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TTDD 2025 CONFERENCE (8th EDITION)

STANDARDISING 6G:

ARCHITECTING INTELLIGENT, SECURE AND SUSTAINABLE NETWORKS & SERVICES

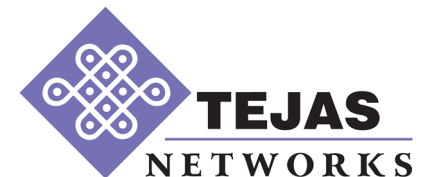
 **Date:** 15-18 July 2025

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Session #2 –Will AI find a Central Role in 6G?

15 July 2025



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Solving for Scale – AI in 6G

by

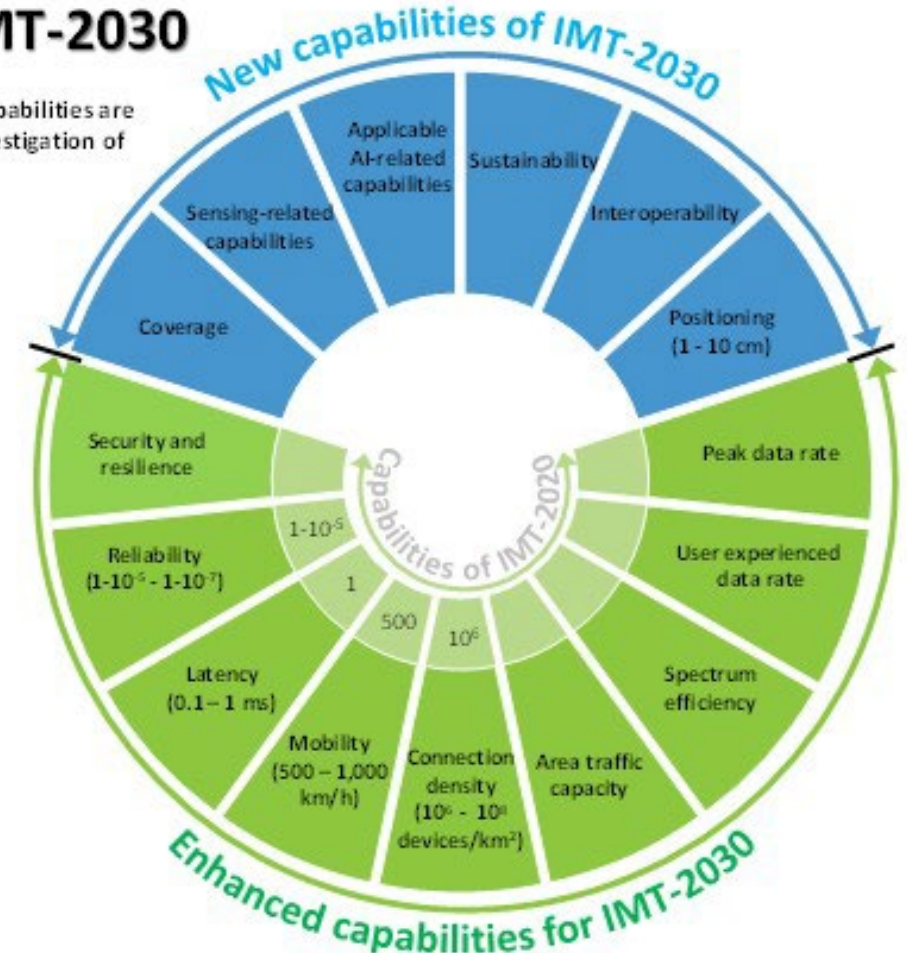
Jagan Shantigram, Tejas Networks

Scaling wireless with 6G

- Peak user throughput – 100Gbps up to Tbps
- Average user throughput – 500Mbps to 2 Gbps
- Latency sub 1 ms
- Mobility – 1000 Km/hr (airplane speeds)
- Connection density – million/ km^2

