

工業技術研究院

Industrial Technology
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Taiwan 6G Research Update

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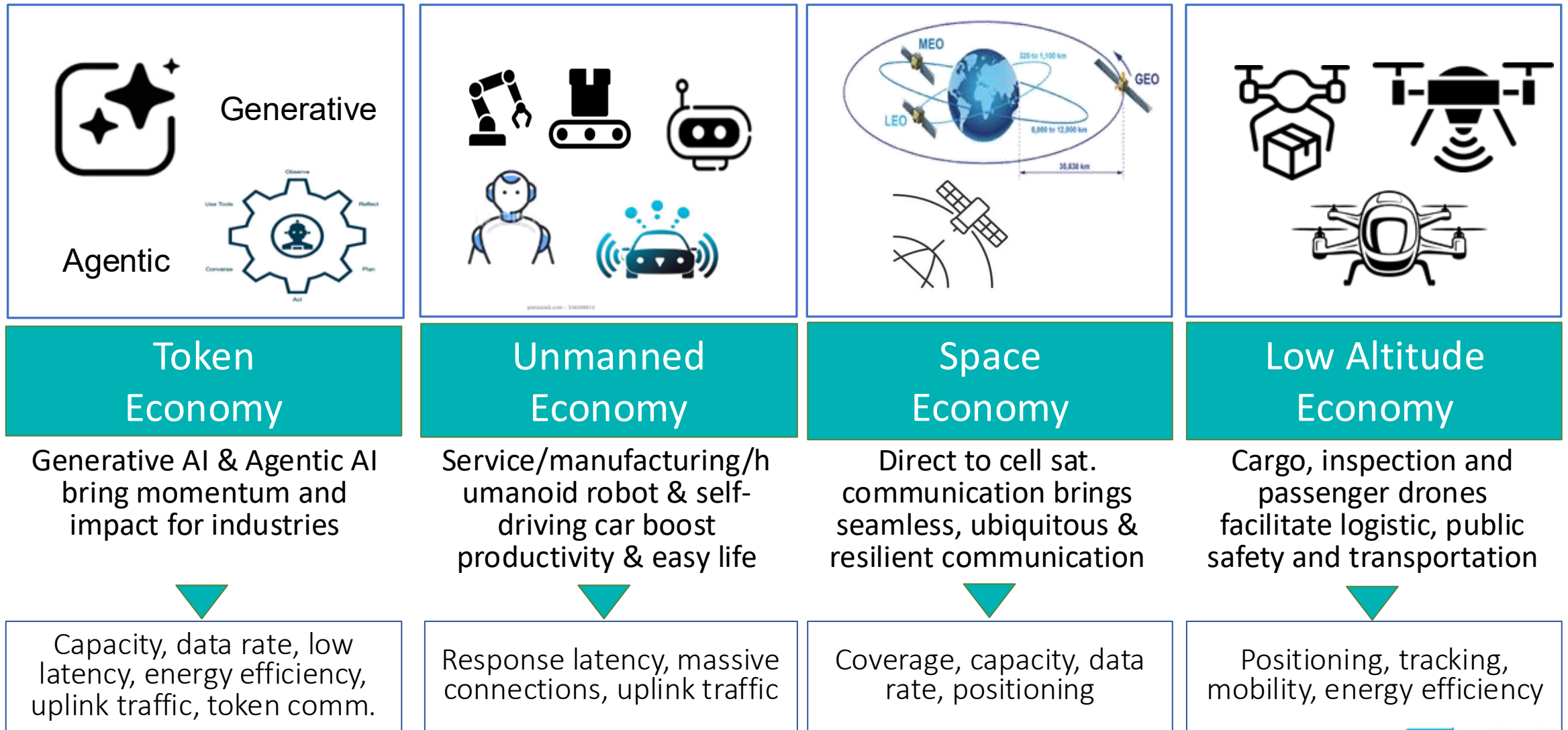
Deputy General Director, ITRI ICL
Chair of 6GIF SIG1/WG2

September 22, 2026

Outline

- **6G Economics & Evolving 6G Enabling Technologies**
- **Taiwan 6G R&D Technologies**

Emerging Economics Fuel 6G Mobile Data Traffic



Matrix of Emerging Economics & 6G Technologies

6G Tech. Economy	NTN	ISAC	AI-RAN	U-mMIMO	All-in-One
Mobile Telecom.	TN/NTN converged Rural & oceanic coverage	- Pedestrians/vehicles sensing - Positioning & navigation	- Dynamic radio resource allocation - Network optimization	- Beamforming efficiency - Capacity boosting	- Campus/factory - Hot spot network
Space Economy	- Direct to cell - Regenerative gNB for sat. payload	- Spaced positioning - Marine, vessel positioning	- AI assisted BB processing - Intelligent management for multi-orbit sat.	- Sat. antenna array - Frequency reuse for multi-beam sat.	N/A
Token Economy	- Space Edge AI inference - Complementary Border guard	- Machine/robot in smart factory - Crowd/traffic detection in smart city	- Edge AI inference - RAN & AI computation	- High efficiency network - High speed backhaul for AI edge server	- Smart private net. for factory/hospital - Connectivity for smart city
Un-manned Economy	- UAV backup command link - Backhaul for remote island UAV	- Radar sensing counter-UAV - Roadside sensing for unmanned vehicle	- AMR/robot dynamic routing - Edge-AI assisted decision for unmanned vehicle	3D connectivity in urban arcade - Physical AI remote connection	- Quick rollout for factory AMR net. - Small private net. for AGV logistic park
Low Altitude Economy	- UAV comm. backbone backup - Inspection UAV backhaul over ocean	- Collision avoidance for eVTOL - UTM for space traffic sensing and location	- Context-aware autonomous decision - Seamless mobility for high speed eVTOL	- UAV airway 3D connectivity - HAPS coverage	Small private net. deployment for low-altitude UAV logistics hubs

Strong

Medium

Weak

N / A



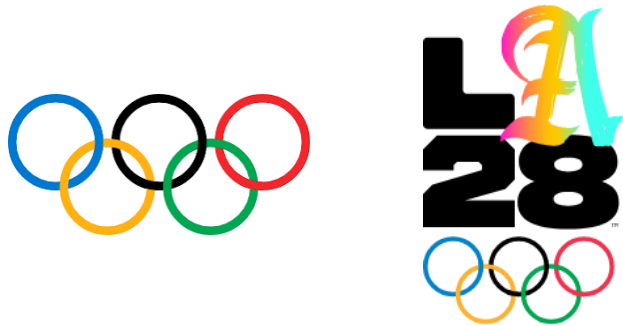
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USA 2028 LA Olympics – Mission 6G 28

Important event for 6G showcase before commercial launch

To advance early, 6G DEMO

1. Demonstrate the value of 6G
2. Demonstrate an innovative use case
3. Utilize or anticipate relevant 6G standards
4. Advance secure, trusted, and open infrastructure; and
5. Could lead to exportable AI technology.

