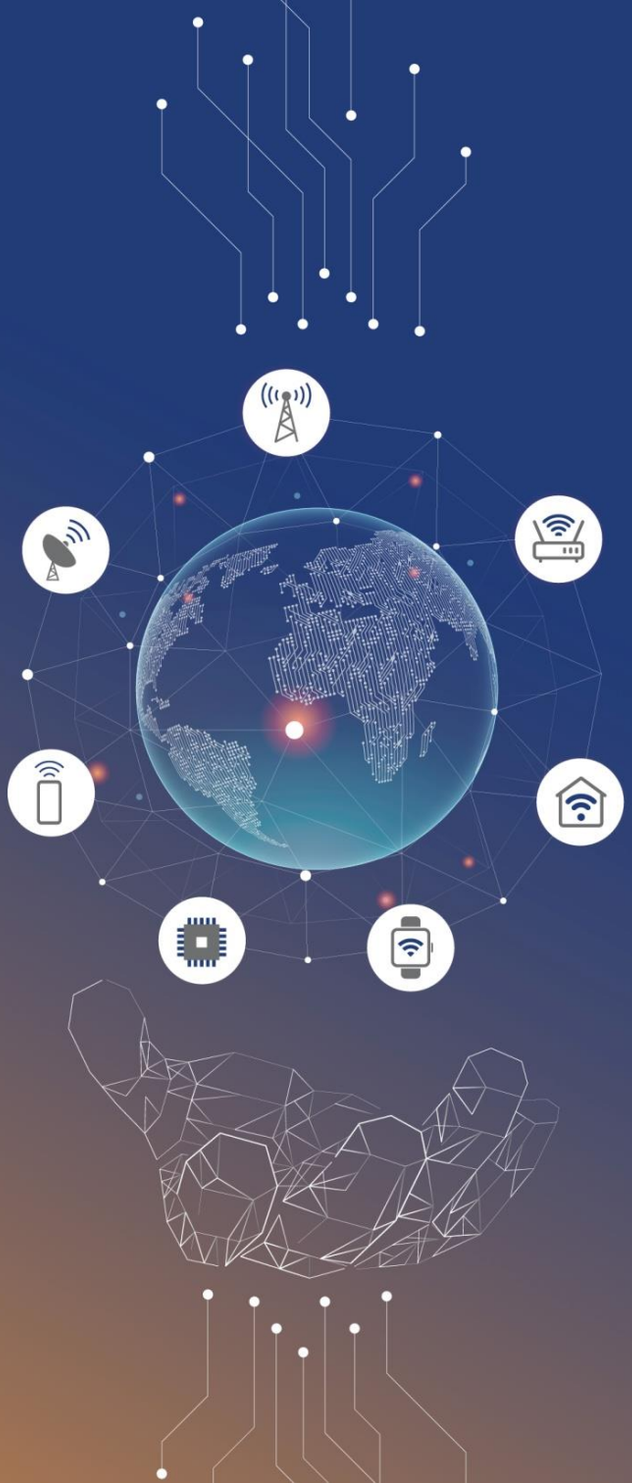
Workshop on

Standards-driven Research @ NCC 2024

28th February 2024

09:00 to 17:30 IST

IIT Madras



Workshop on Standards-driven Research @NCC 2024

TSDSI Technical Activities

Dr A. Paventhan
ERNET India
(Under Ministry of Electronics & IT)
D4-05, IIT Madras Research Park.

OUTLINE

- Why Standardization
- About TSDSI
- Standardization Process @ TSDSI
- TSDSI Activities
- TSDSI case studies – 5Gi, RBSA
- TSDSI Roadmap
- 6G @TSDSI
- TSDSI Role in IMT2030

WHY STANDARDS?

- Resolution of a problem or upgrade technology
- Standardize existing technology/practice
- Bring in new technology
- Meet market requirements
- Inter-operability
- Reliability
- Regulatory compliance
- Economies of scale
- Fair competition

ABOUT TSDSI

Introductory Video of TSDSI [Click here]

An autonomous, membership based, Standards Development Organization (SDO) for Telecom/ICT products and services in India.

We develop standards for access, back-haul, core Telecom networks, ICT solutions & services that best meet India specific needs, based on research and innovation in India.

We work closely with Global standards' bodies to reflect Indian requirements into International Telecom/ICT standards.

We play an important role in incorporation of Indian IP into Global Telecom standards.

Recognised by Department of Telecommunications as India's Telecom SDO

Registered as a Not-for-Profit Society, under the Indian Societies Registration Act XXI of 1860.

