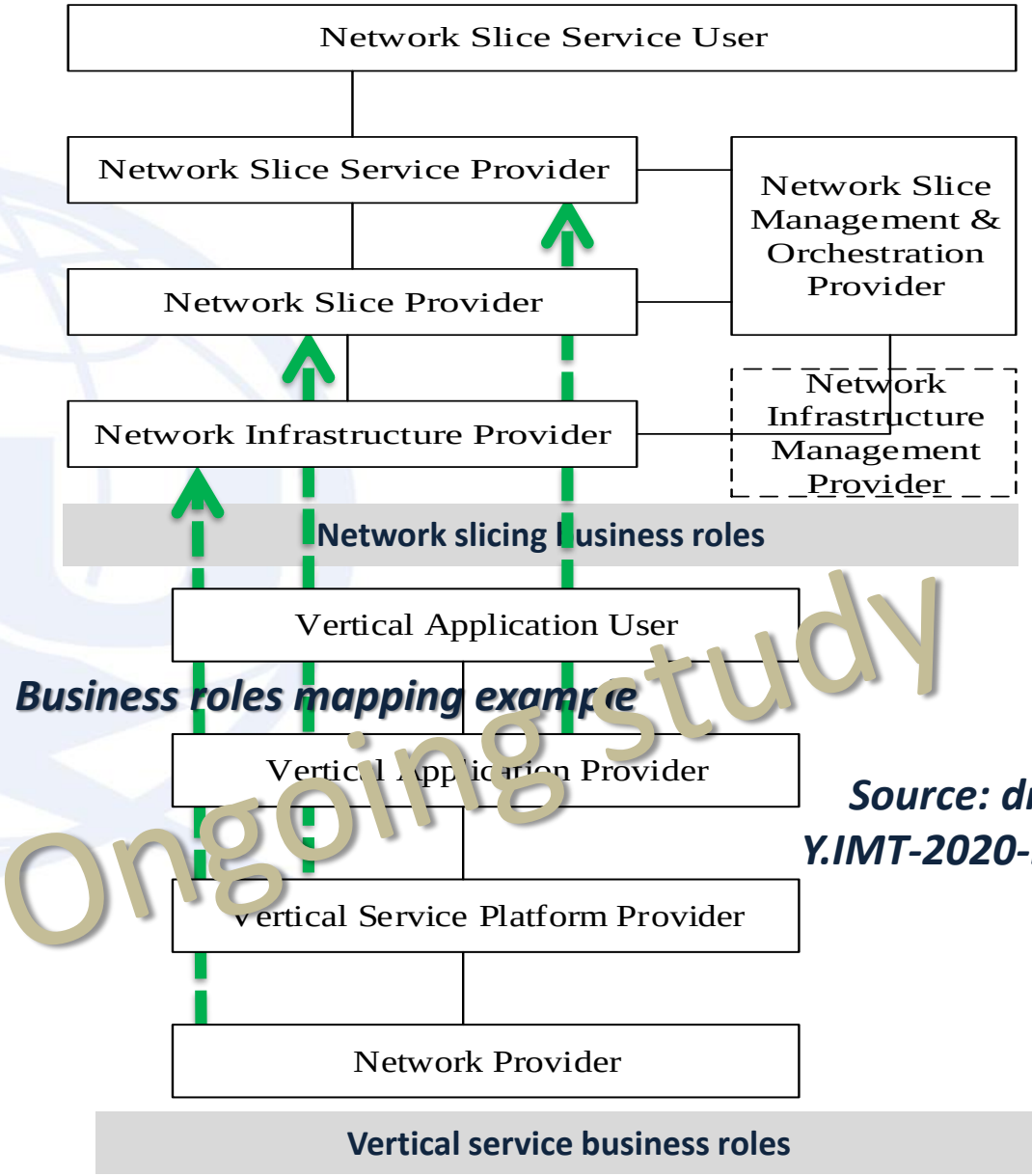
Ongoing ITU-T draft Rec. Y.IMT2020-BM

- 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"

