



Few Ideas on 6G

Topic 1 Handling of diverse services and massive connectivity

Topic 2 Meaningful connectivity: A (sub)-network for all

Source: IIT Bombay



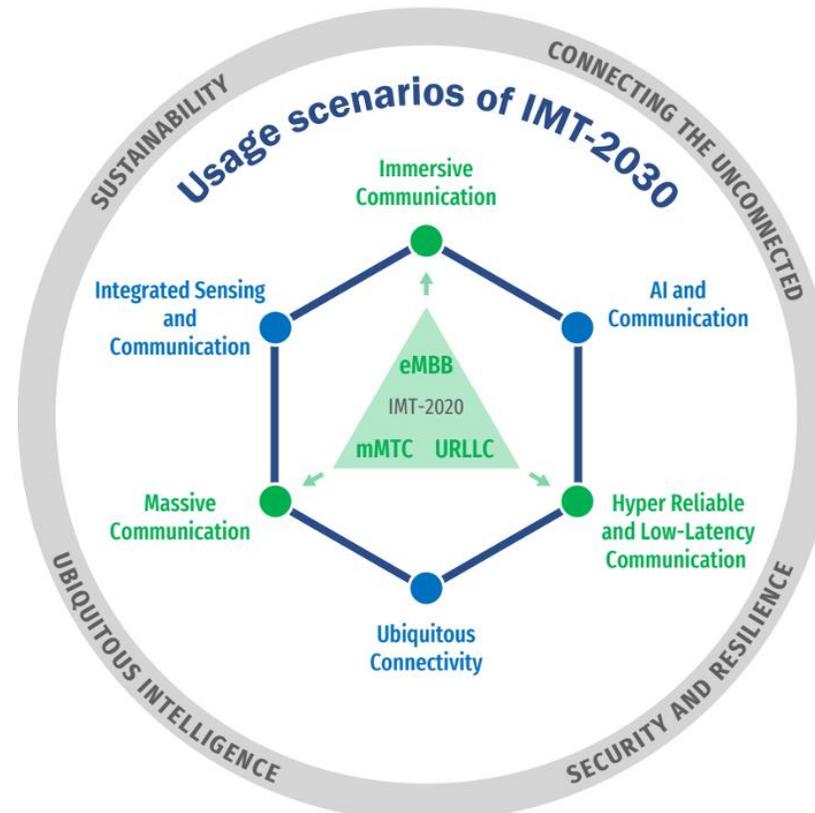


6G Vision (A network for everyone, everything and everywhere)

Handling for diverse services and massive connectivity

- Scalability
- Modularity
- Flexibility
- Simplicity
- Enhanced Security
- Independent evolution of signaling and control plane
- Use-case/Service-specific signaling support

TOPIC 1



Meaningful connectivity A (sub)-network for all

- Affordability
- Fulfillment of region-specific needs
- Meaningful KPIs
- Easy to manage/deploy
- Ease of use
- Coverage expansion
- Connectivity based on available RAT
- Low energy solutions