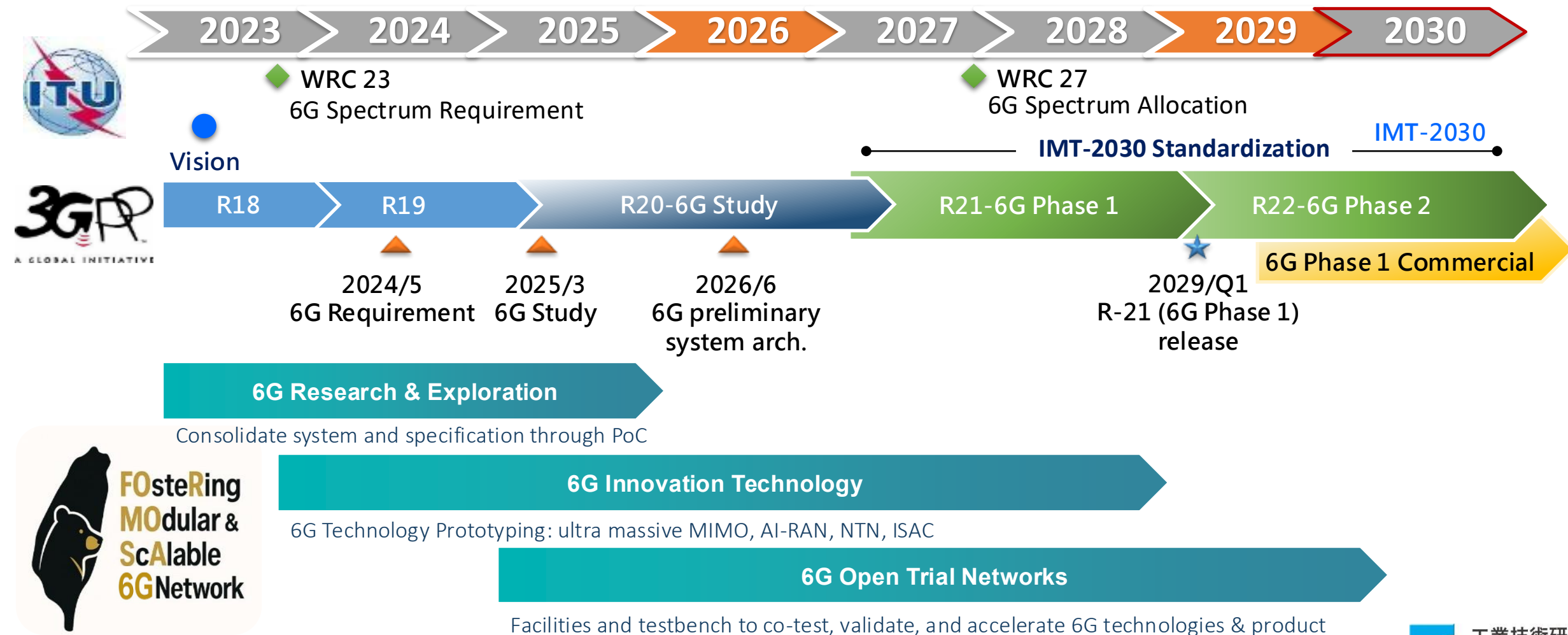


Use Cases

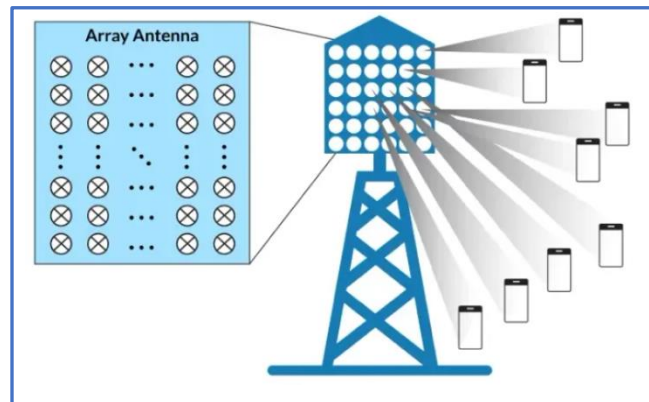
- Artificial intelligence (AI): network optimization, intelligent unmanned aerial vehicles (UAVs), object detection, health monitoring, and personal safety;
- Integrated sensing and communication (ISAC): safety and security of spectators and athletes, UAV detection, digital twinning, and extended reality (XR) experiences;
- Ubiquitous connectivity: non-terrestrial networks (NTN), including for emergency response;
- Immersive communications;
- Mission critical communications; and
- Robotics or “physical AI”

Taiwan 6G Program - Aligning Global Standardization Timeline

3GPP 6G Timeline: 6G SI @ 2025, Phase 1 Release @ 2029, Commercial @ 2030



Macro Broadband 6G Terrestrial Network



Ultra massive MIMO

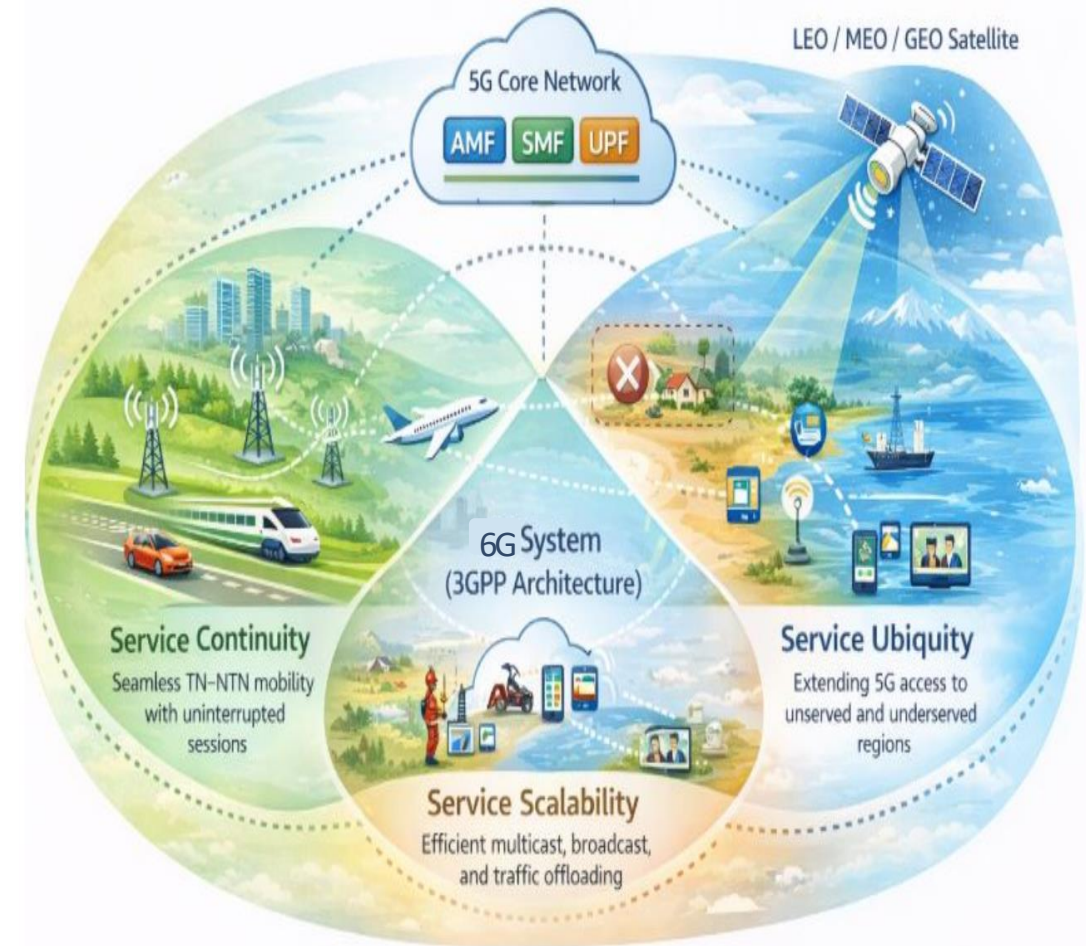
	Bands	Band-width	Antenna Elements	Spectral Efficiency	Antenna Gain	Average cell Throughput	Cell Range
5G	3.5 GHz	100 MHz	192 AE	10 bps/Hz	24 dBi	0.8 Gbps	650m
6G	7 GHz	400 MHz	768 AE	50 bps/Hz	30 dBi	16 Gbps	490m
	x2	x4	x4	x5	x8	x20	~x1

- Native disaggregation architecture (CU/DU/RU) with COTS H/W platform, facilitating cloud-edge collaborated deployment
- U6GHz & 7GHz “Golden Bands” deployment, need to co-locate with 5G site
- Massive MIMO to support 1024 antenna elements, 128TR/256TR
- Single carrier bandwidth is DL/UL 400MHz/200MHz for ~7GHz, MU-MIMO data layer is 8T8R baseline, up to 16T16R

