5G standards:
ITU IMT2020 and the first Italian deployments

Athens, 11 October 2019

ITU-T SG13: Future networks, with focus on IMT-2020, cloud computing and trusted network infrastructures

- Future networks such as IMT-2020 networks (non-radio related parts)
- Cloud computing
- Big Data
- Trusted network infrastructures

In addition explore new areas like

- AI and machine learning
- U-learning
- A path from information to knowledge centric networking

IMT2020/5G focus for Study Group 13: Softwarization, Fix Mobile Convergence, Trust and Data Aware Networking

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

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

ITU-T SG13 deliverables related to IMT-2020

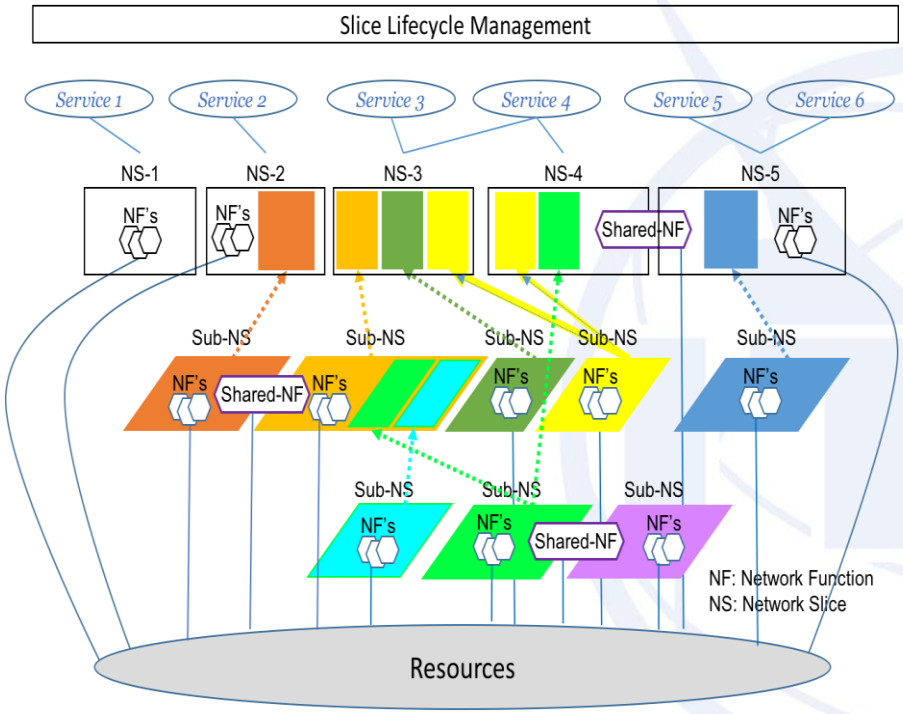
Domain	Approved Recommendations
General	Y.3100: Terms and definitions for IMT-2020 network
Services, Architecture and Management	Y.3011: Framework of network virtualization for future networks Y.3012: Requirements of network virtualization for future networks Y.3300: Framework of software-defined networking 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.3103: Business Role-based Models in IMT-2020 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.2072: Framework of Energy Sharing and Trading Platform Y.3022: Measuring energy in networks
Trustworthy Networking	Y.3051: The basic principles of trusted environment in information and communication technology infrastructure Y.3052: Overview of trust provisioning for information and communication technology infrastructures and services Y.3053: Framework of trustworthy networking with trust-centric network domains
Smart Ubiquitous Networks	Y.3041, Y.3042,Y.3043,Y.3044,Y.3045

