

6G DEEP DIVE -USE CASES

ARVIND PANDEY

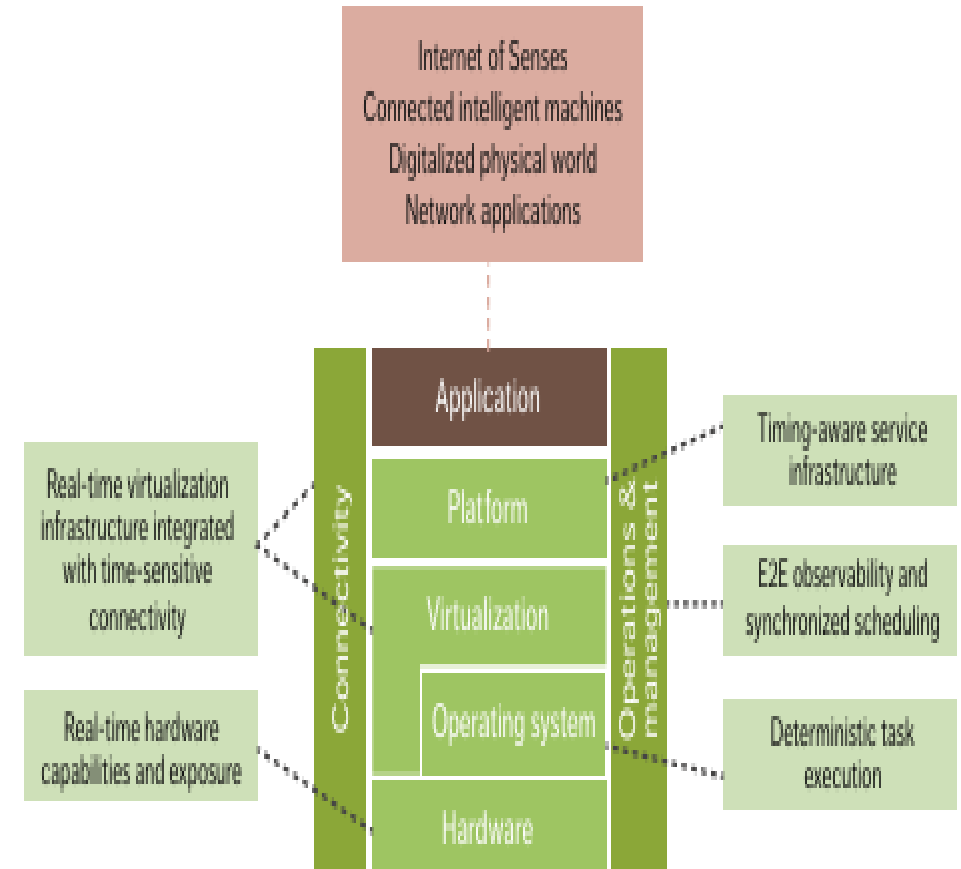
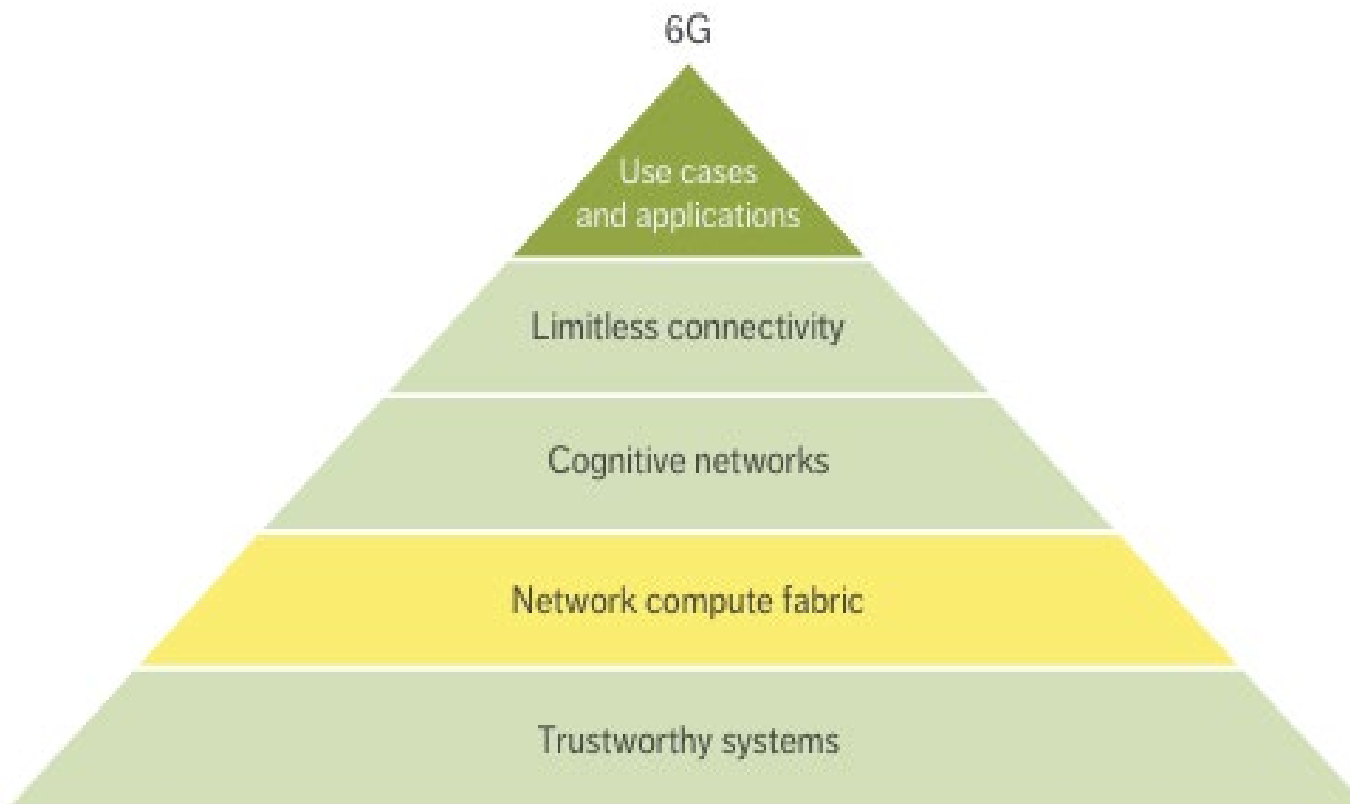
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