Source 5G America

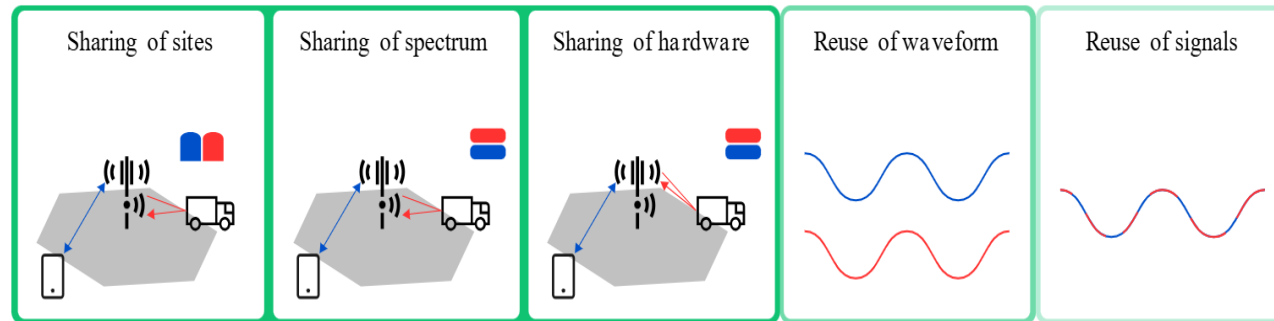
6G NTN Communication

- Direct to cell is Key application
 - L/S bands
 - Powerful sat. deployment for commodity UE
 - Telco. operator & Sat. operator cooperation
- Broadband communication
 - High frequency bands (Ku/Ka)
 - Terabits High throughput satellite w/ antenna array
 - Multi-cell by multi-beam, beam-hopping
 - Cell and beam steering, broadband frequency reuse
 - UE be flat panel solution
- Architecture
 - Transparent mode for MEO/GEO coverage
 - Regenerative mode for LEO broadband & low latency
 - Multi-orbit collaboration and TN/NTN mobility handover

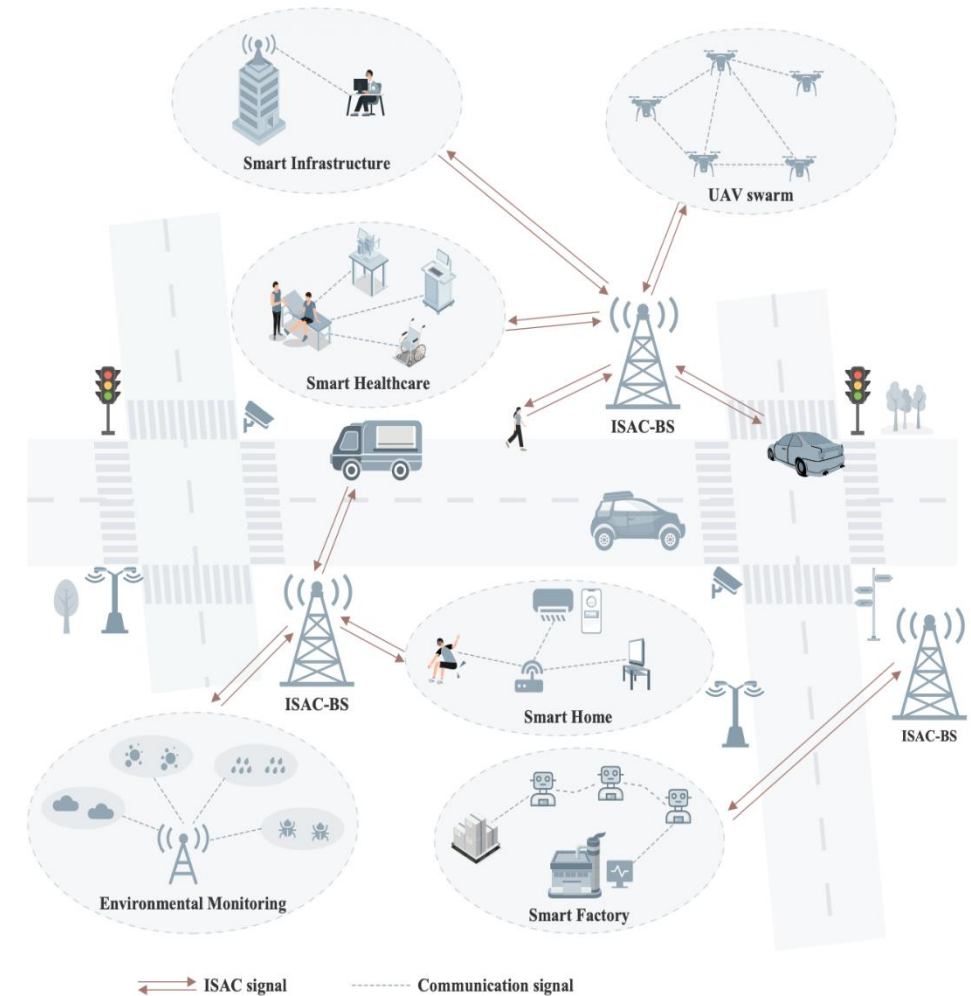


6G ISAC Communication

- Potential use cases
 - Low-altitude economy, intelligent moving life, indoor smart factory (UGV, surveillance)
- Communication and sensing integration (src Ericsson)



- Electrical Steering Array (ESA) is core technology
 - Kind of phased array supporting 4D estimation of X/Y/Z & doppler
 - Capable for multi-site fusion on detection and tracking
- Spectrum depends on use case requirements (bandwidth/density vs resolution), operation & cost tradeoff if share same spectrum with infrastructure



6G AI-RAN



AI for 6G Network

Automate & Optimize: radio resource, user experience

AI-native Air Interface

Mathematic model be replaced by machine learning models

AI-driven automation

enhance fault detection, energy efficiency & proactive maintenance

Semantic Communication

send and interpret “meaning” instead of just raw data



6G Network for AI

Intelligent platform to empower AI applications

Computing Power Networks

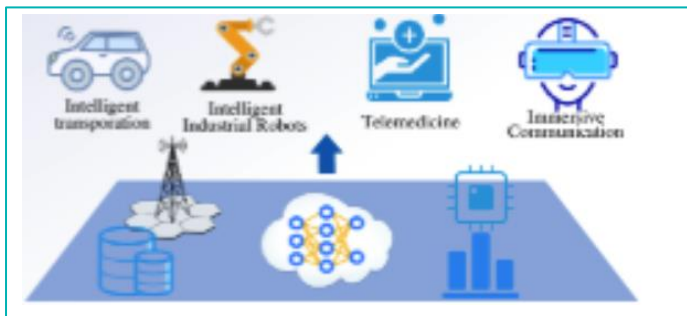
allow AI models to scale seamlessly in RAN Edge

Federated Learning

AI data plane for physical AI to learn and share knowledge in real time.

ISAC

Sensing object and environment for AI applications



6G AlaaS

Enable AI powered service to bring 6G monetization

- Immersive Communication
- Industrial Robots
- Best network for Physical AI

Taiwan's FORMOSA-6G

Taiwan's Strategic 6G Roadmap - Advancing Innovation through Three Core Pillars



FOster**Ring**
MOdular &
ScAlable
6GNetwork



Research & Exploration (before 2026)

Consolidate System and Specification through PoC

- AI-RAN, ISAC, RIS, NTN
- Multi-orbit Satellite Communication



6G Innovation Technology (~2028)

- Modular Hardware, Software & system for NTN
- Core Chips and Antenna Array for Massive MIMO
- Modular Hardware/Software for Open RAN and AI RAN
- Modular Hardware, Software & system for ISAC
- Ku/Ka RF Front-End Chip and Module (FEM)
- Digitizer, ACU & User Terminals for LEO Satellite



Trial Networks Validation (~2029)

- ISAC, Energy Efficiency (EE), Network Digital Twins(NDT), Intelligent Multidimensional (IMD), NTN
- Multi-band and Multi-orbit Broadband SatCom Testbed



Taiwan 6G R&D Vision

- 1st wave product solutions for global 6G pilot trial
- Full-stack home-grown solution

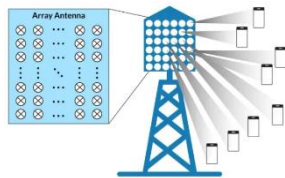
Integrated AI & Communication



AI RAN

- Edge AI RAN solution
- RAN performance enhancement

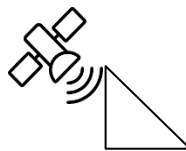
Immersive Communication



Ultra-Massive MIMO

- Open-RAN aNB, All-in-One aNB
- 6G Chip & Modules
 - BB accelerated computing chipset
 - FR3 RF Front Chips & Module

