

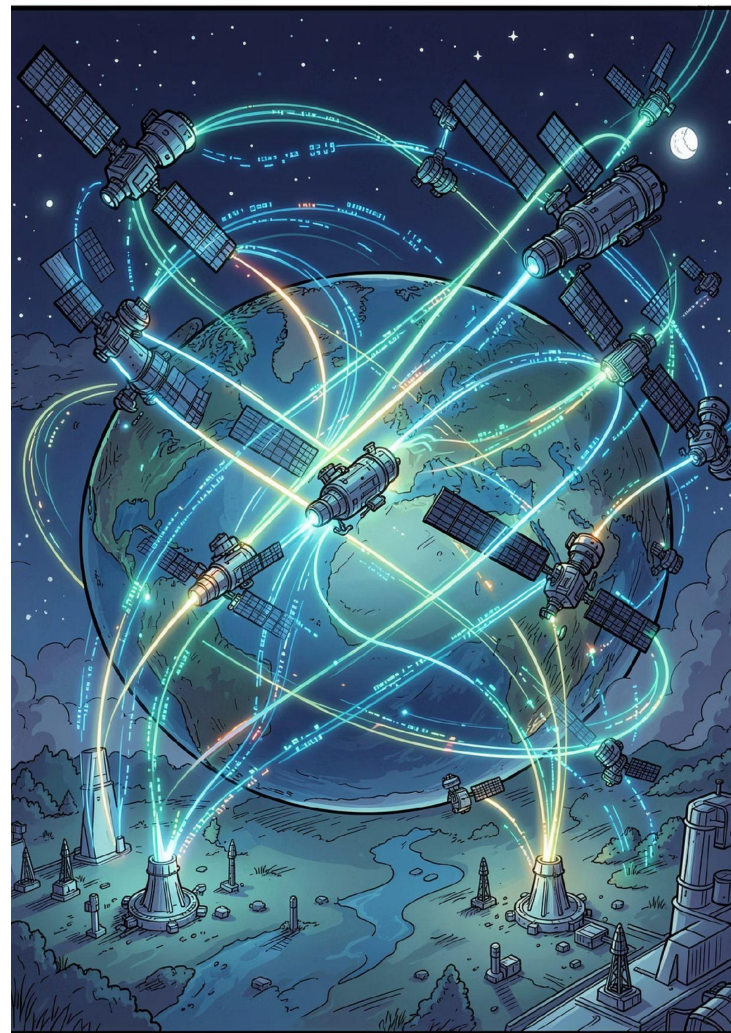
Policy Framework for facilitating early deployment of scalable NTN with longer life cycle

A regulatory and technical roadmap for deploying hybrid LEO/MEO backhaul infrastructure under India's Telecommunications Act, 2023 — from authorization to commercial launch.

TELECOM REGULATION

SATELLITE BACKHAUL

INDIA



Authorization Framework Under the Unified License

Satellite integration in telecom networks requires distinct authorizations across four service domains.



NLD

National Long Distance — backbone transport for domestic traffic



GMPCS

Global Mobile Personal Communications by Satellite



VSAT

Very Small Aperture Terminal — remote transport pipeline



IFMC

In-Flight and Maritime Connectivity

Why Traditional VSAT Backhaul Falls Short

High Latency

RTT delays exceeding 500ms severely degrade real-time applications. Cellular signaling (Abis, S1-MME) is highly sensitive to packet latency.