Objectives

Developing, promoting and standardizing India-specific Telecom/ICT requirements and solutions

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

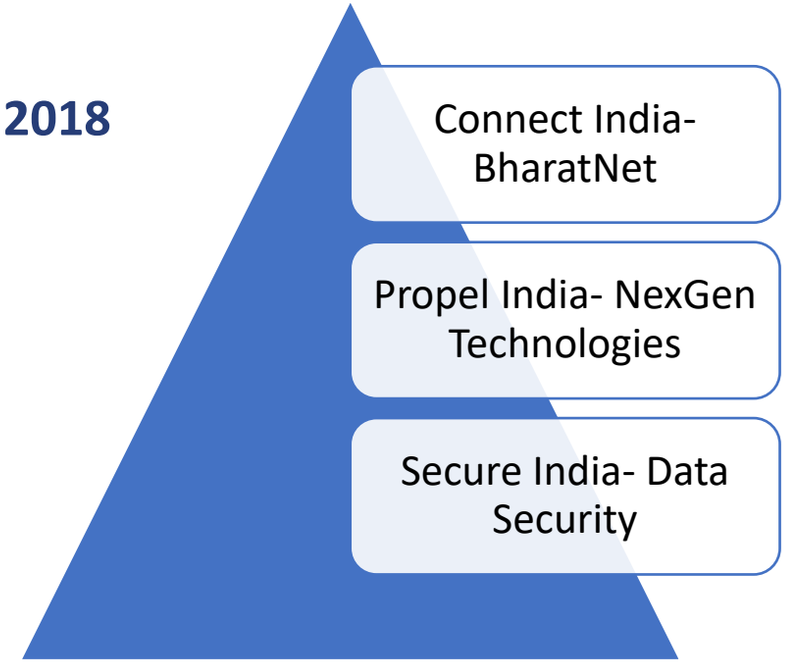
Maintain technology neutrality and provide a uniform playing field for our members

