6G KNOWLEDGE LABORATORY OPENING AND 36th GISFI workshop

"5G and Beyond"

Presented by Mr. Dinesh Chand Sharma

Agenda

- About Project SESEI
- 5G Standardization
  - 3GPP
  - ETSI: 5G building block
- Emerging technologies
- ETSI long term strategy
- Beyond 5G, 6G: European Initiatives

About Project SESEI

Project is a permanent presence in India

SESEI (**S**econded **E**uropean **S**tandardization **E**xpert in **I**ndia) ***is a local face for the European standardization community in India: Dinesh Chand Sharma***

Why SESEI: India is a major trade partners for Europe, Increasing role of standards to gain market access and Evolving & complex nature of regulatory and standardization landscapes, Sharing best practices, work together

Sector: 1. ICT: M2M/IoT, Security, 5G, NFV/SDN, e-Accesibility, eHealth, eCALL… **2. Electrical equipment including Consumer Electronics**: Smart Grid, Smart Meter, LVDC, Micro- Grid, Lift Escalator… 3**. Automotive**: Connected Cars, ITS, e-Mobility… 4**. Smart Cities**: Mobility, Waste, Energy, ICT and other topics of mutual interests such as Machinery Safety, Cableways, Circular Economy, Railways etc.

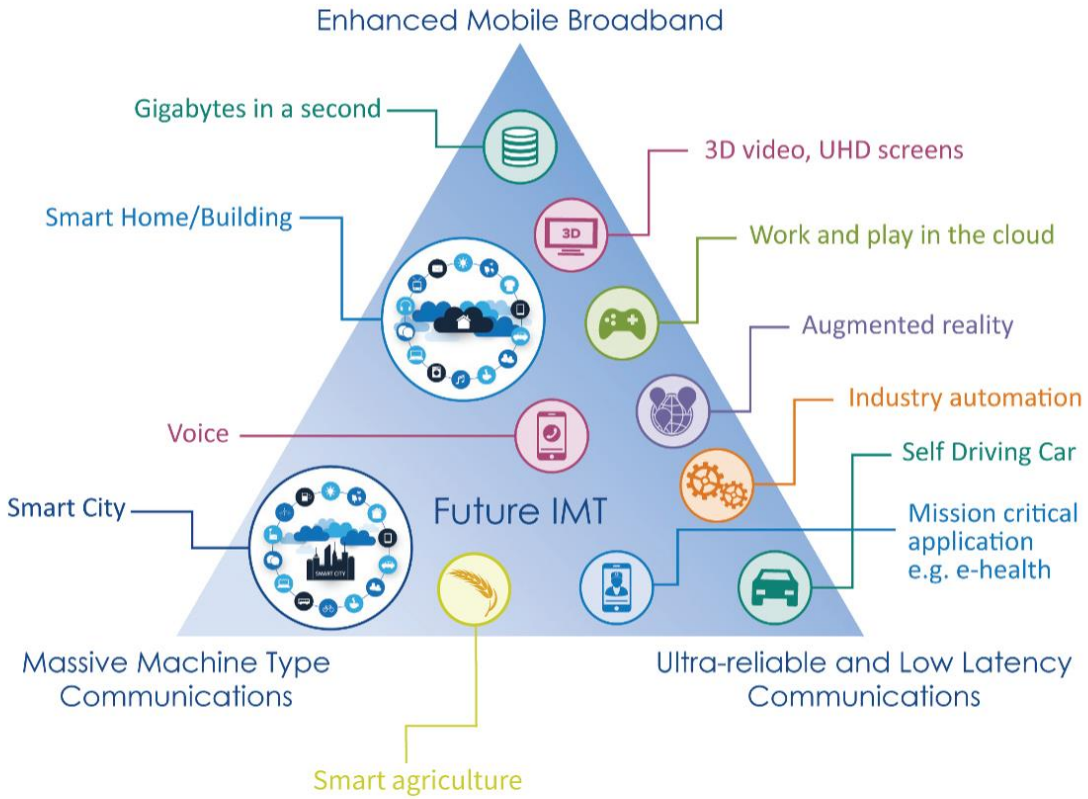
www.sesei.eu , www.sesei.in , www.eustandards.in

5G Standardization (3GPP)

5G – brings new growth

Perfect storm of technology trends:

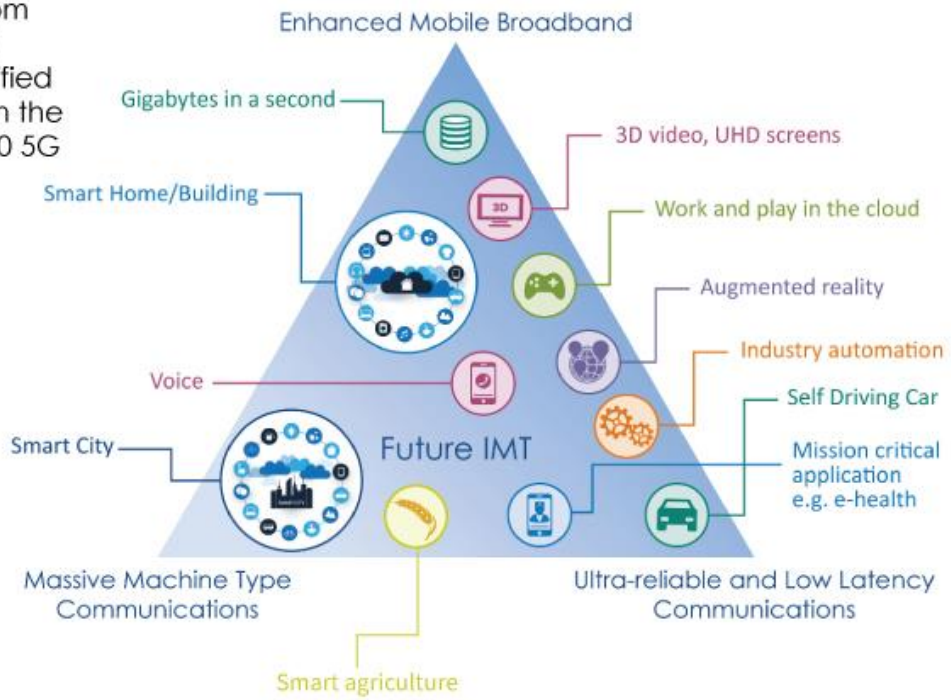
- Availability of a reliable low latency radio and a fully flexible network
- Artificial Intelligence and Automation
- Device revolution for Augmented Reality and Virtual reality
- The Vertical industries going cellular



IMT-2020

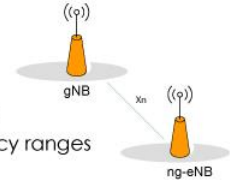
IMT-2020

The 5G NR access technology and the 5G core network from 3GPP will meet the potential deployment scenarios identified during the ITU-R discussion on the requirements for the IMT-2020 5G system



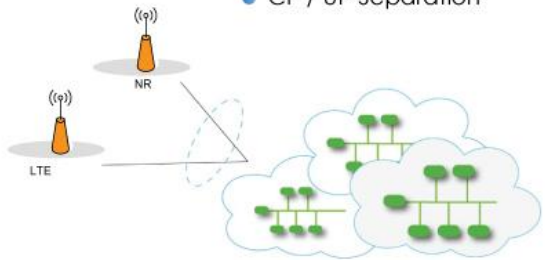
3GPP 5G NR

- Operation from low to very high bands: 0.4 –100Ghz
- Ultra wide bandwidth (Up to 100MHz in <6GHz, Up to 400MHz in >6GHz)
- Set of different numerologies for optimal operation in different frequency ranges
- Native forward compatibility mechanisms
- New channel coding
- Native support for Low Latency and Ultra Reliability
- Flexible and modular RAN architecture: split fronthaul, split control- and user-plane
- Native end-to-end support for Network Slicing



5G Core Network

- Functional entities → Services
- Virtual Core
- Internal Communication: APIs
- Harmonized protocols
- Function/service exposure
- CP / UP Separation



Feature rich 'Releases'

Release 15

- NR
- The 5G System – Phase 1
- Massive MTC and Internet of Things (IoT)
- Vehicle-to-Everything Communications (V2x) Phase 2
- Mission Critical (MC) interworking with legacy systems
- WLAN and unlicensed spectrum use
- Slicing – logical end-2-end networks
- API Exposure – 3rd party access to 5G services
- Service Based Architecture (SBA)
- Further LTE improvements
- Mobile Communication System for Railways (FRMCS)

