



tsdsi NEWSLETTER

Volume 10 | Issue 03 | September 2026

Standardization Activities **P2** | Pre-Standardization Activities **P3** | Post-Standardization Activities **P3** |
Global Standards Roundup **P3** | Operational Matters **P5** | Outreach **P5** | Programme **P6** |
Events **P8** | Membership Updates **P8**

HIGHLIGHTS (July-September 2026)



Hon'ble Minister of Communications
Shri Jyotiraditya M. Scindia
graced the Valedictory Session of
TTDD 2026 on 10 July 2026,
released New TSDSI Technical
Standard & conferred the TSDSI
Outstanding Technical Contributions
(OTC) Awards FY 2025–26



TSDSI releases its Vision 2035

TSDSI will drive inclusive standards development across the entire telecommunication value chain - from core technologies to applications, aligned with India's evolving needs. TSDSI's aims to become a prominent contributor to global standards forums and collaborate with regional and international bodies to advance shared priorities

TSDSI IMC 2026 Standards Pavilion

TSDSI is participating as the Standards Partner at India Mobile Congress (IMC) 2026, featuring an exclusive/first-of-its-kind Standards Pavilion highlighting India's telecom standardisation ecosystem with the theme "Steering India Towards Shaping Global Telecom Standards"

TSDSI updates its Standard on

Data Payload for Intelligent Transport Systems

TSDSI Releases Technical Reports in the Areas of Wireless Over Mobile Technologies, Joint Communication & Sensing, AI Explainability Framework, Network Capabilities Exposure, Network Energy Saving Functionalities, AI-Native Air Interfaces for ITS, Slice-Specific Handovers & PQC Migration Strategies for 5G & 6G

**7th Governing Council of TSDSI
takes over wef 24 Sep 2026**

INVITED ARTICLE



High Altitude Platform Stations operating as IMT Base Stations (HIBS) offer a promising solution for extending connectivity and addressing access and backhaul challenges. Operating around 20 km above the Earth, HIBS can provide wide-area coverage—potentially up to around 100 km radius—and connect directly with standard cellular devices. By complementing terrestrial and satellite networks, HIBS can support connectivity in rural and remote areas, disaster response, BB-PPDR and network resilience.

This edition carries an invited article by Mr. Suresh Kumar Karthikeyan, Co-founder and Chief Technology Officer, Susan Future Technologies Private Limited, a TSDSI member, on this emerging technology and its potential

Whitepaper

A whitepaper on
***Fintech Enabled by Nextgen
Networks has been released***



Standardization Activities

TSDSI has updated its previously published Standard on Common Data Payload for Adaptive traffic Control System and other Intelligent Transportation System Products:

This TSDSI STD 5004 V1.1.0 is an enhanced version of the earlier version, TSDSI STD 5004 V1.0.0, based on the inputs and recommendations received from user industry, domain experts, and the suggestions of the TEC Consultative Committee. The upgraded standard includes a few additional data fields incorporated in the payload enhancements, namely timestamping in respective fields, geolocation features, etc., as required.

TSDSI has released the following new Technical Reports:

Networks Study Group:

- **Joint Communication & Sensing in 5G Networks & Beyond** ([TSDSI TR 6069V1.0.0](#))

The technical report investigates the feasibility of enabling JCAS within the existing 5G NR framework by leveraging legacy reference signals and minimal architectural modifications. A detailed evaluation of candidate downlink reference signals including SS, DMRS, CSI-RS, and PRS has been carried out against key sensing performance indicators such as range resolution, Doppler estimation, angular resolution, and deployment flexibility. The report additionally evaluates the impact of NR numerology, cyclic prefix duration, bandwidth occupancy, and waveform configuration on sensing range, Doppler estimation capability, and sensing resolution across different deployment scenarios.

- **Network Energy Saving functionality: for the 5G-Advanced systems** ([TSDSI TR 6068V1.0.0](#))

This Technical report provides an overview of key network energy saving features of 3GPP 5G advanced along with analysis on its deployment relevance, benefit analysis and user throughput impact of the features. Potential scenarios for further enhancements for network energy saving for next generation (6G) along with key issues and candidate solutions are included to capture the potential extension of the baseline functionality introduced in 5G Advanced.

- **Study Report on Supporting Wi-Fi over Licensed mmWave Band** ([TSDSI TR 6067V1.0.0](#))

This Technical Report establishes the technical and regulatory conditions under which Wi-Fi supported over mmWave Band and 5G NR systems can coexist in the n258 licensed band (24.25–27.50 GHz) under unsynchronised operation.

Services and Solutions Study Group:

- **AI Explainability Framework for 5G & 6G Systems** ([TSDSI TR 6071 V1.0.0](#))

The technical Report studies a policy-driven AI explainability framework for 5GS and 6GS networks, focusing on explainability validation, transparency, auditability, and human oversight of AI/ML-assisted network decisions. It examines technical mechanisms for operator-controlled

decision gating, post-actuation monitoring, and explainability-based assessment under “AI for networking”, without prescribing specific algorithms or implementations. The non-normative outcomes are intended to inform future technical specifications and standardization activities.

