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6G Vision and Technology Prospects - a view from Taiwan

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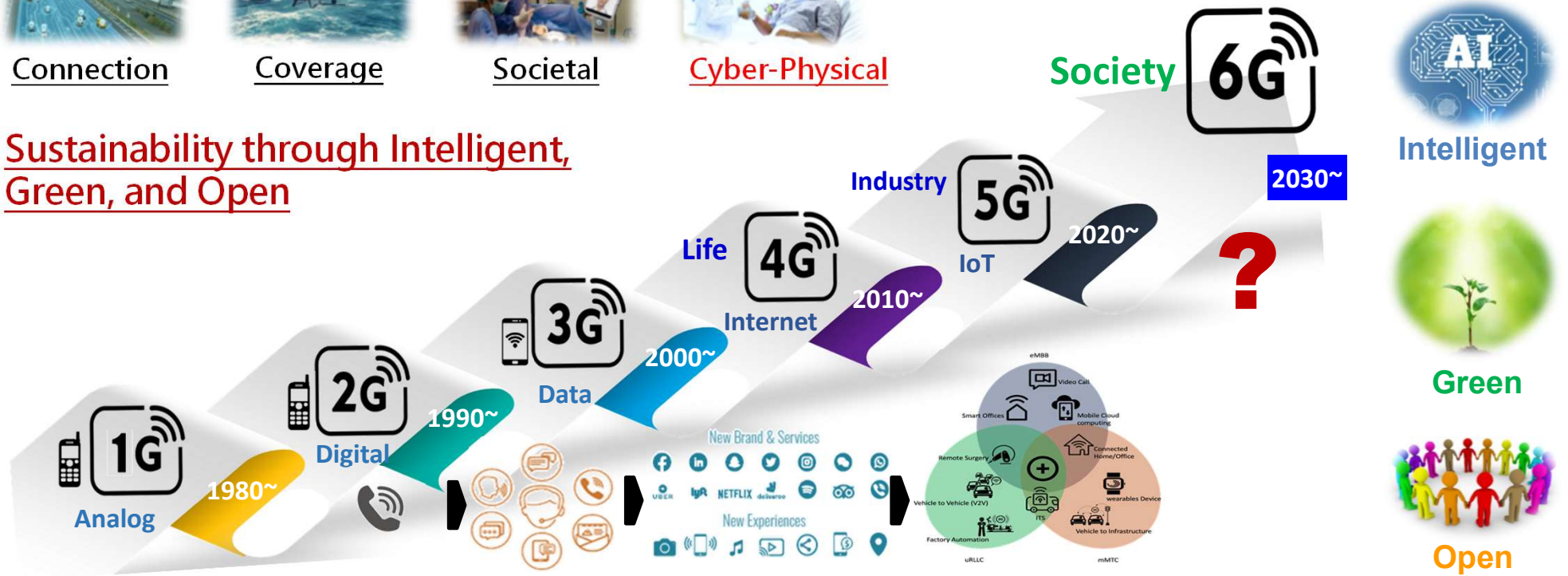
2024/02/13

What is 6G all about?

Connection   **Coverage**   **Societal**   **Cyber-Physical**

Sustainability through Intelligent, Green, and Open

Society **6G**

2030~

Intelligent

Industry **5G**
IoT   **2020~**

?

Life **4G**
Internet   **2010~**

3G
Data   **2000~**

2G
Digital   **1990~**

1G
Analog   **1980~**

Green

Open

eMBB
Video Call
Smart Offices   Mobile Cloud computing
Remote Surgery   Connected Home/Office
Vehicle to Vehicle (V2V)   wearables Device
Factory Automation   ITS   Vehicle to Infrastructure
uRLLC   mMTC

New Brand & Services
New Experiences

Looking for an Intelligent, Green and Open 6G Network, connecting Digital and Physical Worlds

TAICS White Paper on 6G Technology Candidates

台灣資通產業標準協會
Taiwan Association of Information and Communication Standards

TAICS TR-0021(E) v1.0:2023

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A joint effort of 8 universities, research organizations and companies in Taiwan.

Endorsed by all 37 TAICS Members and 8 non-affiliate interested entities.

Chinese version published in 2022 and English version followed in December 2023.