Orthogonal view: technical packages for Softwarization, FMC, ICN, QoS

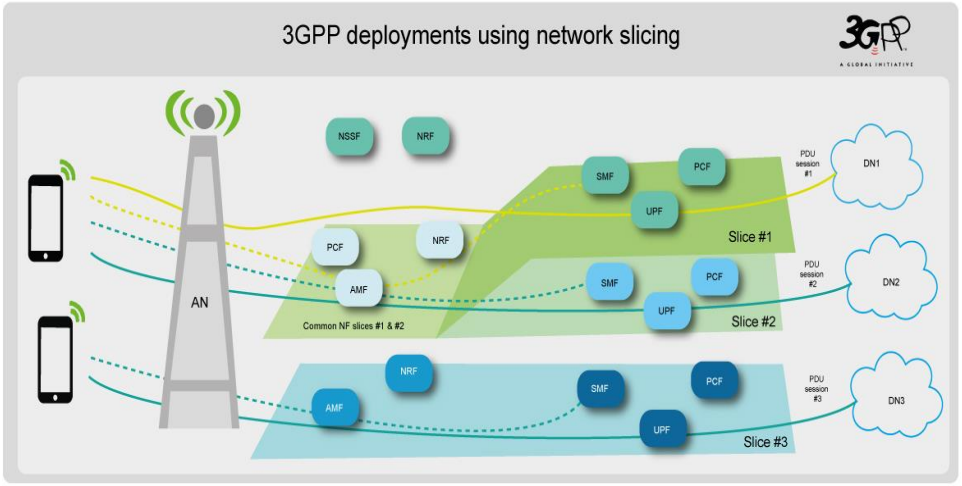
SG13 Studies related to core functions

Y.3101, Y.3102, Y.3103, Y.3110, Y.3111, Y.3112, Y.3150, supplement 44

Conceptual View (Y.3102)



3GPP network from network slicing perspective



Source: 3GPP

Y.3111, Y.3112: interaction between slice management and slice instance management

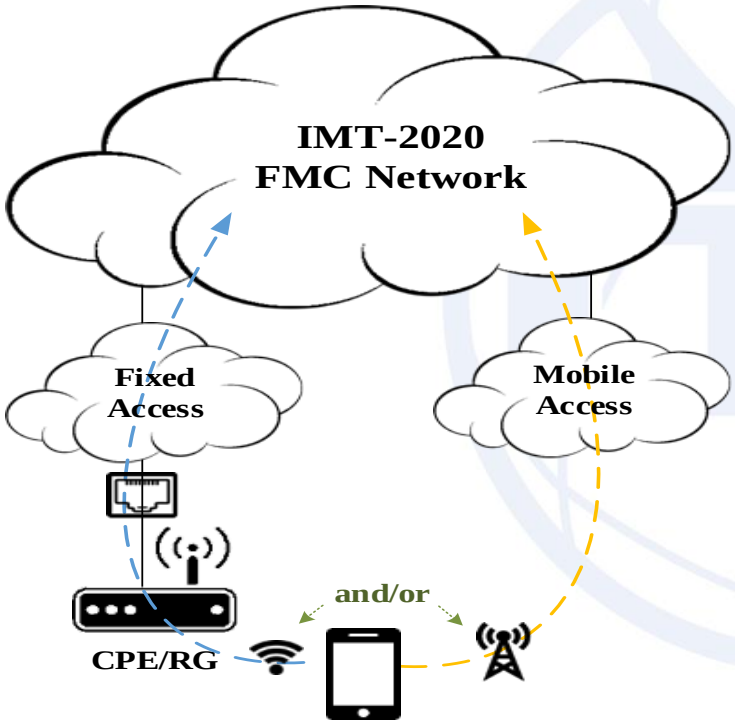
Softwarization related draft recommendations in progress: Multi-layer Multi Domain, Multi Technology Orchestration, Autonomic Management & Control, Advance Data Plane Programmability, Network Slice Support for IMT2020-Part:SDN

How to bring work results which may support 3GPP (slice iteration, interaction slice life cycle management and slice instance management) into 3GPP standardization process?

