Telecommunications
Standards Development
Society, India

TSDSI – An Overview

Bringing the Indian Ecosystem Together to Drive 6G Standards

Our Objectives

- Developing, promoting and standardising India-specific Telecom/ICT requirements and solutions.
- Taking Indian requirements to global standards organisations.
- Helping create standards-based manufacturing expertise in the country.
- Providing guidance and leadership to developing countries.

Our Philosophy

Adhere to the principles of Openness, Transparency, Fairness, Consensus and Due Process in conducting its activities.

Maintain technology neutrality and provide a uniform playing field for its members.

Our Organizational Structure

General Body

***Chairman*:** Satish Jamadagni (Reliance Jio)
***Vice Chairman*:** Suresh Chitturi (Samsung)

Secretariat

Director General: AK Mittal

Governing Council:
21 Elected + 8 Govt. nominees

Standing Committees:
Budget & Finance
Rules & Regulations
Legal & IPR
Standardisation & Transposition
Roadmap
Outreach

Technical Groups:

Study Group - Networks

Chair: Abhijeet Abhimanyu Masal
Vice Chair: *Sonali Garg*

Study Group – Services & Solutions

Chair: Niranth Amogh
Vice Chair: Gomathy Padmanabha

Partnerships & Alliances

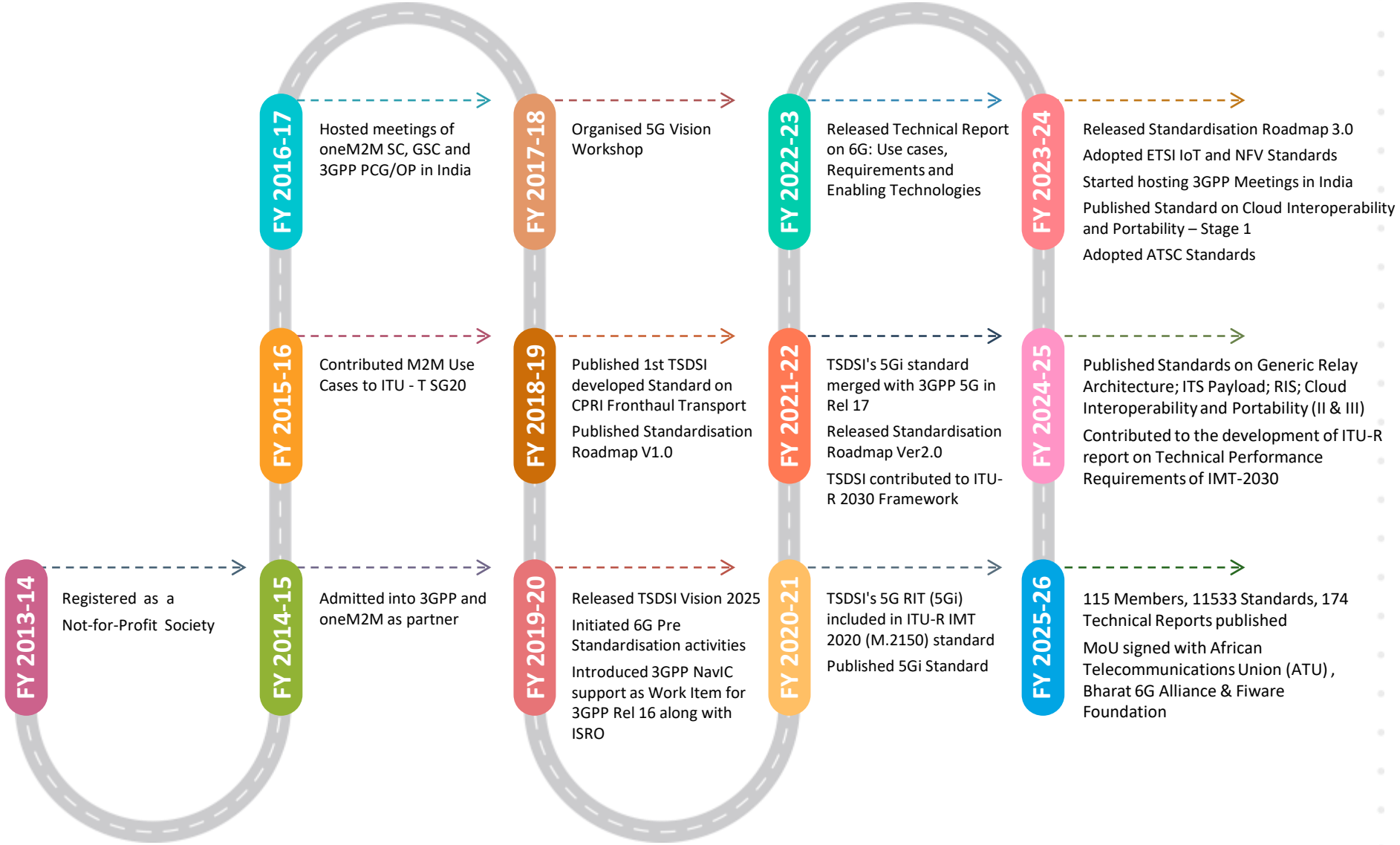
TSDSI is the Organizational Partner of 3GPP. This entitles TSDSI members to become Individual Members of 3GPP through TSDSI and contribute to 3GPP Specifications, taking their IPR into the global arena.