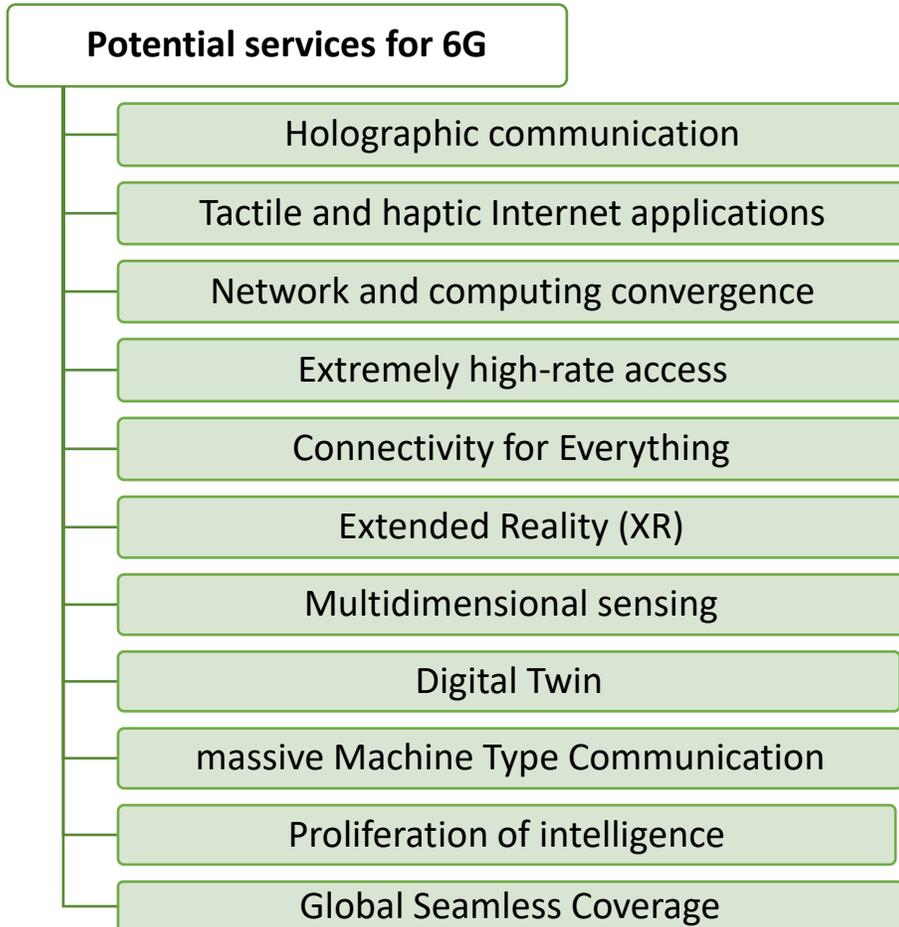
TOPIC 2





Topic 1: Handling of diverse services and massive connectivity

Towards supporting expanded, diverse and massive usage scenarios in 6G



Few highlights from ITU-R M.2516-0 "Future technology trends of terrestrial International Mobile Telecommunications systems towards 2030 and beyond"

Future networks should support the decoupling of signalling and data for robust control and on-demand data services. For instance, low-frequency bands can be used for signalling coverage to simplify mobility management and ensure users have real-time access. High-frequency bands can be enabled on-demand to support high-speed services. Additionally, a unified RAN architecture and signalling design could be considered to support diversity in radio interface technologies and new relationships among BSs and UEs, and wide-area and micro-area networks, which include RAN node cooperation and aggregation.

Rethinking on reducing signaling load on control plane is required considering future massive load requirements in the following directions:

- Decoupling of signaling and data (Section 7.3 ITU-R M.2516-0)
- Thinner or lite protocol stack design (Section 7.3 ITU-R M.2516-0)



Handling of diverse services and massive connectivity

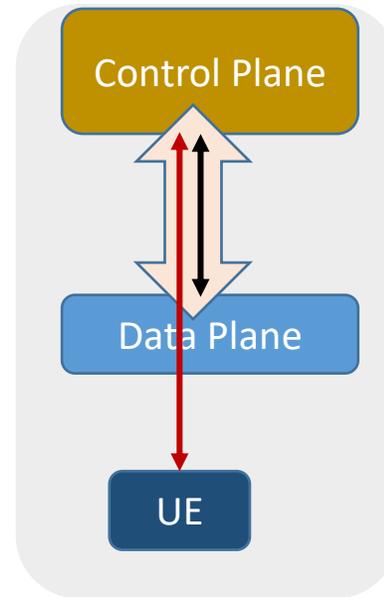
Technical directions to be explored (including one example of solution)

Handling of diverse services

- With massive connectivity expected in 6G era control plane would bear a huge signaling load....Are there any advantages by **decoupling signaling functionality from control plane**?
- Need of **diversified signaling requirements for diversified services**?
- Service/Use case specific signaling **protocols/functions** selection?
- Requirements for **flexible service function placement and chaining** in 6G?