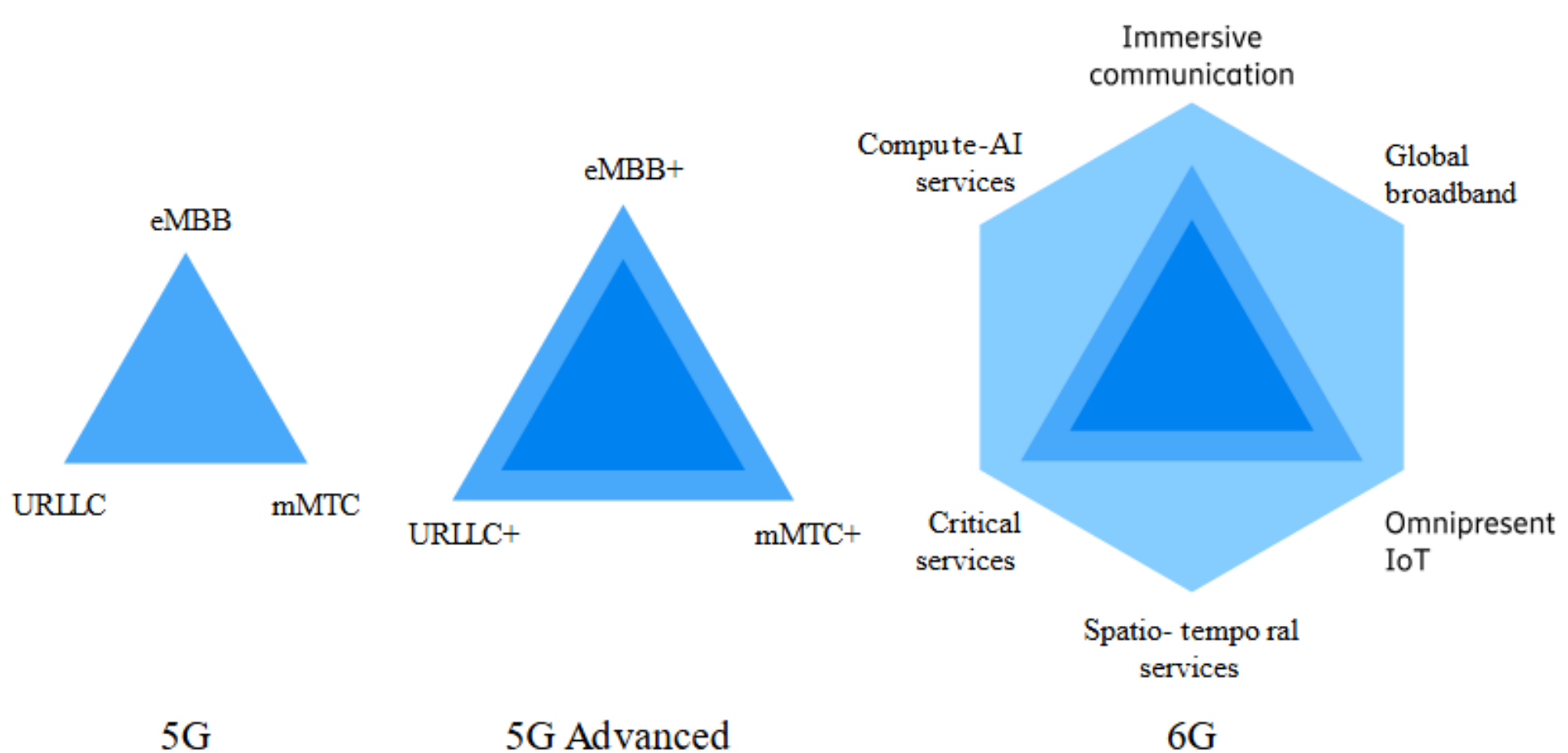
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TECHNOLOGY ENABLEMENT: STRATEGIC SHIFT