TSDSI is Partner Type I of oneM2M project a leading forum driving M2M service layer standards. It entitles TSDSI member organizations to become Individual Members of oneM2M and contribute to standards development in M2M space.

Multilateral MoU

TSDSI is a member of the Multilateral MoU for conducting Global 5G Events (other members being 6G-IA, XGMF, 6G Forum, IMT-2020 (5G) PG, 6G Brasil)

Journey So Far



OUR ACTIVITIES

Technical Groups

Study Group - Networks

- 6G
- 5G Enhancements
- Broadcast offload
- Spectrum Studies
- Open Systems
- Wireless Backhaul
- Visible Light Communications
- Quantum communications

Study Group- Services & Solutions

- **Security** – Security aspects in the end-to-end Telecom/IoT networks & related standards, Multilayer user plane security, Post Quantum Cryptography, QKD interoperability, AI/ML model and delivery of services, enablers for 6G, SEAL extension for UAV/UAM & AI/ML workloads, QLESS for MmTC in 6G among others
- **Application layer** – Localization, Metaverse, UAV Drones, Telerobotics, Sustainable 6G networks, V2X applications in 6G Networks, integrated sensing at application level, public safety use cases for 6G, AI-powered seamless tracking of supply chains
- **Services Architecture and Framework** – Edge solutions, Critical Communications, Tactile Applications, RAN Slice Services, Cloud Interoperability, Rural Broadband services and marketplace, cost modelling data services, Data management (CIP), Smart Agriculture, , ITS & autonomous driving, Network exposure & digital twin, Split AI in 6G context, UAV/UAM, Role based Service delivery mode, Agentic AI & AI explainability frameworks for 5G/6G

Strategic Initiatives

- Technology Roadmap Item Proposal Forums
- Global Standards Coordination, Engagement with Startups & Industry, Standards Driven Research, Test & Certification

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- ITU Sector Member
- Contributions to 3GPP, oneM2M and ITU
- Regularly hosting 3GPP and oneM2M Meetings in India
- Adoption Agreements with ATSC, ETSI and IEEE-SA

- TSDSI Tech Deep Dive Conference
- Workshops to promote Standards Engagement

TSDSI Standardization Roadmap 3.0

tsdsi
India's Telecom SDO

6G/5G ENHANCEMENTS

Use cases and services, KPIs, Key Technologies and network architecture and evolution for 6G, Rural Coverage and Capacity Enhancement, Waveform Design for THz Communication, Network Energy Saving in 5G and its Evolution towards 6G Sustainability Requirements, Channel Models for Integrated Sensing and Communication in Beyond 5G Systems, Non GNSS/NTN Positioning, Ambient IoT – A New Paradigm for Resource-Efficient IoT Deployments, Unified Global Communication Infrastructure Reference Architecture, Network Capabilities Exposure, Sustainable Development with Minimal Energy Consumption in 6G

APPLICATIONS/ VERTICALS

5G use cases for Verticals, Study on System Requirements for NR based Future Railways Mobile Communication System (FRMCS), Collation of Satellite Imagery for agriculture using 5G network, Requirement for a Reference Architecture for Solar-powered Unmanned Aerial Vehicle

QUANTUM COMMUNICATIONS

Next generation secure, adaptable and cost effective solutions for Quantum security, Quantum communication, security and modelling, Trusted node testing, Underwater QKD, PQC in embedded systems and Device Biometrics

VISIBLE LIGHT COMMUNICATION

Standards for Visible Light Communication, Standardization of FSO systems for broadband communication