SG13 studies related to associated activities

IMT2020 Fixed/ Mobile Convergence

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



ITU-T Y.3130

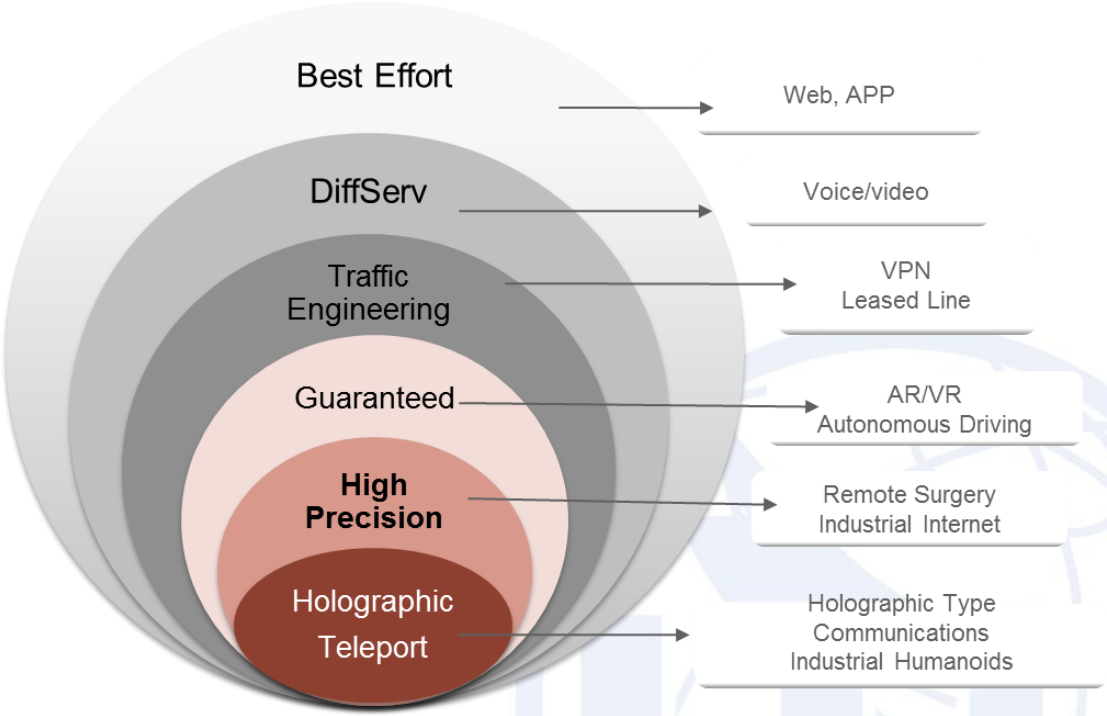
- Traffic switching, splitting and steering between fixed AN and mobile AN on network side
- Traffic switching, splitting and steering on user side
- Other requirements …

draft recommendations in progress:
FMC-Arch, FMC-EC, FMC-MM, FMC-SM)

Liaison with BBF

SG 13 studies related to complementing activities

- Data Aware Networking/ Information Centric Networking
  - Y.3031, Y.3033, Y.3071, supplement 35, 47
  - draft recommendations in progress: ICN function chain, ICN directory service, ICN name mapping & resolution, ICN routing and forwarding
- Trust worthy networking
  - Y.3051, Y.3052, Y.3053
  - draft recommendations in progress: trust-arch, trust-index, trust-pdm)
- Application of ML technologies for IMT2020/5G
  - Y.3170
  - Focus Group created in 2017 with lifetime until February 2019
  - Studies on use cases, data format/ -sources, ML aware network architecture
- Beyond IMT2020:
  - Focus Group on Technologies for Network 2030
  - Facing the evolution towards pervasive and immersive communication services:



The escalation of services and requirements

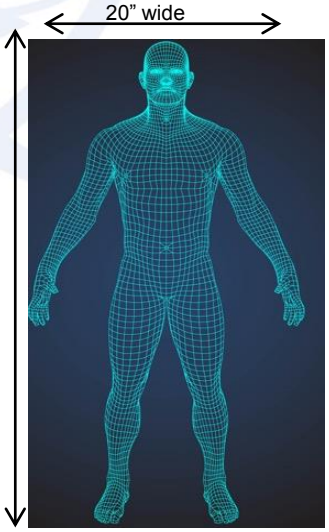
New Media: Hologram

Bandwidth requirement will grow up to terabits for holographic telepresence applications

Effective Pixel Count	Approx. Bandwidth Requirement
31.5 M	1 Gbps
157 M	10 Gbps
755 M	~75 Gbps
1.19G	~90 Gbps
5.10 G	300 Gbps
19.1G	1Tbps