Release 16

- The 5G System – Phase 2
- V2x Phase 3: Platooning, extended sensors, automated driving, remote driving
- Industrial IoT
- Ultra-Reliable and Low Latency Communication (URLLC) enh.
- NR-based access to unlicensed spectrum (NR-U)
- 5G Efficiency: Interference Mitigation, SON, eMIMO, Location and positioning, Power Consumption, eDual Connectivity, Device capabilities exchange, Mobility enhancements
- Integrated Access and Backhaul (IAB)
- Enh. Common API Framework for 3GPP Northbound APIs (eCAPIF)
- Satellite Access in 5G
- Mobile Communication System for Railways (FRMCS Phase 2)

Release 17

- NR MIMO
- NR Sidelink enh.
- 52.6 - 71 GHz with existing waveform
- Dynamic Spectrum Sharing (DSS) enh.
- Industrial IoT / URLLC enh.
- Study - IoT over Non Terrestrial Networks (NTN)
- NR over Non Terrestrial Networks (NTN)
- NR Positioning enh.
- Low complexity NR devices
- Power saving
- NR Coverage enh.
- Study - NR eXtended Reality (XR)
- NB-IoT and LTE-MTC enh.
- 5G Multicast broadcast
- Multi-Radio DCCA enh.
- Multi SIM
- Integrated Access and Backhaul (IAB) enh.
- NR Sidelink relay
- RAN Slicing
- Enh. for small data
- SON / Minimization of drive tests (MDT) enh.
- NR Quality of Experience
- eNB architecture evolution, LTE C-plane / U-plane split
- Satellite components in the 5G architecture
- Non-Public Networks enh.
- Network Automation for 5G - phase 2
- Edge Computing in 5GC
- Proximity based Services in 5GS
- Network Slicing Phase 2
- Enh. V2x Services
- Advanced Interactive Services
- Access Traffic Steering, Switch and Splitting support in the 5G system architecture
- Unmanned Aerial Systems
- 5GC LoCation Services
- Multimedia Priority Service (MPS)
- 5G Wireless and Wireline Convergence
- 5G LAN-type services
- User Plane Function (UPF) enh. for control and 5G Service Based Architecture (SBA)

These are some of the Rel-17 headline features, prioritized during the December 2019 Plenaries (TSG#86)

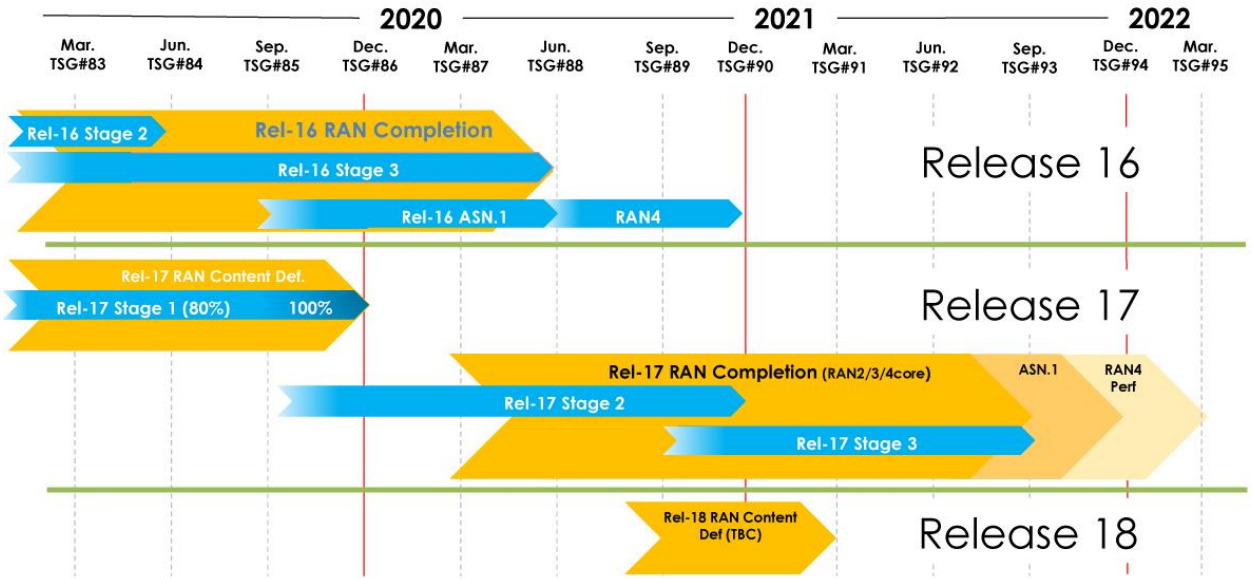
Start of work: January 2020

Full details of the content of Rel-17 are in the Work Plan: www.3gpp.org/specifications/work-plan

