

INDIA SATCOM-2022



Satellite Communication - Technology Evolution & Future Trends

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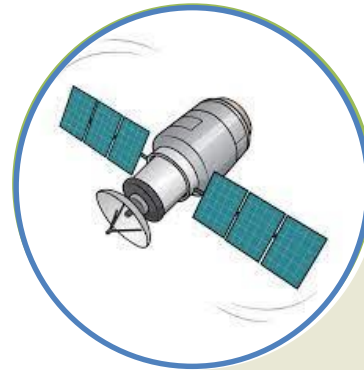
Satellite Communication Role - Technology Facts

Satellite technology helps to bridge the digital divide as it can be used in areas where there is no terrestrial alternative.



Homogeneous &
Scalable

Software defined
products & service



Purpose built &
Proprietary

Hardware centric
solution

The Opportunities

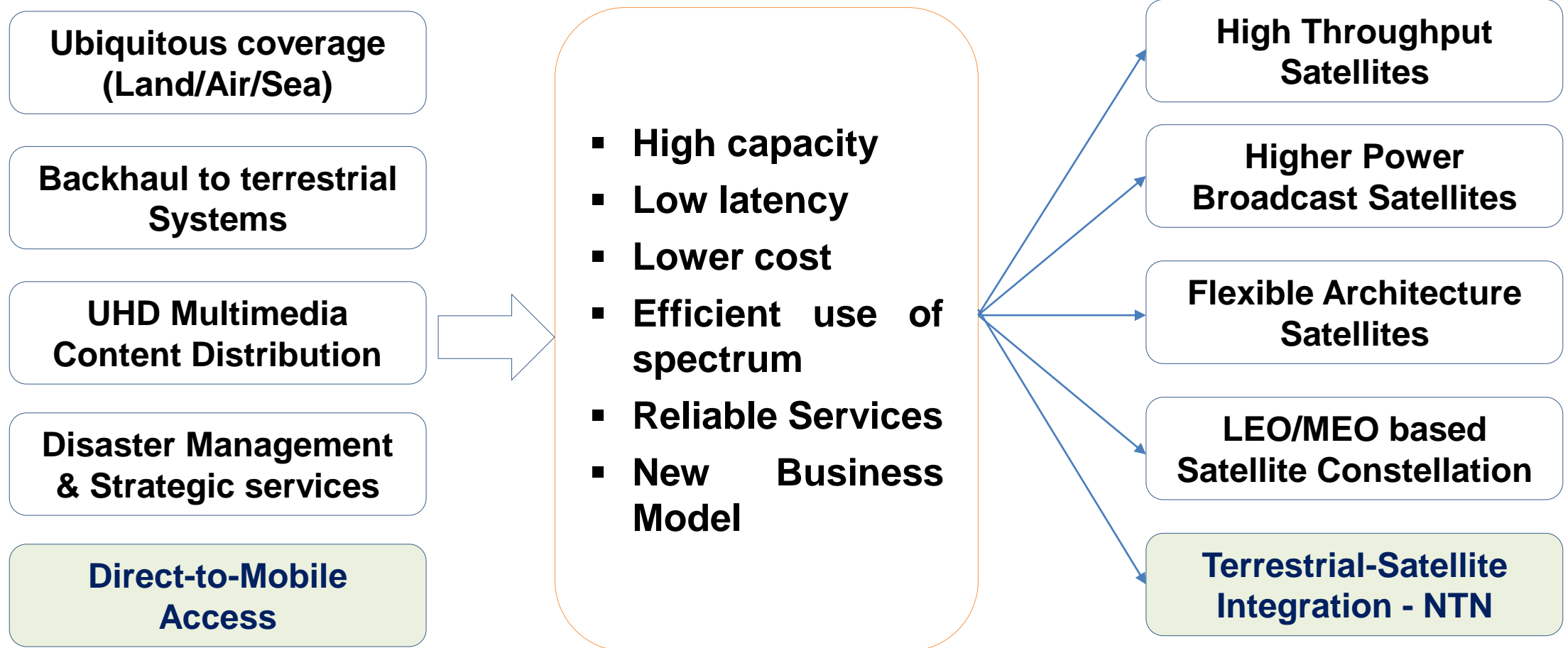
Space Disruptions: Advancement in Satellite Technology