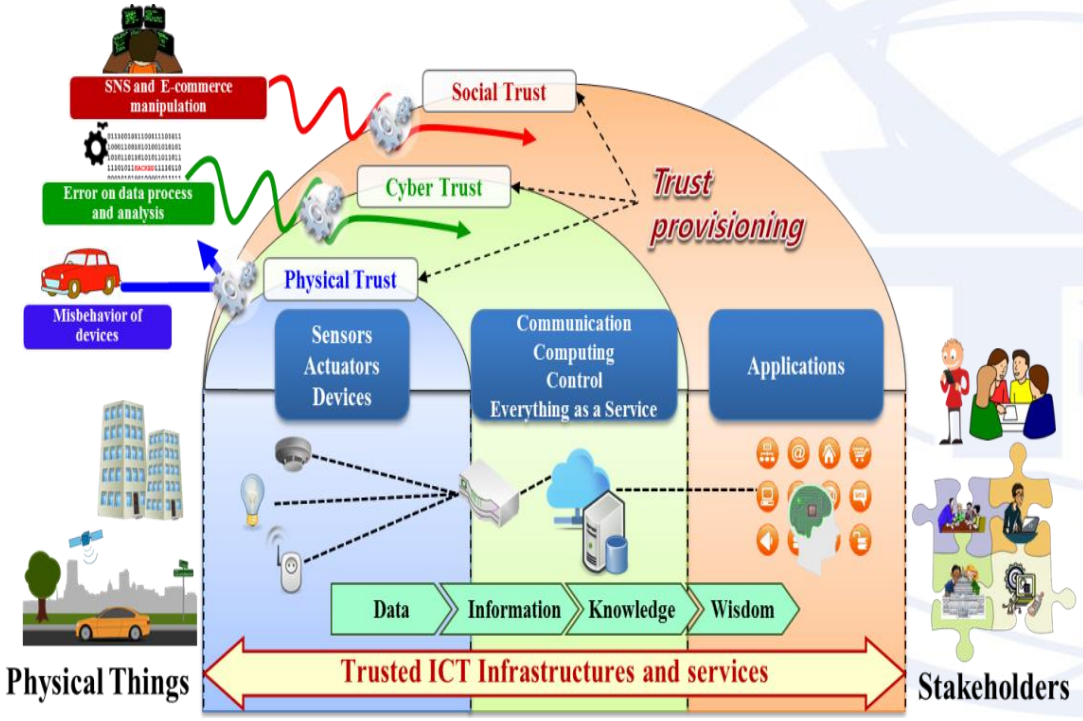


Source: draft Y.IMT-2020-BM

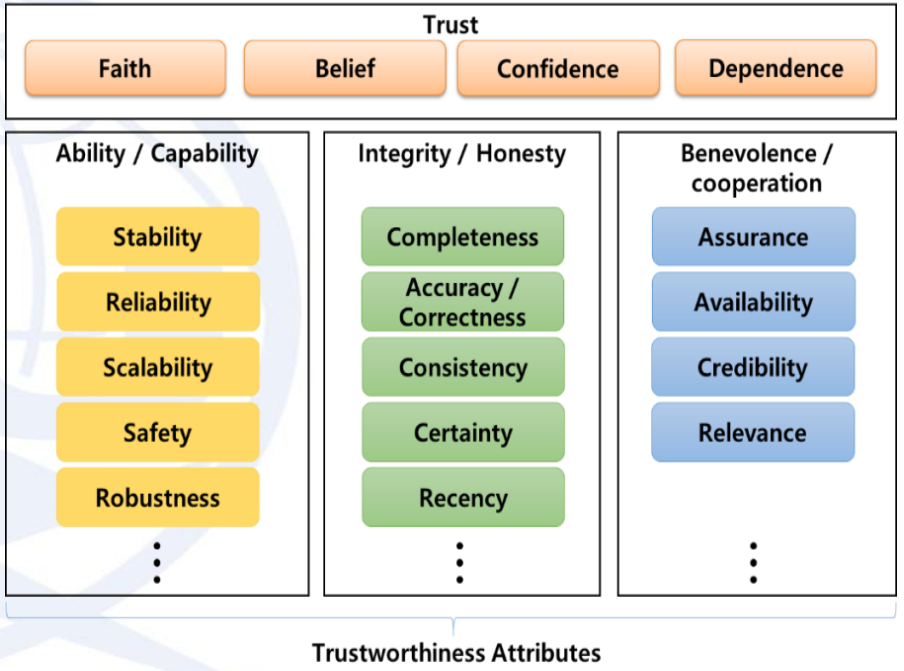
Trust in 5G/IMT-2020 networks

5G/IMT-2020 security threats demand shift away from "Assuming Trust" to "Positive Validation"

Concept of trusted ICT infrastructures and services [ITU-T Y.3052]



Attributes related to trustworthiness [ITU-T Y.3052]



Inputs to Trust in 5G studies (from SG13 achievements on "Trusted ICT infrastructures and services"):

- ***Y.3051*** *The basic principles of trusted environment in ICT infrastructure*
- ***Y.3052*** *Overview of trust provisioning in ICT infrastructures and services*
- ***Y.3053*** *Framework of trustworthy networking with trust-centric network domains*
- ***Y.3054*** *Framework of Trust-based Media Services*

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 Y.3012: Requirements of network virtualization for future networks Y.3300: Framework of software-defined networking Y.3320: Requirements for applying formal methods to software-defined networking Y.3321: Requirements and capability framework for NICE implementation making use of software-defined networking technologies Y.3322: Functional Architecture for NICE implementation making use of software-defined networking technologies **Y.3101: Requirements of the IMT-2020 network** **Y.3102: Framework of the IMT-2020 network** **Y.3110: IMT-2020 Network Management and Orchestration Requirements** **Y.3111: IMT-2020 Network Management and Orchestration Framework** **Y.3112: Framework for the support of Multiple Network Slicing** **Y.3130: Requirements of IMT-2020 fixed- mobile convergence** **Y.3150: High level technical characteristic of network softwarization for IMT-2020** **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 Y.3032: Configuration of node IDs and their mapping with locators in future networks Y.3033: Framework of data aware networking Y.3034: Architecture for interworking of heterogeneous component networks in FNs **Y.3071: Data Aware Networking (Information Centric Networking) – Requirements and Capabilities** **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 Y.3022: Measuring energy in networks
Socio-Economic aspects	Y.3013: Socio-economic assessment of future networks by tussle analysis Y.3035: Service universalization in future networks
Smart Ubiquitous Networks	Y.3041, Y.3042,Y.3043,Y.3044,Y.3045