SPECTRUM STUDIES

Spectrum Coexistence studies towards 6G, Flexible Dynamic Spectrum Access architecture

NON-TERRESTRIAL NETWORKS

Positioning in 6G Communication networks using Multi GNSS including NavIC, Multi-dimensional multihop non terrestrial networks with BS functionality onboard

INTELLIGENT TRANSPORT SYSTEMS

Standard and regulations for Autonomous driving System, Reference Architecture for Automated Electric Road Transportation, Connected Multi-Modal Transportation

CLOUD

Cloud Resource Management in Future Networks

WIRELESS BACKHAUL

UAV based backhaul, 4G/5G Fronthaul & Backhaul, Wireless-to-Building (WTTB)

SECURITY

Security standards for IoT and Machine-to-Machine, Quantum Security

AI/ML

AI/ML in & for Future Networks, AI/ML based Mobility Enhancements

OPEN SYSTEMS

Open Disaggregated Networks

RURAL BROADBAND

Architectures for Rural Broadband

TSDSI Accomplishments

Group	Technical Reports Published	Technical Standards Transposed
Study Group-Networks	20	11243
Study Group-Services & Solutions	154	290

Technical Standards Developed and Published

- Cloud Interoperability & Portability Standard (Stage I, II and III)
- 5Gi (merged with 3GPP Rel 17 in 2022)
- CPRI Fronthaul Transport
- A Generic Relay Architecture for 5G and Beyond (adopted by TEC as National Std)
- Methods and Interface Design for RIS-assisted Communication Systems
- Standardization of common data payload for adaptive traffic control system and other Intelligent Transportation system

Standards Adopted

- Adoption of ETSI IoT and NFV Standards as TSDSI Standards
- 19 Specifications of ATSC 3.0 Standards
- Transposed 3GPP and oneM2M Specifications into TSDSI Standards

TSDSI transposed standards mandated as National Standards by TEC

- 3GPP Specifications for 3G, 4G and 5G
- 3GPP Specifications for Indian Telecom Security Assurance Requirements
- oneM2M Rel 2 & Rel 3 Standards

Technical Reports Published (1/2)

6G / 5G Enhancements

- Study on Framework for AI/ML Operation Splitting in 6G Context
- AI Driven Massive Digital Twinning Framework for Networks
- Railway Communications using 5G: Use Cases & Reference Architecture
- Dynamic Joint Deployment of SDN Controllers and Hypervisors for Softwarized 5G and Beyond
- The Role of Edge Intelligence in a 6G Communication Network
- Study of Multiple Access for 6G Communication
- Suggested Recommendations for Sustainable 6G Networks
- Radiative Near Field Communication with Extreme MIMO
- Systems Requirement for NR based Future Railways Mobile Communication System
- Enhancing RBSA for 5G: Pioneering Next-Generation Connectivity Solutions
- 5G Extensions for Broadcast Offload
- Slice Identification in 5G RAN for End-to-End Secure Services
- 6G: Use Cases, Requirements and Enabling Technologies
- Visible Light Communication/Li-Fi
- Enhancements of flexible UL/DL Resource Utilization
- Functional Split and Fronthaul Interface in FBS Driven C-RAN for 5G and Beyond

Spectrum Studies

- Characterization of E-band for 4G/5G Backhaul & Rural Broadband
- 6 GHz spectrum for IMT services in India

Broadcast Convergence

- Broadcast Offload
- 5G Broadcast based Service Delivery for TV, Radio, IPTV and File-casting
- 5G Extensions for Broadcast Offload

Applications / Verticals

- Recommendations for use of Dynamic AI/ML Models for Self-Sustainable V2X Applications in 6G
- Enablement of Common Data Payload for Agricultural Automation Solutions
- Study on the Usage of oneM2M for Smart Agriculture end-to-end Monitoring Use Case in Indian Context
- System requirements in Metaverse use cases in mobile network
- Communication Requirements & Recommendations for Energy Sector
- Enablement of Common Ontology for Adaptive traffic control system and other Intelligent transportation system products
- Slice Identification in 5G RAN and Core for End-to-End Secure and Resilient Slice Services
- Study of UAV/Drone 3GPP Standard Applicability to India Use Cases
- Drone Communication Services
- Public Protection Disaster Recovery (PPDR)
- Indian Languages in Mobile Transactions
- Information Centric Networking
- Data Pruning in Smart IoT Applications
- M2M Use Cases in Various Verticals - India Context
- NB IoT capabilities for Energy Metering
- Semi-autonomous collaborative telerobotics
- Research Directions and Collaboration on Intelligent Transport Systems Communication Standards