Providing guidance and leadership to developing countries

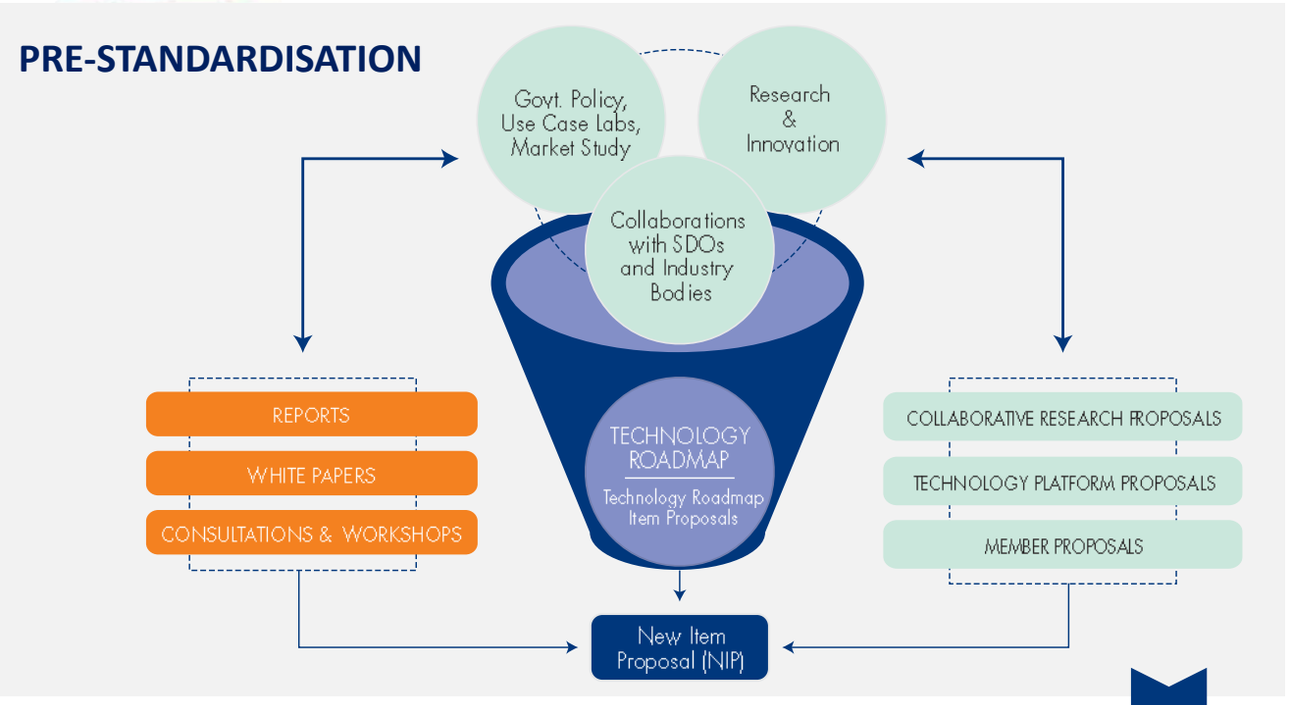
TSDSI VISION

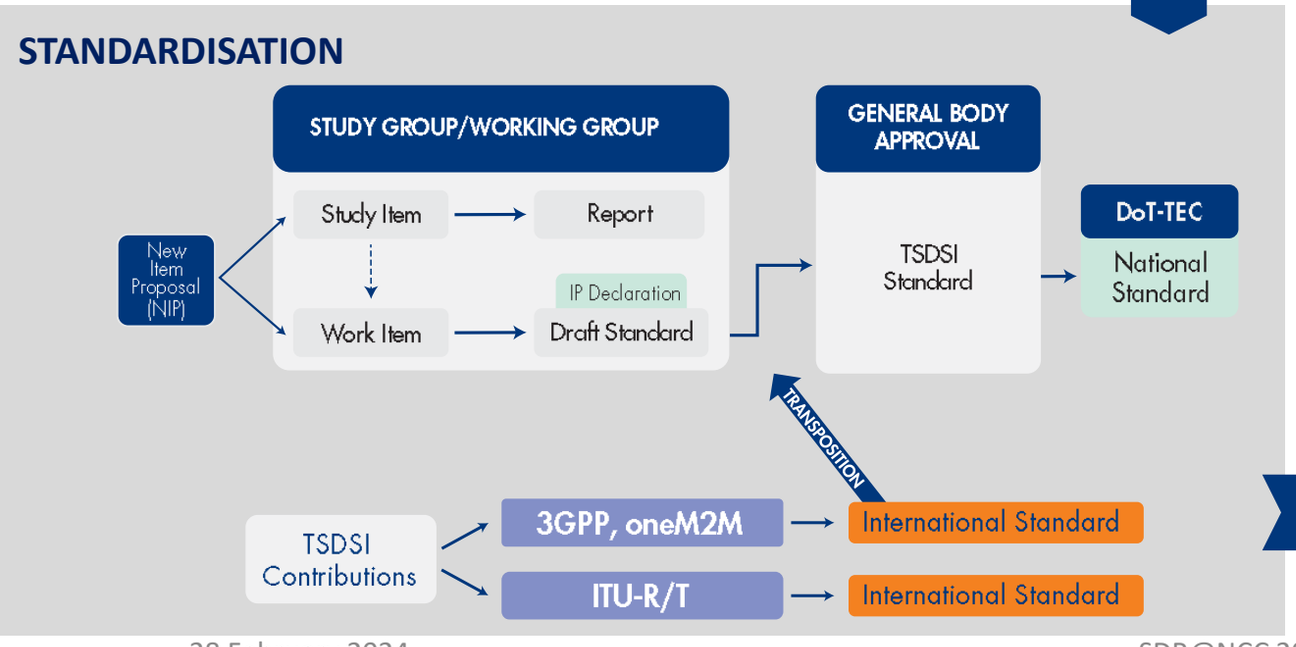
"To ensure that Digital Communication Standards increasingly drive domestic, economic and policy activities and enhance India's competitiveness for ICT goods and services in global markets. It aims to do this by creating a leadership position through India's participation and contribution to emerging Digital Communication Standards in global SDOs".

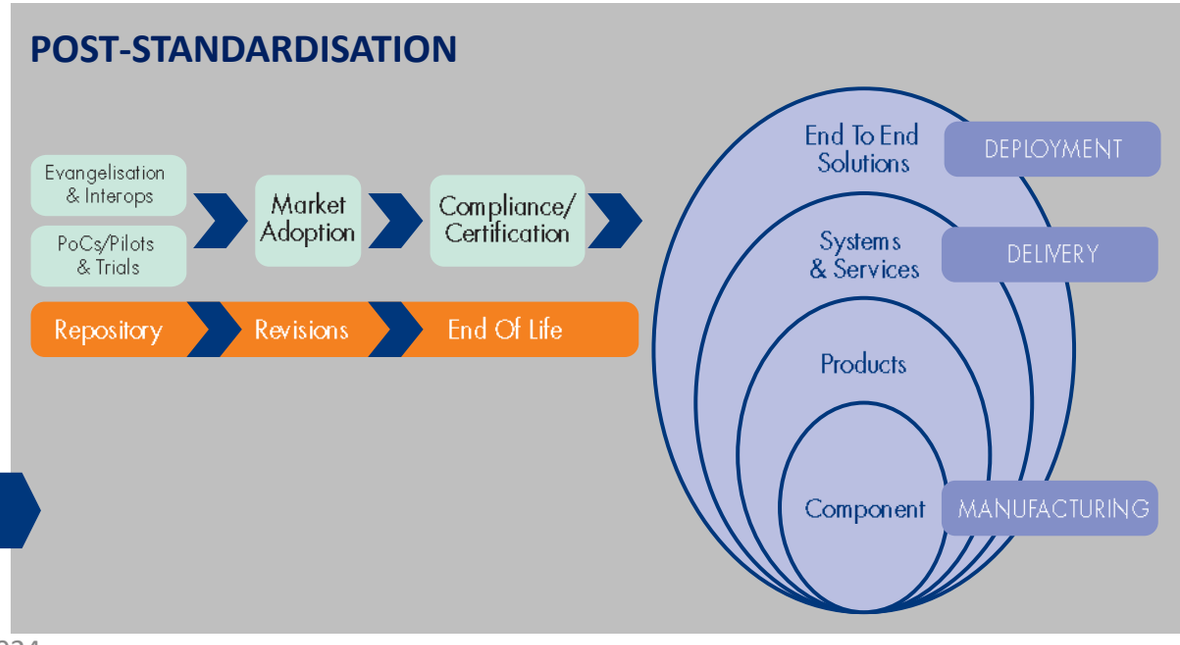
Standardization as an Enabler for NDCP 2018