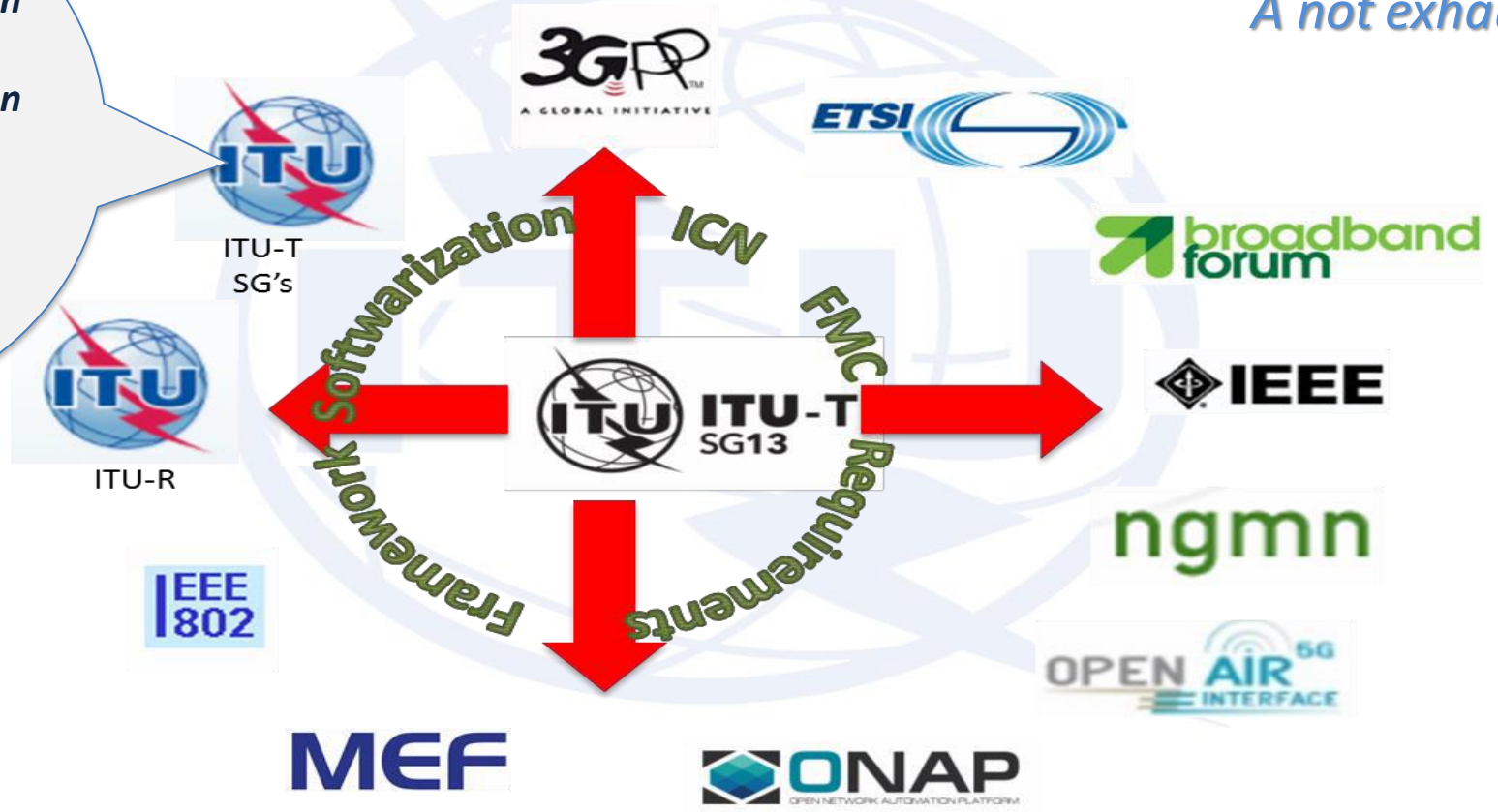
Conclusions

ITU-T SG13 relationships with 5G related SDOs, Consortia, Alliances, Fora

SG2: collaboration on Management
SG5: collaboration on Energy Efficiency

and obviously collaboration with SG11, SG15, SG17

A not exhaustive picture



Source: adapted from SG13 Chairman's presentation at 6th SG13 Regional Workshop for Africa, Abidjan, 26-27 March 2018

The complex 5G standardization landscape - draft list of key stakeholders and focus

(Source: adaptation from one contribution to May 2017 TSAG)