Technical Reports Published (2/2)

Open Systems

- Open Disaggregated RAN

Wireless Backhaul

- Solar Panel Based Optical Wireless Communication
- Channel Characteristics of 60GHz for 4G/5G Backhaul
- Evaluation of the existing IAB architecture in 5G Networks

Security

- PQC in Embedded System to Secure the Connected Devices
- Study on Security enabler for 6G
- Interoperability of Multi-vendor QKD Hardware using SDN
- Network Security Encryption Mechanism
- Enhancement of Privacy in Future Networks
- Usage of oneM2M for Smart Agriculture End-to-End Monitoring Use Case in the Indian Context
- Study of Post-Quantum Cryptography for Future 5G Networks and Application
- Enhancement of the Privacy of User Subscription Identity in Future Networks
- Reducing Threats to the National Critical Infrastructure using DNS
- Study on the security aspects of Artificial Intelligence (AI) / Machine Learning (ML) models for 5G and 6G applications
- A location privacy-preserving scheme to mitigate the authentication relay attack under False Base Station (FBS) in 5G and 6G

Services Architecture

- Enablement of Common Edge Connectivity for Public Utility Purposes
- Implications of Network Slicing on Unified Communication as a Service (UCaaS)
- Slice Identification in 5G RAN and Core for Scalable and Resilient Slice Services
- Edge Intelligence for haptics IoT use cases
- Network Security
- Performance Measurements for Dual SIM Devices
- Cloud Interoperability and Portability Standards
- Rural Broadband Services and Architecture
- Service Delivery using 5G Broadcast for TV, Radio, IPTV and File-casting

https://tsdsi.in/tr/

PUBLISHED WHITE PAPERS

tsdsi
India's Telecom SDO

[Automated Electric Road Transportation]

[Insights into Smart City Solutions]

[Standardization Opportunities for Quantum Communication Technologies]

[6G Use Cases and Enabling Technologies]

[Status of Telecom Startup Ecosystem in India]

[Privacy & Personal Data Protection on Mobile Devices]

[Feasibility of Open Source for 5G]

Engagement with Global Forums

TSDSI@ITU

- Sector Member of ITU-R and ITU-T
- 5Gi standard - recognized as one of the ITU-R Recommendation M.2150, now merged into 3GPP 5G Rel 17
- Contributing regularly to ITU-R WP5D IMT2030 (aka 6G)
- Contributing to ITU-T SG13, FG AINN
- A.5 Certified by ITU-T

