

ETRI

Electronics and Telecommunications
Research Institute

6G R&D in Korea

- Korean Perspective

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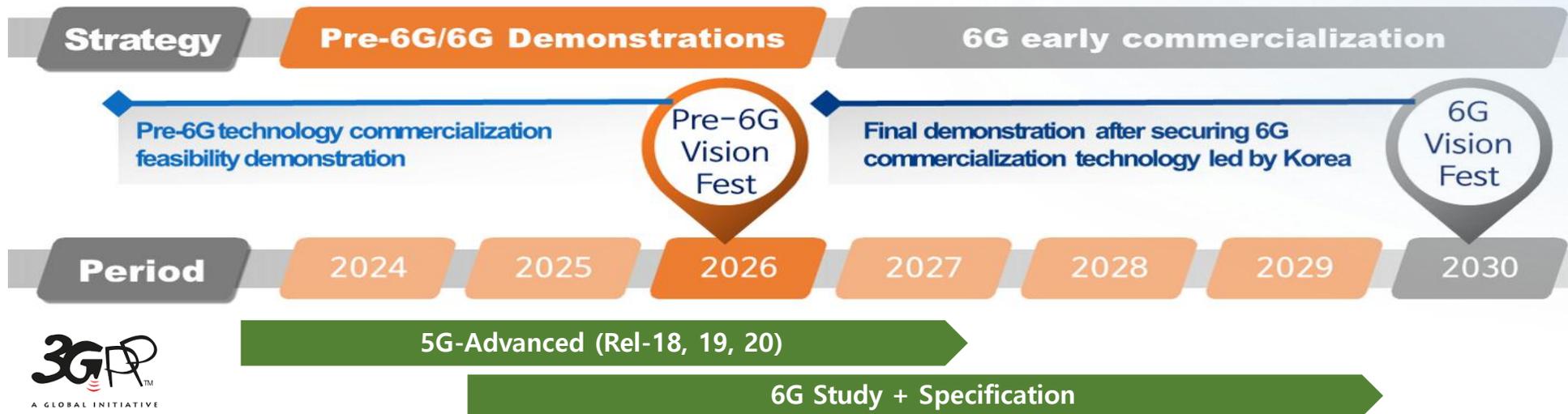


01 · Korea 6G Research



	Hyper Performance	Hyper Broadband	Hyper Precision	Hyper Space	Hyper Intelligence	Hyper Trust
6G Phase 1 (2021~2025) 165M\$	1Tbps level data rate	100~300GHz frequency candidate band	Latency 1/10 of 5G	Up to 10km from the ground	AI technology to entire Network	Security by design embedded

	Advanced Wireless	SW-Centric	Beyond Com.	Energy Saving	Supply Chain
6G Phase 2 (2024~2028) 327M\$	Upper Mid-Band Coverage Expansion	Open RAN Cloud-native AI-native	Computing + Com. Sensing + Com.	AI based power saving High-efficient & Low energy devices	UE/RAN components Optical components



01 - Korea 6G Research

🌀 Project: Development of 6G LEO Satellite Communication System (Start Soon)

- **Scope:** 6G LEO Sat. Comm. **Payload**(incl. ISL), 6G LEO Sat. Comm. **Ground System**(GW & Terminal)
- **Budget and Period:** 246M\$, 2025~2030 (6 years) *Budget, updated based on the current exchange rate
- **2 Satellites Launch: Y2030 (6G NTN)**



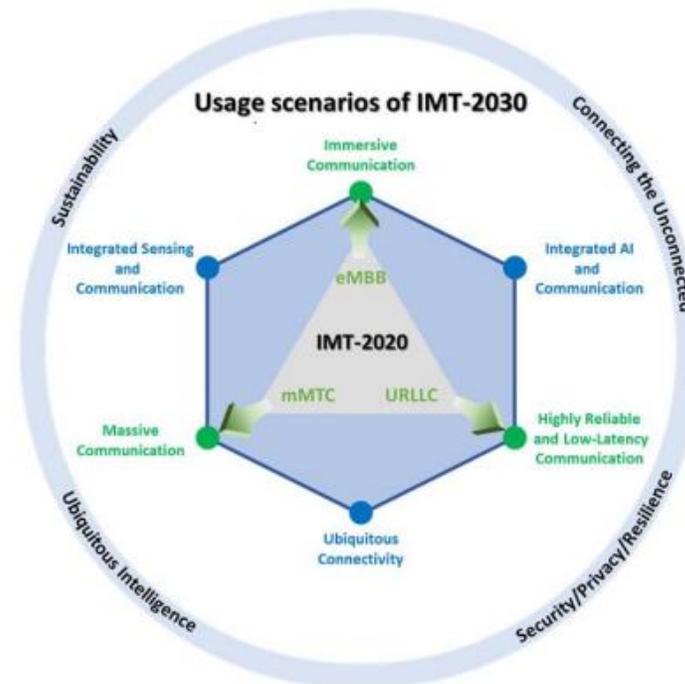
02 · 6G Technologies | IMT-2030 Framework