One of the prospective solution

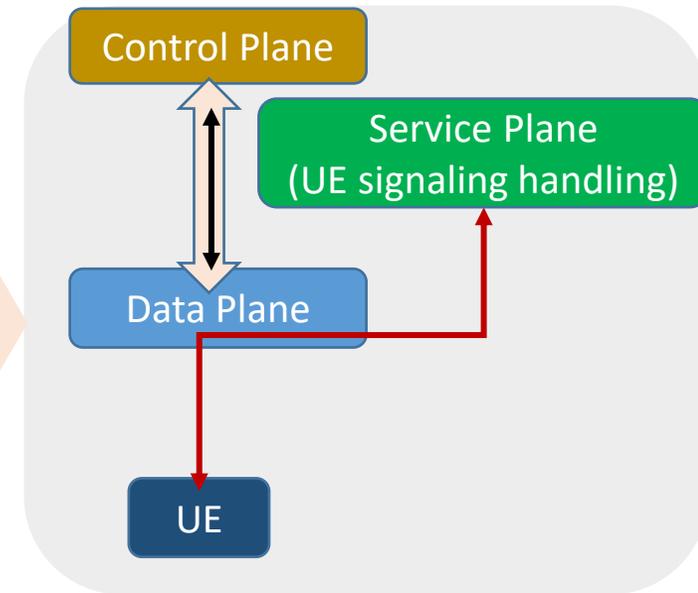
Interaction between control plane and UE for all types of use cases



Existing architecture

Customized and flexible use-case specific treatment for UE signaling handling

Decoupled UE signaling handling from control plane



A prospective solution



Handling of diverse services and massive connectivity

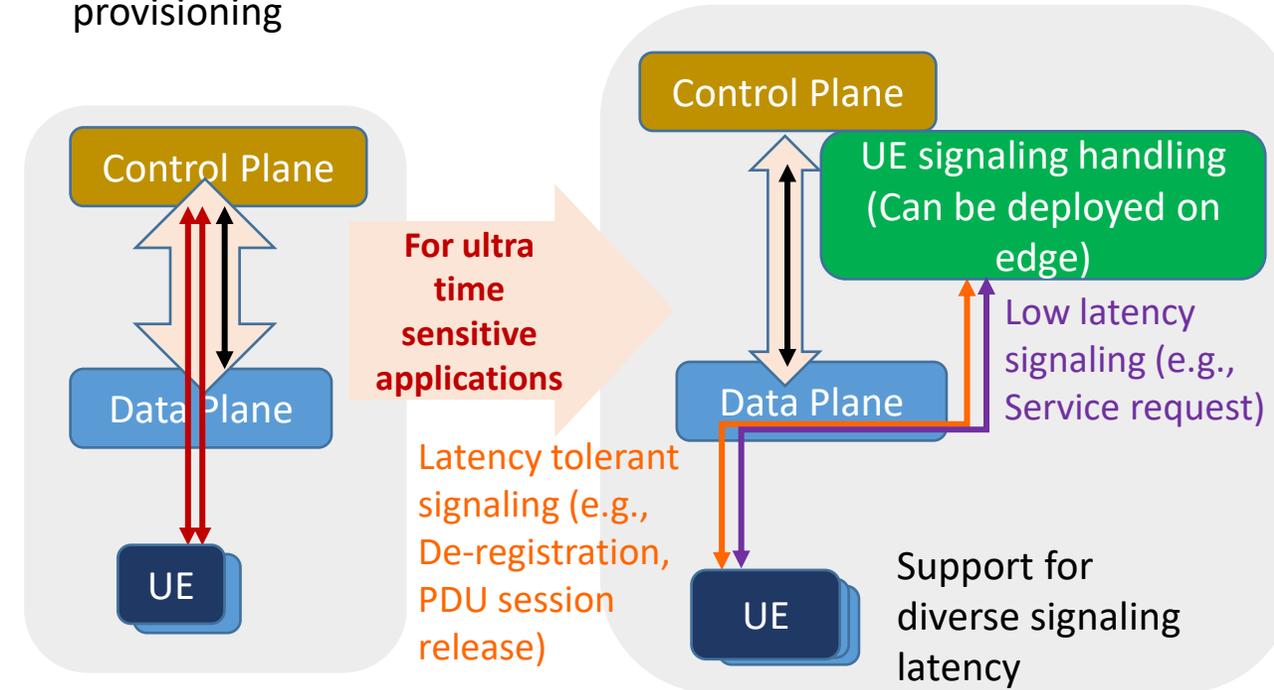
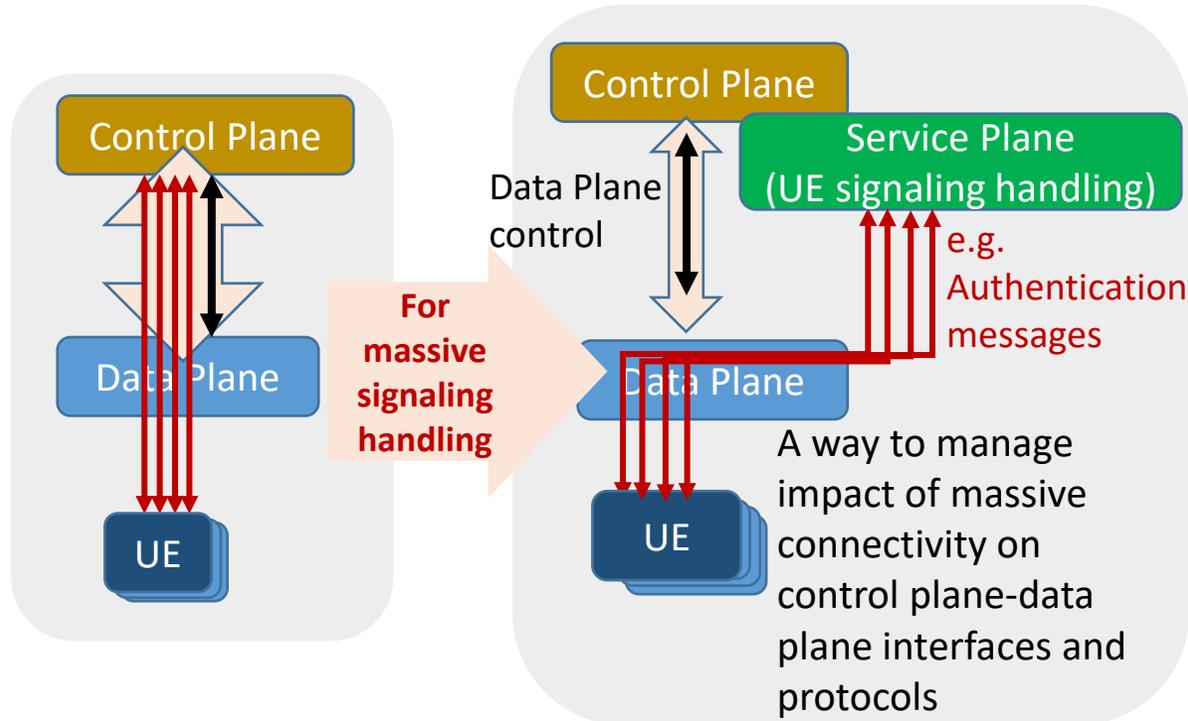
Example Use cases

