

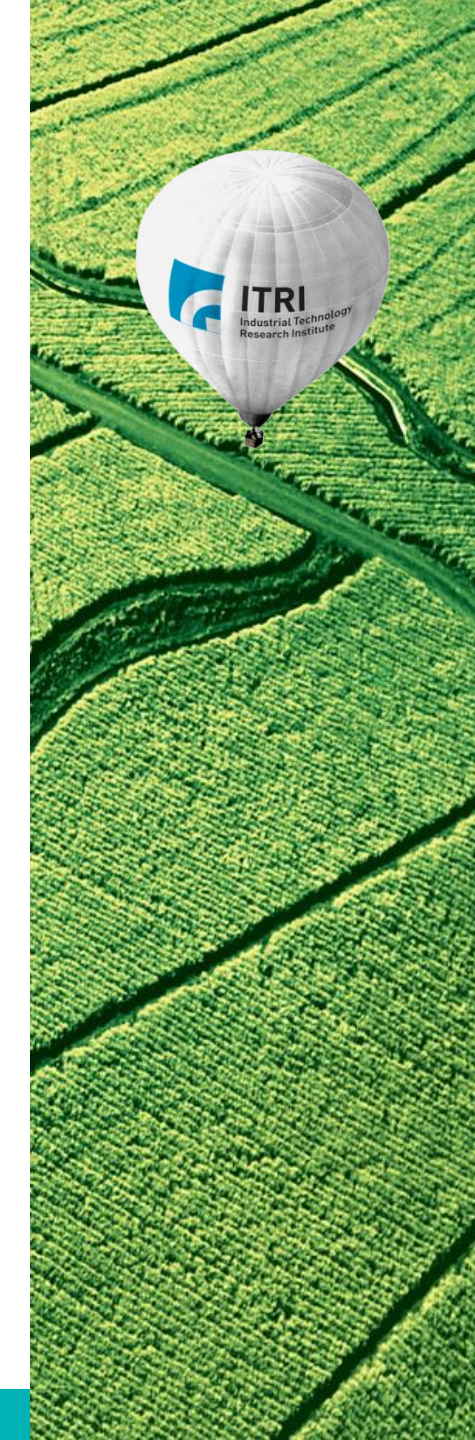
# ITRI

Industrial Technology  
Research Institute

## Toward 6G - what we are looking for

Tina Liao  
Deputy Project Director, ICL/ITRI

Jan 25, 2023





## About ITRI / ICL

# Industrial Technology Research Institute (ITRI)

**Founded in 1973**

**An independent non-for-profit innovation institution to create economic and societal values**

- Develop advanced technologies for commercialization
- Cultivate open innovation with academia, industry, and [global partners](#)
- Incubates startups in emerging industries

# Industrial Technology Research Institute (ITRI)

Taiwan's Largest and One of the World's Leading High-Tech Applied Research Institute

<b>Total Staff</b> <b>6,042</b> PhD 1,266 Master 3,763 Bachelor 1,013		<b>Startups &amp; New Business Units</b> <b>157</b>	<b>Industry Services</b> Provided Services 17,464 Transferred Technologies 513
<b>Alumni</b> <b>27,508</b>	<b>Total Patents</b> <b>31,939</b>		 <b>Incubatees 213</b>