Ubiquitous Connectivity



LEO / NTN

- Transparent mode NTN aNB
- Regenerative mode NTN aNB
- Sat. UE Chips & system

Integrated Sensing & Communication

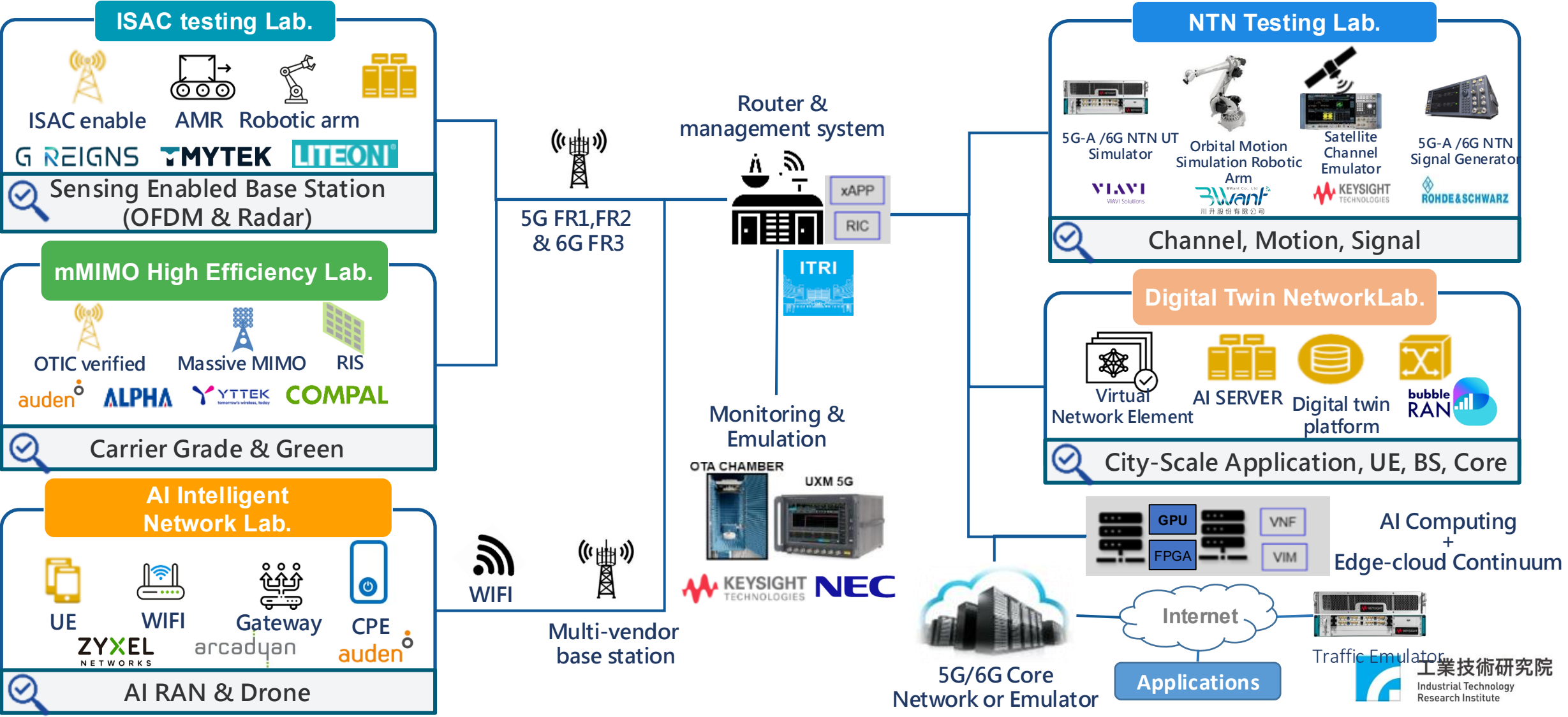


Low-altitude ISAC

- ISAC RAN system solution
- Multi-modal ISAC networking & sensing

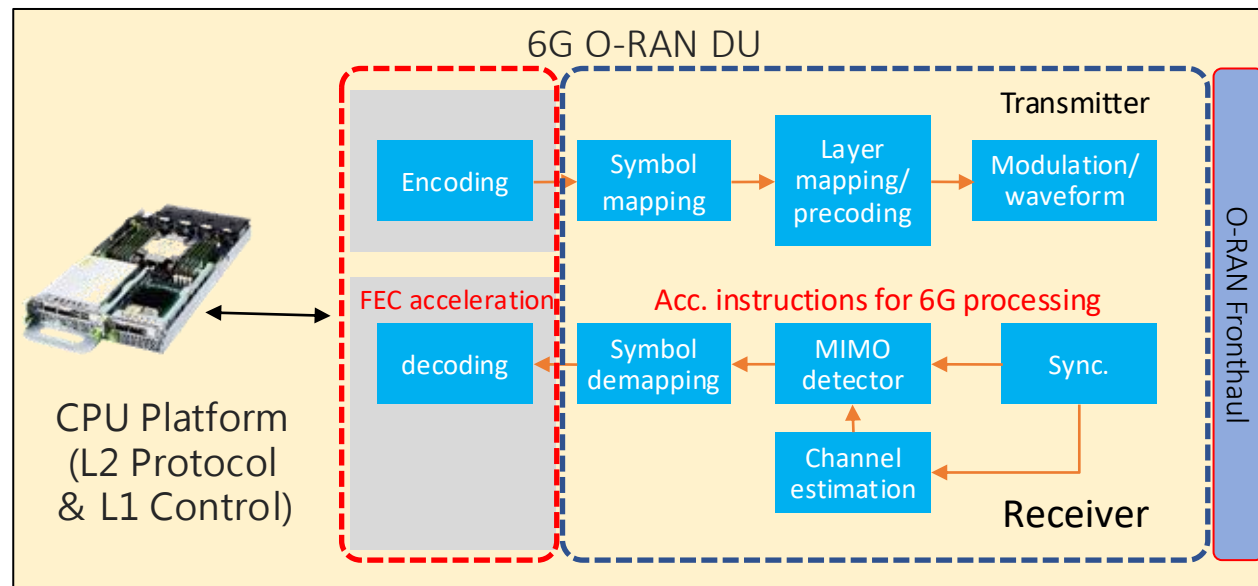
6G Open Trial Network

Facilities and testbench to co-test, validate, and accelerate 6G technologies and product



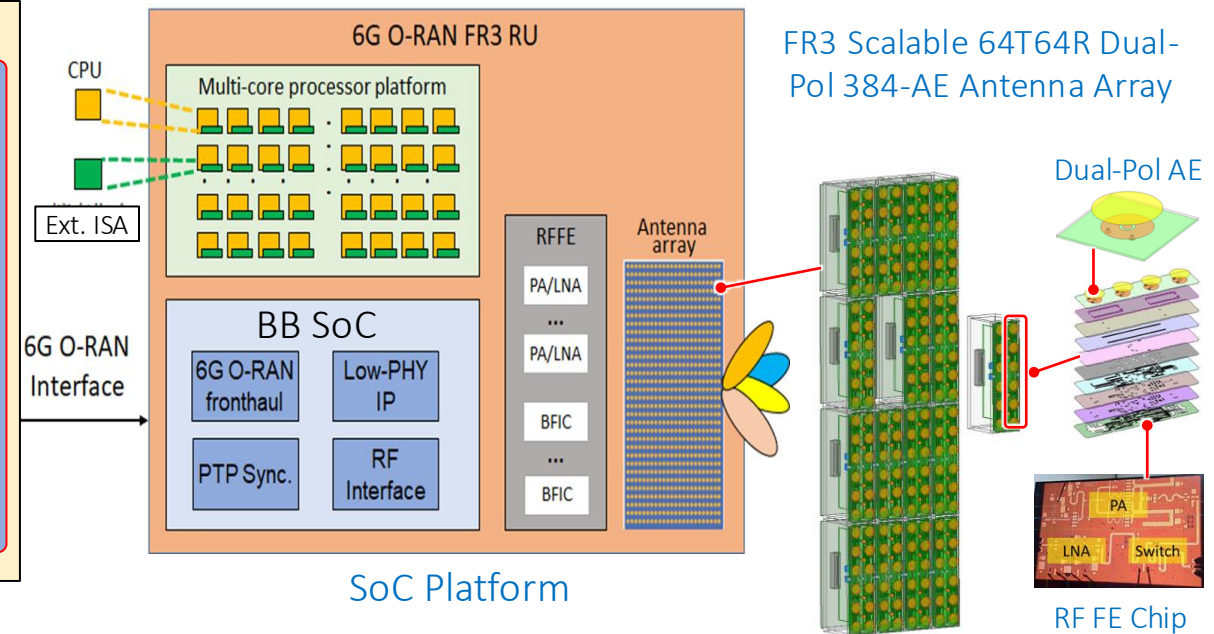
6G Ultra Massive MIMO System Technology

- 6G ultra massive MIMO system, disaggregation architecture, high bandwidth fronthaul
- High performance DU baseband processing, beam processing, high performance baseband accelerator
- 6G ultra massive MIMO RU system, antenna array, based on SoC platform