Standardization Lifecycle







TSDSI Technical Structure & Strategic Initiatives

Technical Groups

Study Group - Networks

- 6G
- 5G Enhancements
- Broadcast offload
- Spectrum Studies
- Open Systems
- Wireless Backhaul
- VLC

Study Group- Services & Solutions

- **Security** - Covering Machine KYC, Post Quantum Cryptography, security aspect of AI/ML model transfer in 5GS, security enablers for 6G, CEIR
- **Application layer -** Automotive, Health, and Finance, Indian Language Support for Financial Transactions, Metaverse, UAV Drone, Common payload agriculture automation solutions, robotics, integrated sensing at application level
- **Services Architecture and Framework** – Defining Architecture and Protocol Requirements, Development of Service Framework, Rural Broadband, Common Edge Connectivity, Cloud Interoperability, IoT/M2M, Public Safety/Critical Communications, Cost Modeling,

Strategic Initiatives

- Technology Roadmap Item Proposal Forums (Quantum, IoT/M2M, AERT)
- Global Standards Coordination, Engagement with Startups & Industry, Standards Driven Research, Test & Certification

- ITU Sector Member
- Contributions to 3GPP, oneM2M and ITU
- Agreements with ATSC, ETSI and IEEE-SA for adopting their standards

- TSDSI Tech Deep Dive Conference
- Workshops to promote SDR, contributions to 3GPP, ITU (including WTSA)

Published Standards and Reports

Group	Technical Reports Published	Technical Standards Published
Study Group-Networks	12	8,821
Study Group-Services & Solutions	136	223

Technical Standards Published

- Cloud Interoperability & Portability Standard
- 5Gi (merged with 3GPP Rel 17 in 2022)
- CPRI Fronthaul

Standards Adopted by TSDSI

- ETSI IoT and NFV 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 ITSAR
- oneM2M Rel 2 & Rel 3 Standards

TSDSI standards submitted to TEC for adoption

- CPRI-Fronthaul, ATSC transposed standards

https://tsdsi.in/published-standards/

Technical Reports Published

6G / 5G Enhancements
- 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

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

Open Systems
- Open Disaggregated RAN

Wireless Backhaul
- Channel Characteristics of 60GHz for 4G/5G Backhaul

https://tsdsi.in/tr/

Applications / Verticals
- Communication Requirements and Recommendations for Energy Sector
- Enablement of Common Ontology for Adaptive traffic control system and other Intelligent transportation system products
- 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

Services Architecture
- Unified Network Slicing Model
- Edge Intelligence for haptics IoT use cases
- Performance Measurements for Dual SIM Devices
- Cloud Interoperability and Portability Standards

Security
- Study of Post-Quantum Cryptography for Future 5G Networks and Application
- Digital Process for Know Your Machine Custodian
- Smartphone User Data & Privacy Protection
- Reducing Threats to the National Critical Infrastructure using DNS

Current Standards development activities

6G / 5G Enhancements

- Architecture for 6G Communication Systems
- Coreless RAN
- AI Architecture for RAN
- Tactile applications edge intelligence- 5GS
- B5G - Multilevel E-to-E User Plane Security
- Fronthaul Interface in FBS Driven C-RAN
- Methods and Interface design for RIS-assisted communication
- Functional split and fronthaul interface in FBS driven C-RAN for 5G and beyond (TR Published)

Broadcast Convergence

- Extension of Broadcast Offload

Services Architecture

- Rural Broadband Services Architecture
- Cloud Interoperability & Portability

Wireless Backhaul

- Characterization of E-band for 4G/5G Backhaul & Rural Broadband (TR Published)
- Evaluation of the existing IAB architecture in 5G Networks (TR Published)