Latest Update: April 2023

# ITRI in Taiwan, reaching out to the world





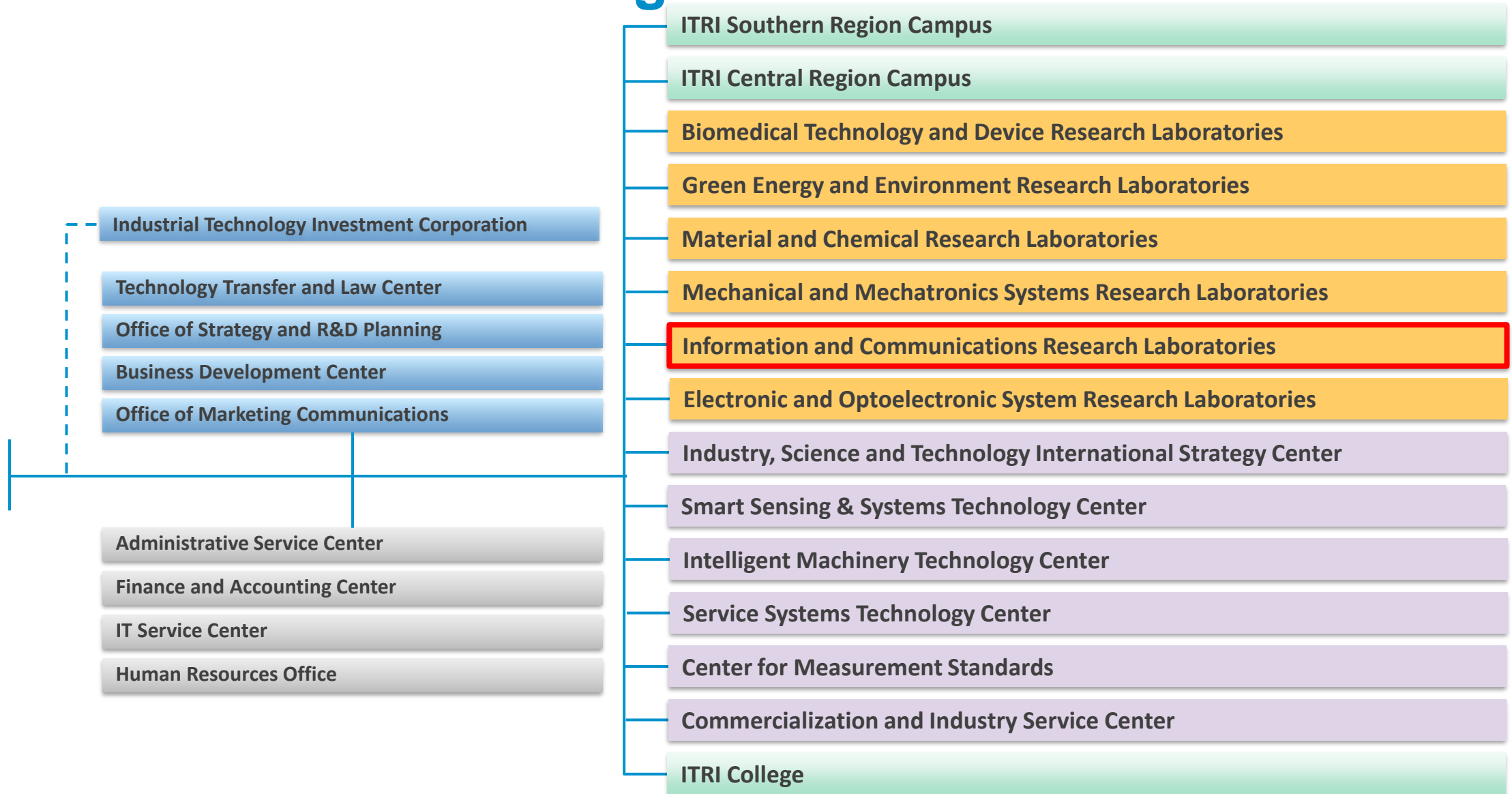
# International Recognitions

- Seven-time winner of Top 100 Global Innovator
- 10 CES Innovation Awards Honorees (2018-2023)
- Edison Awards for seventh consecutive year (2017-2023)
- 50 R&D 100 Awards in total since 2008