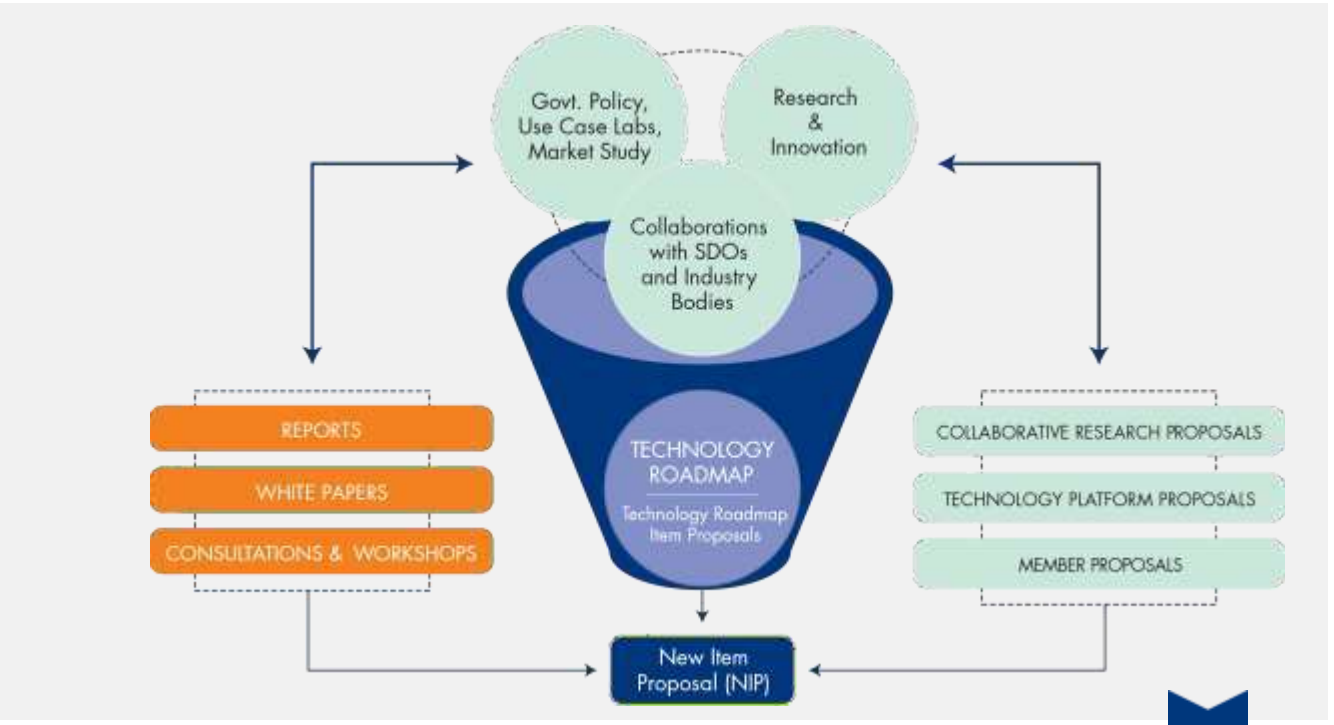
TSDSI@3GPP

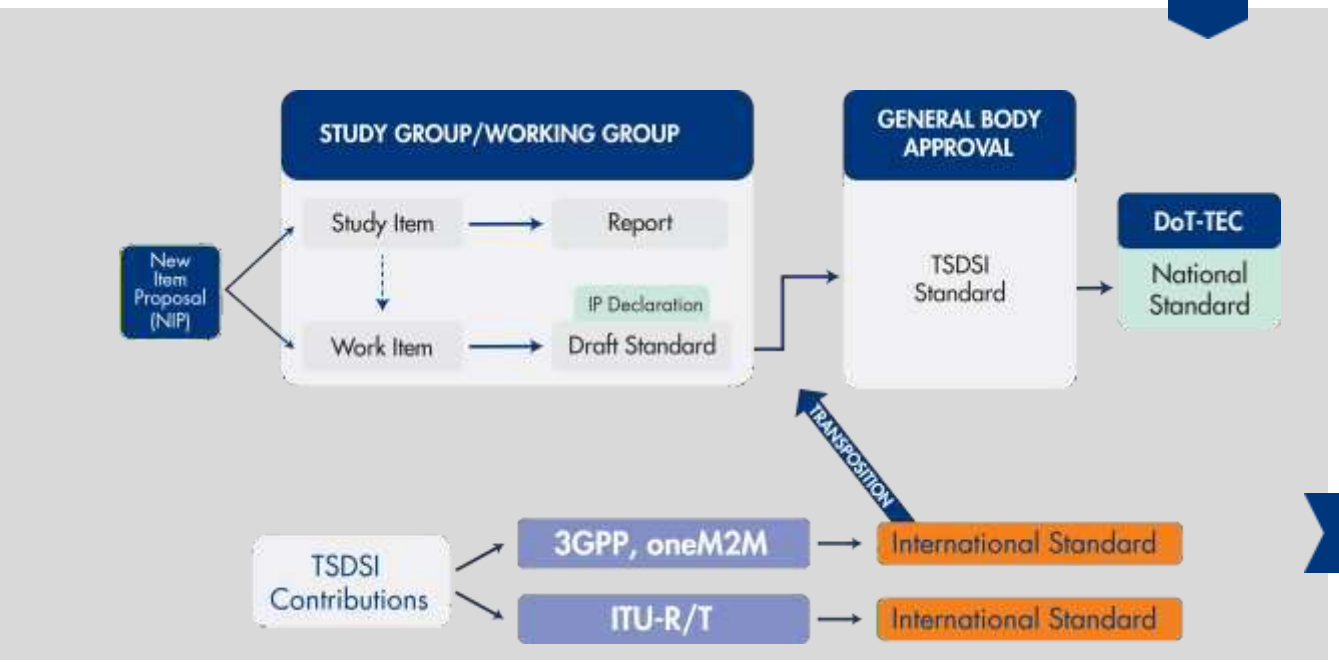
- One of 7 Organizational Partners of 3GPP | 49 TSDSI members are 3GPP IMs
- Regularly hosting 3GPP WG meetings in India
- TSDSI transposed 3GPP Specs are submitted to TEC for adoption