- **Study on Network Capabilities Exposure** ([TSDSI TR 6070 V1.0.0](#))

This technical report captures the existing exposure mechanisms available in different standards, examining different Indian ecosystem-based 6G use cases (e.g. related to AI/ML, Edge Computing, network exposure) against the existing CAPIF exposure framework defined in 3GPP TS 23.222. It identifies gaps that need to be considered for the exposure framework in order to support such Indian eco system based 6G use cases.

- **AI-Native Air Interface for ITS** ([TSDSI TR 6066 V1.0.0](#))

ITS environments experience rapid channel variations, resulting in time-varying delay, Doppler shifts, and signal attenuation. Traditional communication system design relies on fixed algorithms and predefined waveforms, which may not always perform optimally under varying channel conditions and hardware imperfections. This technical report analyses two approaches to using AI that can potentially enhance physical layer performance in these scenarios: one, a novel ML-based receiver for symbol detection in MISO systems, and the other, end-to-end learned waveform design based on a BICM framework.

- **Study of Slice-Specific Handovers for 5G and Beyond Networks** ([TSDSI TR 6065 V1.0.0](#))

For Network Slice-based Random Access, different random-access resources may be assigned to different NSAG(s), allowing access resources to be differentiated based on the associated network slice. Unexpected failures of Network Functions belonging to different slices within the 5GC may further disrupt handovers, require unnecessary session restarts and cause potential failures in latency-sensitive and XR services. This report studies resilience mechanisms to ensure continuous service delivery and optimized handover performance in next-generation 5G networks, thereby supporting robust slicing architectures for critical applications.

- **PQC Migration Strategies for 5G and 6G Mobile Networks** ([TSDSI TR 6064 V1.0.0](#))

The study provides deployment-oriented guidance for migration of 5G and 6G systems to post-quantum cryptography (PQC), focusing on the interfaces and security protocols used in Global standards. It identifies the PQC- relevant interface within 3GPP networks, examines the impact of quantum computing on the symmetric and asymmetric cryptography used. The report suggests that operators require structured guidance to plan and execute an orderly transition to towards PQC ready designs. The study outlines a phased migration strategy based on hybrid Post-Quantum/Traditional (PQ/T) mechanisms, PQC only key-establishment methods, and PQC-capable certificate models (composite, dual, and PQ-only).

ACTIVITIES



Technical Activities

TSDSI members are currently conducting technical studies and developing standards in the following priority areas to align with the workplans and enable timely contributions to 3GPP and ITU for 6G technologies: RAN and Core architecture and interface Design; Positioning and ISAC; HAP-based Networks; AI/ML; FWA, Vertical Industry Specifications (e.g. IOT, V2X, IIOT); Terrestrial Network Coverage enhancement (e.g. Relays, RIS etc)

New proposals on topics in these areas and additionally from the TSDSI Standardization [Roadmap 3.0](#) are being deliberated in the Networks, and Services & Solutions Study Groups.

Following new technical activities have been initiated in the reporting period:

Networks Study Group:

Development of Standards:

- Technical Specification for supporting WoMT non-synchronous operations in mmWave licensed band ([WI1-NIP469](#))

Technical Studies:

- Study on AI/ML-Driven Handover Mechanisms and Cross-Domain Interoperability for Hybrid TN–NTN NG-RAN ([SI 180](#))

Services and Solutions Study Group:

Technical Studies:

- Feasibility study on a RAN-decoupled interworking architecture for migration of LTE access to future core ([SI 183](#))
- Study on reference architecture, APIs and possible AI-native enhancements for SLA-Preserving Semantic Communication ([SI 182](#))
- Study on AI/ML Assurance Requirements and Framework of Heterogeneous Networks ([SI 181](#))

Please visit [here](#) for a full list of ongoing technical activities.

Please reach out to vaishali.upperwal@tsdsi.in and chandrakanta@tsdsi.in for details of our technical activities in the Networks and Services & Solutions Study groups respectively.

Liaisons

TSDSI has received the following liaison statements (LS):

- From ITU-R WP 4B Liasion Statement to External Organizations on the Schedule for updating Recommendation ITU-R M.2177 to REVISION 1
- From TEC Development of Technology Standards for using Wi-Fi over mmWave in IMT spectrum (26 GHz band) allotted to TSPs in India

TSDSI has sent following liaison statements (LS):

- To TEC on Update on Adopted Specifications from ATSC 3.0 Standards: Information About D2M Test Results in the frequency range 470-582 MHz

List of Liaisons received and sent by TSDSI can be viewed at <https://tsdsi.in/liaison-statements/>.





TSDSI Vision 2035



Since the publication of TSDSI's Vision 2025, which was released in 2020, the global telecom landscape has transformed significantly. Simultaneously, India's digital environment has also changed dramatically, laying emphasis on the use of digital technologies for public good.

TSDSI initiated a process to revisit and align its vision and strategy based on evolving industry dynamics and technologies, leveraging emerging opportunities. A team of experts led by Prof. Sridhar of IIIT Bangalore, facilitated by TSDSI secretariat was constituted to develop a new vision for TSDSI.

Inputs were garnered from various expert stakeholders representing the broad telecom ecosystem (covering industry, startups, academia, manufactures, associated industries, service providers, policy makers, regulators, industry associations and global SDOs), through structured survey interactions. A draft Vision 2035 document was formulated based on these inputs and further refined based on multiple rounds of discussions in the TSDSI Standardization Committee and Governing Council. The Vision 2035 document was subsequently adopted by the General Body in August 2026.