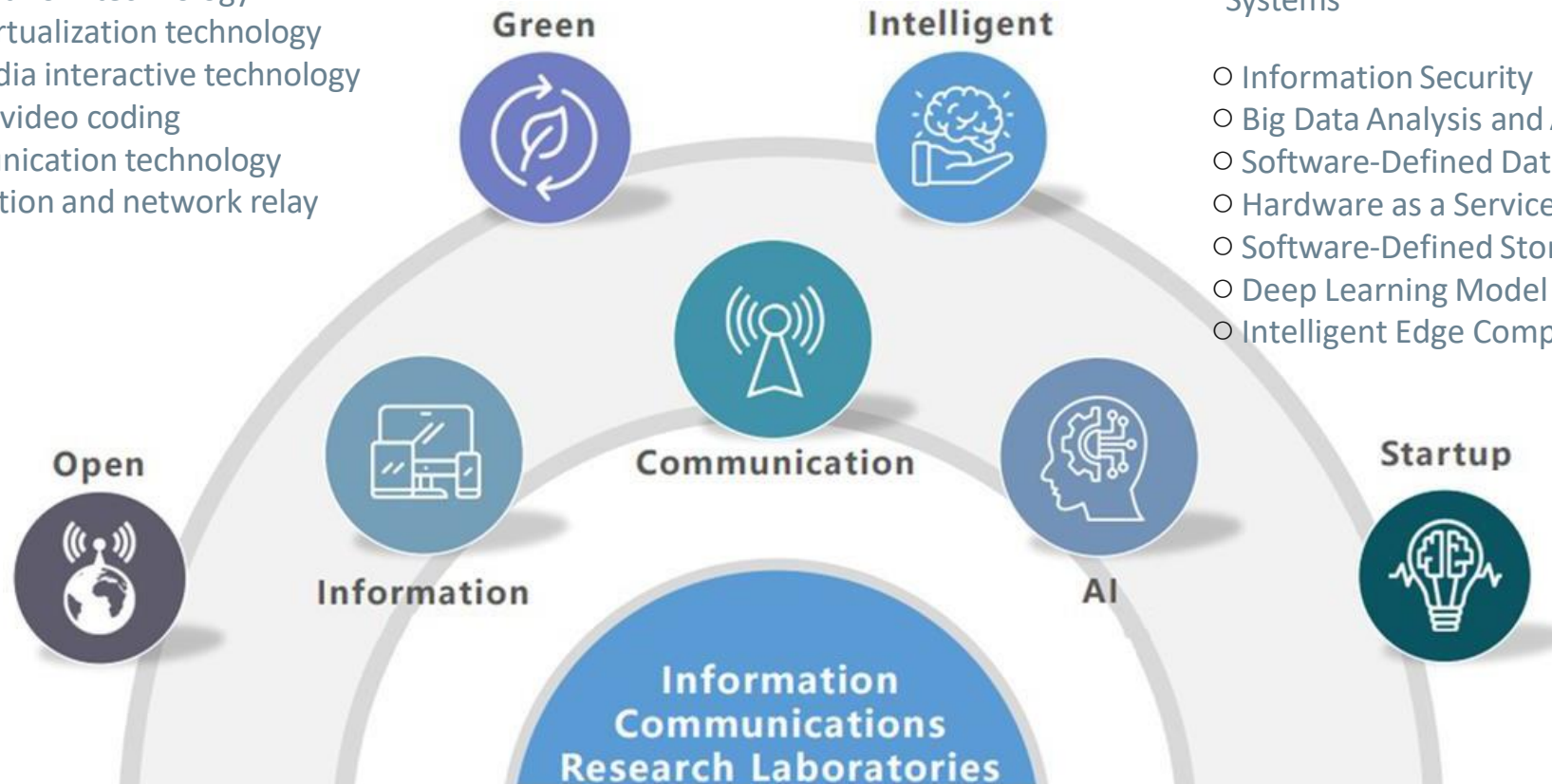
Gold, silver, and bronze awards of 2023 Edison Awards

# ITRI Organization



# Information and Communications Research Laboratories (ICL)

- Wireless network access technology
- Wireless communication signal processing platform, protocol, Baseband, RF and Antenna
- Privacy network management
- V2X communication technology
- Software-defined network technology
- Network function virtualization technology
- AR/VR/MR multimedia interactive technology
- Core technology for video coding
- LEO satellite communication technology
- Remote communication and network relay