Limited Bandwidth

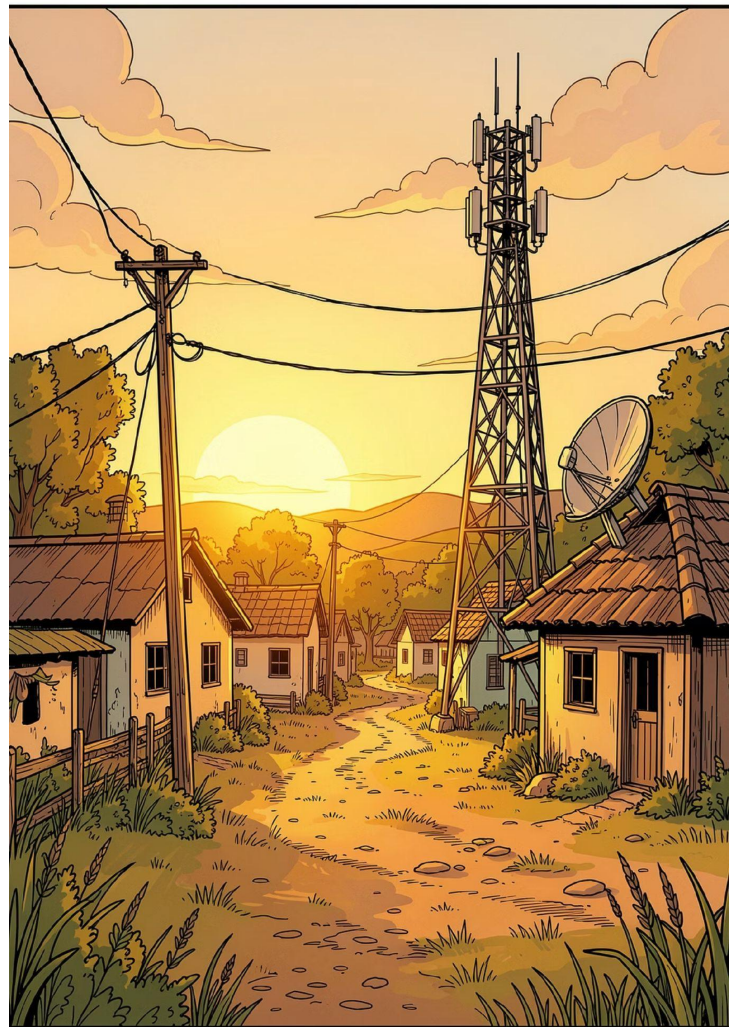
Finite, localized spectrum causes congestion during peak hours, restricting data rates to access nodes.

High Cost per GB

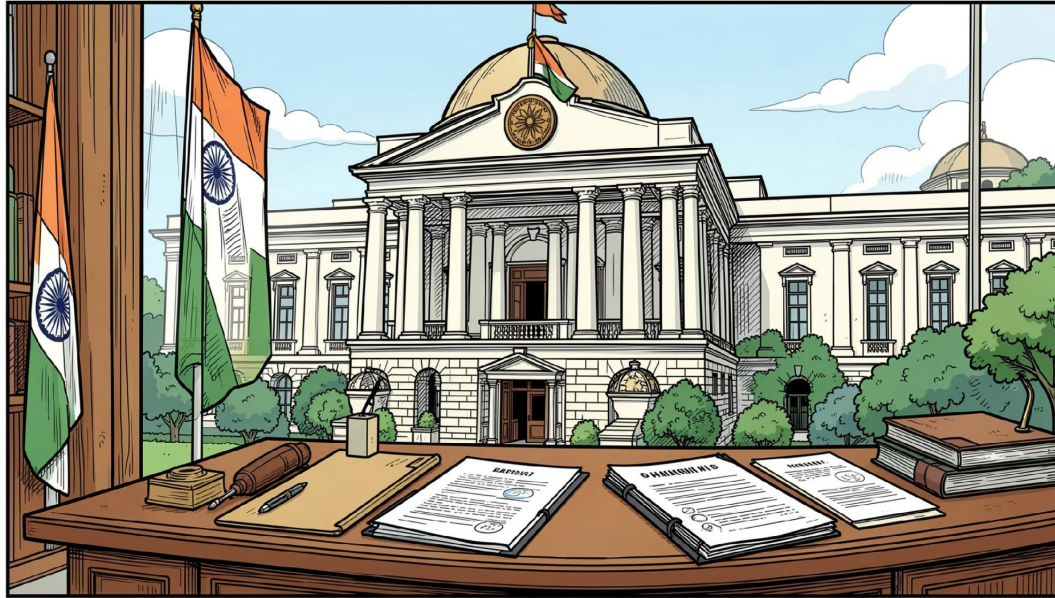
Transponder leasing costs make 5G-grade scalability financially unviable for low-revenue rural deployments.