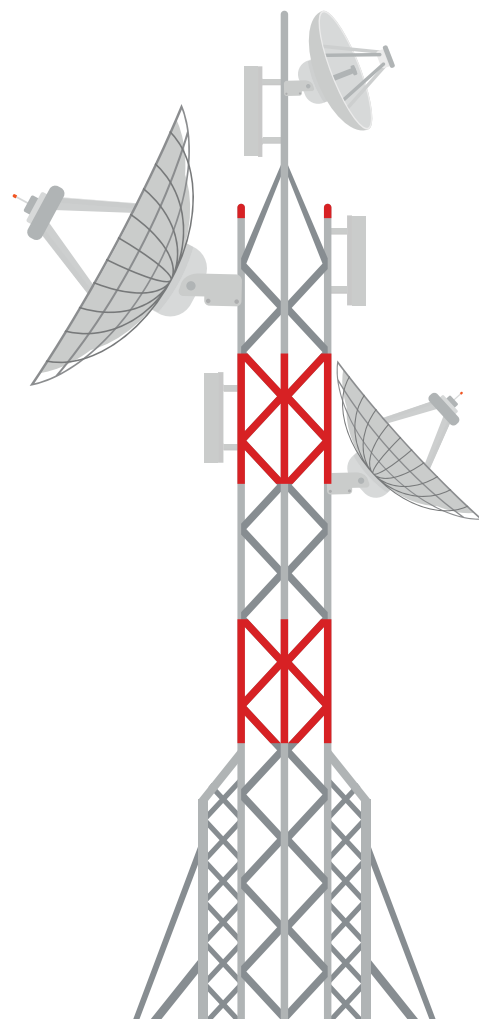
TSDSI VISION and STRATEGY 2035: TSDSI will drive inclusive, standards

development across the entire telecommunication value chain - from core technologies to applications, aligned with India's evolving needs. TSDSI aims to become a prominent contributor in global standards forums and collaborate with regional and international bodies to advance shared priorities.

It focusses on the following four pillars:

1. Technical activities aligned with Standardization Roadmap
2. Foster a collaborative environment to promote development of standards and reflect India's interests in global standards forums
3. Build capabilities for standards development and related processes in the ecosystem
4. Evolve into an inclusive, self-sustaining and a globally leading telecom standards development organization

Short term and long term (up to 2035) objectives, categorised under each of the above pillars have been identified in the Vision document. Recommended strategies for achieving these along with monitoring mechanisms have also been described. The document can be viewed on the TSDSI website at [link here](#).



ACTIVITIES



Pre-standardization Activities



The IoT/M2M TRIP forum released a White paper on **FinTech Enabled by Nextgen Networks** on September 2026. The whitepaper investigates the aspects like convergence of AI and NGN technologies, edge computing, cloud-native architectures, network slicing, IoT connectivity and advanced AI technologies such as machine learning, federated learning, predictive analytics, and intelligent automation, low latency, high reliability, and distributed edge intelligence, enable real - time financial services, and personalized user experiences can be effectively leveraged to bridge existing gaps in a step-by-step manner. It demonstrates how advanced network capabilities and AI as enablers can offer seamless, interoperable, secure, and cost-efficient financial services by supporting real-time decision-making, intelligent automation, and optimized network performance. The study also proposes gaps in current platforms, and potential requirements and solutions for next-generation FinTech systems.

Post-standardization Activities

TSDSI had transposed 873 new and updated 3GPP specifications (Release 13 to 19) and submitted to TEC for adoption as National standards.

GLOBAL STANDARDS ROUNDUP



ITU-R

The **ITU-R WP5D** meeting #53 was held in Geneva from 28th Sep to 08th Oct 2026. 5 delegates from TSDSI registered for the meeting. 3 submissions - covering Contribution towards ITU-R M. [IMT-FWA]; Contribution towards ITU-R M. [IMT-2030.SUBMISSION] and Contribution towards ITU-R M. [IMT-2030.PROCESS]

ITU-T

A TSDSI contribution to **SG13** based on its work related to development of a standard on QoS aspects of Multi-User Semi-Autonomous Telerobotics was accepted as WI during 2025. After deliberations on the contribution as the baseline a draft Recommendation ITU-T Y.2362, titled "Application-driven network configuration requirements for multi-user telerobotics-based solutions for developing countries." has been released by ITU-T. The same could be released formally as a recommendations during the next meeting after following the due approval process. The draft Recommendation is available on the ITU website: [Y.2362: Application-driven network configuration requirements for multi-user telerobotics-based solutions for developing countries](#)

TSDSI Status Report on various activities related to ITS & V2X was presented to ITU CITS Meeting held on 21 September 2026 in online mode.

3GPP:

TSDSI members continued to participate and contribute in the 3gpp Working group and TSG meetings of 3GPP held during the reporting period.

oneM2M:

The 76th Technical Plenary meeting of oneM2M was held at Sejong University, Seoul, Republic of Korea, from 7–11 September 2026. A joint working session and workshop with ETSI's MEC Industry Specification Group were conducted to advance work on edge AI & MEC Interworking. The Testing & Developer Ecosystem Working Group of oneM2M also organized a Developer Event with TTA from 2–4 September 2026. The participants successfully verified CSE-to-CSE registration, Announcement, GeoQuery, MQTT/WebSocket bindings, and ETSI MEC interworking functionalities.