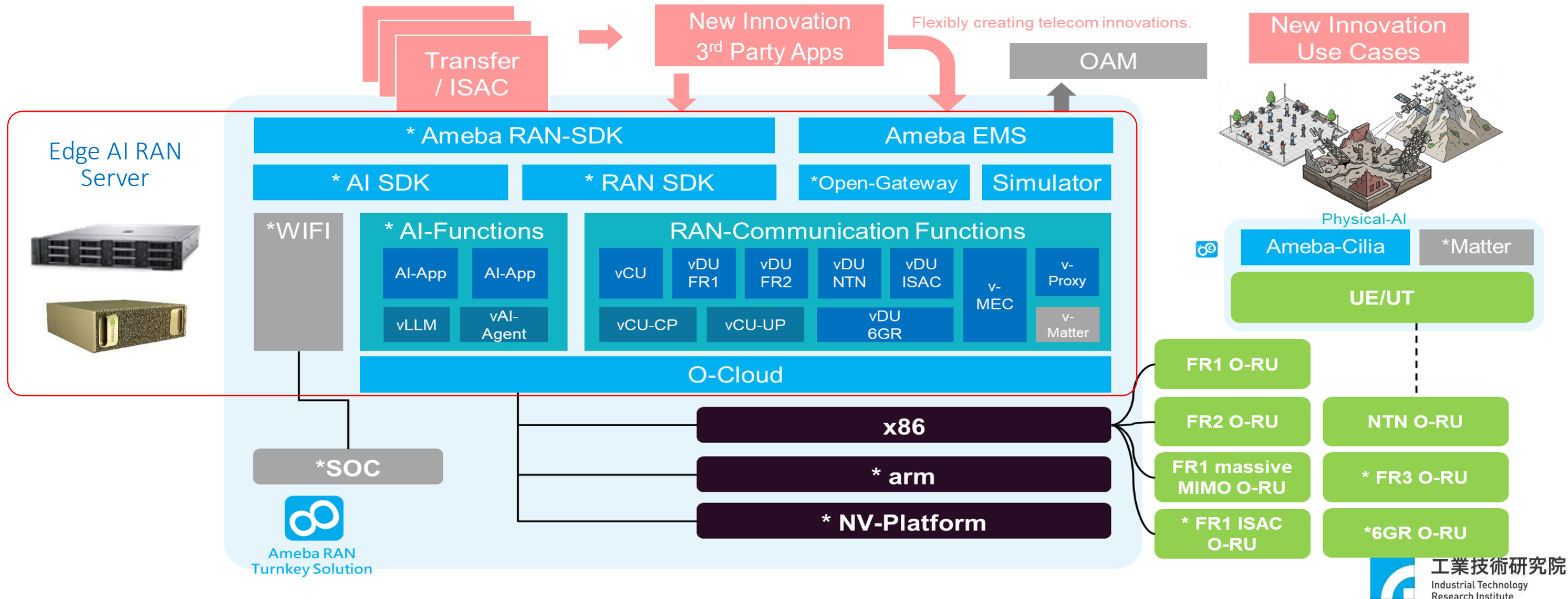
x86 Server + accelerator

Multi-core ARM + GPU Platform



AI-RAN System Technology

- Edge AI RAN system supporting 'AI for Network' and 'Network for AI' use cases
 - SW Framework enables integrated RAN, AI & MEC in one system
 - RAN & AI SDK to facilitate 3rd party Apps development