Signaling for massive connectivity

Signaling handling for ultra-low latency applications

- Massive connectivity for billions (a lot more..) of devices (MIoT) and people envisioned for 6G
- Excessive load on control plane (and its interfaces) need to be reduced for improved control plane scalability in 6G

- Ultra low latency signaling may be required for certain 6G use cases like Industry time sensitive networks, holographic presence-based applications, real time environment modeling, synchronized controlling of multiple devices, AI/ML based dynamic service provisioning





Topic 2. Meaningful connectivity: A (sub)-network for all

A sub-goal/first step towards Inclusivity and Ubiquitous connectivity in 6G

Recommendation ITU-R M.2160-0 "Framework and overall objectives of the future development of IMT for 2030 and beyond"

2.1 Motivation and societal considerations

The motivation for the development of IMT-2030 is to continue to build an inclusive information society towards contributing to support the United Nations Sustainable Development Goals (SDGs). To this end, IMT-2030 is expected to be an important enabler for achieving the following goals, among others:

- **Inclusivity:** Contributing towards further bridging of digital divides, to the maximum extent feasible, by ensuring affordable access to **meaningful connectivity** to everyone.
- **Ubiquitous connectivity:** Towards connecting unconnected, IMT-2030 is expected to include affordable connectivity and, at minimum, basic broadband services with extended coverage, including sparsely populated areas.

3 Usage scenarios of IMT-2030

Ubiquitous Connectivity

This usage scenario is intended to enhance connectivity with the aim to bridge the digital divide. Connectivity could be enhanced, *inter alia*, through interworking with other systems (see § 5.1.2).

One focus of this usage scenario is to address presently uncovered or scarcely covered areas, particularly rural, remote and sparsely populated areas.

Typical use cases include, but not limited to, **IoT and mobile broadband communication**.