Partner Engagements

A 5G Multilateral MoU was signed in 2016 between 5GIA (EU), 5G Americas, 5G Forum (S. Korea), 5GMF (Japan), and IMT 2020 PG (China) to organise "Global 5G events" – hosted by each partner in their region by rotation 5G Brasil joined the group subsequently. TSDSI joined the group in 2020 and hosted the 11th Global 5G Event in August 2024 in AIRTEL, Gurgaon. 5G Americas left the group in 2024.

Subsequently, the MoU goals and scope of future events have been revisited by the partners and revised to align with the evolving global landscape and representation from various regions. An annual "XG" event will be hosted by each partner in their region, by rotation, to promote the growth of XG ecosystems by discussing regional requirements, market forces, deployment strategies and experiences, pilots and trials for the XG technologies in the partner regions, and enhance engagements towards development of XG technologies and leading to global standards.



Programme

TSDSI Tech Deep Dive 2026 Conference



The 9th edition of the conference, TTDD 2026 was held from 7 to 10 July 2026 with the theme **“Shaping the Next Decade of Telecommunications: 6G Standards, Systems and Cross-Sector Synergies.”**

The Valedictory Session of the conference was graced by the Hon'ble Union Minister of Communications and Minister of Development of North Eastern Region, Shri Jyotiraditya M. Scindia, at Hotel Hyatt Regency, New Delhi on 10 July 2026. He also witnessed signing of a Memorandum of Understanding (MoU) between TSDSI & Department of Telecommunications (DoT) under the TDIP scheme. The MoU provides financial support from DoT for the FY 2026-27 towards global SDOs membership fee for TSDSI, support to startups and MSMEs towards TSDSI and 3GPP membership fee, support through TSDSI to startups and MSMEs for participation in international standards meetings especially for 3GPP meetings and hosting of global SDO meetings (3GPP, oneM2M) by TSDSI in India.

The conference featured 66 distinguished speakers from across the ecosystem covering industry players, startups, research and academia, government bodies, international standard development organizations (SDOs), and regional forums. They enriched the conference through keynotes and panel discussions, addressing a wide range of topics in following technical sessions on Emerging 6G Architecture Options; AI Native 6G ; Security, Privacy & Trust in 6G ; HAPS-based Connectivity – Technical Feasibility, Trials, and Market Dynamics; Priority Verticals & Transformative Use Cases in 6G; Open and Interoperable Systems for Seamless Connectivity of Heterogeneous Networks; “WRC-27 at Our Doorsteps: Perspectives on IMT Spectrum Priorities” ; Partners' Perspectives on the Conference Theme.

- **Emerging 6G Architecture Options** - 6G is expected to follow a disciplined evolution of 5G, while introducing AI-native, intent-driven and compute-aware capabilities. AI-on/for/with-RAN, together with the possible introduction of a service plane alongside the traditional Control Plane (CP) and User Plane (UP), represents an important area of architectural evolution; P2P-based and service-based RAN–core models are under study
- **AI Native 6G** – The session noted that AI Native 6G is not just about faster Networks or smarter algorithms. It is about building a trusted intelligent infrastructure that can support future industries, govt. & societies.
- **Security, Privacy & Trust in 6G** – This session showcased mapping of TSDSI work to 3GPP/IETF/ETSI and highlighted key research and Standardization topics. It noted that Quantum resilience is essential for future Networks.
- **HAPS based connectivity** – Terrestrial Network & Non-Terrestrial Network convergence will bring GEO, LEO, HAPS and terrestrial networks together as an integrated 3D connectivity ecosystem, with NTN becoming a core infrastructure component.

- **Priority Verticals & Transformative Use Cases in 6G:** Discussed healthcare and agriculture, ubiquitous connectivity along with explainable and trustworthy AI; Recommended a National Reference Model for 6G Use Cases
- **Open & Interoperable Systems for heterogenous networks** - Discussed key use cases for heterogenous Networks and gave recommendations for Interoperable Cellular-WiFi-NTN.

A special session on Spectrum matters, titled **“WRC-27 at Our Doorsteps: Perspectives on IMT Spectrum Priorities”** was organised on the concluding day of the conference in hybrid mode. this session deliberated on the WRC Agenda Item 1.7 which focuses on new IMT spectrum across 4.2–4.8, 7.125–8.4 and parts of 14 GHz, against the backdrop of the likelihood of India facing significant future spectrum demands due to high mobile traffic and data consumption.

The conference technical deliberations concluded with a Panel Discussion on Partners' Perspectives on the Conference Theme, featuring representatives from global SDOs and Industry Forums. The panelists concurred on the need for 6G to prioritise intelligent, resilient and inclusive connectivity, with AI standards focused on interfaces—not models. There should be a focus on viable use cases, digital inclusion, sovereign capabilities and reuse/refarming of existing spectrum.

TSDSI extends its sincere gratitude to the conference **Session Sponsors—NOKIA and Tejas Networks—for their valued support**, and to its **Media Partner, tele.net**, for effectively amplifying the conference proceedings, key discussions, and highlights throughout TTDD 2026.