Usage scenario

- eMBB → Immersive Communication
- URLLC → Hyper Reliable and Low-Latency Communication
- mMTC → Massive Communication
- **Ubiquitous Connectivity***
- Integrated Artificial Intelligence and Communication
- Integrated Sensing and Communication

Capabilities

- Peak Data rate, User experienced data rate
- **Coverage***, Reliability, Latency, Mobility, Connection density and so on
- AI related capabilities
- Interoperability, Sustainability
- Sensing-related capabilities and so on

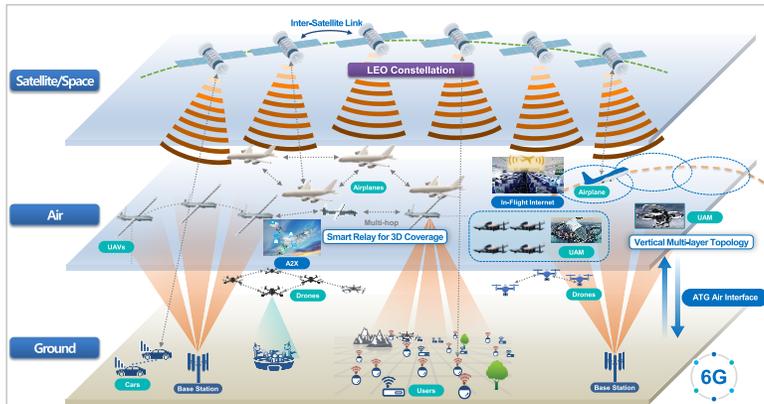
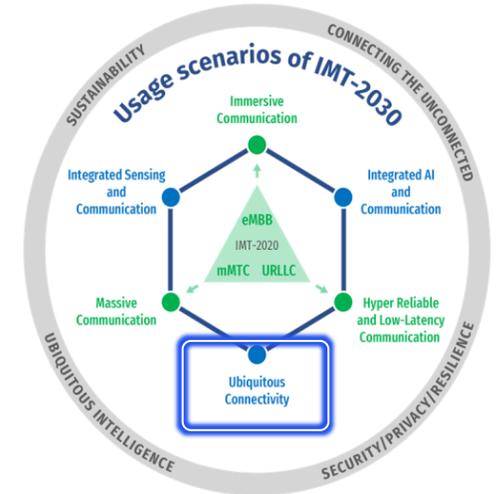


02 · 6G Technologies | Key Features

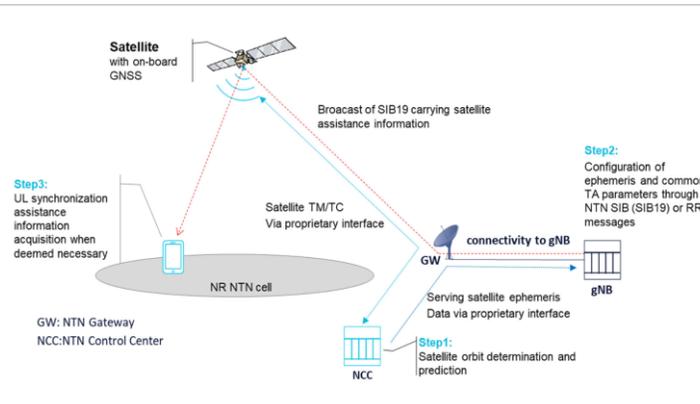
3D Network Design

- 6G integrated TN-NTN networking protocols
- 6G NTN radio transmission technologies
- 6G LEO satellite payload component technologies