© 3GPP - February 2020

Release Schedule

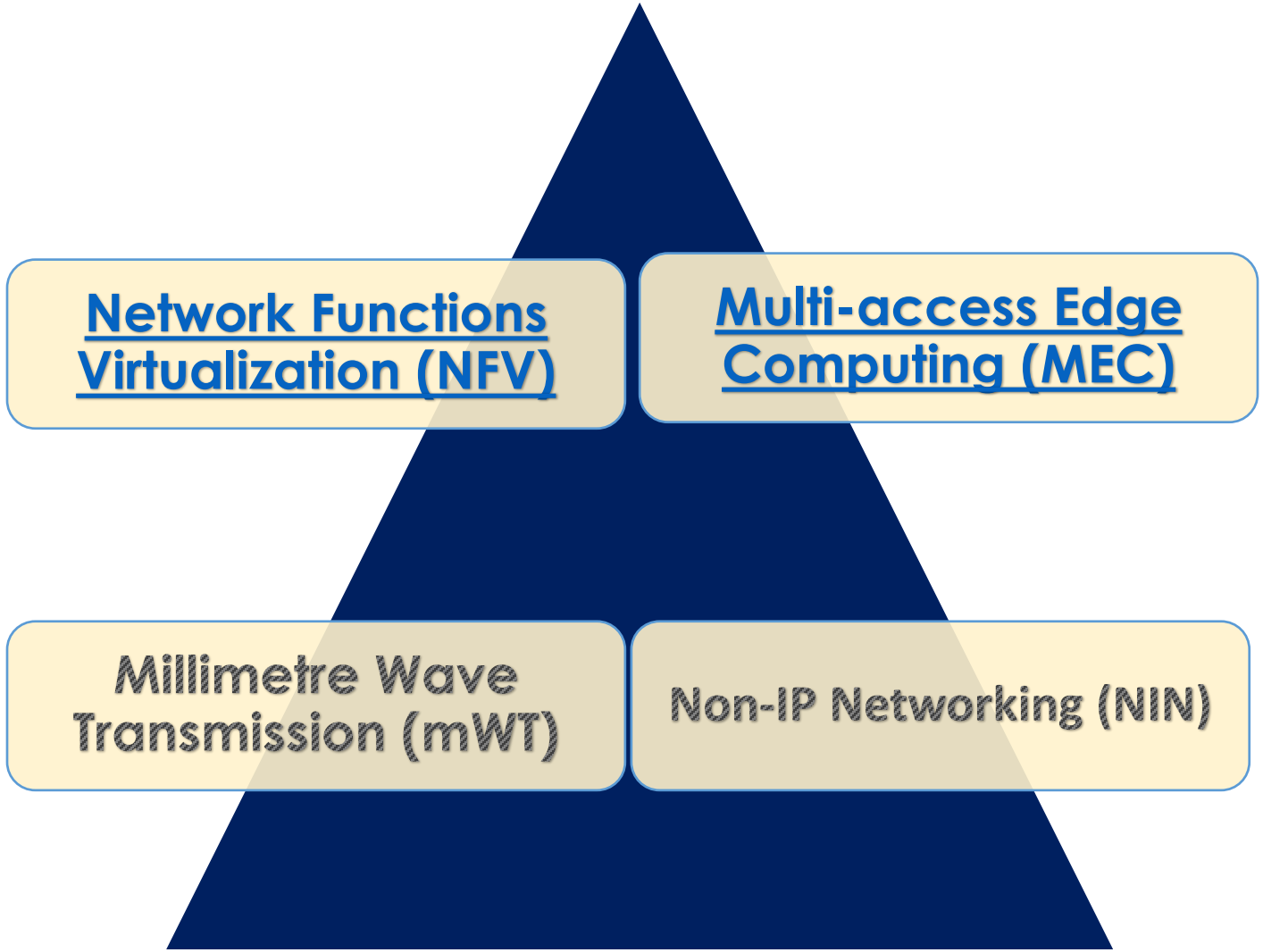
- Phase 1 (Rel-15) addresses the more urgent subset for commercial deployments
- Phase 2 (Rel-16) Completes the 3GPP IMT 2020 submission (ITU-R) and addresses all identified use cases & requirements…
- Massive effort to complete Rel-16 on time in 2020.
- E-meetings and COVID-19 have challenged the ability of the groups to meet the timelines (right)
- During TSG SA#89-e the TSG Chairs (CT, RAN and SA) confirmed that their groups will continue to study the situation, to arrive at the best common decision possible at the next Plenaries
- A firm decision on a delay to the freeze date of 3GPP Release 17 will be made in December 2020.