(Visit conference website for the session recordings and presentations) [“https://ttdd.tsdsi.in/sessions”](https://ttdd.tsdsi.in/sessions)



ANNOUNCEMENTS



TSDSI Outstanding Technical Contributions Awards:

The Hon'ble Union Minister of Communications and Development of North Eastern Region, Shri Jyotiraditya M. Scindia, conferred the prestigious TSDSI Outstanding Technical Contributions (OTC) Awards for the Financial Year 2025–26 in the Valedictory session of the 9th TSDSI Tech Deep Dive (TTDD) 2026 Conference, at Hyatt Regency, New Delhi, on 10 July 2026.

The awards recognise individuals from TSDSI member organisations who have contributed significantly to and/or championed technical activities during the Financial Year, across the two Technical Study Groups of TSDSI, namely, Services & Solutions and Networks Study group.

The recipients of the TSDSI Outstanding Technical Contributions (OTC) Awards for FY 2025–26 are:



Mr Abhijan Bhattacharyya

Tata Consultancy Services

For the TSDSI Standard on “Multi-user semi-autonomous telerobotics system- QoS aspects” & TSDSI Technical Report on “Framework for AI/ML Operation Splitting in 6G Context”



Mr Saurabh Khare

Nokia Solutions & Networks India Pvt. Ltd

For TSDSI Technical Report on “Study on Security Enabler for 6G”



Mr Siddharth Das

Nokia Solutions & Networks India Pvt. Ltd

For the Technical Report “System Requirements for NR-based Future Railways Mobile Communication System”

7th GC Slate

Elections for the 7th Governing Council slate of TSDSI were conducted on 28 July 2026. Subsequently, elections for the positions of Chair and Vice Chair of the Governing Council were held on 11 August 2026. Mr Satish Jamadagni, Senior Vice President – Global Standards, Reliance Jio, and Mr Ashwani Kumar, Head of Standards & Spectrum Engagements, Nokia Solutions & Networks Pvt. Ltd., were elected as Chair and Vice Chair, respectively. The Governing Council has 21 elected member and 8 government nominee positions.

The new Governing Council formally took over from the outgoing Governing Council at the 57th Governing Council Meeting, held on 24 September 2026 in New Delhi.



SGSS Working Group Leadership

Elections for the Chair & Vice Chair positions of the SGSS Working Groups were held alongwith the 7th GC elections. The following experts were elected unopposed:

Working Group (WG)	Position	Leader Name	Organisation
WG#1 Security	Chair	Mr Saurabh Khare	Nokia Solutions & Networks India Pvt. Ltd
WG#1 Security	Vice Chair	Dr Reshmi TR	Society of Electronic Transaction and Security (SETS)
WG#2 Applications	Chair	Mr Abhijan Bhattacharyya	Tata Consultancy Services Ltd (TCS)
WG#2 Applications	Vice Chair	Ms Poornima Shandilya	Centre for Development of Telematics (C-DOT)
WG#3 Services Architecture &	Chair	Dr A Paventhan	ERNET India
WG#3 Services Architecture & Framework	Vice Chair	Mr Gnanaprakash Sebastian	Tata Elxsi Limited

TSDSI Standards Pavilion @IMC 2026



TSDSI is partnering with India Mobile Congress (IMC) 2026 as a Standards Partner, showcasing India's growing contributions to global telecommunications standards and highlighting the critical role of standards in enabling innovation, interoperability and technology adoption.

Showcasing Standards in Action: As part of this partnership, TSDSI will be setting up a first-of-its kind Standards Pavilion, demonstrating how standards translate into real-world technologies and solutions.

Exhibitors Showcasing Standards-Based Innovation: The TSDSI Standards Pavilion will bring together five exhibitors (TSDSI member organizations) featuring their products, solutions, implementations, innovative projects and

technologies and use cases aligned with standards.

- Freestream Technologies in collaboration with SRM Institute of Science and Technology (SRMIST): Next-Gen Broadcasting & 5G
- Nokia – Reliance Jio: 6G MRSS
- Invas Technologies: IoT(oneM2M) based Smart Farming
- Skye Air Mobility: UAS Traffic Management platform
- Rostan Technologies: Connected Vehicle & IoT Solutions
- HFCL: 5Gmm Wave CPE

OUTREACH



Speaking opportunities:

During the reporting period, Mr. A. K. Mittal, Director General, TSDSI, delivered keynote addresses at the following events:

- **Keysight World Tech Day India 2026** on 4 August 2026 in Bengaluru in the topic "From Disruption to Opportunities: Role of Innovation and Standards in Shaping the Next Gen Technologies"



- **C-DOT 43rd Foundation Day on 25 August 2026** in New Delhi on "Beyond Connectivity: Secure, Trusted and Intelligent Communication"



- **2nd Edition of the Critical Communications India Conference** at the GCF & TCCA Mission Critical Services Certification Workshop on 3 September 2026 in New Delhi

Capacity Building:

Mr. P. K. Jaswal, Consultant – Process, Quality, IT & Membership Development, delivered a lecture on "TSDSI: Organisational Setup, Functions and Working" and "TSDSI Contributions and Engagements with Global Forums" as part of the Induction Training of the ITS 2024 Batch. The session was conducted under the module "Introduction to International Organisations in ICT Domain" on 4 August 2026 at NCA-T, Ghaziabad.