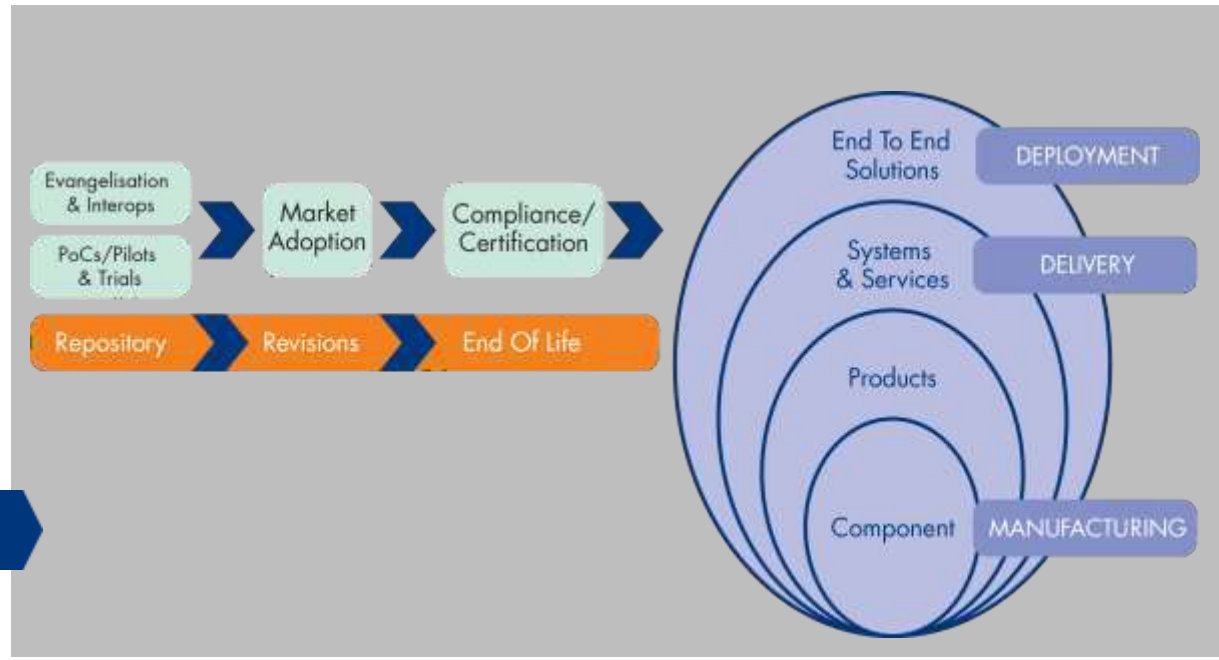
TSDSI@oneM2M

- TSDSI is Partner Type **I** of oneM2M | 49 TSDSI members are oneM2M IMs
- Regularly hosting oneM2M TP meetings and awareness workshops in India
- TSDSI transposed oneM2M Specs are submitted to TEC for adoption