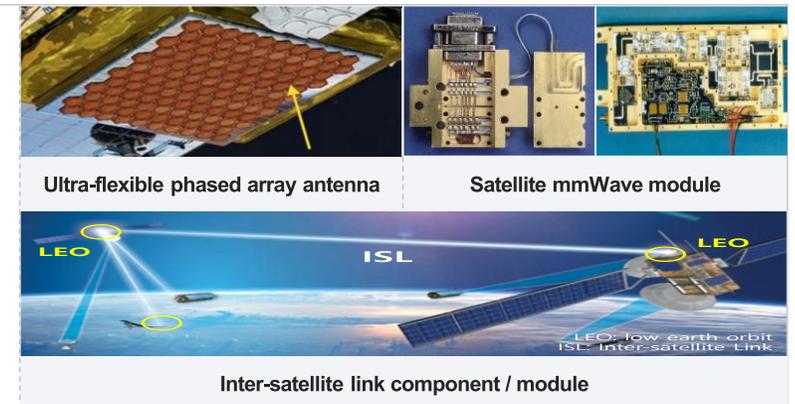
Ubiquitous Connectivity



Integrated TN-NTN networking



NTN radio transmission



LEO satellite payload components

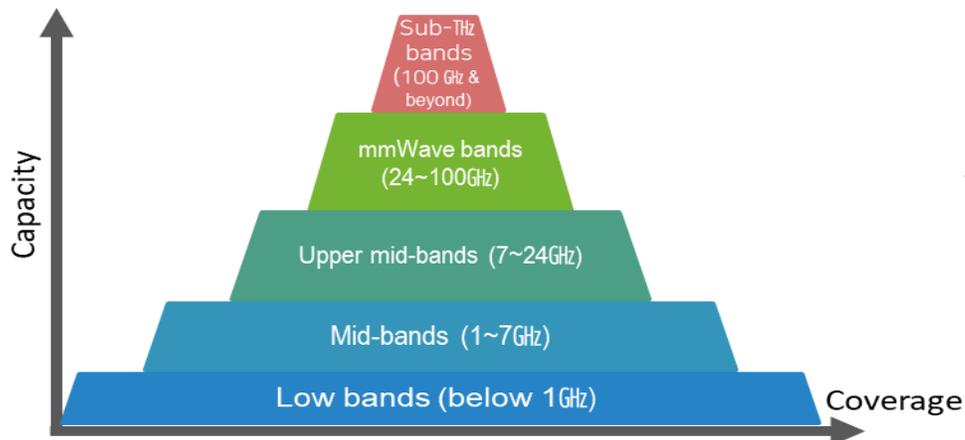
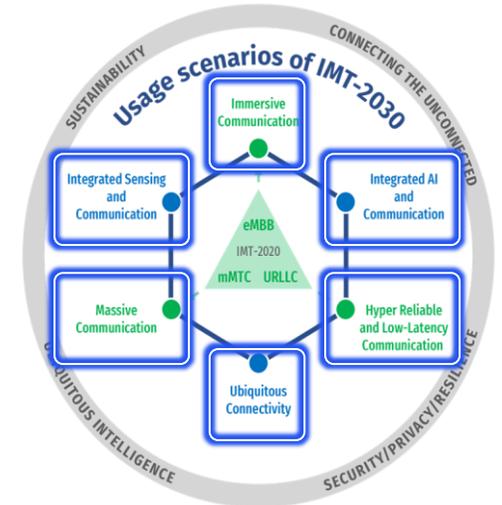
02 · 6G Technologies | Key Features

🕒 New frequencies | More usage scenarios → More spectrum

Mobile comm
expanding
to whole
industrial areas

- ▶ High Band (mmWave + sub-Thz) → Sensing & Ultra Capacity
- ▶ Upper Mid Band (7-24GHz) → Coverage & Extreme Capacity
- ▶ Mid Band (1-7GHz) → Coverage & Capacity
- ▶ Low Band (below 1GHz) → Extended Coverage