TAICS: Taiwan Association of Information and Communication Standards
www.taics.org.tw/eng

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Framework for 6G Technology Development in Taiwan

White Paper on 6G Potential Technology

Framework

Overview
- 6G Potential Technology White Paper Framework
- Envisioning 6G key living applications

6G Key Technology Challenges
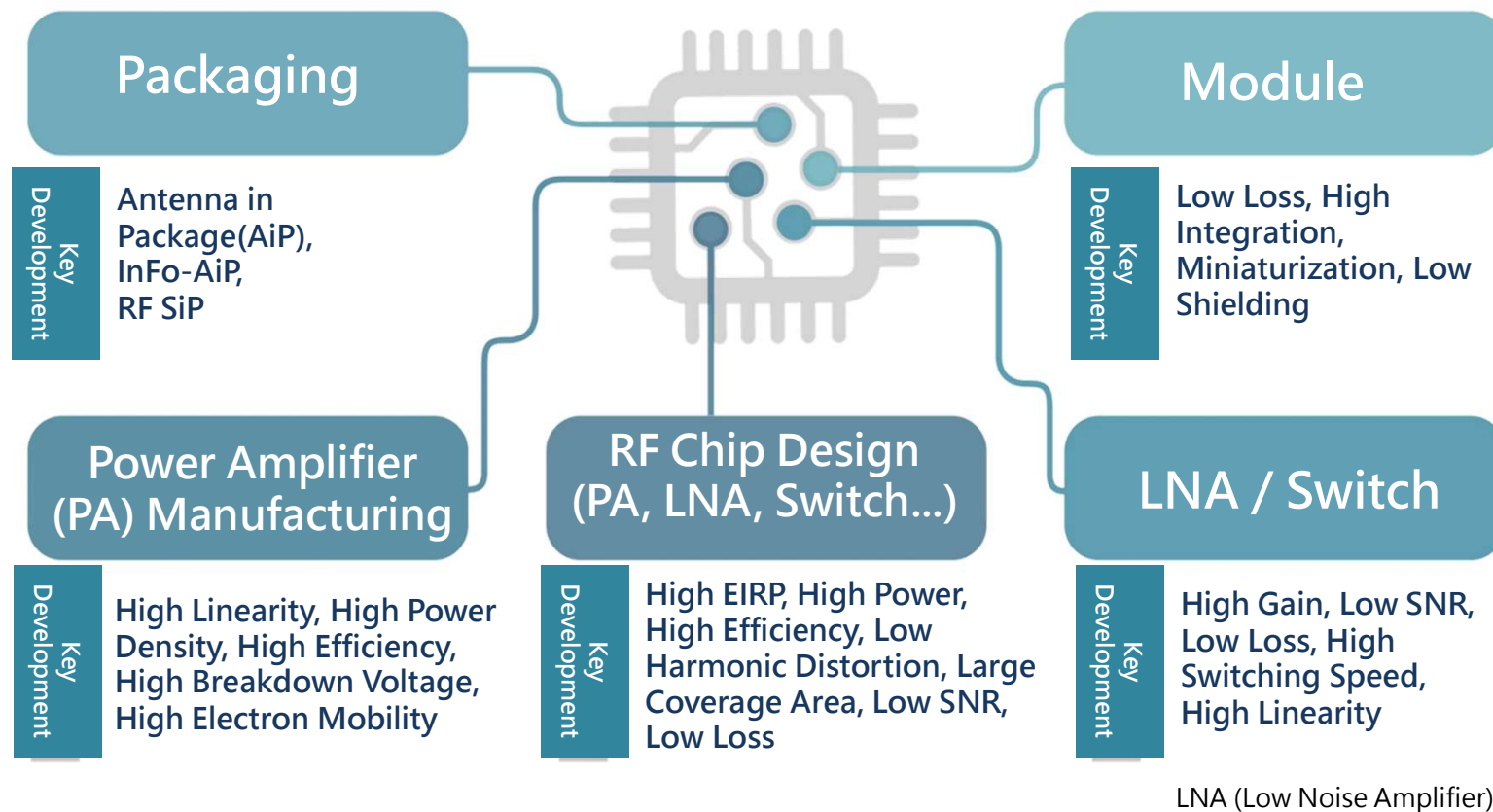- Exploring 6G features & requirements
- Key technology challenges in 6G

Taiwan's 6G Potential Technology Capabilities
- The strength and opportunities of the Taiwan industry
- Potential 6G technologies
- Direction for 6G potential technology development

Conclusion
- Conclusion
- Recommendations

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Taiwan's Industry Advantage in Compound Semiconductor High-Frequency Components

Packaging

Key Development

Antenna in Package(AiP), InFo-AiP, RF SiP

Module

Key Development

Low Loss, High Integration, Miniaturization, Low Shielding

Power Amplifier (PA) Manufacturing

Key Development

High Linearity, High Power Density, High Efficiency, High Breakdown Voltage, High Electron Mobility

RF Chip Design (PA, LNA, Switch...)