Low ROI in Sparse Regions

Upfront hub and terminal CAPEX yields poor returns in sparsely populated areas.



Required Authorizations Under the Telecommunications Act, 2023



Three-Tier Authorization Structure

01

DoT Telecom Authorization

Network and Service Authorization under Section 3 of the Act for establishing and operating satellite infrastructure.

02

IN-SPACE Space Segment Approval

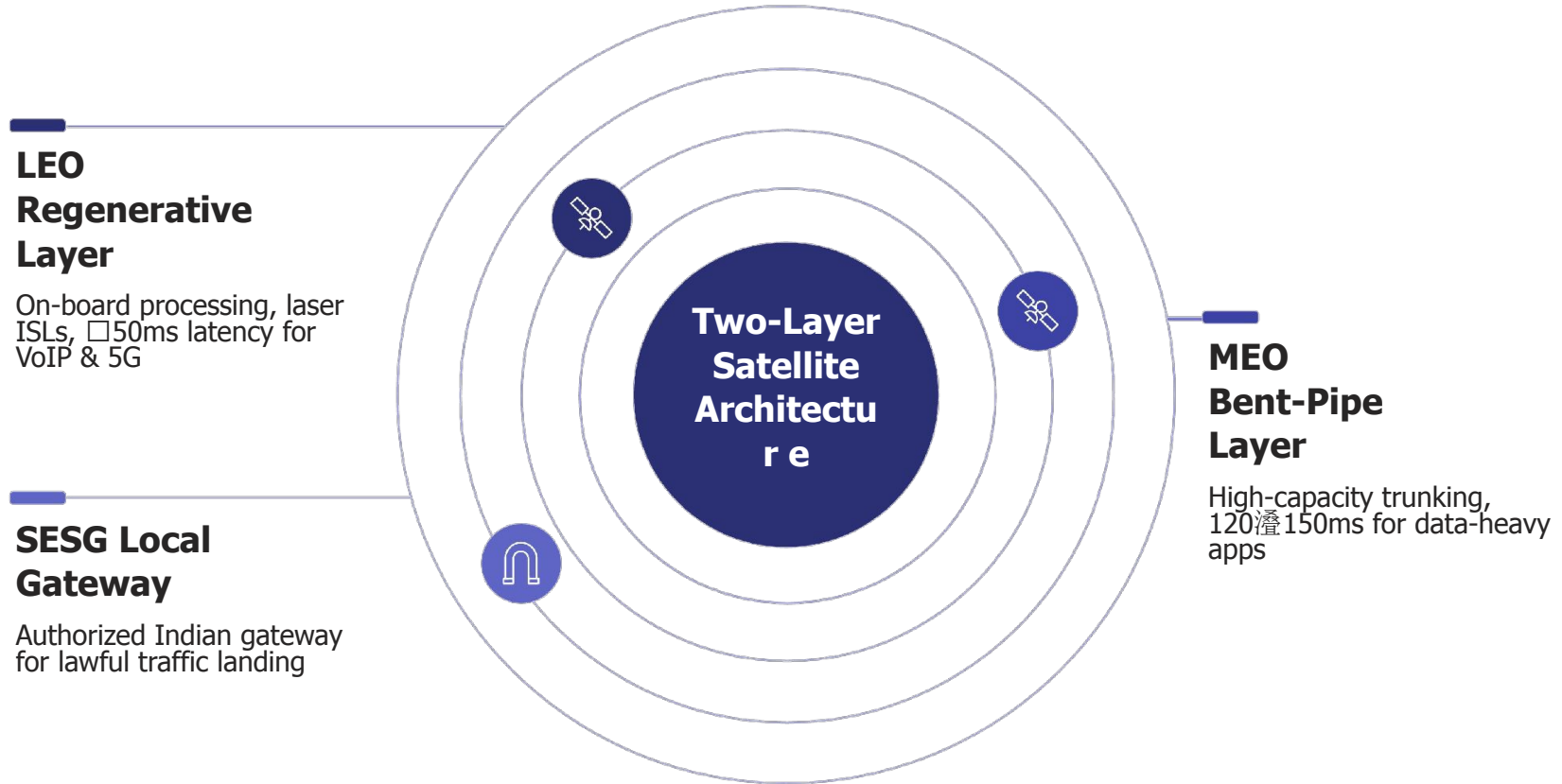
Orbital slot and landing rights to enable commercial communications over Indian territory.