The Membership development team of TSDSI conducted dedicated orientation sessions on TSDSI and its processes for its newly inducted members. Potential opportunities for contributing to standards development by the members were also discussed.

INVITED ARTICLE



HAPS as IMT Base Stations (HIBS): Bridging India's Digital Divide and Strengthening National Resilience

- Mr. Suresh Kumar Karthikeyan, Co-founder and Chief Technology Officer, Susan Future Technologies Private Limited

India's digital economy depends upon the availability of reliable, affordable, and resilient broadband connectivity. At the heart of every mobile network lie two fundamental building blocks of the Radio Access Network (RAN): Access and Backhaul. Access connects user equipment to the base station, while backhaul connects the base station to the core network and the Internet. If either link is unavailable or degraded, broadband services become unreliable regardless of advances in radio technology.

In geographically challenging regions, both access and backhaul face significant obstacles. Deploying and maintaining fibre infrastructure across mountains, dense forests, river valleys, islands, and sparsely populated regions is complex and costly. Fibre routes are frequently disrupted by landslides, floods, cyclones, falling trees, and road construction activities. Simultaneously, terrestrial cellular networks are constrained by terrain obstructions, dense vegetation, and non-line-of-sight propagation conditions, limiting coverage and service quality.

India's National Broadband Mission 2.0 and Bharat 6G Vision seek to provide ubiquitous, affordable, resilient, and sustainable broadband connectivity. Achieving these goals requires innovative architectures that complement conventional terrestrial infrastructure. High Altitude Platform Stations as IMT Base Stations (HIBS) offer one such transformative opportunity.

Connectivity Challenges in the Western Ghats

The Western Ghats region in India exemplifies the challenges associated with rural broadband deployment. Districts such as Uttara Kannada in Karnataka are characterized by dense forests, steep terrain, wildlife reserves, river valleys, and dispersed settlements.

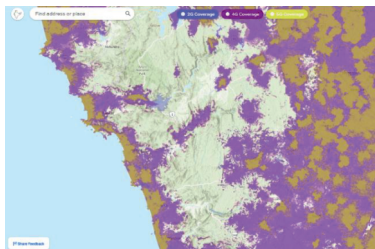


Figure 1 Cellular Coverage Map — Uttara Kannada District
(Ref: <https://www.airtel.in/wirelesscoverage/>)

Coverage maps reveal persistent connectivity gaps in areas with heavy vegetation and terrain elevations. Extending reliable broadband into such regions often requires a large number of terrestrial sites, extensive transport infrastructure, and significant operational expenditure.

Beyond Rural Connectivity

A common perception is that hilly and forested regions have limited populations and therefore do not justify large-scale connectivity investments. However, the value of communications infrastructure extends far beyond population density.

These regions frequently contain nationally important infrastructure and activities, including highways and transport corridors, railway routes, hydroelectric and power facilities, forest and wildlife management systems, coastal and maritime operations, border and security installations, tourism and ecotourism ecosystems, and communities that are especially vulnerable to disasters. Furthermore, these are often the areas most vulnerable to landslides, floods, earthquakes, cloudbursts, cyclones, and forest fires.

Recent disasters in Wayanad, Uttarakhand, Himachal Pradesh, Nepal, and other mountainous regions have demonstrated the importance of maintaining communications even when conventional infrastructure becomes inaccessible.

During such emergencies, communications become a critical lifeline supporting rescue operations, medical teams, disaster management authorities, law enforcement agencies, and affected citizens.

Connectivity in such regions should therefore be viewed not merely as a commercial service, but as a strategic national infrastructure capability.

HIBS: A Cellular Base Station in the Sky

High Altitude Platform Stations operating as IMT Base Stations (HIBS) provide a unique approach to addressing both access and backhaul challenges. Operating at approximately 20 km altitude within the stratosphere, a HIBS functions as a 3GPP-compliant cellular base station positioned above terrain obstructions and dense vegetation.

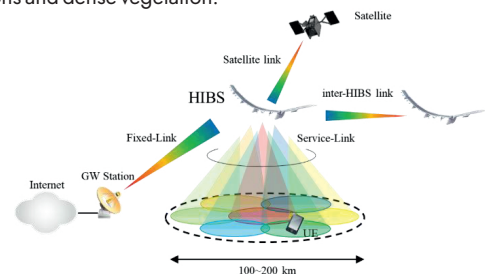


Figure 2 HIBS System-Level Architecture (Ref: APT Report No. APT/AWG/REP-92)

Unlike terrestrial towers that must navigate hills, valleys, and forests, a HIBS enjoys near-line-of-sight visibility across vast regions. A single platform can potentially provide coverage over a radius approaching 100 km, creating an umbrella coverage footprint spanning thousands of square kilometres.

The same platform can support both access connectivity and backhaul connectivity, addressing the two most challenging aspects of broadband deployment in remote regions.

HIBS Versus Satellite-Based Rural Connectivity

Satellite broadband has emerged as a significant technology for extending connectivity into underserved regions. However, direct-to-device and broadband satellite solutions face practical deployment challenges in rural and remote India.