- Unmanned Aerial Vehicle Systems and
- Audio Mobile Video Applications
- Perception and Processing for Unmanned Vehicles
- Technologies for Financial and Regulatory Systems
- Connected Vehicles and Autonomous Driving Systems
- Information Security
- Big Data Analysis and Artificial Intelligence
- Software-Defined Data Center
- Hardware as a Service (HaaS) Technologies
- Software-Defined Storage Service Technologies
- Deep Learning Model Technologies
- Intelligent Edge Computing Platform Technologies



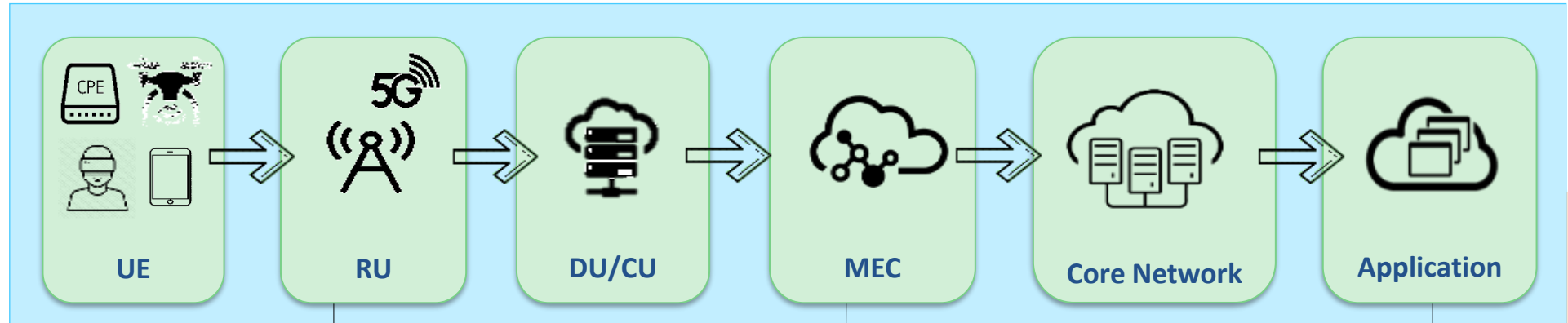


5G

What have we done in 5G?

# Taiwan 5G Open Network Ecosystem

End to End Open Network Solution; Your Trusted Agile Partners



ASKEY 鴻海科技集團  
WNC Wistron NeWeb Corp. COMPAL  
ALPHA Networks SERCOM  
QCT

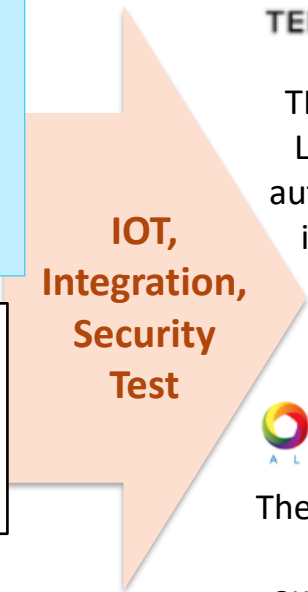
ADVANTECH ASKEY  
ADLINK TECHNOLOGY INC. QCT  
Gemtek

Hwaom SYSTEMS INC. LEO  
Fhinet 富鴻網 Wayle IN

htc PEGATRON  
ASKEY ASUS  
WNC COMPAL

FOXCONN 鴻海科技集團 htc  
COMPAL QCT  
ALPHA Networks PEGATRON

Atayalan  
FOXCONN 鴻海科技集團 QCT



TIP Community Lab in Taiwan, authorized by TIP in June 2021.



The First OTIC Lab in Asia-Pacific, authorized and by O-RAN Alliance in June 2021.