SDO name	Focus
3GPP (3rd Gen Partnership Project)	Core Network and Terminals
3GPP	Radio Access Network (RAN)
3GPP	Service and System Aspects
BBF (Broadband Forum)	Architecture and Migration
BBF	Routing and Transport
BBF	Wireless-Wireline Convergence
ETSI (European Telecommunications Standards Institute)	ISG MEC
ETSI	ISG NFV
ETSI	Millimetre Wave Transmission
GSMA (GSM Association)	Network 2020
IEEE (Institute of Electrical and Electronics Engineers)	Next Generation Fronthaul Interface (1914) Working Group
IEEE	Time-Sensitive Networking for Fronthaul - 802.1cm
IETF (Internet Engineering Task Force)	Deterministic Networking - DETNET
IETF	Distributed Mobility Management - DMM
IETF	Service Function Chaining - SFC
ITU-T	(Non-radio) Network and Service aspects
ITU-R	Radio aspects
MEF (MEF Forum)	Lifecycle Service Orchestration
MEF	Technical Committee, 5G Transport
NGNM (Next Generation Mobile Networks)	5G Work Programme
OASIS	TOSCA
oneM2M	Machine-to-Machine technology
ONF (Open Networking Foundation)	Architecture
ONF	Mobile Networks
SCF (Small Cell Forum)	Small Cells
TMF (TM Forum)	Zoom

Open Source Organization Name	Focus
OAI (Open API Initiative)	API Description Format
OCP (Open Compute Project)	Networking
ODL (Open Daylight)	Open SDN Platform
ON.Lab (Open Networking Lab)	Central Office Re-architected as a Data Center - CORD
ON.Lab	Open Network Operating System - ONOS
ONAP (Open Network Automation Platform)	Merger of Open Source ECOMP and OPEN-O
OpenStack	Private and Public Cloud Software (Neutron Project)
OPNFV (Open Platform for NFV)	Network Function Virtualization Components
OSM (Open Source Mano)	Management and Orchestration software

Cooperation among standards development organizations

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

Participation at common events, joint sessions, workshops;
exchange of views (liaisons and other ways) and sharing of roadmaps

Third annual ITU IMT-2020/5G Workshop and Demo Day (2018): Geneva, 18 July 2018
https://www.itu.int/en/ITU-T/Workshops-and-Seminars/201807/Pages/Programme.aspx

ITU-T SG13 supervises the "Joint Coordination Activity on IMT-2020" (JCA-IMT-2020)

- To promote high-level coordination in IMT2020 standardization
- A global IMT-2020 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 SDOs and Fora
- Mailing list for discussion and info sharing: **https://www.itu.int/en/ITU- T/jca/imt2020/Pages/subscription.aspx**

Conclusions

- **5G is challenging but progressing with high pace**
  - An immense field of development, involving a large number of technologies
  - A number of SDOs, and innumerable fora, alliances, consortia and projects work on it
- **Cooperation among the different stakeholders is essential**
  - ITU-T SG13 has established relationships to contribute to a coordinated development of 5G standards specifications
  - The 5G standardization process is expected to be inclusive for diverse communities (e.g. different vertical industries (IoT), regions and countries with different contexts of development) - in this context, as one of its missions, ITU-T SG13 works to include requirements and interests of the developing countries in technical standardization
  - ITU-T SG13 is building links with the research community, including via the creation of a new Focus Group on «Machine Learning for Future Networks including 5G» to study potential application of ML-based mechanisms in 5G/IMT-2020 networks
  - The JCA- IMT2020 is promoted as platform for coordination and information sharing across the 5G/IMT-2020 standardization arena.

Thank you very much for your attention

Backup information

FMC technology package

Area	Full title of document	Status 29 May 2018	Approved/ Planned
Requirements for FMC	Y.3130 Requirements of IMT-2020 fixed- mobile convergence	Approved	13 Jan 2018
Architecture 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 management	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

ICN technology package

Area	Full title of document	Status 29 May 2018	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 47 “Information-Centric Networking - Overview, Standardization Gaps and Proof-of-Concept	Approved	18 April 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	July 2018

QoS technology package (under consideration)

Area	Full title of document	Status 29 May 2018	Approved/ Planned
QoS	IMT-2020 network QoS monitoring architectural framework	Ongoing	July 2018