

India's Role in Standards and Ecosystem Readiness towards 6G

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Bharat 6G Vision

- Technological advances in 6G to impact not just the “comfort” and “coolness” factors of user experience
- But also the lives & livelihoods of users
 - **Affordable**
 - Enable remote skilled services with improved human-machine and machine-machine communications having high reliability and low latency
- **Ubiquitous** broadband connectivity
- **Sustainable** solutions



Key focus areas

Must-Haves:

- NTN-Terrestrial Integration for ubiquitous coverage
 - No coverage holes across the entire country
 - Satellites, HAPS,...
- Mobile broadband networks with very high spectral efficiency
 - RAN virtualization right up to tower
 - Low energy footprint to improve sustainability
- Shared use of spectrum
 - Especially in NTN to ensure ubiquitous coverage

Wish-List

- New sensors and devices for tactile internet, AR/VR, ambient awareness, etc

Sustainability and Higher Capacity of Mobile Broadband

- Not easy to add new spectrum in the “nice” bands (< 4 GHz)
- Single-cell MIMO and 1:1 re-use reaching the limits of spectral efficiency
 - Besides, MIMO is energy intensive (relies on scattered energy to support multiple parallel streams of data to a user)
- For sustainability, need to focus energy towards user
 - Beamforming becomes important
- To increase capacity, need to move towards “cell-free” connectivity with multiple links
 - More fiber penetration, denser cells, more virtualization of RAN

Ubiquitous Connectivity

- Despite adding lakhs of sites, India still has substantial areas with poor coverage
 - Forest / desert / hill dwellings
- Seamless integration of NTN (satellite, pseudo-satellite) with terrestrial networks is the answer
 - LEO satellites can be reached from handhelds open to sky
 - Very modest data rates
 - Pseudo satellites can give broadband from handhelds open-to-sky
 - modest data rates too from indoors in single / two-storey dwellings

India's Role in 6G Standardization

- Indian focus in ITU on Ubiquitous Coverage
 - Defining requirements that ensure 100% coverage of the country using Terrestrial and Non-Terrestrial Networks
- TSDSI studying ubiquitous urban coverage using RIS
- Indian entities in 3GPP contributing strongly towards
 - increased spectral efficiency
 - use of AI/ML at all network layers to improve system efficiency and sustainability
 - Ambient IoT, ...

Ecosystem Readiness for 6G

- 5G rolled out by 2023
 - Among the fastest in the world
- Telecom system and device manufacturing have ramped up rapidly in last 3 years
 - RAN
 - Core
 - Phones, IoT devices, ...
- Space and drone sectors growing rapidly
- By 2030, can expect innovative devices and network components to
 - Increase affordability
 - Address new use cases
 - Improve sustainability
- Burgeoning space sector will disrupt LEO satellite cost
- Drone innovations expected to make HAPS feasible

Bharat 6G Alliance (B6GA) formed

- To ensure that **6G technology is a powerful force multiplier** for the Indian economy in the coming decade
- Enable **India to become a leading global innovator** of advanced, sustainable and affordable telecom systems and solutions
 - particularly public goods that vastly improve lives and livelihoods
- Ensure India contributes significantly to meeting the IMT-2030 requirements of **ubiquity, sustainability and affordability**

Thank You