# EU-Taiwan H2020 5G TOC (Targeted Opening Call)

Horizon 2020 (FP8) 2014-2020

2014~2015

Phase I  
Proof of Concept

- Participation in two proposals
  - METIS-II
  - Crosshaul



2016~2017

Phase II (Call 1)  
Technology Verification

- 5 Million Matching Fund
- 5G Scope Paper, Reviewers



2018~2021

Phase III (Call 2)  
Proof of Service

- 4 Million Matching Fund
- 5G Scope Paper, Reviewers



■ Taiwan and EU will continue 6G bilateral cooperation through **Targeted Opening Call (TOC)**: RF technology evolution, 5G components co-design, ultra-low latency technology, low latency and real time technology, etc.

**6G**

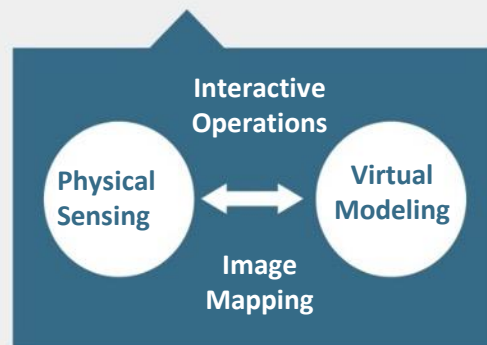
**What are we doing in 6G?**

# 6G Vision

## 6G Application Services Beyond 2030

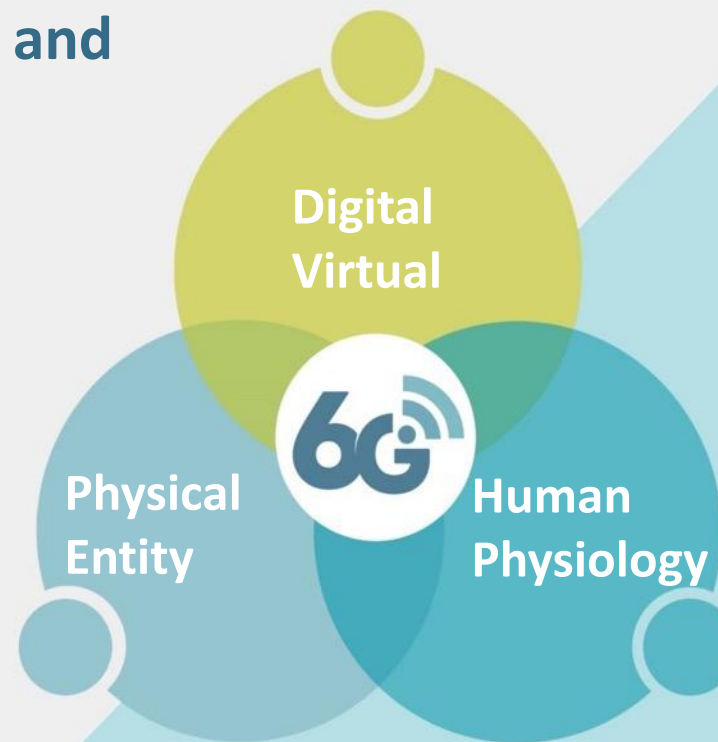
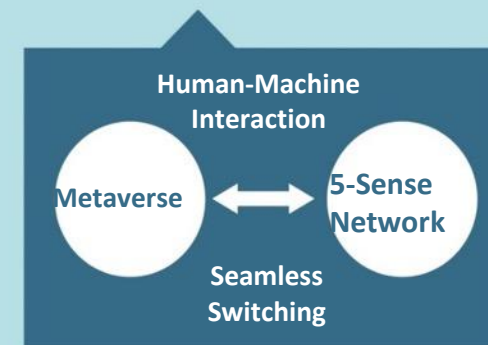
### Integration of Digital and Physical Worlds

Enhanced Machine-Type Communications



### Augmentation of Human Strength

Enhanced Human Communications



Source: TAICS White Paper on 6G Technology Candidates, Oct.,2023

[https://www.taics.org.tw/Publishing.aspx?PubCat\\_id=3](https://www.taics.org.tw/Publishing.aspx?PubCat_id=3)



**White Paper on 6G Technology Candidates**  
 發佈日期：2023-12-30 / 文件編號：TAICS TR-0021(E) v1.0

This white paper meticulously examines a comprehensive overview of the international considerations for 6G technology scenarios and characteristics, also synthesizes consensus from Taiwan's industrial, academic, and institutional research entities. It highlights Taiwan's strengths in the 6G era and proposes potential development directions for 6G technologies. This white paper aims to serve as a reference for policy management and industry research and development in Taiwan's journey towards 6G technology. This white paper is supported by Department of Industrial Technology, Ministry of Economic Affairs.