03

SESG Gateway Authorization

Satellite Earth Station Gateway Provider Authorization for connecting satellite segments to terrestrial networks.

Hybrid LEO/MEO Payload Architecture



Technical Inputs: Spectrum, Latency & Gateway Localization

□ **50ms**

LEO Latency

Non-Geostationary constellations dramatically improve real-time IP traffic and VoIP quality vs. GEO's □600ms

1 Tbps

Phase 2 Target

Aggregate throughput for 20,000 sites at 50 Mbps per site — requiring Q/V-band feeder links

2 Tbps

Full Rollout

Total network capacity at 100鎧 Mbps per site across all 20,000 remote locations

100%

Data Sovereignty

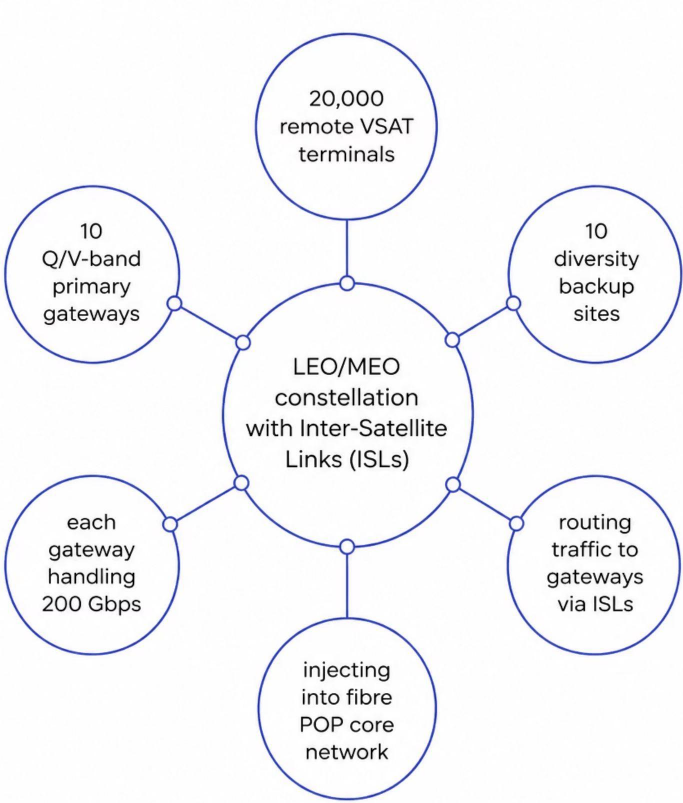
All domestic telecom traffic must route through gateways physically located within India

□ Spectrum for satellite backhaul is allocated **administratively** under the Telecommunications Act, 2023 — not through auctions — enabling faster rollouts.

Feeder Link Strategy: Scaling to 20,000 Sites

Spectrum Hierarchy for Maximum Capacity

Q/V-Band (Primary) 37.5–52.4 GHz — up to 5 GHz contiguous bandwidth per gateway. Essential for multi-hundred Gbps throughput.	Ka-Band (Fallback) 27.5–30 GHz uplink / 17.7–20.2 GHz downlink. Subject to congestion and 5G coexistence constraints.
Optical/Laser Links Terabit-per-second capacity per gateway, bypassing RF constraints. Requires strict cloud-free site selection.	



Ideal Gateway Locations in India

Gateway placement must balance low rain-fade zones, high fiber density, and geographic coverage to maintain 99.9% availability during monsoons.