Key Development

High EIRP, High Power, High Efficiency, Low Harmonic Distortion, Large Coverage Area, Low SNR, Low Loss

LNA / Switch

Key Development

High Gain, Low SNR, Low Loss, High Switching Speed, High Linearity

LNA (Low Noise Amplifier)

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Taiwan's 6G Potential Technologies: 12 Key Directions

- Sub-THz Radio Communication
- Massive MIMO Technology
- RIS
- JCAS/ISAC
- Open RAN
- All Photonic Network

- AI-native Network
- 6G Edge Computing
- Automated Network Mgmt.
- Non-Terrestrial Network
- 6G Device Power Saving
- Network Security

TW 6G

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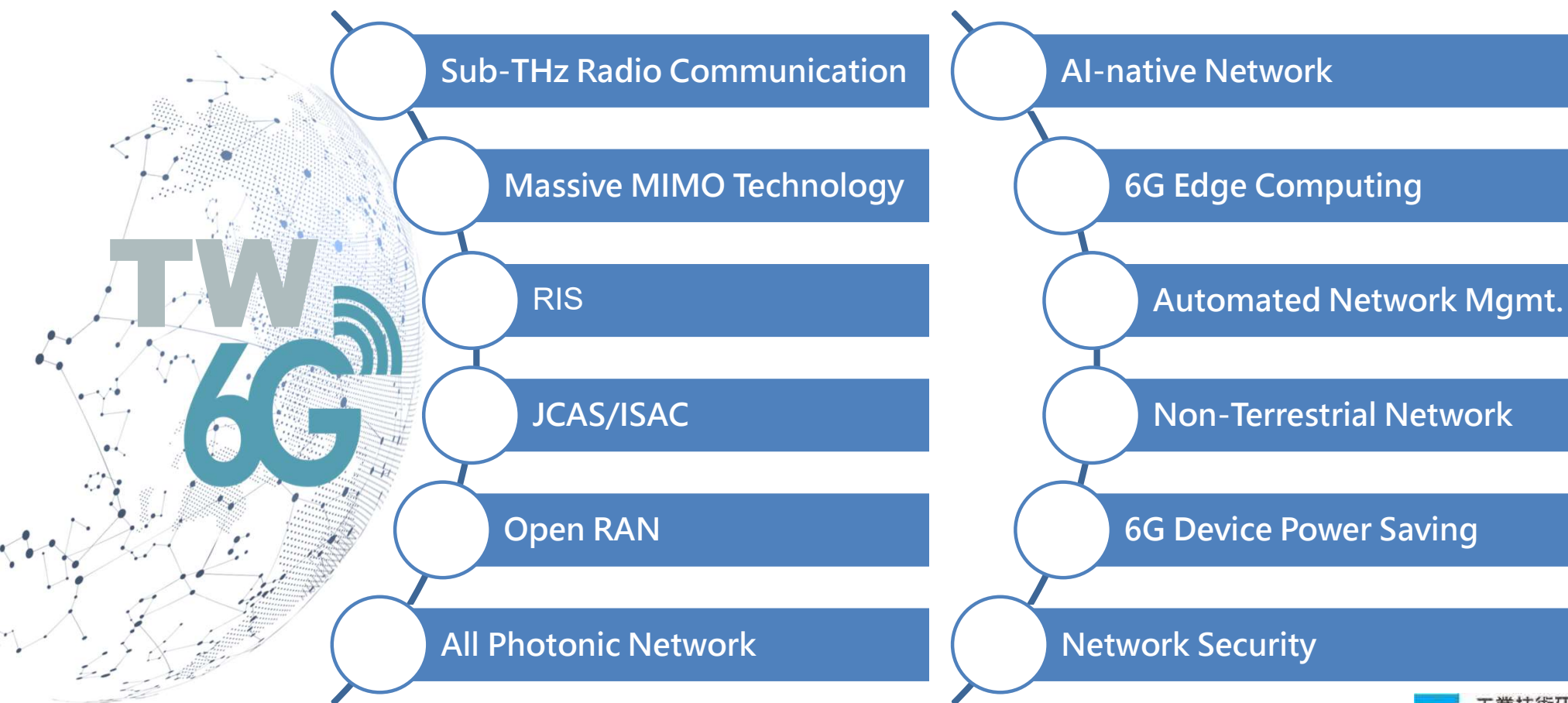
Key Areas for B5G and 6G Technology Work in Taiwan

"Service is the King!"