Defining "Meaningful connectivity", and establishing KPIs for it

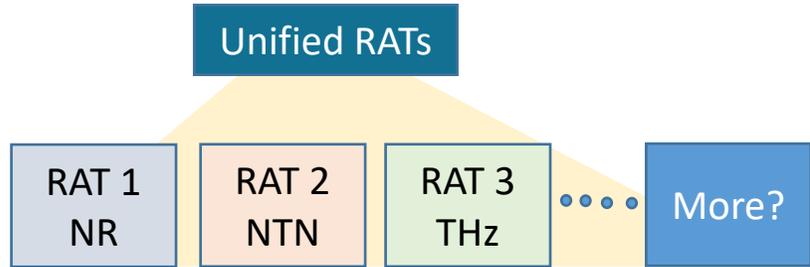
- Do the KPIs for "Meaningful Connectivity" remain consistent across all scenarios?
- Defining new KPIs/KVs for affordability, sustainability, usage complexity for e.g., cost/bit, joules/bit
- Multiple levels of network services
 - Network with reduced capabilities
 - Network with enhanced capabilities
 - New KPIs for meaningful connectivity to support use cases like Agricultural IoT and mobile broadband scenarios in Rural areas which are apparently missing in 5G



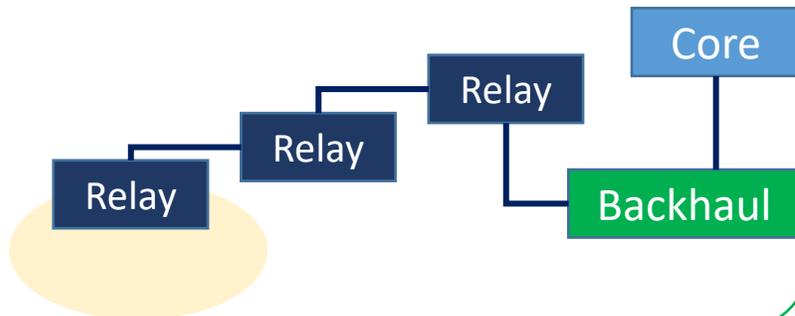
Meaningful connectivity: A (sub)-network for all

Technical Directions/requirements to be explored (Few examples)

Unification of multiple RATs for seamless integration and open interfaces for interoperability



Expanding coverage through IRS or multihop communication using relays on demand



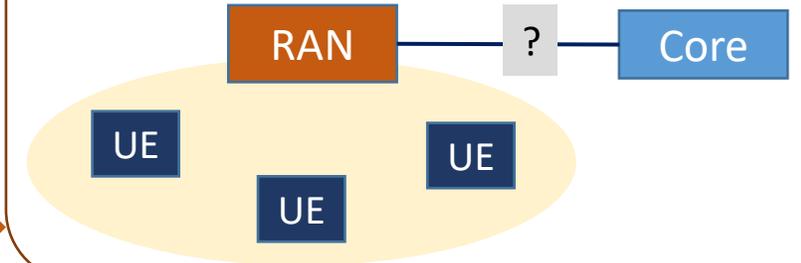
Next steps in this direction

To identify requirements, use cases and need for including new KPIs or KVs related to

- Interworking with NTN to enhance coverage, inclusion of more RATs is also envisioned
- Fixed wireless access/very low mobility
- Expanding Coverage for ultra-remote area
- Affordable solutions
- Easy to manage technologies
- Low energy solutions

Can lead solutions for meaningful connectivity to all with achievable KPI

Automated and simplified local sub-network through RAN only for stationary/low mobility scenarios



- Inclusion of Unlicensed spectrum (may need new interfaces)
- Use of AI/ML based computing and communication at nodes for providing region-wise network support (requirements towards ease of use)
- Information exposure about energy availability and use of this information to make energy-aware smart network decisions



Meaningful connectivity (Example Use cases)

Tele-Education for rural communities

- Recent pandemic has generated and highlighted the need for tele-education facility everywhere
- Tele-Education support leveraging meaningful connectivity KPIs for rural communities can provide following services



Rural IoT: Agriculture IoT

- IoT technology in agriculture can provide real-time information about weather, their crops and soil conditions to farmers
- Agriculture IoT deployment using meaningful connectivity can help in
 - Optimizing maintenance
 - Boost efficiency
 - Reducing wastage
 - Bump up crop yields
 - Keep livestock healthy...



Study item proposals for 6G

- 1 New SID: Study on handling of diverse services and massive connectivity in 6G
- 2 New SID: Study on meaningful connectivity in 6G