Many satellite broadband solutions require dedicated user terminals, specialized installation, and subscription models that may be difficult to sustain in economically constrained communities. While satellite technology continues to evolve, affordability remains a critical consideration for large-scale rural adoption.

HIBS offers a fundamentally different approach. Since HIBS operates as an IMT base station, connectivity may be provided using ordinary smartphones and standard cellular devices, leveraging the existing 3GPP ecosystem without requiring specialized satellite terminals.

This significantly lowers barriers to adoption while preserving the user experience associated with terrestrial mobile broadband networks.

The Link Budget Advantage of HIBS

One of the strongest technical advantages of HIBS is its superior radio link budget.

Consider an example at 850 MHz:

Parameter	HIBS	LEO Satellite
Altitude	20 km	600 km
Frequency	850 MHz	850 MHz
Relative Path Loss	Baseline	+29.5 dB

INVITED ARTICLE



The free-space path loss difference is approximately:

$$\Delta\text{FSPL} = 20 \log_{10} (600 / 20) \approx 29.5 \text{ dB}$$

This means a HIBS platform operating at 20 km altitude enjoys nearly 30 dB lower propagation loss than a typical 600 km Low Earth Orbit satellite.

A 30 dB improvement corresponds to approximately 1000 times greater received signal power under equivalent assumptions.

This additional link margin can help overcome dense tree-foliage attenuation, rural indoor-penetration losses, terrain shadowing, weather-related impairments, and weak coverage at the edges of a cell. For villages located within dense forest environments, this additional margin can often determine whether a broadband service is usable indoors and under heavy vegetation cover.

Integration with Terrestrial Networks

HIBS is not intended to replace terrestrial networks or satellites. Rather, it forms a complementary layer within a future integrated communications architecture.

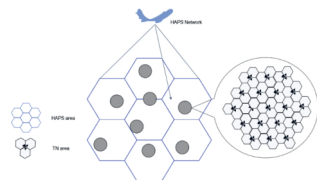


Figure 3 Integrated Terrestrial and Non-Terrestrial Architecture (Ref: 3GPP TR 38.863)

Future mobile networks are expected to evolve into an integrated multi-layer architecture in which terrestrial networks provide high capacity in dense urban areas, HIBS delivers wide-area regional coverage and network resilience, and satellite systems extend connectivity globally. Together, these layers create a ubiquitous communications fabric capable of supporting future 6G services.

HIBS Access Spectrum

HIBS access links provide direct connectivity between user equipment and the HAPS platform. These links operate under Mobile Service allocations and are intended to support IMT-based broadband services.

RR	Region 1 (MHz)	Region 2 (MHz)	Region 3 (MHz)	India (MHz)
5.312B^	694-960	698-960	-	-
5.314A~	-	-	698-960\$	703-733, 758-788, 890-915, 935-960#
5.388A*	1710-1980, 2010-2025, 2110-2170	1710-1980, 2110-2160	1710-1980, 2010-2025, 2110-2170	Same as Region 3
5.409A+	2500-2690		2500-2655	Same as Region 3

^ 694-728 MHz, 830-835 MHz and 805.3-806.9 MHz is limited to reception by HIBS

\$ Australia, Maldives, Micronesia, Papua New Guinea, Tonga and Vanuatu

China, India, Indonesia, Japan, Korea (Rep. of), Malaysia, the Philippines and Thailand ~ 698-728 MHz and 830-835 MHz is limited to reception by HIBS

* 1710-1785 MHz in Regions 1 and 2, and 1710-1815 MHz is limited to reception by HIBS* 2110-2170 MHz is limited to transmission from HIBS

+ 2500-2510 MHz in Regions 1 and 2, and 2500-2535 MHz in Region 3 is limited to reception by HIBS

IMT-2030: Resilience and Extended Connectivity

The IMT-2030 framework identifies **Resilience and Extended Connectivity** as a key requirement for future 6G systems, requiring networks that can extend service to underserved and remote regions, support emergency communications, recover rapidly from infrastructure failures, and maintain reliable connectivity for national critical infrastructure.

This capability will be especially important for the pan-India integrated Broadband Public Protection and Disaster Relief (BB-PPDR) network that India is seeking to establish for first responders and public-safety agencies. With dedicated spectrum assigned nationally for PPDR operations and internationally harmonized IMT spectrum ranges identified by the ITU to support broadband PPDR applications, an IMT-based network can provide interoperable mission-critical voice, data, video, situational-awareness, drone, and telemedicine services across agencies.

HIBS can strengthen this national BB-PPDR architecture by forming a rapidly deployable, wide-area and resilient IMT layer above flooded, landslide-affected, forested, or otherwise inaccessible terrain, allowing authorized PPDR users to remain connected even when terrestrial towers, fibre routes, power supplies, and transport links are damaged. HIBS should therefore be considered a strategic enabling technology for both India's public-safety communications and the broader IMT-2030 objectives of resilience and extended connectivity.

HAPS Cell Architecture

To maximize spectrum efficiency and capacity, HIBS platforms employ advanced multi-beam antenna systems. The antenna array is composed of seven antenna panels (six side panels and one downward facing panel) as shown below. Antenna elements on each panel are co-phased to form one beam in two crossed linear polarizations to serve one cell. There are a total of seven cells in two layers, one cell in the 1st layer and six cells in the 2nd layer.