All
Usage
Scenarios

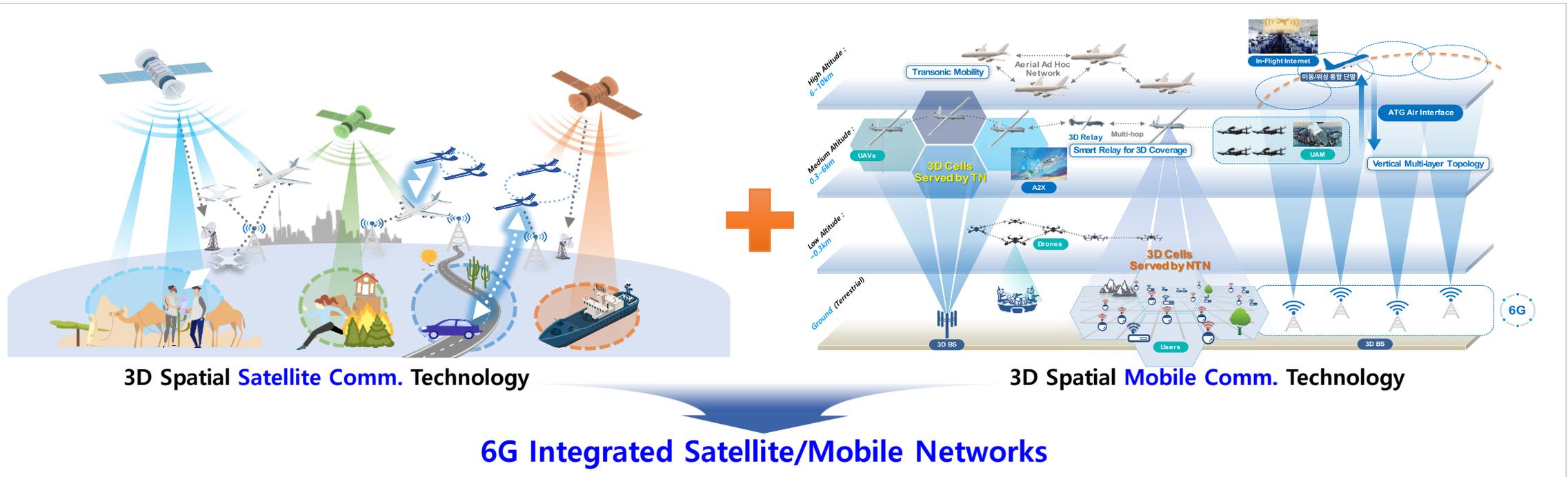


- ▶ KOREA 6G Candidate Upper Mid band | 7.125 ~ 8.4, 12.75 ~ 13.25, 14.8 ~ 15.35GHz (Global 6G Candidates: 4.4~4.8, 7.125~8.4, 14.8~15.35 GHz)
- ▶ 6G Spectrum competition: China (5.925-7.125 GHz) vs. USA (7.125-8.4 GHz)
- ▶ Channel Bandwidth | 100~400 MHz in the Upper Mid Band
- ▶ Spectrum Technology
 - 4G: Carrier Aggregation
 - 5G: Dual Connectivity
 - 6G: Advanced Duplex

03 · ETRI 6G Technologies | NTN in 6G Phase 1

6G Hyper-Space Network Technology (2021~2025)

- ▶ Development of an **integrated TN/NTN technology** that provides Gbps-level services to 3D space UEs
 - 3D spatial satellite communication technology for the air from a satellite
 - 3D spatial mobile communication technology for the air from the ground
 - 3D spatial network services provided in the form of the integration of 3D spatial satellite and mobile communications