Applications / Verticals

- Integrated Communication and Sensing
- Local Language for financial workflows
- Standardization of common data payload for adaptive traffic control system and ITS interoperability

Current Technical Studies

6G / 5G Enhancements

- Waveforms for B5G
- Channel Modeling , PHY Layer Req. for NFC in 6G
- Joint Communication & Sensing in B5G
- Qualitative Metrics for 6G KPIs
- Futuristic Architecture of 5G Backbone and Slicing
- Dynamic Joint SDN Controllers and Hypervisors
- Security Aspects of AI/ML
- Privacy Preserve - Detection False Base Stations
- Network Energy Saving functionality of the 5G-Advanced system and its Evolution
- Minimum Performance Specs for the Communication Edge
- Minimum Performance Spec for Mobile Devices
- Unified network slicing model
- Joint communication & sensing in 5G networks & beyond
- New waveforms and Multiples access for 6G communication
- Channel modelling and physical layer requirements for near-field communication in 6G networks
- Waveforms for B5G communication system

Security

- Security Enablers for 6G
- Security aspect of AI/ML model transfer in 5GS
- security and privacy of the user identity
- Location privacy-preserving scheme to mitigate authentication relay attack-False Base Station in 5G
- 5G and Beyond Network Security Architecture to support Multilevel End-to-End User Plane Security
- A Technical Exploration of the Significance and Implementation of Central Equipment Identity Register (CEIR)

Wireless Backhaul

- Characterization of E-band for point-to-multipoint backhaul

Spectrum Studies

- Sub-THz Channel Modeling
- Dynamic spectrum access

Services Architecture

- Common Edge Connectivity for Public Utility Services
- Cost model considering network assets and utilization
- Smart Agriculture end-to-end monitoring use case in Indian context
- Rural Broadband services and Architecture
- Carrier Grade Linux Specification

VLC

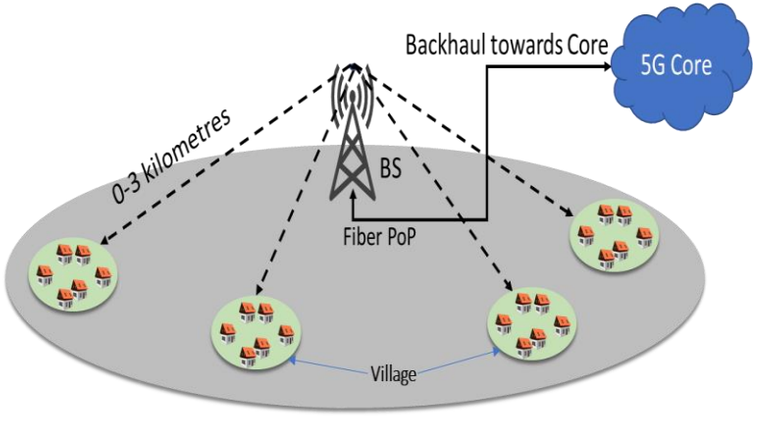
- Enhancement to media access control (MAC) protocols for visible light communication (VLC) in indoor scenarios
- Solar Panel Based Optical Wireless Communication

Applications / Verticals

- Study on semi-autonomous collaborative telerobotics
- Intelligent Transport Systems Communication
- common payload for Agricultural Automation Solutions

TSDSI's 5G Journey: From Requirements to Global Standard

Courtesy : "A Case for Large Cells for Affordable Rural Cellular Coverage", Saidhiraj Amuru, Radha Krishna Ganti et al.



Config A	• 700 MHz • ISD 1.732km • 120/500 km/h
Config B	• 4 GHz • ISD 1.1732km • 120/500 km/h
Config C (LMLC)	• 700 MHz • ISD 6 km • 3/30 km/h

Existing rural models 3G, 4G, 5G

New model 5G

3GPP 5G Standard + Indian Enhancements

To address Indian needs

Technical studies and finalization done in TSDSI

India Requirement LMLC

TSDSI's LMLC Req. incorporated @ ITU in Q3 2017

TSDSI creates 5Gi Standard

TSDSI 5Gi Standard merged into 3GPP Rel17

Rural Broadband Services Architecture (RBSA)