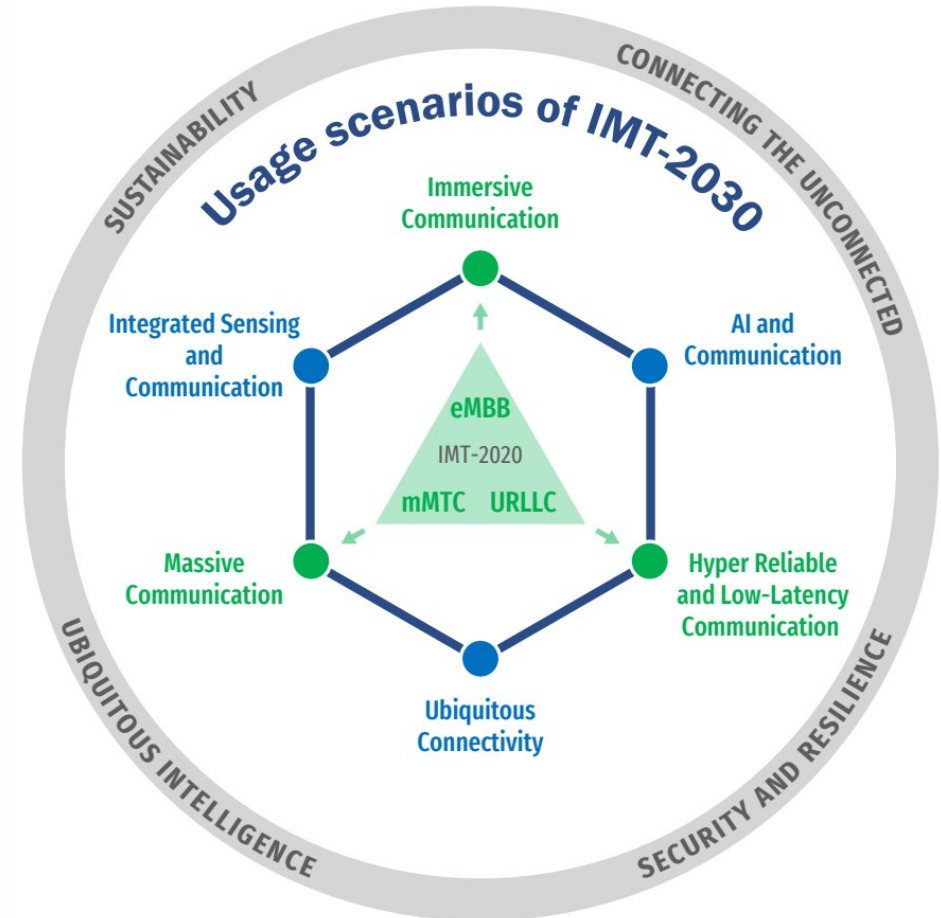
Capabilities of IMT-2030

NOTE: The range of values given for capabilities are estimated targets for research and investigation of IMT-2030.



How is 6G different

- Higher data rates - 10x more traffic from new applications
- Make network into a computing infrastructure
- Support On device AI applications
- Support VR/AR/XR
- Support massive sensors and process their data



Source: Recommendation [ITU-R M.2160](#).

10X Throughput in RAN – how?

- Channel bandwidth are about 2x-4x of 5G (400Mhz at 4.6Ghz, 1Ghz at 7.1 GHz and at 14 GHz)
- No change in waveform
- Maybe some gain with high MCS (up to 4096 QAM in rare scenarios)
- ✓ Geo-spatial multiplexing
 - ✓ Distributed MIMO (?)
 - ✓ mMIMO – 256+ antenna arrays (higher frequency, higher antenna density)
 - ✓ Spatial multiplexing with beam directivity

AI for 6G

- Centralized – network applications
 - Large volumes of data
 - Operationally expensive and not scalable to manage high density networks
 - Efficiency of network resources
- Distributed – embedded in the RAN
 - Embed solutions in the RAN layers – Physical, MAC and the Network
 - Hardware acceleration
 - Integrated data from sensing and communication