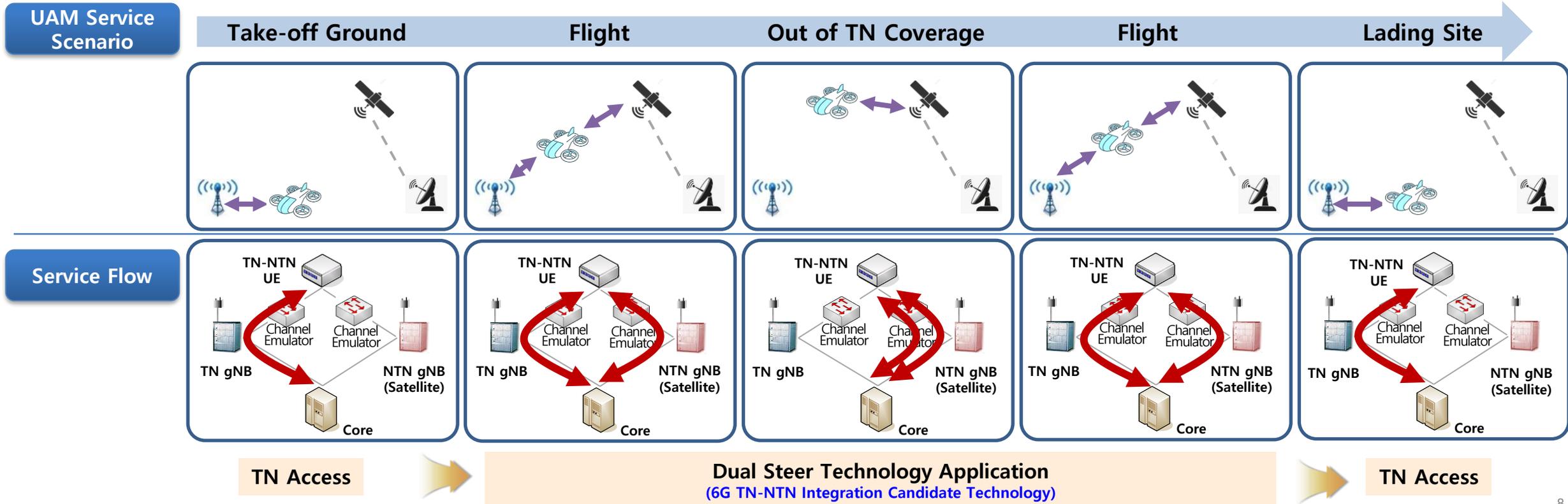


03 · ETRI 6G Technologies | NTN in 6G Phase 1

Implementation of TN-NTN Interworking PoC and World's First Demonstration Using Dual Steer Technology (2025)

▣ Pre-implementation of Dual Steer Technology Prior to 3GPP Dual Steer Standardization

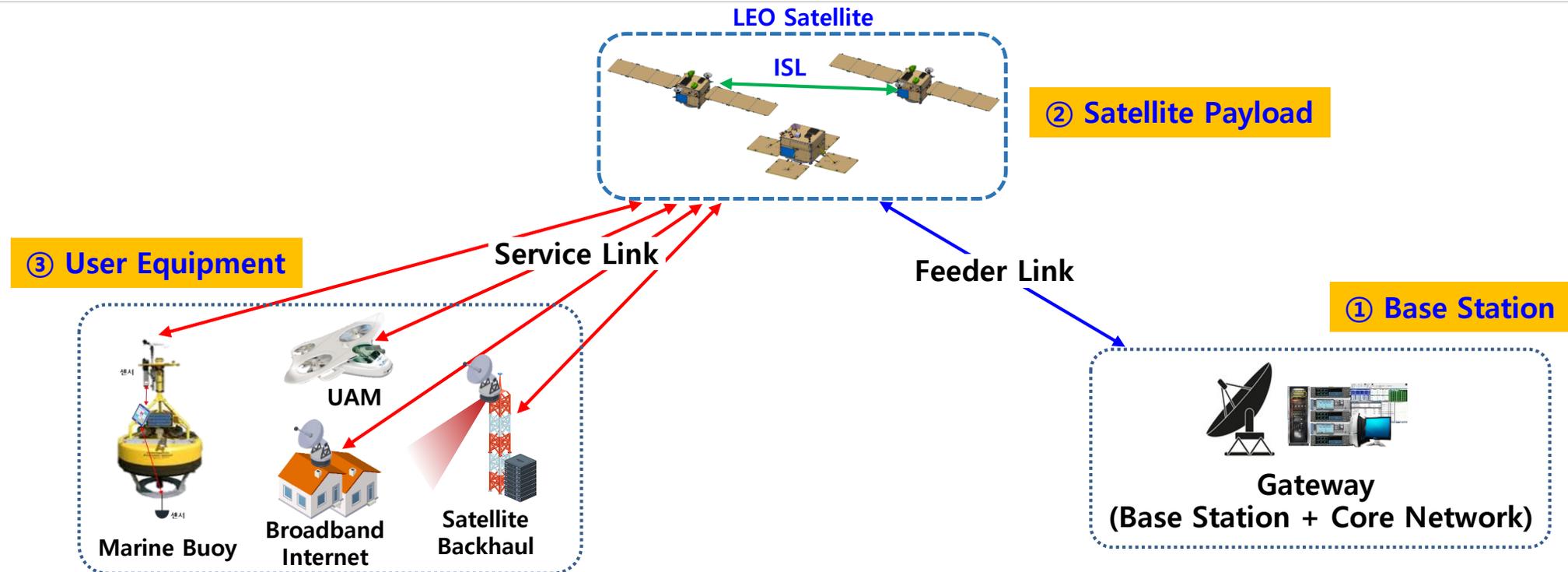
- Implementation of TN-NTN Dual Steer Using 3GPP Rel-16 ATSSS (Access Traffic Steering, Switching, and Splitting)
- Steering Mode: TN-NTN Load Balancing (Steering, Splitting, and Switching)