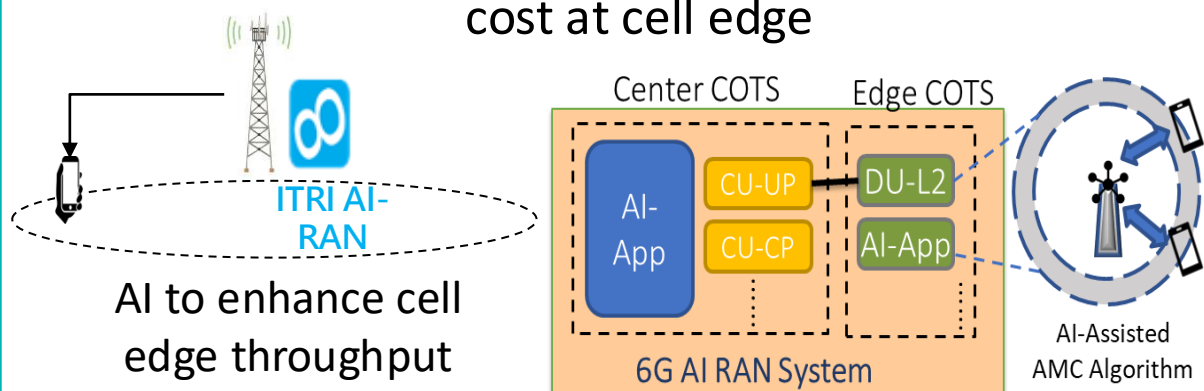


AI-RAN Use Case Practices

Cell edge RAN performance boosting & Edge real-time translation

AI for Network

AI enhanced effective throughput and communication cost at cell edge

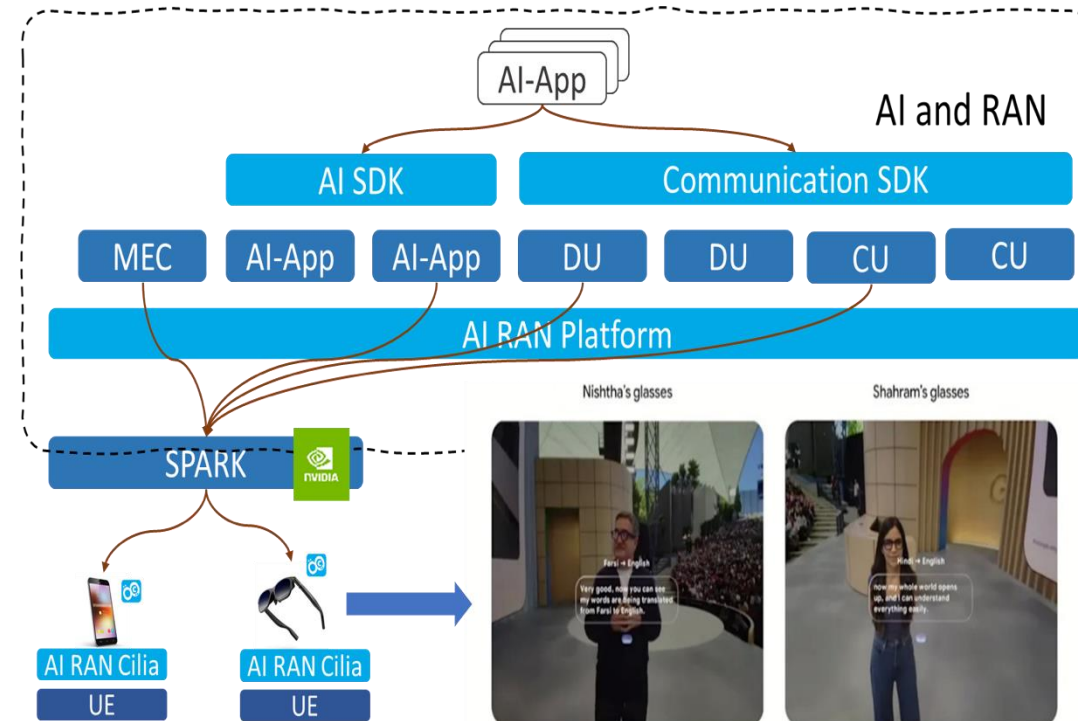


2.34X improvement

75% cost reduction

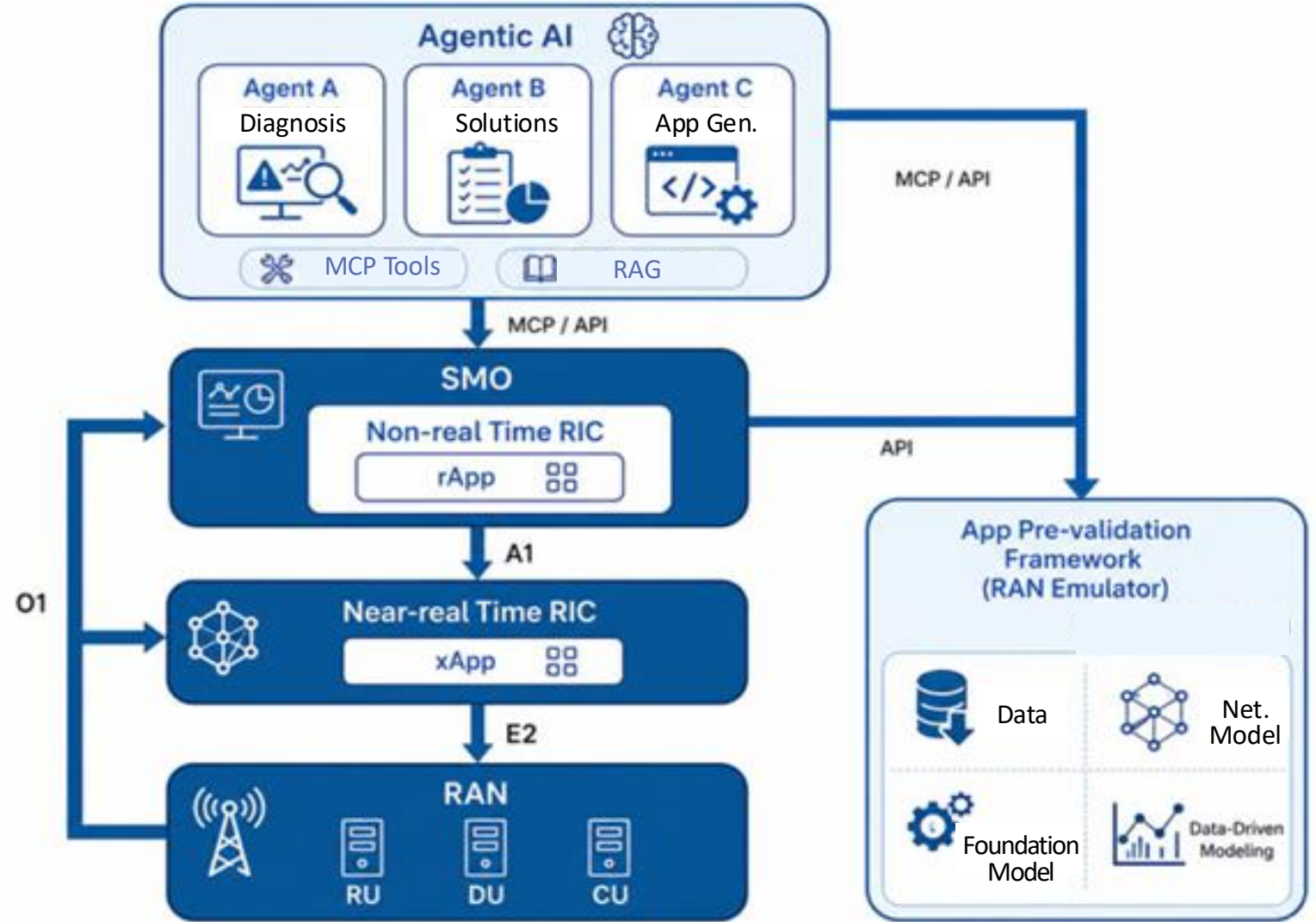
Network for AI

AI RAN system enables end to end real-time translation service at RAN territory



Agentic AI-RAN for 6G SMO/RIC

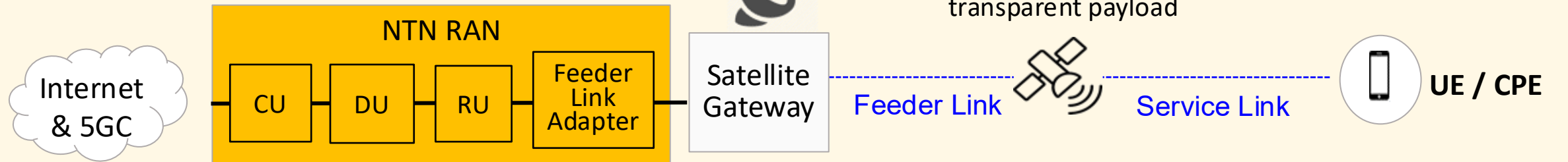
- Multi-Agent driven Autonomous Network
 - Agentic AI RAN: multi-agent pool collaborated to take intent inputs into action decision for RAN management
 - MCP Tools: connect SMO/RIC API to execute RAN actions
 - RAG: domain knowledge fine tune for decision improvement
 - RAN Emulator: Pre-deployment validation for generated app.



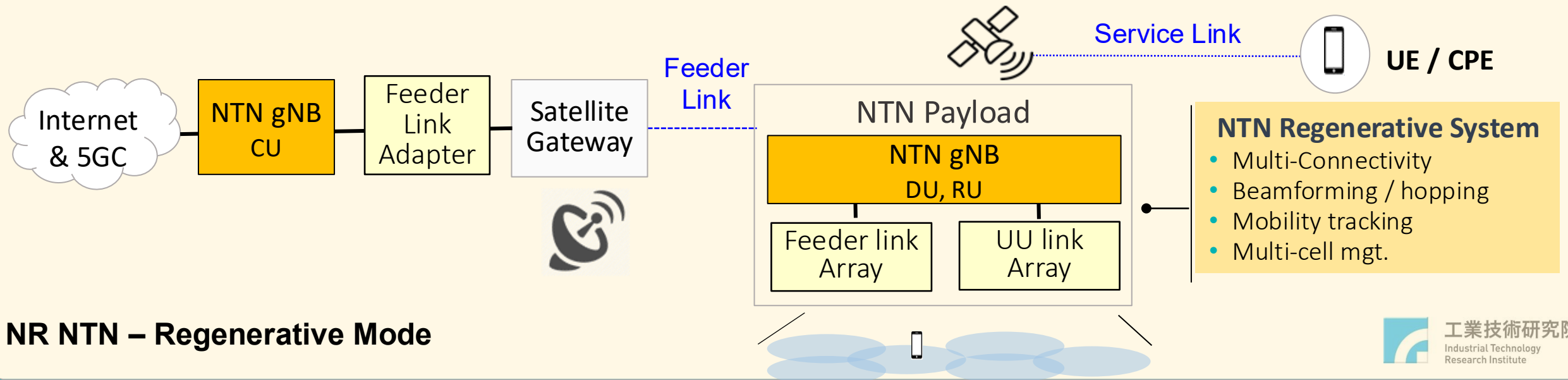
NR NTN System Technology

NTN Transparent System

- Beam management for NTN
- Mobility tracking
- Frequency converting
- Frequency offset compensation



NR NTN – Transparent Mode



World's 1st 3GPP NTN LEO Conditional Handover Trial

World's 1st 3GPP Rel-19 Conditional Handover in Ku-band NR-NTN
over In-Orbit Commercial LEO Satellites with FR1 Parameters