[Download](#)



# 6G Timeline



IMT-2030 & Beyond



◆ WRC 23

6G Spectrum Requirement

◆ WRC 27

6G Spectrum Allocation

● Trends

● Vision

● Standardization

↑ Initial submit    ↑ Final submit



Innovation, Requirement,  
Proof of Concept

Prototyping, Standardization,  
Ecosystem Building

Interoperability,  
Pre-Commercial Trial

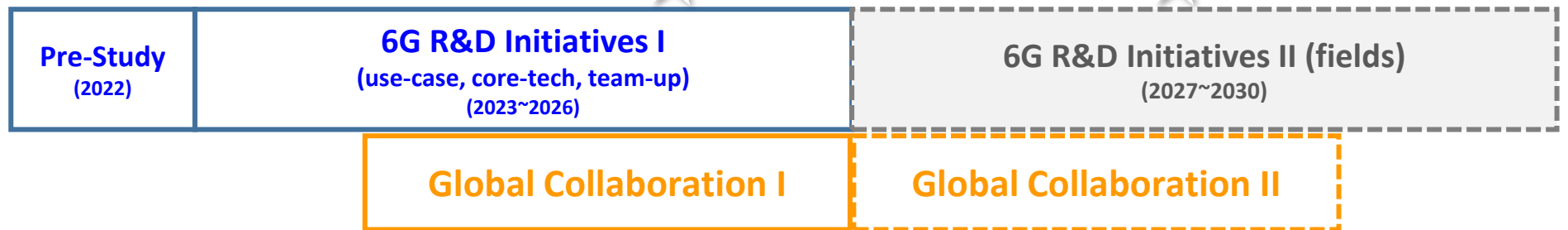
★ 2~4 Trial Systems

★ Private Network Trial

Thunder Eggs

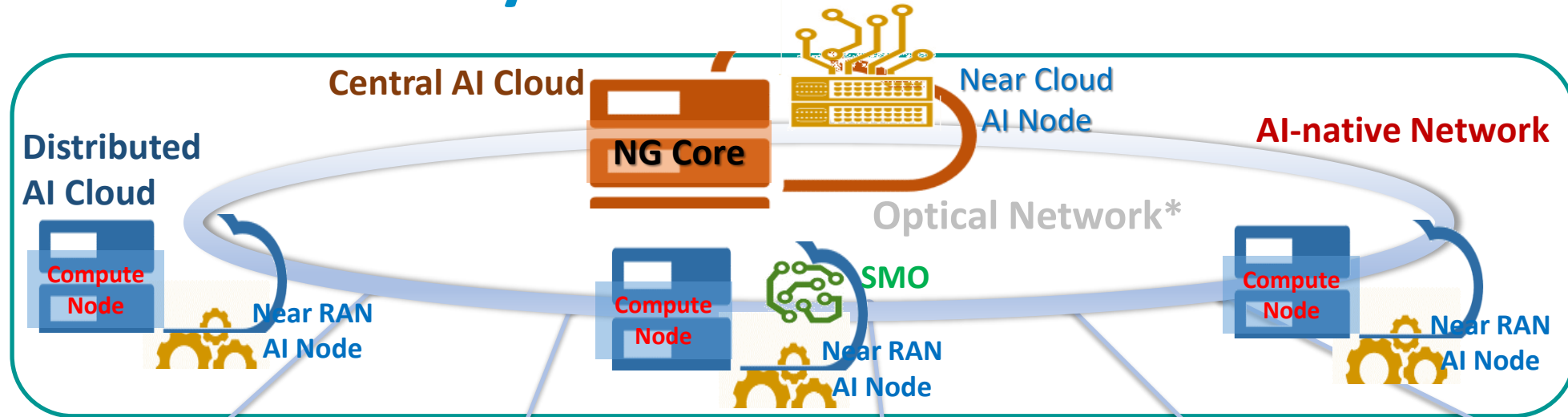


blind box



Source: 3GPP, ITU Mar 2022

# 6G Trial Systems of Research Institutes



**NTN** NTN ngNB

Remote Area Access

**RIS** ngNB

Zero-Blind Uniform Signal Quality