"RIS, Deployment MIMO and Testbed"

"SA solution for Private Networks"

"Gesture Detection and Control/ICAS"

"AI-native in RAN and CN"

"Compound Semiconductor HF Components and Modules"

Service · O-RAN · 6G · RIS · JCAS · CHIPS · AI

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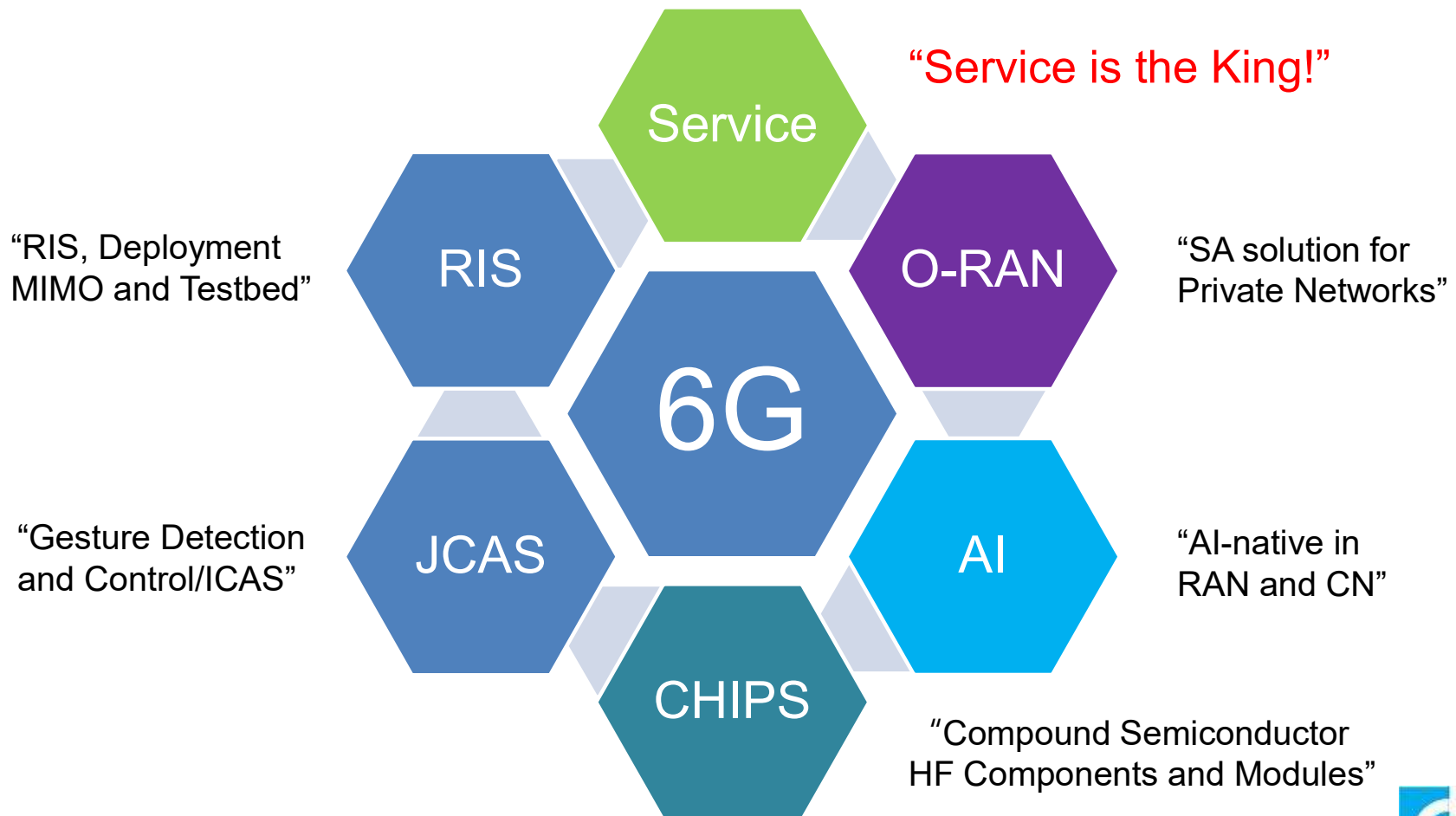
Example of Collaboration (EoC): RIS O-RAN integrated field trial

2024   2025   2026   2027

A. Indoor Field Trial @ ITRI Lab
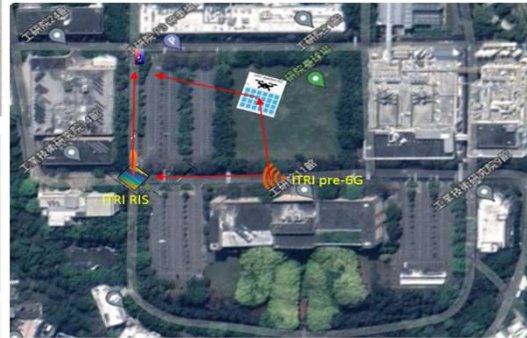

3 RU, No RIS

Facility provision:
- ITRI FR2 O-RAN components with open IF & Logging data
- Equipment for OTA measurement