Mega-constellations: New entrants with disruptive business models

Standards: Inclusion of satellites in 5G standards

Satellites need to “plug in” to carrier standards

Requirements Driving SATCOM Evolution



Application

Requirement

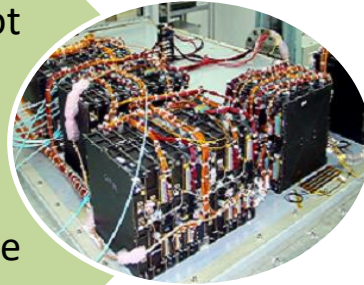
Technology

Satellite Technology Evolution

Making it viable for communication



- Opting of band like Ku, Ka & Q/V band
- Frequency reuse & high-powered spot beams
- In air configurable - Coverage, Power & Spectrum
- Software defined payload design- maximize use of resources
- Non-Geo Mega constellation



- Reusable rocket – lower the launch cost (<\$100/ Kg-Starship)
- Growth of small launch vehicle - Suitable for nanosatellite
- Repair/Service orbiting satellites
- Mitigate space debris- Mission Extension Vehicles (MEV) by Refueling & Self-destruction technologies

Technology Advancement

Antenna & Base band Technologies: - A must for LEO/MEO

- Flat Panel - smaller, lighter, auto acquiring (*KYMETA, ALLSPACE, etc*)
- Multi-orbit operation using single antenna
- Increased spectral efficiencies - DVB-S2X
- Advanced modulation & coding schemes



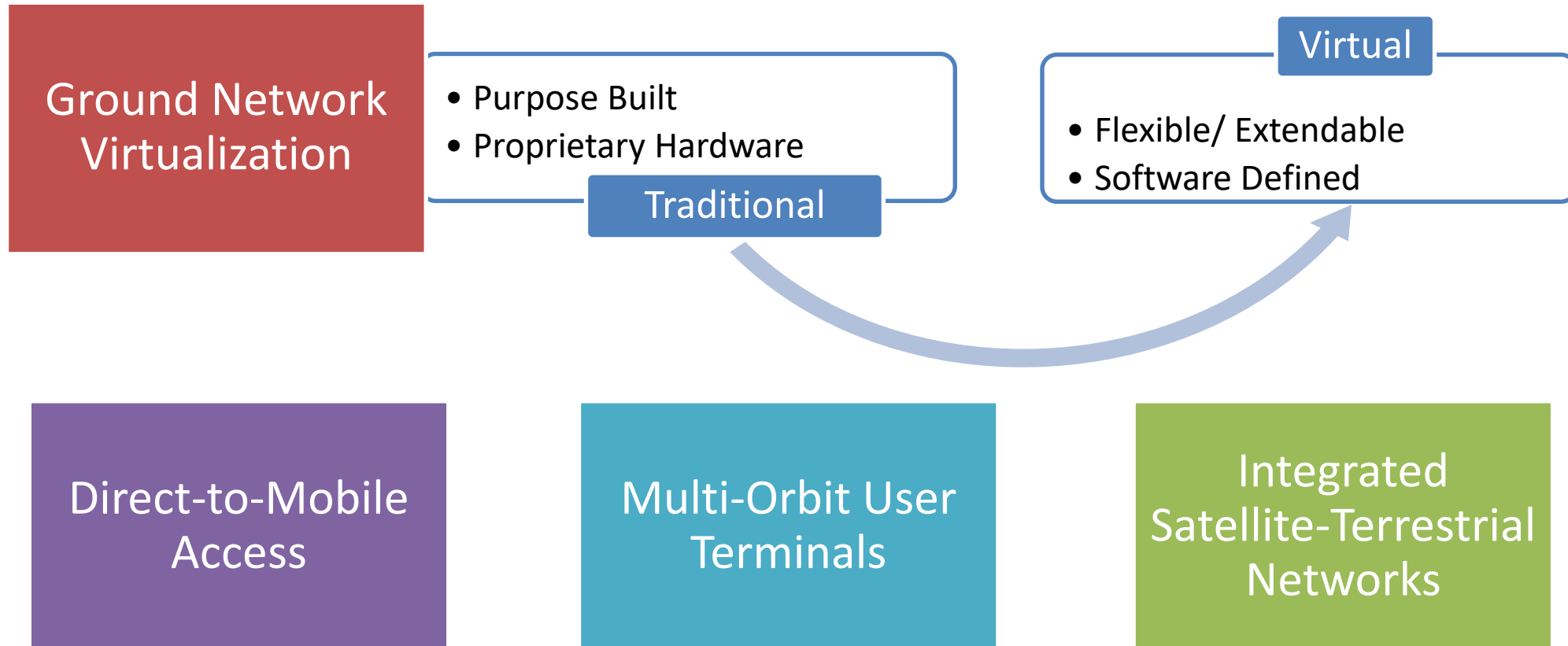
- Advance manufacturing 3D printing - reduces delay
- Mass production of satellite (lower cost/satellite)
- Reducing the satellite size and mass (Micro-Geo Sat)
- Electric propulsion - used orbit raising & station keeping