**JCaS** JCaS ngNB

Precision Positioning

**Ultra Massive MIMO\*** MIMO ngNB

Immersive Broadband

**Sub THz\*** Sub THz ngNB

Holographic Interaction

Universal Coverage

Intelligent Connection

Ubiquitous Sensing

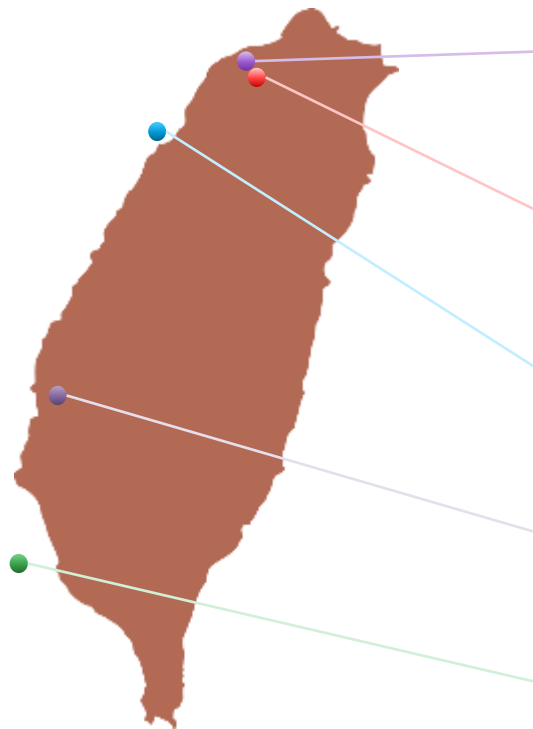
Mission Critical Comm.

Ultra Massive Connection

Ultra Broadband Comm.

\*: planning in phase II project

# Academia 6G Research



Sub-THz Transceiver Circuits/Systems

LEO Satellite NTN Communications

Optical Fiber Embedded O-RAN

AI enabled Open CN-RAN Integration

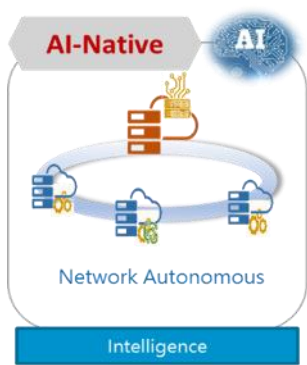
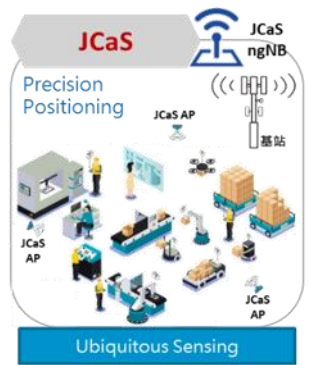
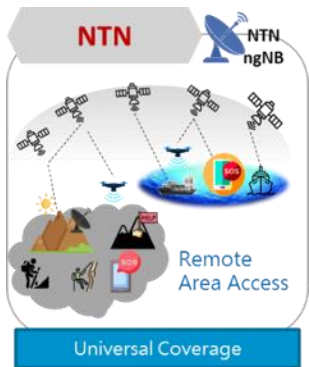
Large Scale mmWave RIS Development