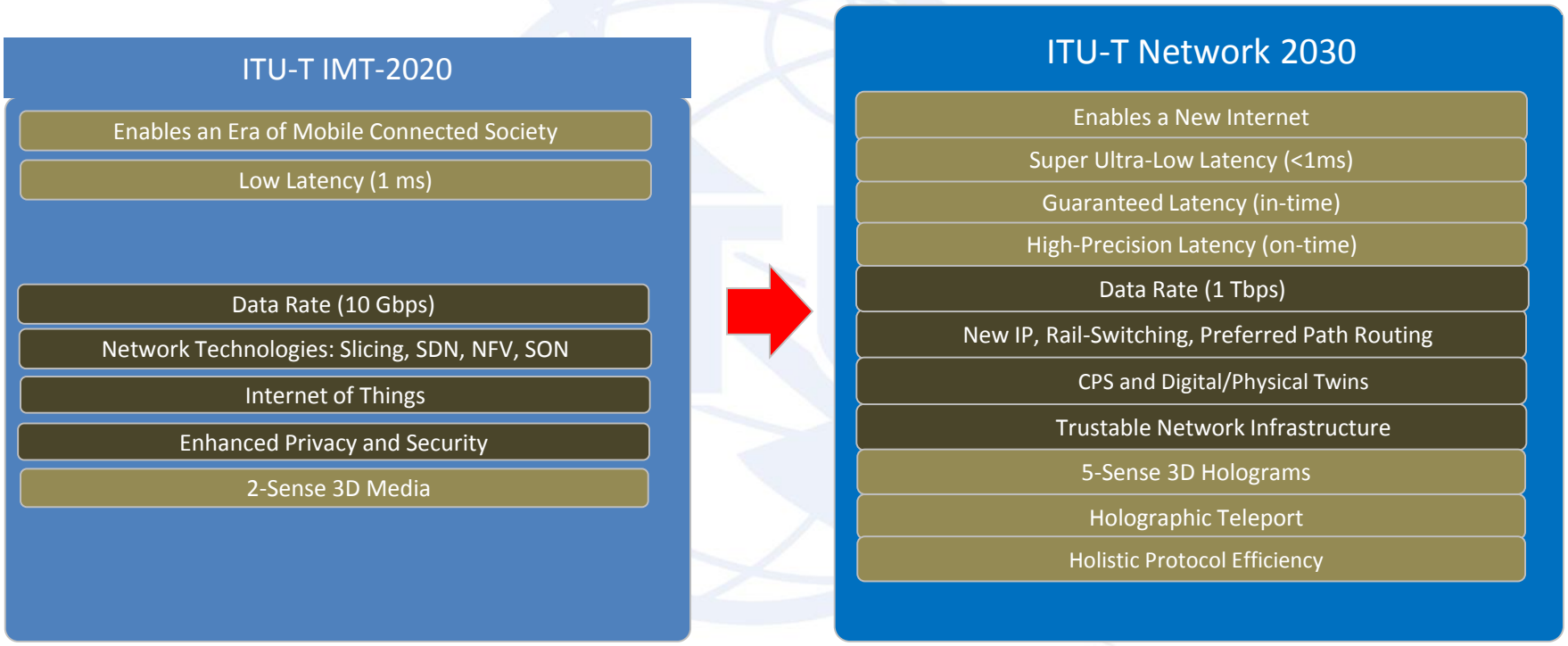
	Dimensions	Bandwidth
Tile	4 x 4 inches	30 Gbps
Human	77 x 20 inch	4.62 Tbps

color, FP (full parallax), 30 fps
(reference: N. Peyghambarian, University of Arizona)



Source: 20th Century Fox

From IMT 2020 to Network 2030



5G on field: TIM trials

Torino first 5G Italian city

San Marino first 5G European Country

Demo Areas in Genova, Roma, Naples

MISE Trial : Bari Matera (with Fastweb, Huawei and 52 partners)

5G TIM use cases

- **Virtual Reality**
- **Public Safety, Push-to drone**
- **Environment monitoring**,
- **Smart City Control Room**: IoT platform and control center
- **Public Safety wearable CAM** & Bracelets
- Smart Parking, Assisted Driving
- **Connected Factory in the Cloud**

… and more

- H2020 Projects
- R&D with 9 Universities

TIM Approach: Project, Activities, Partnerships

Industry Influencing

EU 5G Action Plan

- 3GPP
- GSMA
- ETSI
- IETF
- ITU
- NGCM
- BBF

Partnerships

- Ericsson
- Huawei
- Juniper
- Qualcomm

5G for Italy

+52 partners

- UniTo, PoliTo
- UniBa, PoliBa, Uni Salento
- SSSA

Labs

- 5G Radio Lab
- 5G Core Slicing Lab
- FutureNet Lab
- IoT Open Lab
- Giga Services Lab
- Machine Learning Lab
- I4.0 Competence Centres

Ecosystem

- Torino 5G
- San Marino 5G
- Bari Matera 5G
- EU Horizon2020
  5G Crosshaul, Fantastic5G
  Flax5Gware, MiWaves
  Metis II, MonArch

Thank you for your attention!

Your presenter of today

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