- Positive but not sufficient -

New Trends in Satellite Communication



Technology advancement will not be the only source of change for the satellite communications industry. Other drivers of change will include;

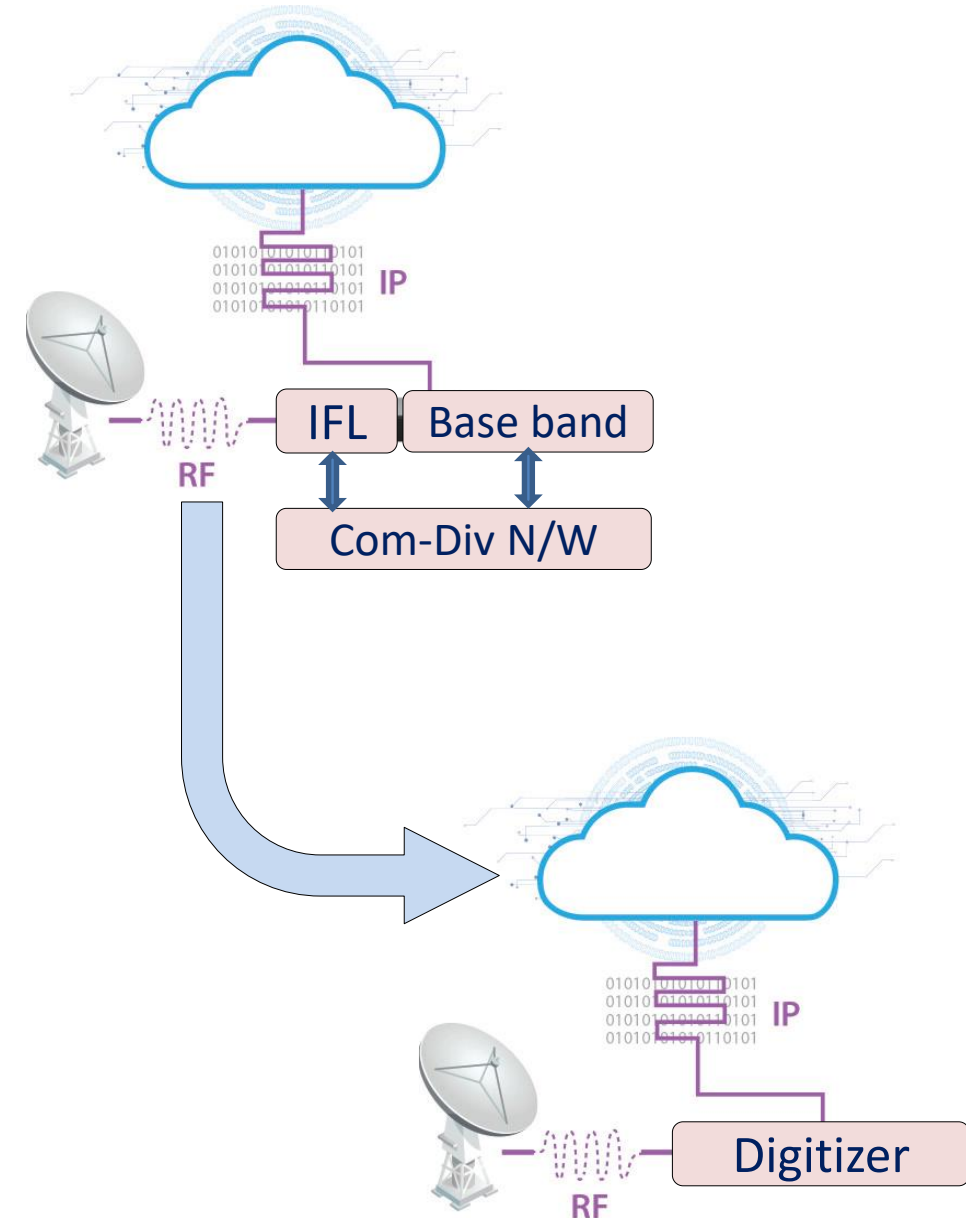


Virtual Ground network



Ground segment is a hotbed of innovation of the overall space ecosystem

- **Digitization of the RF chain** - Digitized RF running over IP, eliminates range limitations between baseband and earth station locations i.e. traditional RF over fibre.
 - ✓ Digitization will not replace HPAs and LNAs but to see how far up the RF chain it is possible to digitize. For e.g. - Digital Intermediate Frequency Interoperability (DIFI) Consortium.
 - ✓ Digitization opens the door to the adoption of fully virtualized and software-defined ground systems.