05 · ETRI 6G Future Research | NTN (Satellite)

6G LEO Satellite Communication System ('25~'30) «Launch of two 6G LEO satellites in 2030»

- ▶ Objective: Development & Verification of Core 6G LEO Satellite Comm. Technologies
- ▶ Scope: 6G LEO Sat. Comm. Payload(incl. ISL), 6G LEO Sat. Comm. Ground System(GW & Terminal)



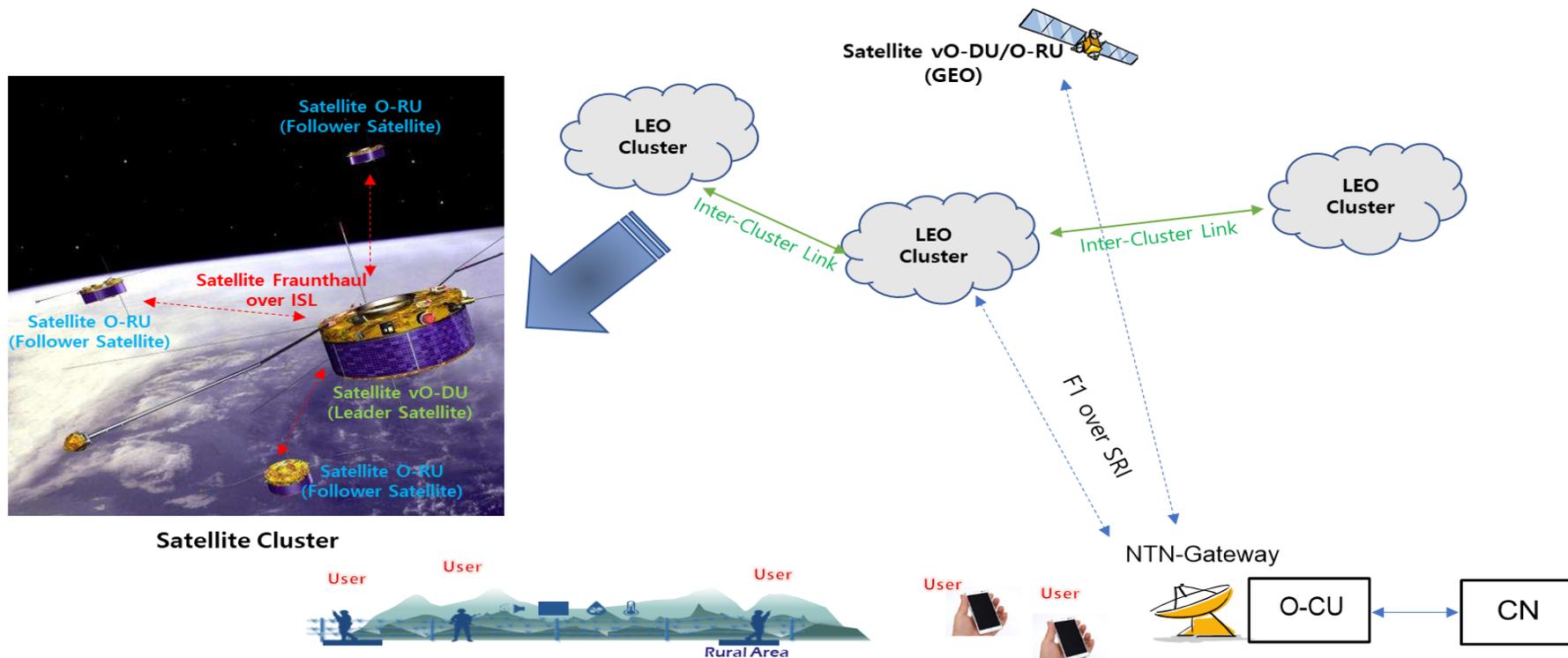
* LEO: Low-Earth Orbit, ISL: Inter-Satellite Link