RBSA - TSDSI SGSS Study Item

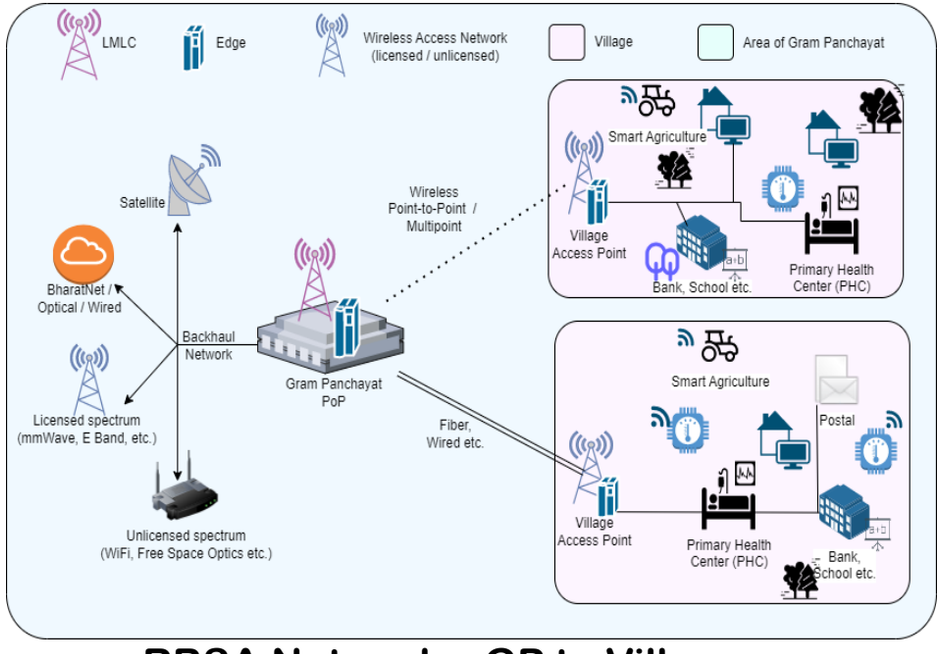
- Study existing rural connectivity infrastructure
- Propose RBSA for rural applications and service deployment
- Study service enablement and network provisioning functions

RBSA Study Item – Stage 1 (Completed)

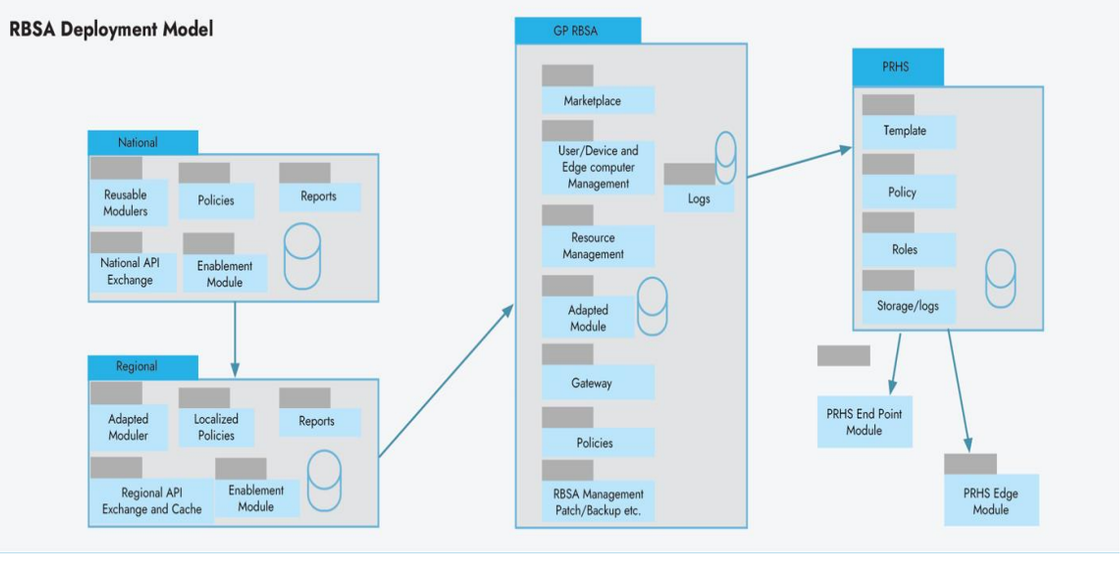
- TSDSI Technical report on RBSA published in June 2023
- **Recommendation:** Pilot / standards specification development

RBSA Work Item – Stage 2 (in progress)

- RBSA – Operational Framework and Marketplace Design
- Technical specification on RBSA