Test Scenario:
- Indoor office, Single RIS, nomadic UE

B. Outdoor Field Trial @ ITRI Campus

Facility provision:
- ITRI FR2 O-RAN components
- System performance measurement

Test Scenario:
- Outdoor campus, 2 RISs, mobile UEs

C. Outdoor field trial @ CHT Research Campus
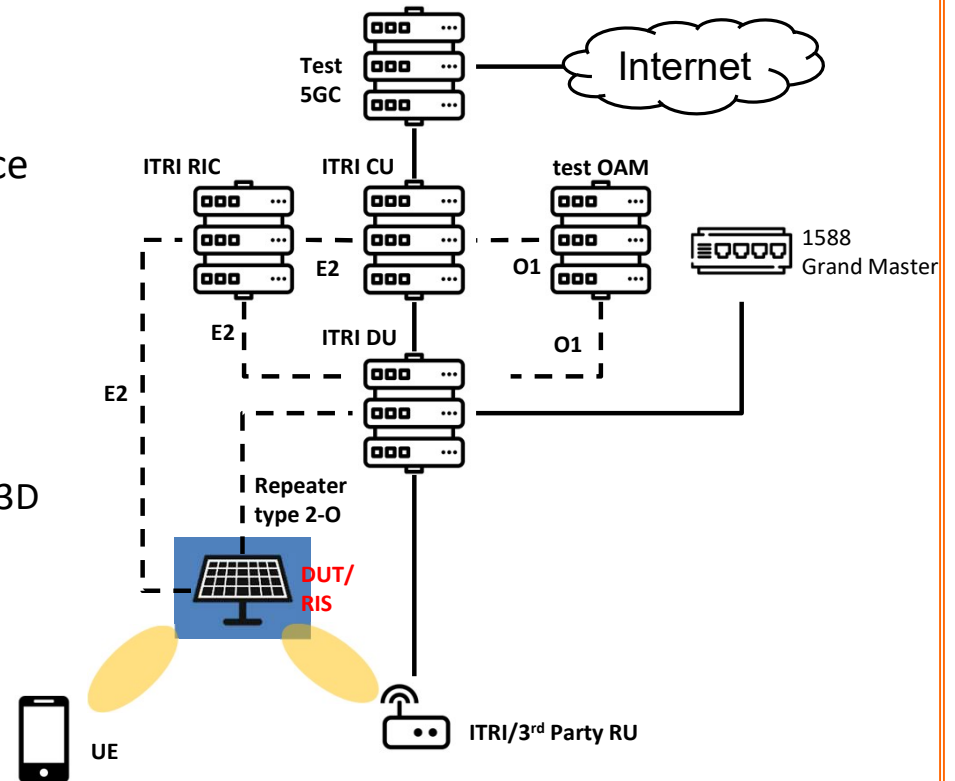

Facility provision:
- Commercial O-RAN infrastructure
- System performance measurement

Test Scenario:
- Outdoor campus, Multiple RISs

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EoC: RIS end-to-end testbed

- RIS module and FR2 O-RAN network integrated system
- RIS control & management interface with reference code
  - network-control IF:
    - BS central control / BS distributed control
- Testing framework, scenario, procedures, items & tools
  - Measurement of RIS signal gain, signal attenuation, 3D beam-pattern, etc.
  - First level- SNR
  - Second level- App Throughput/ Error Rate

EoC: Bridging Taiwan O-RAN ecosystem into RIS testbed

Service Providers	中華電信 Chunghwa Telecom
Applications & Software	
Platform	ALPHA Networks AUO auden MiTAC LITEON wiwynn
System & Technology	工業技術研究院 Industrial Technology Research Institute NYCU NSYSU NCCU
Chipset & Hardware	MEDIATEK

Academia & RTO   Private Sectors

- **Future devices and flexible infrastructure**
- **What we are capable to contribute**
  - Proxy with Taiwan O-RAN ecosystem
    - Chipset, commercial platform & well-connected semiconductor souring channels

  Electronic RIS modules & array
  - System validation for complicate RIS scenarios
- **What we expect for return**
  - System proven towards commercially feasible O-RAN RIS integration network
  - Specifications & solutions with reasonable cost & RIC/gNB

Looking forward to further collaborations

ITRI is now registered in EU.

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