- **Coupling them with cloud technologies** - Baseband signals can be kept in the Cloud and then converted to analog RF in the antenna hub.
 - ✓ Just a few clicks on a cloud-based application and RF system can be re-configured for a different carrier type or even a different use case.
 - ✓ Leading cloud players - Amazon (AWS), Microsoft (Azure) and Google (Cloud).
- **Industry Standards:** Adoption of open standards



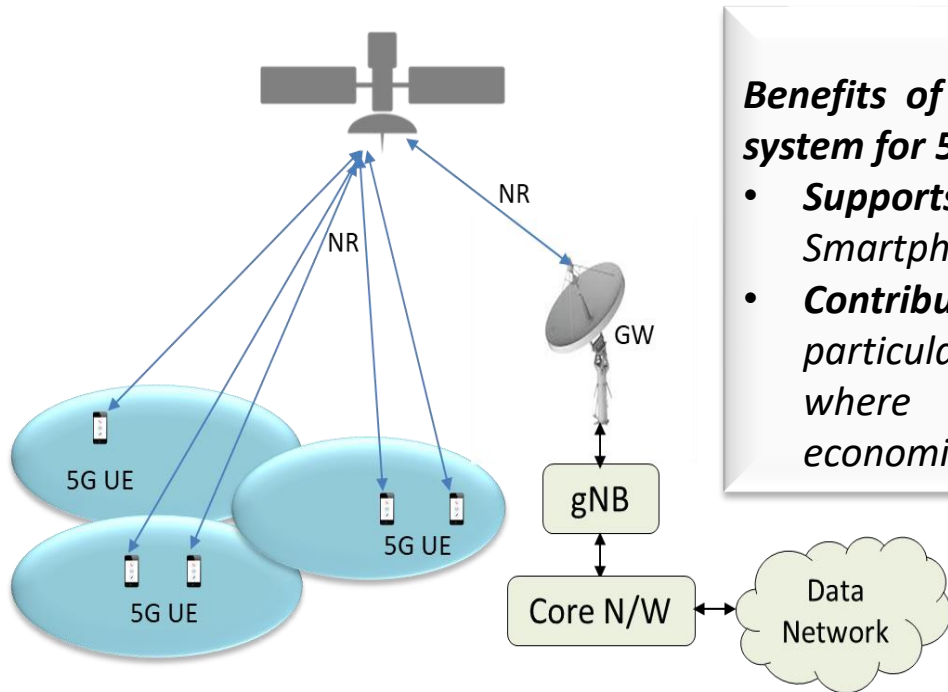
Integrated Satellite & Terrestrial Networks



Study by 3GPP on Integrated satellite and terrestrial network infrastructure for 5G

- Possible due to lower latency & ubiquitous coverage of satellite
- Two potential architecture options (i.e. transparent & regenerative) to connect 5G UE