Location	Region Covered	Strategic Rationale
Jodhpur / Jaisalmer	North & West	Lowest rainfall index in India; immune to severe cloud attenuation
Bhuj, Gujarat	West & Central	Low rain fade; proximity to international subsea cable landing stations
Bengaluru Outskirts	South	Reliable connectivity to major NLD fiber loops
Chennai, Tamil Nadu	South & East	High density of Tier-4 data centers and submarine fiber backbones
Indore / Bhopal	Central India	Central coordinates optimize MEO bent-pipe look-angles

Phase 1 1,000 Site ESA Rollout — 12 Month Roadmap

1疊3

DoT Unified Authorization (Network & Service) + IN-SPACe landing rights for LEO/MEO constellations

Months

1

2

Months 4疊6

WPC spectrum application (Ku/Ka user terminals, Q/V-band gateways) + TEC MTCTE ESA certification

Months 7疊9

3

Gateway construction at Jodhpur & Chennai + WPC import clearance for 1,000 ESA terminals

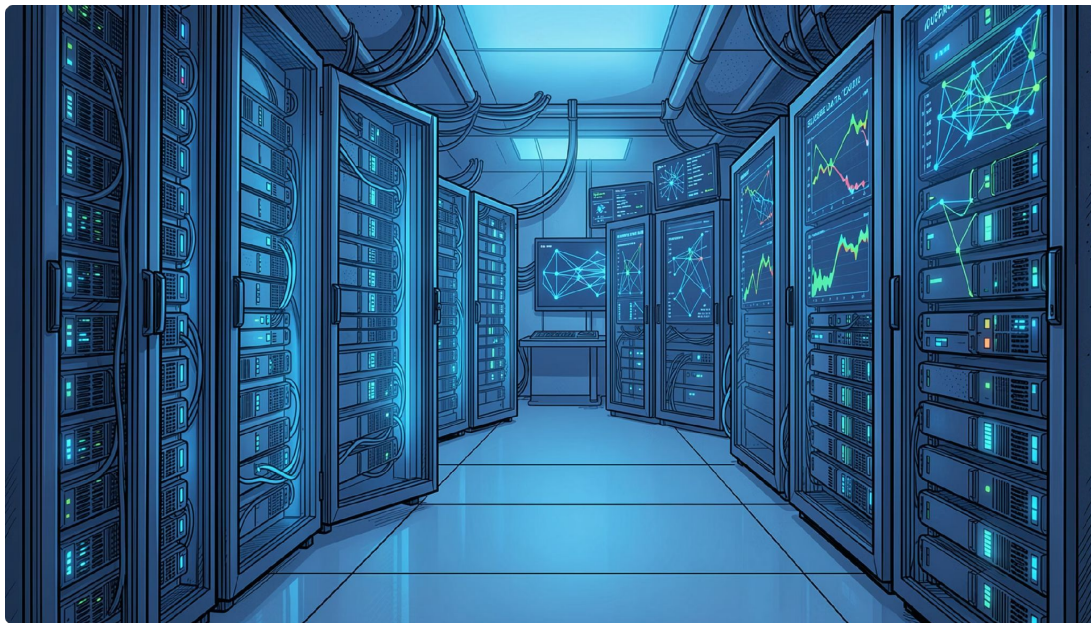
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Months 10疊12

Line-rate LI testing at gateways + end-to-end LEO/MEO handover validation + Service Commencement Certificate

Phase 1 target: 2 Primary + 2 Diversity gateways delivering 100 Gbps aggregate throughput to 1,000 ESA-equipped sites at 100 Mbps each.

Regulatory Compliance: Data Sovereignty & Lawful Interception



Mandatory Compliance Obligations

→ Data Sovereignty

All telecom data, logs, and traffic must be stored locally in India. No routing or sharing outside Indian borders.

→ Lawful Interception ☐ LI ☐

Gateways must support line-rate packet mirroring (up to 200 Gbps per hub) to India's Centralized Interception System under the 2024 Rules.

→ OBP Security Clearance

Cryptographic architecture maps of On-Board Processing units must be submitted to DoT to prevent traffic diversion to foreign gateways.