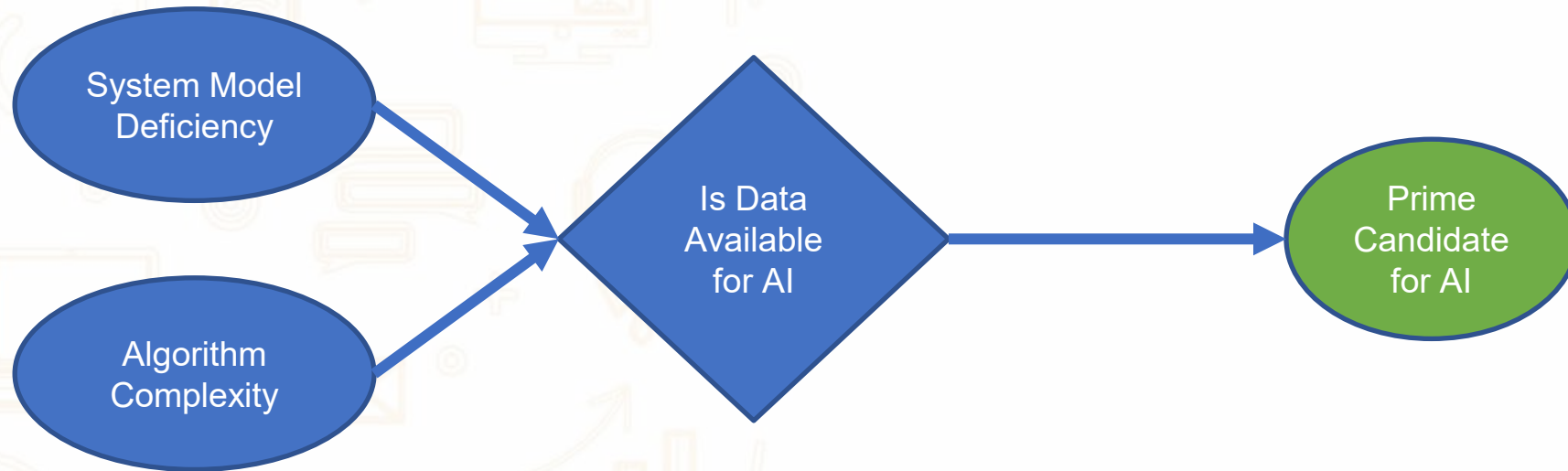
Centralized – AI for the network

- Central data collection and analysis
- Manage large amounts of KPI without having to invest in manpower
- Intent based network management
- Service assurance
- Example Agents unique to 6G
 - Energy saving
 - RIS configuration
 - AI Ops
 - Location service



Distributed - AI in the RAN

Qualifying use cases



Ability to acquire relevant data is critical for AI use cases

3GPP Research - Using AI in the RAN

- Transmitter and Receiver chains using neural networks – to achieve the spatial multiplexing gains, each BS has to have multiple Digital to RF chains operating at multiple Gbps
 - Possibility to achieve the Tx and Rx chains using a neural network
- Channel state estimation – channel state feedback grows in size with the number of antenna and the width of the channel (number of PRB sub-bands). This uses a big chunk of the uplink resources.
 - Use a channel state information model to forecast future values
 - Use a encoder (UE) and decoder (gNB) for compression of CSI
- Beam management – the number of beams makes the process of beam selection and formation to be time taking and complex
 - Use ML (supervised or RL) to learn and predict the top-K beams, reducing the overall candidate set and hence the time and complexity
- Positioning – non Line of Sight UE position cannot accurately be determined by the 3 sensor Time difference of arrival (TDOA) approach due to multipath inaccuracies
 - The model uses the channel information and the timing measurements as inputs – sent by the UE/gNB to the LMF where the model is run

Will AI find a central role in 6G?

Opportunity

- AI techniques are evolving at a breakneck pace – solutions are likely to emerge for some of the challenges of today
- AI models can learn user behaviours, and application behaviours – using that knowledge to optimize network resource allocation
- ML techniques can be used to improve existing algorithms in the network, fine tune them for better performance
- Well understood models can be implemented for regular task as hardware accelerators

Risk

- RAN is sensitive to TCO – incorporating AI accelerators have to bring down the cost (per bit) and energy used (per bit)
- Mobile networks today are built using mathematically explainable algorithms and outcomes – AI may introduce solutions that are not understood or explainable
- AI models may have an unpredictable output when presented with input data not previously seen



Thank You
Jagan Shantigram
jagannathsh@tejasnetworks.com