05 · ETRI 6G Future Research | NTN (Satellite)

Low Cost/High Efficiency Next-G Open NTN Technology '3D Open RAN'

Development of an 3D Open RAN Based Regenerative Satellite Systems

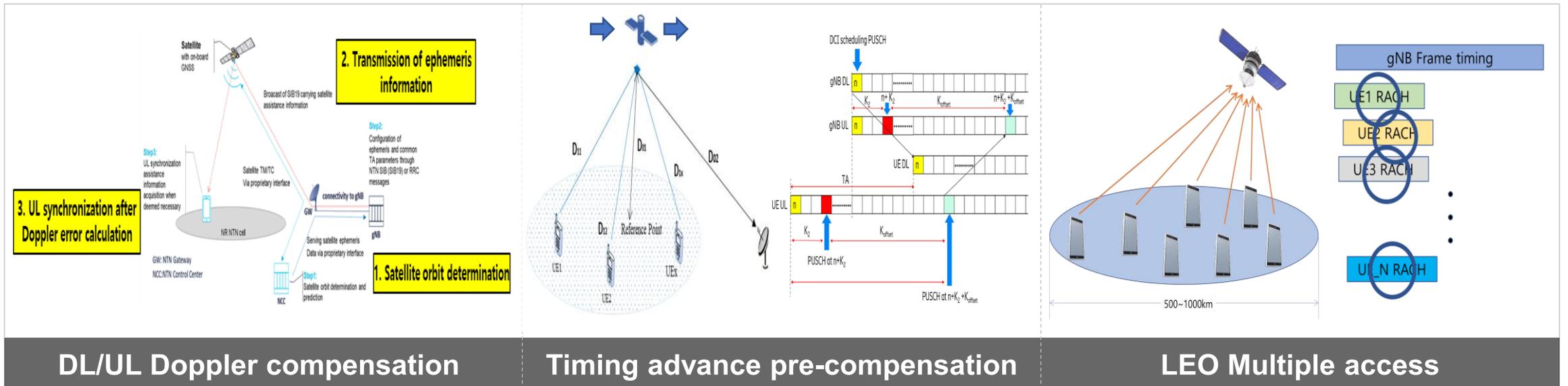
- Functional Split Structure in Satellite Networks (e.g., O-CU on Ground and O-DU/O-RU on Satellite)
- 3D Open RAN Technologies on Open Interface, AI/ML-Based Intelligence, and Satellite Virtualization
- Requirements and Use Cases on O-RAN Based Regenerative Satellites



05 · ETRI 6G Future Research | NTN (Satellite)

Launch of Regenerative 6G IoT-NTN satellite based on Software Defined Architecture ('29)

- ▶ **Technologies that overcome the extreme Doppler and long propagation delay of LEO satellites**
 - Downlink/uplink Doppler compensation technology for large Doppler error environments
 - Timing advance pre-compensation and HARQ-ARQ improvement technology for long propagation delay environments
- ▶ **Multiple access technology for wide-area satellite coverage and fast-moving LEO satellites**
 - Non-orthogonal multiple access technology suitable for initial access for LEO satellite environments