RIS-aided FR3 Massive MIMO System

4-D Sub-THz Radar System

# 6G Joint R&D Initiatives

## Breakthrough



## Institute/Academia



## Industry





# International Collaborations

## 6G Workshops



Dr. Willcock, Chairman,  
6G-IA

Dr. Ting, Director General, ICL,  
ITRI

TAICS and 6G-IA MoU  
Ceremony



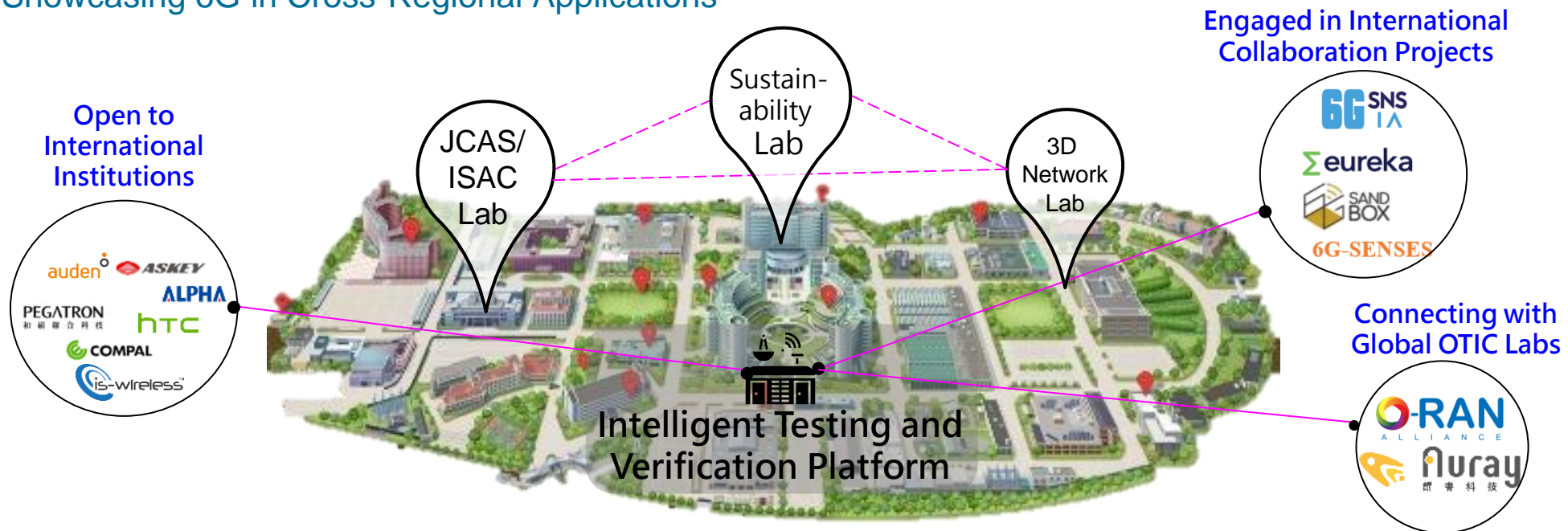
## 6G Engagements





# ITRI Campus 6G Testbed

- Real-World Testing for 4,000+ Users (Indoor & Outdoor)
- Network Behavior Diversity: Offices, Dorms, Sports Fields, Restaurants, etc.
- Three 6G Labs: 6G Network Element Testing → Campus-Wide Real Environment Validation → 6G Scenario Verification Including:
  - Precise Object Recognition & Motion Sensing, Holographic Communication, Unmanned Systems Communication Collaboration
- Key Areas for Collaboration
  - 6G Network Element Integration Testing & OTIC Certification
  - Joint 6G Project Collaboration
  - Showcasing 6G in Cross-Regional Applications



# Looking for Collaboration Partners in SNS JU



The Taiwan government will provide funding for Taiwanese teams in the SNS projects.

PARTNERSHIP

TOGETHER WE CAN GO FURTHER

TOGETHER WE CAN DO MORE

photo: eastgate revival ministries

Contact:

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Industrial Technology Research Institute(ITRI)