AIRBUS

eutelsat

Ka band

Ku band



Gateway

5G gNB

Ku Antenna

SHARP

5GC

NR-NTN UE

MEDIATEK



ROHDE & SCHWARZ Lab tests & measurement devices

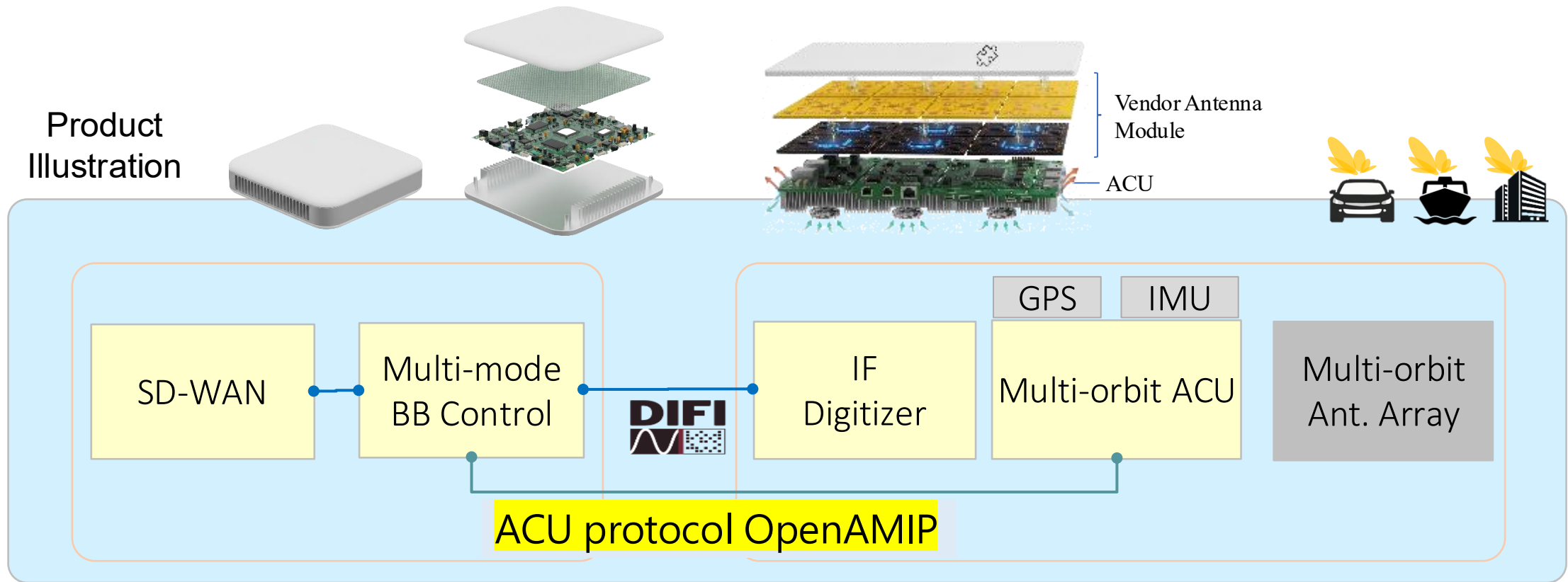
Noordwijk (NL), September 2025



NL, April 2026



Non-3GPP Multi-Orbit Sat. UT



- Link Heart-beating & Routing
- Traffic Steering
- Load Balancing

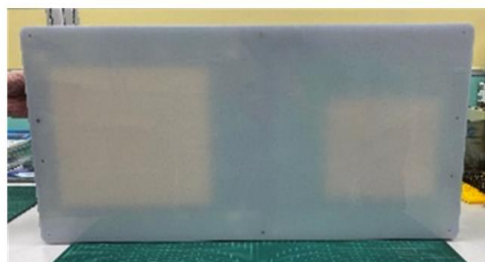
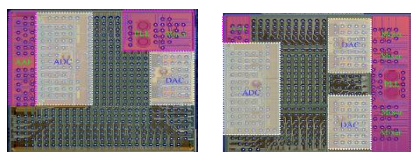
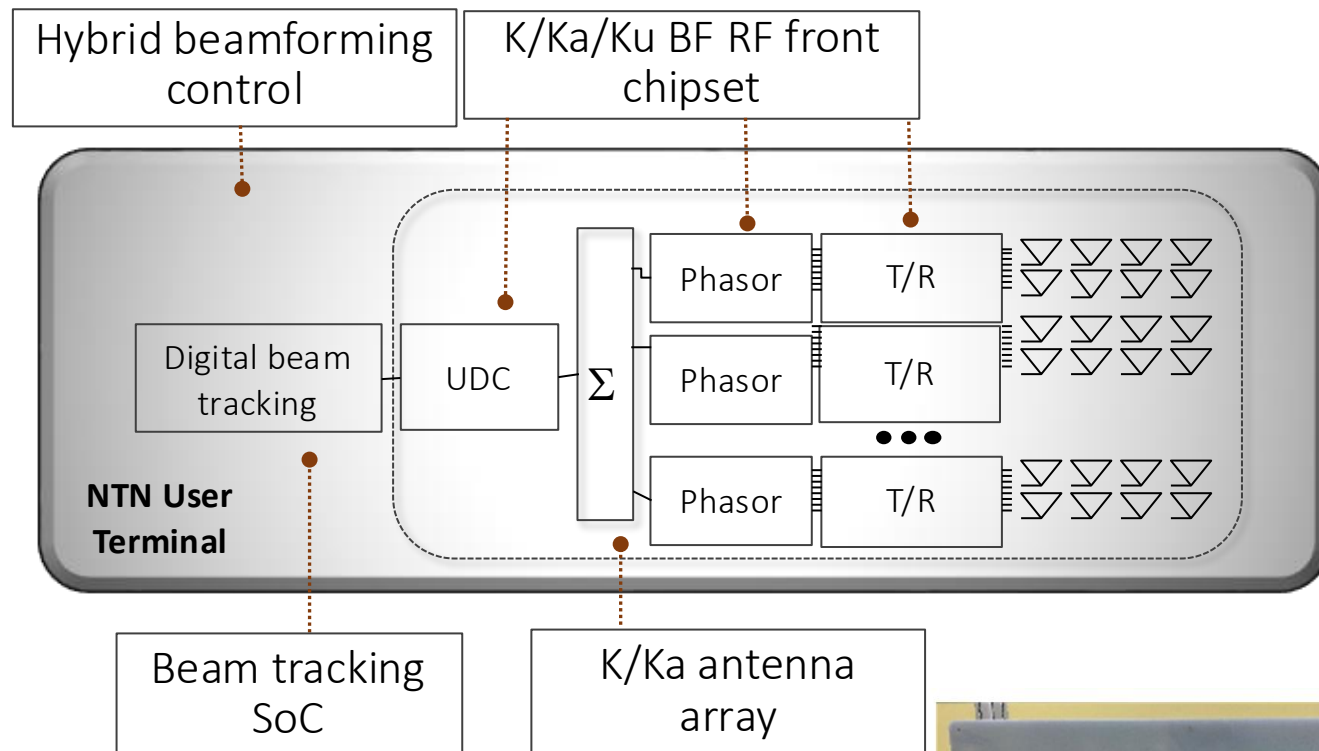
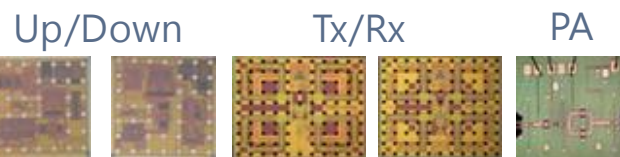
- SW-Defined Waveform
- Mod/Demod/FEC/sync./pkt processing