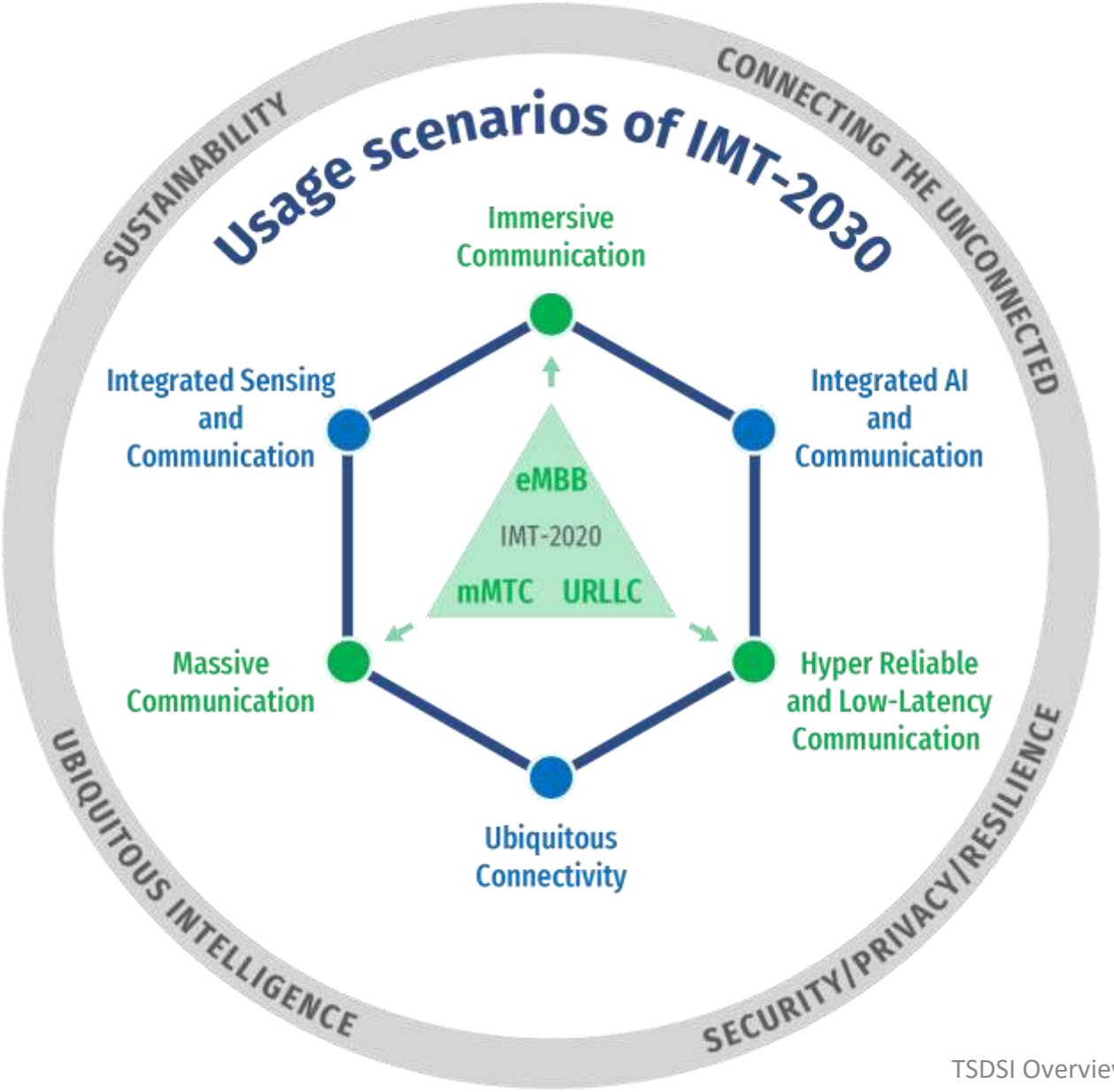
Standardization Lifecycle







ITU-R FRAMEWORK FOR IMT-2030 AND TSDSI ROLE



TSDSI contributed to ITU-R Framework document and Future Technology Trends document in 2021-22 and 2022-23

Current Standards Development Activities

6G

- Coreless RAN
- New Architecture for 6G Communication Systems
- AI Architecture for RAN (SON/RRM)
- Update to TS on Methods and interface design for RIS- assisted communication System
- Positioning standard for 6G using Multi-GNSS including NavIC in India
- Functional Split and Fronthaul Interface in FBS driven C-RAN for 5G and Beyond

Wireless/Backhaul

- Characterization of E-band for 4G/5G Backhaul & Rural Broadband

Applications

- Local language repository as an enabler for financial workflows
- Integrated Communication and Sensing
- Architecture and information flow to enable application-layer driven dynamic QoS provisioning for multi-user intelligent telerobotics and similar applications requiring exchange of multi-modal data traffic
- Recommendations for Network architecture and requirements for enabling AI-powered seamless operation and tracking for mine supply chains leveraging non-public and public networks

Services Architecture & Framework

- Architecture to support tactile applications with edge intelligence over 5G system
- Rural Broadband Services Architecture (RBSA) – Operational Framework and Marketplace Design
- Technical Standard & Regulation for Autonomous Driving Systems
- AI-Native Digital Twin Architecture for Massive Digital Twinning in 5G/6G

Security

- QLESS: Quantum-Safe Lightweight Secure Session for mMTC in 6G

Technical Study Areas

Ongoing Technical Study Areas

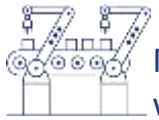
- 6G
- 5G Enhancements
- VLC
- Quantum
- Security
- Application Layer (focusing on vertical domains)
- Services Architecture & Frameworks
- AI/ML
- UAV