Source: 3GPP TSG SA#87e, 17-20 March 2020, e-meeting document SP-200222

5G Standardization (ETSI)

ETSI: 5G building blocks



- While much of the **5G standardization work will be done in 3GPP**
- Several ETSI's TBs and ISG provide input to 3GPP and/or collaborate with 3GPP

Network Functions Virtualization (NFV)

- **In Nov 2012 - Service providers came together and formed ETSI NFV ISG**
  - NFV Major Benefits: Network on demand, "network elasticity"
  - develops NFV standards, proofs-of-concept and conducts its research in two-year phases.
  - Six working groups: TST, SOL, REL, IFA, EVE, and SEC and more than 100 publications have been produced since its formation.

- **Scope of the 5G-related activity**
  - ETSI ISG NFV has defined the reference architecture which is used as baseline architecture for 5G
  - Strong collaboration with other SDOs, open-source projects, and industry forums to ensure NFV delivers deployable solutions for 5G

- **NFV Achievements**
  - Release 1 (2013 – 2014), Release 2 (2015 – 2016), Release 3 (2017-18) & Release 4 (2019-20)

Published NFV specifications are available here>>

Multi-access Edge Computing (MEC)

- MEC offers application developers and content providers cloud-computing capabilities and an IT service environment at the edge of the network.

- **Scope of the 5G-related activity:**
  - MEC is a key enabler for a significant number of 5G use cases
  - MEC is well positioned as a key contributor to fixed-mobile integration
  - Like NFV, MEC also defines architecture and APIs for management of MEC compute infrastructure.
  - Additionally, MEC also defines APIs for several services such as Radio Network Information Service (RNIS) and Location Service

- **MEC Achievements:**
  - Foundation for Edge Computing created – Fully standardized solution to enable applications in distributed cloud created by ETSI MEC + 3GPP

ETSI MEC published related specifications are available here>>

Millimetre Wave Transmission (mWT)

- ETSI established **mWT ISG** to provide a platform and opportunity for companies and organizations involved in the microwave and millimetre-wave industry to address the challenges involved in using this spectrum

- **mWT** concerns the use of millimetre wave spectrum for radio transmission, which lies in the 30GHz to 300GHz range (with wavelengths from 10mm to 1mm).

- **Scope of the 5G-related activity:**
  - Facilitate the use of the V-band (57-66 GHz), E-band (71-76 & 81-86 GHz) and in the future higher frequency bands (from 50 GHz up to 300 GHz) for large volume applications in the back-hauling and front-hauling to support mobile network implementation.
    - Wireless backhaul and front-haul serving the requirements of 5G in terms of capacity, topology, latency and any other technical or network feature
- **mWT achievements:**
  - ETSI GR mWT 012 , mmWave Semiconductor Industry Technologies: Status and Evolution
  - **Latest publications** are available here

Non-IP Networking (NIN)

- ISG on NIN has been set up recently to standardize a digital communications technology fit for the 21st century.
  - Standardize the concept of a flow, control plane protocols for managing flows, and appropriate packet formats.
  - It has identified several technical issues with the current (TCP/IP-based) technology which prevent it delivering the required levels of service without excessive complexity or, in some cases, at all.