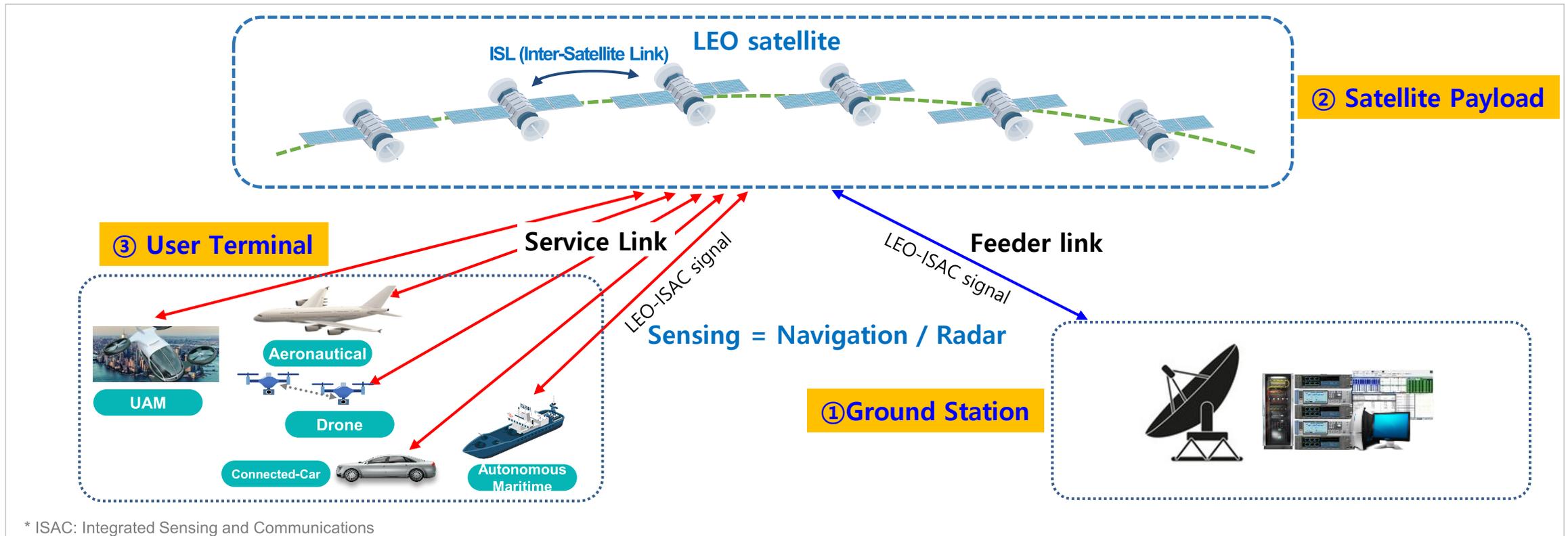
*LEO: Low-Earth Orbit, DL: Downlink, UL: Uplink

05 · ETRI 6G Future Research | NTN (Satellite)

LEO Satellite based Integrated Sensing and Communication (ISAC)

Development of core-technology to overcome critical challenges in LEO-ISAC

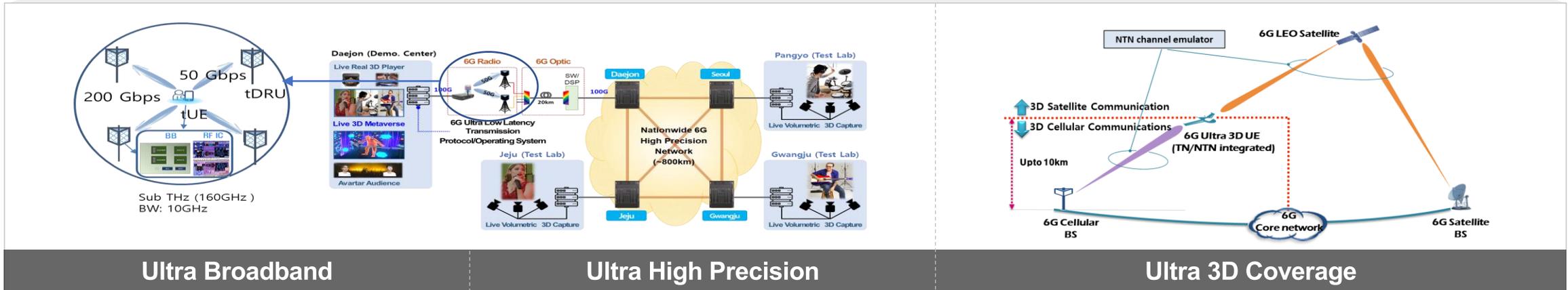
- Rate-Splitting Multiple Access (RSMA)-based precoder design to overcome intra-/inter-function interference.
- Bistatic-based structure to overcome severe LEO path loss and confliction b/w uplink and echo signal.



05 · ETRI 6G Future Research | PoC plan



- 1
 - 200 Gbps Ultra Broadband
- 2
 - 5 msec@800 km End to End Ultra High Precision
- 3
 - Gbps level TN/NTN integrated Ultra 3D Coverage



A futuristic cityscape at night, illuminated with blue and white lights. The scene features a large satellite in the upper left corner, emitting a beam of light towards the city. In the upper right corner, an airplane is shown in flight, also emitting a beam of light. The city below is a dense urban environment with numerous skyscrapers and buildings, all lit up. A large body of water is visible in the foreground, reflecting the city lights. The overall atmosphere is one of advanced technology and global connectivity.

THANK YOU