- Flow control
- Timing and synchronization
- Data acceleration

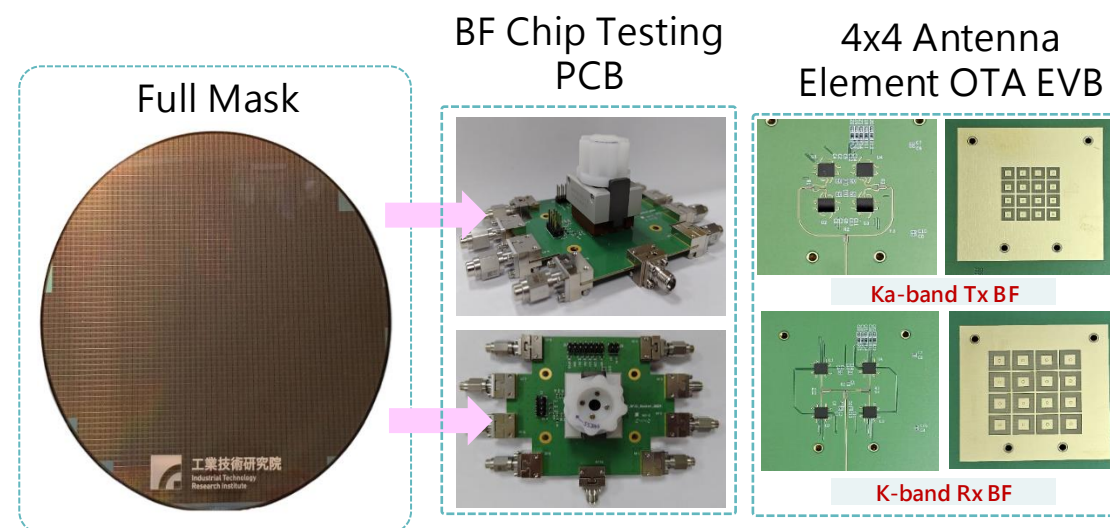
- Attitude Detection
- Acquisition & Tracking
- Emission Power Density Control

- Fast Calibration
- Sparse Matrix
- Multi-Bands

LEO UT Hybrid Beamforming RF Chip and Array Modules



- High Integration
- High Energy Efficiency
- Low Cost, &
- High Speed Control

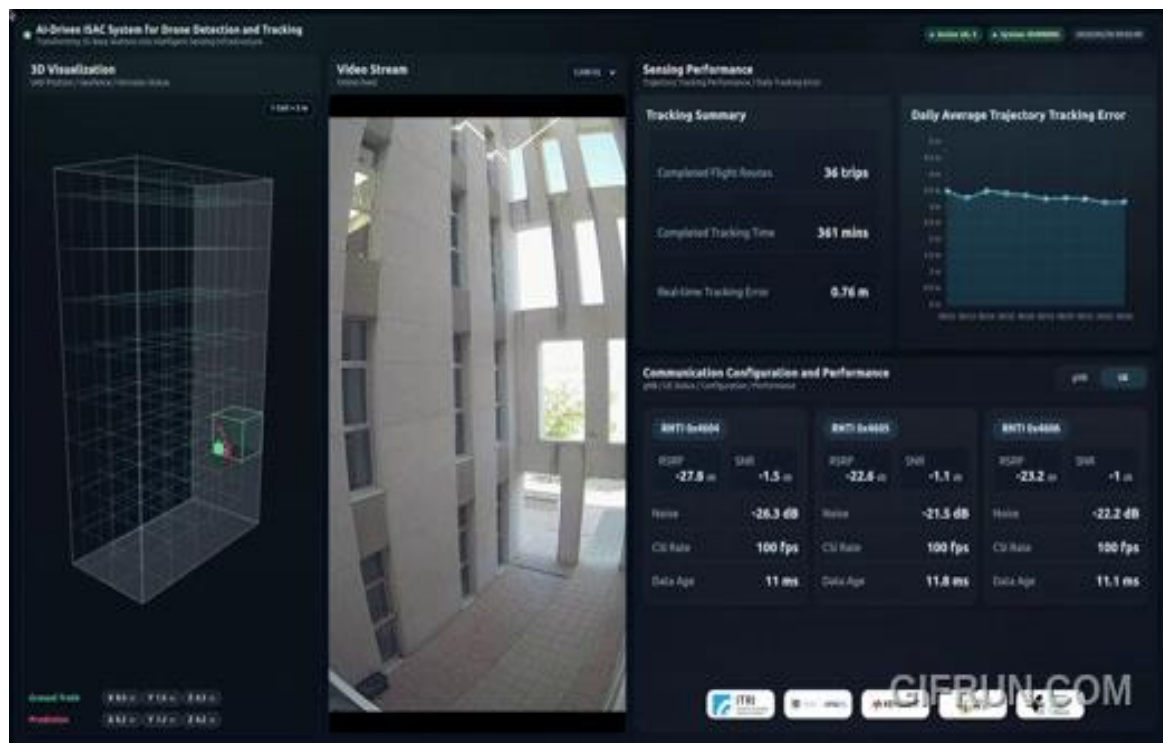


- Tile-based Modularization
- AiP Packaging

ISAC System Technology

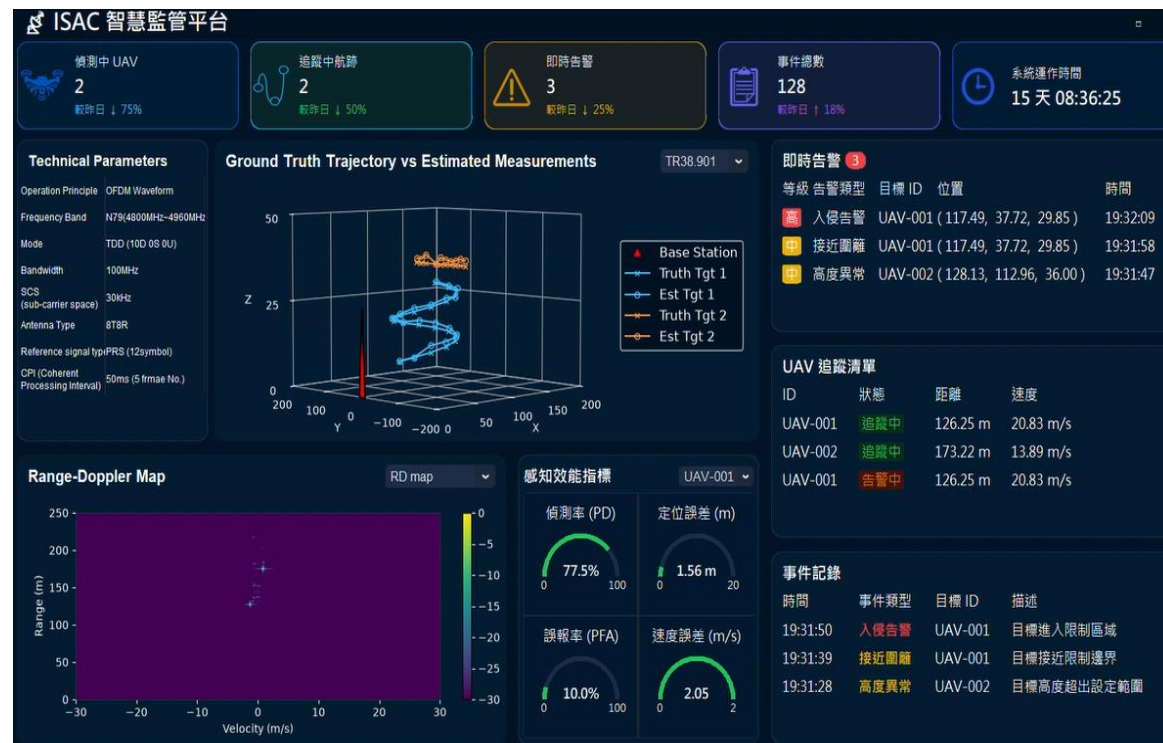
Multi-Site Network Sensing

- ISAC Drone Sensing: Beamforming, Radar-based CSI & RD Map
- Heterogeneous sensor fusion: camera recognition, ID mapping & false alarm



ISAC aNB System

- ISAC link level & system level simulation (support DMRS/PRS reference signal with channel model)
- ISAC over-the-air system validation (FR1, 100MHz & 4T4R gNB system supporting Range/Doppler/Angular detection)



Conclusion

- 6G brings new opportunities for existing and emerging AI, unmanned, space, low-altitude economics
- Taiwan's 5G supply chain is constantly evolving for collaborating with global partners in upcoming global 6G ecosystem
- Taiwan 6G project expects to deliver 1st wave solutions to the international market once 6G specifications are finalized in 2028

Thanks for your attention!

INNOVATING
A BETTER FUTURE