- The new protocols will provide:
  - virtual elimination of delays in forwarding real-world signals: not only audio and video but also tactile feedback and the position of vehicles or industrial robots
  - multicasting of live content (such as sports events) to an unlimited number of subscribers
  - more efficient use of spectrum and of processing power
  - better security, both privacy and resilience to denial-of-service
  - better performance when accessing remote content such as web pages
  - ways of guaranteeing network service sustainability
  - extensibility: packet formats do not have to be the same throughout the system, and introducing new features such as a new kind of addressing only affects the control plane messages

Emerging Technologies

Emerging Technologies

- **List of Emerging Technologies standardized by ETSI or touched by our standardization:**

  - 3GPP Telecom Management
  - 5G
  - Internet of Things (IoT)
  - Mobile Communications
  - Multi-access Edge Computing (MEC)
  - Securing Artificial Intelligence (SAI)
  - Smart Body Area Networks
  - Smart appliances
  - Smart cities
  - Smart Grids
  - Smart Metering
  - Zero touch network & Service Management (ZSM)
  - Human Factors (HF) and accessibility
  - Augmented Reality
  - automotive Intelligent Transport Systems (ITS)
  - Broadband Satellite Multimedia
  - Broadband Cable Access
  - Broadband Wireless Access
  - Certification Authorities and other Trust Service Providers
  - Cybersecurity
  - Broadcast
  - Digital Enhanced Cordless Telecommunications (DECT)
  - Energy efficiency (EE)
  - Experiential Networked Intelligence (ENI)
  - Environmental Aspects

Complete list can be access here:
https://www.etsi.org/technologies

ETSI: Long Term Strategy (valid until 21)

Strategy in brief

- ETSI's Long Term Strategy provides a:
  - high-level description of the major ambitions and aims of ETSI
- It sets the strategic framework for:
  - ETSI's work and its leading contribution to the digital transformation of private and public sectors, positioning ETSI technical standards as core to the digital economy
- It has identified technologies such as:
  - 5G, cloud computing, internet of things, data technologies and cybersecurity as priority areas for standardization
- The impact of digital transformation and evolution of ICT presently & in near future can be seen through:
  - Socio-economic, Policy and Technology trends

Socio-economic

- Digital technologies are not only impacting our daily life at large, they also influence:
  - Economic models, open-up new opportunities, as well as enable new ways of interaction not possible in the past.
- Digital technologies are also transforming:
  - learning and having a major impact on education. ETSI is investing in education about standardization
- ICT standards contribute to define:
  - Our modern world, impacting and influencing markets and economies locally, nationally, regionally and globally, and providing new ways for interaction and integration
- ICT standards allows for:
  - Integration and are applicable across traditional sector boundaries

Policy trends

- Industrial policies in the globalization era is at the top of the EU's agenda:
  - EU 2020 flagship initiatives
  - Entrepreneurship 2020 Action Plan
  - Small Business Act for Europe
- Digital economy is the single most:
  - Important driver of innovation, competitiveness and growth
  - Well proven now during this unfortunate period of COVID-19
- Policy makers worldwide are driving digital economy
- ETSI priority is to ensure connection with the policy makers & alignment with policies in Europe

Technology trends 1(2)