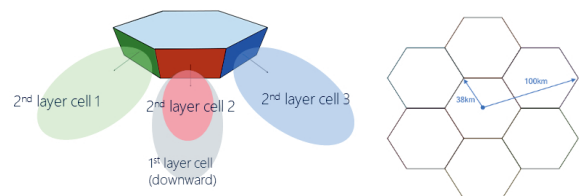


Figure 4 HIBS antenna model and Multi-Beam Cell Layout (Ref: 3GPP TR 38.863)

The multi-beam antenna system supports spot-beam generation, beam steering, frequency reuse, capacity scaling, and dynamic resource allocation. These mechanisms allow HIBS to achieve wide-area coverage while maintaining the performance expected from modern mobile broadband systems. Conclusion HIBS is moving from standardisation and technical study toward practical deployment: 3GPP, ITU-R, APT, the HAPS Alliance and TSDSI are advancing 6G NTN requirements, spectrum and operational frameworks; CEWIT is studying HAPS propagation in India; and industry trials by SoftBank, Airbus, NTT DOCOMO and others have demonstrated LTE/5G connectivity, spectrum sharing and platform performance, with pre-commercial services planned in Japan. With wide-area coverage, standard-device compatibility and an approximately 30 dB link-budget advantage over typical LEO satellite access links, HIBS can complement terrestrial and satellite networks to address India's access and backhaul gaps, disaster response, BB-PPDR requirements and national resilience, supporting the National Broadband Mission 2.0 and Bharat 6G Vision. All HIBS stakeholders must collaborate on standardised adoption to make this promising technology affordable and accessible to all. To further advance this effort, TSDSI Study Group Networks is undertaking a study on "IMT Base Station on HAPS for Ubiquitous Coverage and Resilience."



About the Author:

Mr Suresh is a wireless network enthusiast and open-source supporter. After completing his Bachelor's in Electronics and Communication Engineering from College of Engineering Guindy, he worked on building wireless and cellular communication networks including LTE, 5G, LPWAN, LoWPAN and UWB Networks for over a decade. He is the Co-founder and CTO of Susan Future Technologies Private Limited, leading the venture with a vision to build a sustainable future. He is also pursuing master's research in 5G non-cellular Radio Access Network at IIT Madras. He actively contributes to national and global telecom standardization efforts, including the study of High-Altitude Platform Stations (HAPS) and 6G Non-Terrestrial Networks (NTN) in TSDSI Networks Study Group. He has contributed to the Technical Performance Requirements of IMT2030 at ITU-R through TSDSI. He has also contributed to India's NFAP-2025.

EVENTS



Upcoming Events

Meetings/Workshops/Conferences/Webinars	Date	Venue
ITU-R WP5D#53 Meeting	28 Sep - 8 Oct 2026	Geneva, Switzerland
India Mobile Congress 2026	7-10 Oct 2026	New Delhi
3rd International Bharat 6G Symposium 2026	8-9 Oct 2026	New Delhi
3GPP PCG#57/OP#56	21 - 22 Oct 2026	Online
oneM2M TP#77	16 - 20 Nov 2026	Sophia Antipolis, France
ITU-R SG5	30 Nov - 1 Dec 2026	Switzerland, Geneva
3GPP CT/RAN/SA#114	7 - 11 Dec 2026	Boston, US
IEEE ANTS 2026	17-20 Dec 2026	Roorkee, India

Visit [here](#) for the Upcoming Calendar of Events.

MEMBERSHIP UPDATES



TSDSI welcomes following organisations that joined us as members in July-Sep 2026:

New Corporate Members: Mantiswave Networks Private Limited, Quantum Cybertech Private Limited, i-Ascendance Software Private Limited, QINSIGHT Labs Private Limited, QNNX Private Limited, Synergy Quantum India Private Limited, Felsite Technologies Private Limited, Sanyark Space Technologies Private Limited, Nibiaa Devices Private Limited, OptM Media Solutions Private Limited, CORAN Labs Private Limited, Indian Institute of Science

New Guest Members: NanoAI Technology Private Limited, Proxelera Private Limited, Ylectric Technologies Private Limited, Directorate Coordination of Police Wireless (DCPW), TekUncorked AllIoT Private Limited, BaSig Wireless Laboratories India Private Limited, Sampige Semiconductors Private Limited

The full member list can be viewed here https://tsdsi.in/present_members/.

To apply for TSDSI membership, please visit <https://tsdsi.in/membership/>.



About TSDSI

Telecommunications Standards Development Society, India (TSDSI), aims at developing and promoting India-specific requirements, standardizing solutions for meeting these requirements and contributing these to international standards, contributing to global standardization in the field of telecommunications, maintaining the technical standards and other deliverables of the organization, safe-guarding the related IPR, helping create manufacturing expertise in the country, providing leadership to the developing countries (such as in South Asia, South East Asia, Africa, Middle East, etc.) in terms of their telecommunications-related standardization needs.

TSDSI is recognised by the Department of Telecommunications as India's Telecom Standards Development Organisation (SDO).

TSDSI is registered as a Society under the Societies Registration Act (Act XXI of 1860).