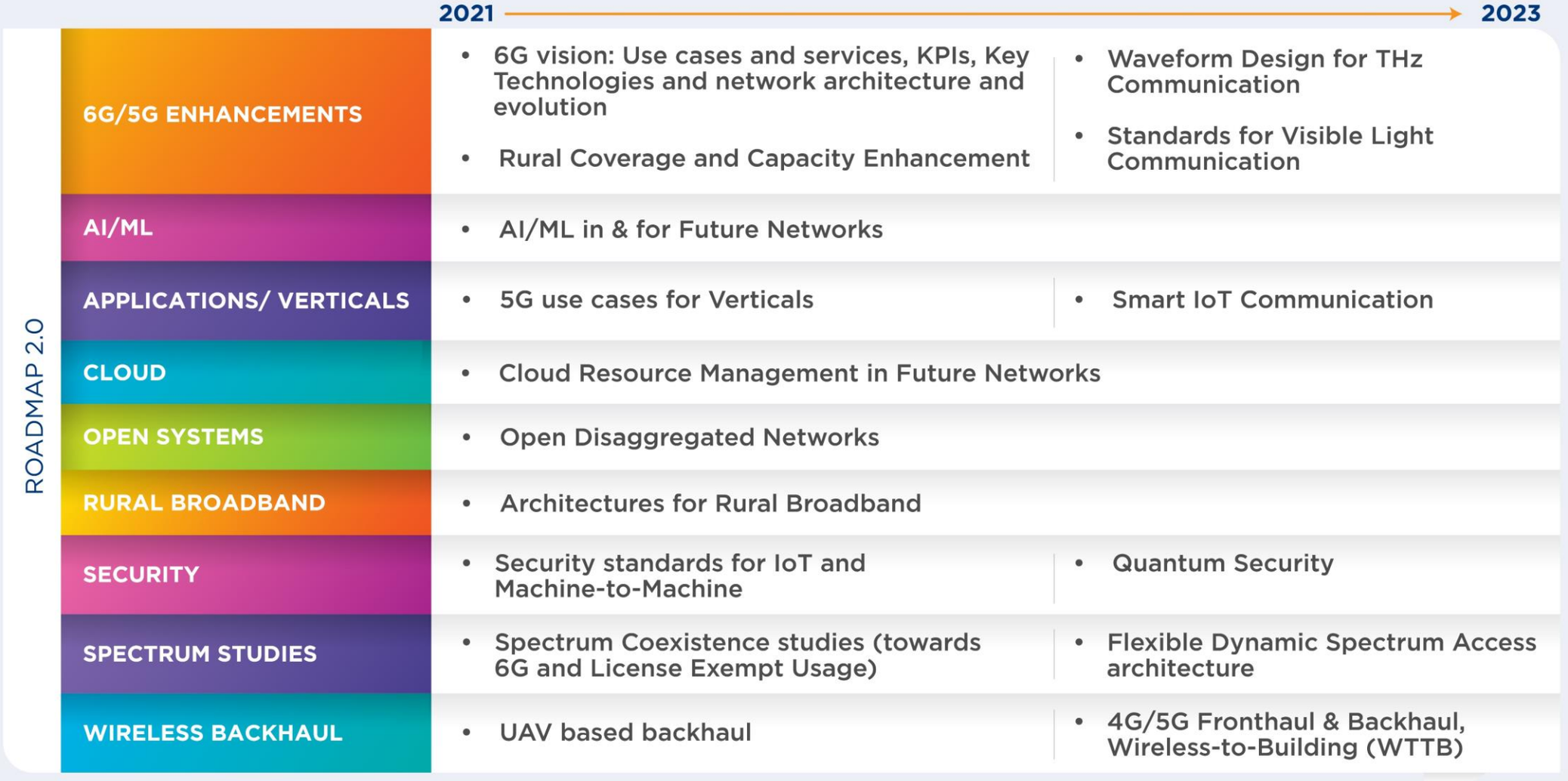


RBSA Network – GP to Villages



Standardization Roadmap 2.0

Roadmap 3.0 in approval stage



6G @ TSDSI

Adopted a two-pronged strategy:

1. Steer research in India to serve its goals
2. Continue engagement with global standard bodies for harmonization of efforts including ITU WP 5D.

TSDSI began 6G work with an introductory workshop "Telecom Technologies for the next Decade" in Jan'20

Published Technical Report 6G: Use Cases, Requirements and Enabling Technologies in Jul'22