6G CAPABILITIES DRIVING USE CASES



6G CAPABILITY ENHANCEMENT

Capability Dimension	4G/5G Baseline (Deployable Today)	5G-Advanced Partial Enhancement	6G-Ready Platform Enhancement
Sensing	Dedicated sensor networks with separate IoT connectivity	Integrated passive sensing in limited scenarios	Native ISAC across network footprint with no separate sensor network required
AI Processing	Application-layer AI on remote cloud or separate edge servers	AI-assisted network management; limited edge inference	AI-native network with inference co-located with sensing and communication
Latency and Reliability	URLLC targeting 1ms in controlled environments; reliability up to 99.999%	Enhanced URLLC with improved tail reliability in some scenarios	HRLLC across diverse outdoor environments including remote and high-mobility scenarios
Positioning	Metre-level outdoor positioning	Sub-metre positioning in enhanced scenarios	Centimetre-level 3D positioning across network footprint
Coverage	Terrestrial only; significant rural and remote gaps	Some NTN trials; not standardised for operational use	Integrated terrestrial and NTN with seamless handover
Digital Twin Support	Periodic data updates from cloud-connected assets	Higher frequency updates in 5G-connected environments	Continuous real-time twin updates from ISAC and edge AI
Multi-Sensor Integration	Vendor-specific integration with significant technical debt	Some standardization in 3GPP Release 18 for specific scenarios	Natively integrated multi-modal sensing through common ISAC architecture

- Mixed Reality - Immersive shared experiences
- Global Internet - Digitalization for everyone everywhere
- Autonomous Mobility - Supporting smart transport
- Critical services - Priority emergency communication
- Spatial Data - Exposing data related to coordinates
- Massive Digital Twin - Data collection, management and modeling
- AI communication - Super awareness and AI offload



IMT-2030 Capability	Platform Function	UC1 Railway	UC2 Public Safety	UC3 Logistics
Integrated Sensing and Communication (ISAC)	Continuous environmental and asset sensing	Track geometry, vibration, obstruction	Crowd density, hazard detection, responder tracking	Cargo condition, vehicle movement, corridor sensing
AI and Communication (AIAC)	Edge-native anomaly detection and prediction	Predictive maintenance, safety alerting	Risk mapping, incident prioritization	Delay prediction, cargo risk analytics
Hyper-Reliable and Low-Latency Communication (HRLLC)	Safety-critical and coordination communication	Train safety alert within milliseconds	Multi-agency emergency coordination	Disruption and tampering alerts
High-Precision Positioning	Asset location and digital twin fidelity	Track defect localization to meter level	Responder and casualty positioning	Container and vehicle tracking
Digital Twins	Situational awareness and decision support	Asset health dashboard	GIS command dashboard	Freight corridor intelligence dashboard
Non-Terrestrial Network Integration	Resilient coverage in remote and	Remote railway sections	Disaster-affected areas, border regions	Remote freight corridors, port approaches

EMERGING USE CASES

Proposed 6G Use Case	Why 5G/4G Cannot Do It	Potential
Autonomous Smart Grid System	Requires real-time Digital Twin +	High
Quantum-Secure Infrastructure Native PQC/QKD integration Very High	Requires real-time Digital Twin +	very high
National BESS Swarm	Management Platform	
	Coordinated control of millions of batteries	
Quantum-Secure Defence	Quantum-safe networking Very High	High
Surgical Operations	Ultra High Reliability Low latency	high
Logistic, IoT based Operations	Ultra High Reliability Low latency	high

Integrated Sensing, AI-Native Networks and Low-Latency Response

HOW CAN WE FUEL USE CASES

1. 6G based Digital Fabric for PoC
2. Fuel up with standardization
3. Common API with Common 6G Platform Narrative
4. Technology & user collaboration- Evolve Biz Model
5. Common Operational Challenge Across Priority Sectors
6. Loal to Global
7. Contribution to Revenue Generation and Market Creation



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