**Non Terrestrial Network (NTN) architecture supported in Release-17:
Connectivity with transparent NTN-based RAN**

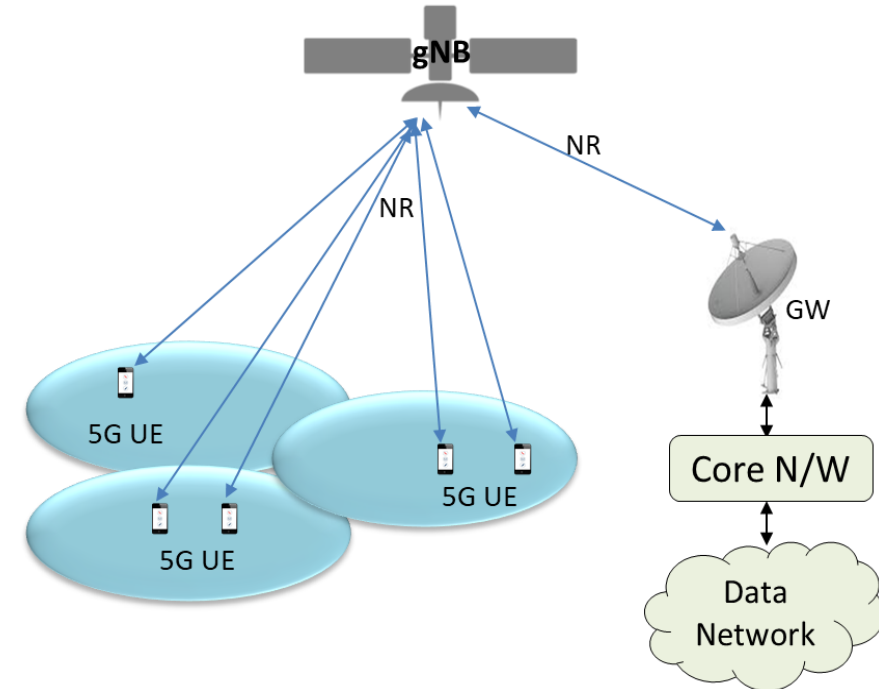


Benefits of the integrated satellite-terrestrial system for 5G

- **Supports any type of device – IoT & Smartphone.**
- **Contributes covering the entire territory in particular in low density population areas where tower deployment is non-economically attractive**

Next Generation Node B (gNB) processing station is on ground that process the 5G signals from the core network.

**NTN architecture under consideration for standardization in Rel-18:
Connectivity involving regenerative NTN-based RAN**



The on-board of the satellite designed to align with the 5G waveform specifications.

The gNB processing is incorporated into the satellite payload

Space based Direct-connectivity-to-Mobile

- Space-Based Cell Tower – fill the coverage gaps that MNOs un-reached using their ground based towers.
- Connect existing Mobile phone directly with satellite for voice, image, video and data.
- **3GPP Rel-17** is accelerated the emergence of these services with the inclusion of NTN

Opportunity

Expand Network Coverage- Worldwide on land, at sea and air.

Minimal Additional CapEx Required- No investment for ground infrastructure (Except Gateway).

No modifications to standard mobile phones.



Operators (Development stage) – SpaceX (25 sq mtr PAA)-partner with T-Mobile, AST SpaceMobile (64 sq mtr PAA) , Lynk Global (Tested SMS), OmniSpace, GlobalStar (iPhone 14 pro – Message service), Sateliot.

SATCOM– Indian Scenario



ISRO/ DOS have been the architects of growth for space sectors in all domain of space i.e. Launch Vehicle, Spacecraft, Payload & Ground segment.

ISRO has played a crucial role in developing satellite capacity in India using C-band, extended C-band, Ku-band, Ka/Ku band

Industry is Undergoing a transformation due to evolving technologies, new business models and new services.

To keep pace with global growth trends, India needs to adopt more flexible practices towards adopting latest technology.

Integrated efforts to achieve this Goal from-

- Technical standard bodies
- Regulators - Flexible & light touch regulation

Year 2022 Era of Reforms

- Simplification in Mandatory performance verification Testing (MPVT)
- Rationalization of NOCC & MPVT charges
- Enhanced scope of Satcom licenses
- Infrastructure Sharing – Gateway
- Relaxation of technical specifications by TEC

Year 2023 Ray of Hope

- Pending Release of **SATCOM Policy** – draft policy issued >2 years back
- Early finalization for **NGSO Specifications** by TEC
- Flexible use of spectrum – **Technology Neutral**.
- **Single Window Clearance** – avoiding multiple and sequential approvals between DoT & DoS

The future will see a mix of various technologies and the market should be permitted to determine which one is best suit - **Technology neutral regulations and licensing provisions**

Thanks !!!