Other Focus Areas

Spectrum, Drones, HAPS, FWA, Small Cells, Open Hardware & Platforms, Carrier Grade Linux Systems, NR NTN & NR IoT NTN, Broadcast Offload

Our Membership

TSDSI attracts members from all sections of Telecom/ICT Ecosystem

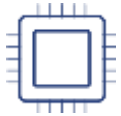

Manufacturers with Indian IP


Domestic Manufacturers


Telecom Service Providers


Other Services


R&D Organisations


Semiconductor components designers/ manufacturers


Manufacturers of Mobile Device/CPE End User Devices


Government Departments/ Autonomous Bodies


Developers of Application solution/ Service Platform


Academic Institutions

An organization can join TSDSI as a Corporate/Associate/Guest member. Corporate Members can join 3GPP and oneM2M.

Membership Type	Description	Privileges
Corporate	Entities registered in India and engaged in Telecom related activities	• Participate in and Contribute to Technical Activities • Participate in Decision making and voting • Eligible to hold office bearer positions
Associate	Industry Associations, Foreign Entities, Foreign Industry Associations	Participate in & Contribute to Technical Activities
Guest	Organizations who wish to explore the need for becoming a member before taking up Corporate or Associate Membership, can be granted, on request Guest Membership for a period of 6 months.	Participate in Technical Activities and contribute on invitation

Join Us

Member List

References

Current Technical Studies: SGN

6G / 5G Enhancements

- New Candidate Waveforms for Link level performance Enhancements for NR NTN & NR-IoT NTN in LEO Satellite Systems
- Use case study for RIS empowered end-to-end applications for future smart villages and unplanned urban areas in developing nations
- Simulation Environment and benchmarking for RIS performance Evaluation
- Study of Autonomous Reconfiguration of RIS for Reduced
- Control Overhead
- Open interfaces for RIS-assisted communication
- TSDSI Contribution to ITU-R IMT-2030 TPR
- Handling of Diverse Services in Future Mobile Networks
- Minimum Performance Spec for Mobile Devices
- Network Energy Saving functionality of the 5G-Advanced system and its Evolution
- Joint communication & sensing in 5G networks & beyond
- Defining qualitative metrics for 6G KPI definitions
- Study of waveforms for B5G communication systems
- Functional Split and Fronthaul Interface in FBS driven C-RAN for 5G and Beyond

Wireless Backhaul

- Characterization of E-band for 4G/5G Backhaul & Rural Broadband

Spectrum Studies

- Sub-THz Channel Modeling
- Study of the channel model for integrated sensing and communication network in FR3 and THz band

Quantum Communication

- Trusted node mapping for diverse Quantum channels
- Underwater QKD

VLC

- Solar Panel Based Optical Wireless Communication
- Enhancement to media access control (MAC) protocols for visible light communication (VLC) in indoor scenarios

Others

- Evolution Aware Solutions for LoRa Deployment
- Study on scalable and energy-efficient synchronization in digital broadcasting systems

Current Technical Studies: SGSS

Security

- PQC Migration Strategies for 5G and 6G Mobile Networks
- Extension of SEAL for Authentication, Authorization, and Key Exchange of UAV/UAM-Hosted Applications and AI/ML Workloads in 5G/6G Networks
- 5G and 6G Beyond Network Security Architecture to support Multilevel End-to-End User Plane Security
- AI/ML-based Security Implementation in 6G Wireless Communication Systems
- SDN-Based Optical Network for QKD: Secure and Adaptive Architecture

Applications / Verticals

- Public Safety Use Cases for 6G Networks
- AI-Powered Air Interface for ITS
- Study of Slice-specific Handovers for 5G and Beyond Networks
- Study on Solution for Artificial Intelligence supporting Use cases in Agriculture Domain – Plant Leaf disease Identification

Services Architecture

- Agentic AI framework for Autonomous Telco operations
- AI Explainability framework for 5GS/6GS
- Study on UAV communication and security standards for secure airspace control
- Network Capabilities Exposure
- Enablement of common edge connectivity for public utility purposes
- Framework for AI/ML operation splitting in 6G context
- Carrier Grade Linux Specification
- AI-Enhanced Massive Digital Twinning Framework for Networks Supporting Sustainable Development Goals
- Technology recommendations for Telecom Service Providers to increase efficiency towards Capex/Opex

Thank You