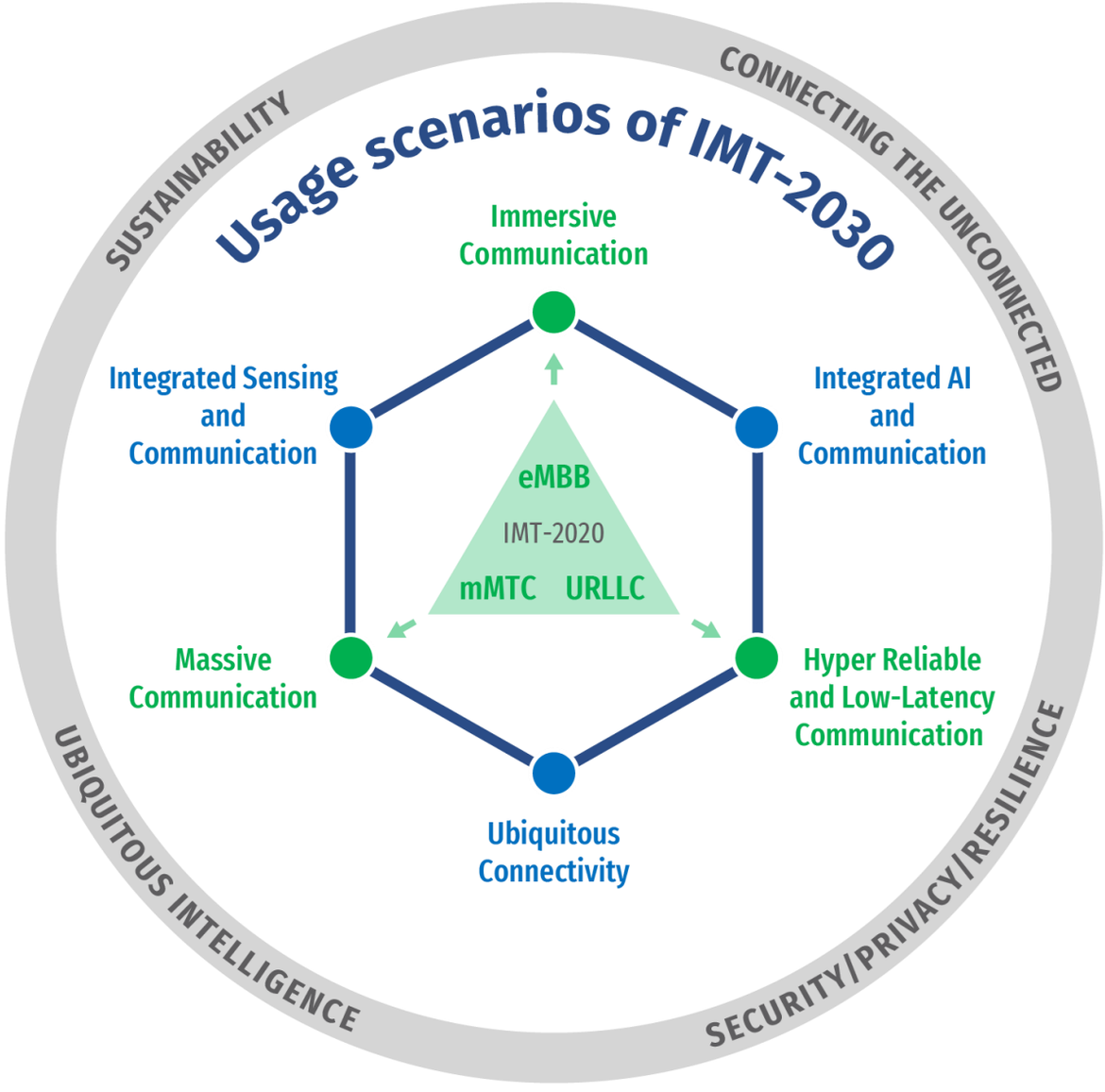
Use Cases & Enabling Technolgies

- Ubiquitous connectivity / compute Experience
- Immersive Interactive Experience
- Automated Transportation
- Surveillance for industries and civic crime control
- Enabling Smart Villages / remote area accessibility including e-health and education
- Supply chain and logistics
- Industrial Internet / Tactile Internet
- Native AI andML in networks

Key Technology Enablers

- New Radio interfaces
- Combined communications and Sensing technologies
- Enhance privacy and security
- Energy efficiency and sustainability
- Coverage enhancements
- Native AI/ML in radio interface technologies
- Integrated terrestrial and non-terrestrial communications
- Explore new spectrum management mechanisms

ITU-R FRAMEWORK for IMT-2030 & TSDSI Role



TSDSI contributed to IMT2030 Framework document and Future Technology Trends for IMT 2030 and Beyond

Resources

- Visit **https://tsdsi.in/about/** for more information on TSDSI
- Introductory Video on TSDSI **@ https://tsdsi.in/introductory-video-of-tsdsi/**
- TSDSI Standards **https://tsdsi.in/published-standards/**
- TSDSI Transposed Standards at **https://tsdsi.in/3gpp/** and **https://tsdsi.in/onem2m/**
- TSDSI Technical Reports from **https://tsdsi.in/tr/**
- TSDSI White Papers:
  - 6G at **link here**
  - Status of Telecom Startup Ecosystem in India at **link here**
  - Focus on Open-Source for 5G at **link here**
  - Privacy and Personal Data Protection on Mobile Devices at **link here**
- Download our monthly bulletins from **https://tsdsi.in/tsdsi-monthly-bulletin/ and newsletters from https://tsdsi.in/newsletter/**

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Thank You

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