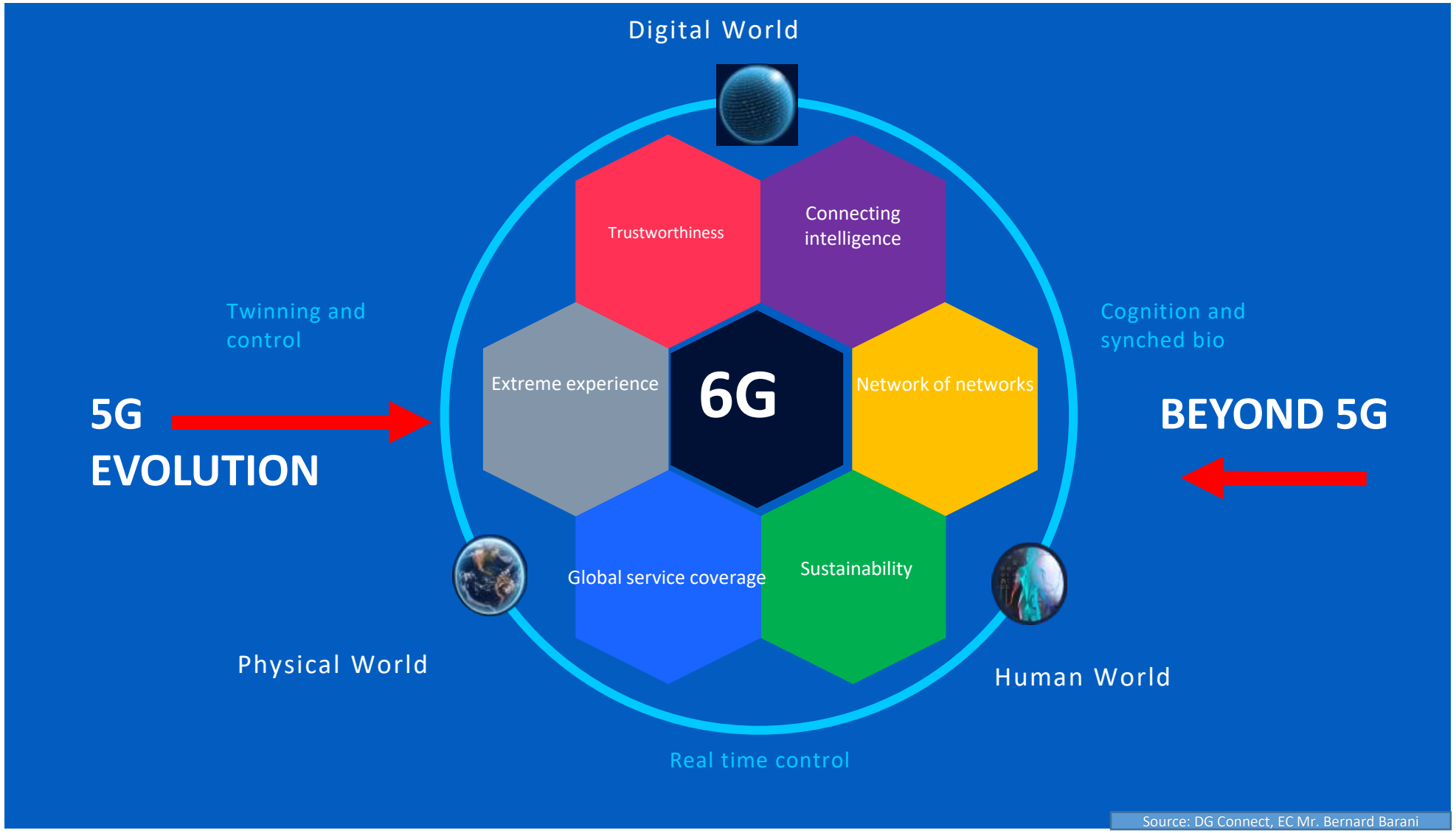
- Technology is the driving factor of:
  - Digital transformation leading to fundamental changes in societies and economies.
- Role of hardware and software in digital era and in ICT products are evolving:
  - Hardware is becoming generic and cost-effective
  - Software is bringing most value add to an increasing range of products and services
- New developments such as 5G (eMB, MMTC, ULLC) through various building blocks such as NFV, MEC, mWT, NGP, ZSM, IoT/M2M etc. will:
  - Enable automating the world through real time processing and control capabilities

Technology trends 2(2)

- Virtualization and Clouds allowing:
  - Optimization of resources and making use of resource intensive computation
- Security and Privacy aspects of the systems is extremely important
- Open innovation is a major trend in technology development

Beyond 5G, 6G: European Initiatives

Developing Vision



Source: DG Connect, EC Mr. Bernard Barani

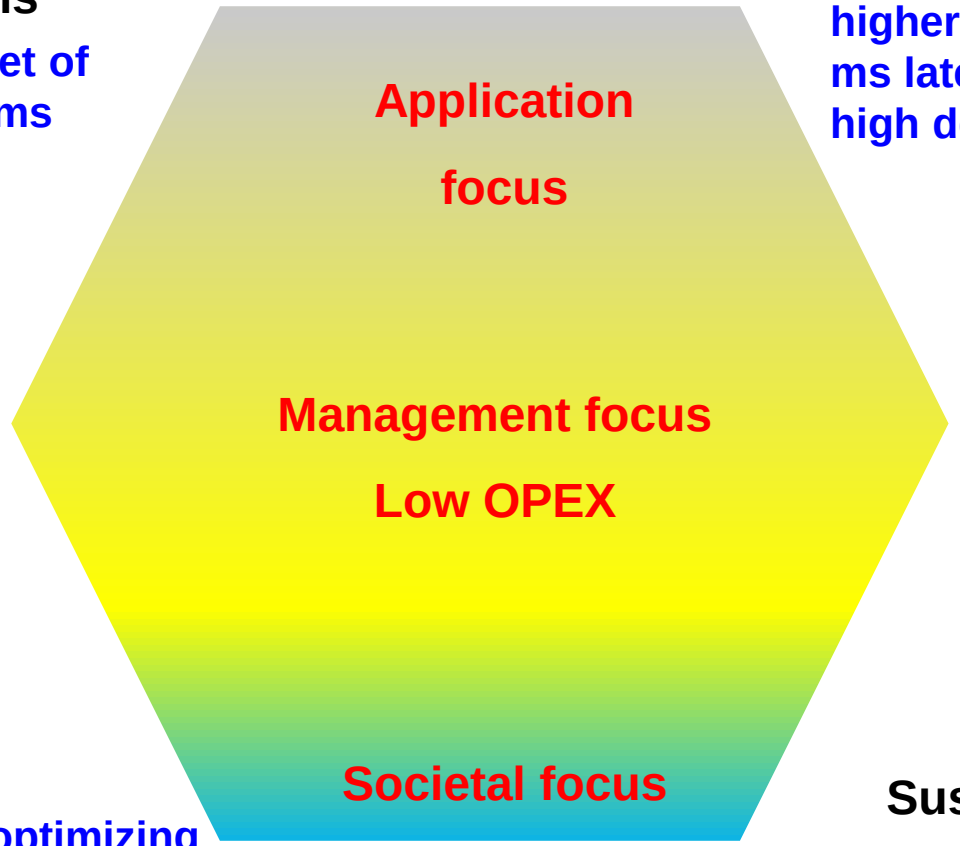
6 Dimensions of 6G

New classes of applications

XR, Holographic coms, Internet of Senses; massive machine coms

Vertical use cases beyond 5G

higher capacity, xGbs speed, new spectrum, sub ms latency, location, reliability beyond 5x9, ultra high device density



Fully Automated Infrastructure

Autonomous management, Distributer IA, Self learning..

Ultra high security

Quantum, blockchain, from component to application

Ultra low energy/EMF

Optical techs, architecture, optimizing computing vs networking, EMF aware..

Sustainable Development goals

Affordability of tech, Open RAN, infrastructure access, climate change..

Source: DG Connect, EC Mr. Bernard Barani

Towards a 6G European Initiative

5G PPP: ICT-52 implementation of 8 6G exploratory projects, 1 flagship= 60 M€
University of Oulu started 6G research as part of Academy of Finland flagship programme

Strategic Autonomy in critical technology areas

European Green Deal

Full digitalisation of the Industry

EU Industry global competitiveness

Industry 6G Partnership Proposal (Smart Networks & Services)

https://ec.europa.eu/info/files/european-partnership-smart-networks-and-services_en

5G IA INFRASTRUCTURE ASSOCIATION | CISPE.cloud | 2020 NETWORLD | NESSI | Alliance for Internet of Things Innovation

Accelerating 5G Deployment: CEF2, pan European corridors for Connected Cars

6G Vision and technologies across a comprehensive supply chain

Source: DG Connect, EC Mr. Bernard Barani

Conclusion

- 3GPP is industry driven - Standardization of interfaces enables an interoperable, multi-vendor approach to deployment
- 5G new radio (nr) remains high focus for RAN groups
- Release 17 focus will continue to expand towards new use cases and new sectors…with particular progress on IoT
- 5G will be a multi-Release technology (beyond Release 17)
- While much of the 5G standardization work will be done in 3GPP, Several ETSI's TBs and ISG provide input to 3GPP and/or collaborate with 3GPP
  - NFV, MEC, mWT, NIN etc.
- ETSI long term strategy has identified **5G technology** among others as priority area for standardization
- European Partnership for smart networks and services (Horizon Europe programme) will help to develop technologies/standards for digital infrastructures of future (next generation internet, smart connectivity and services)

Dinesh Chand Sharma

(Seconded European Standardization Expert in India)

Director – Standardization & Public Policy

SESEI C/O EBTC, DLTA Complex, Gate No 3, 1st Floor, 1, Africa Avenue, New Delhi 110029

Mobile: +91 9810079461, **Tel:** +91 11 3352 1525,
dinesh.chand.sharma@sesei.eu

www.sesei.eu ⇔ www.sesei.in