

RIS/O-RAN testing Framework

Tammy Wu

Industrial Technology Research Institute(ITRI)

Information and Communications Research Laboratories(ICL)

Division for Emerging Wireless Application Technology

TammyWu@itri.org.tw



RIS/O-RAN testing Framework

- ITRI, ICL and ICL-M Div.
- RIS end-to-end testbed
- Bridge O-RAN ecosystem into RIS testbed



Tammy Wu
TammyWu@itri.org.tw

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



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



Industrial Technology Research Institute, ITRI

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



Total Staff: 6,042 (~04/2023)

PhD: 1,266
Master: 3,763
Bachelor: 1,013
Alumni: 27,508



Total Patents (~04/2023)

31,939

**Startups &
New Business Units** (~Q1/2023)

157



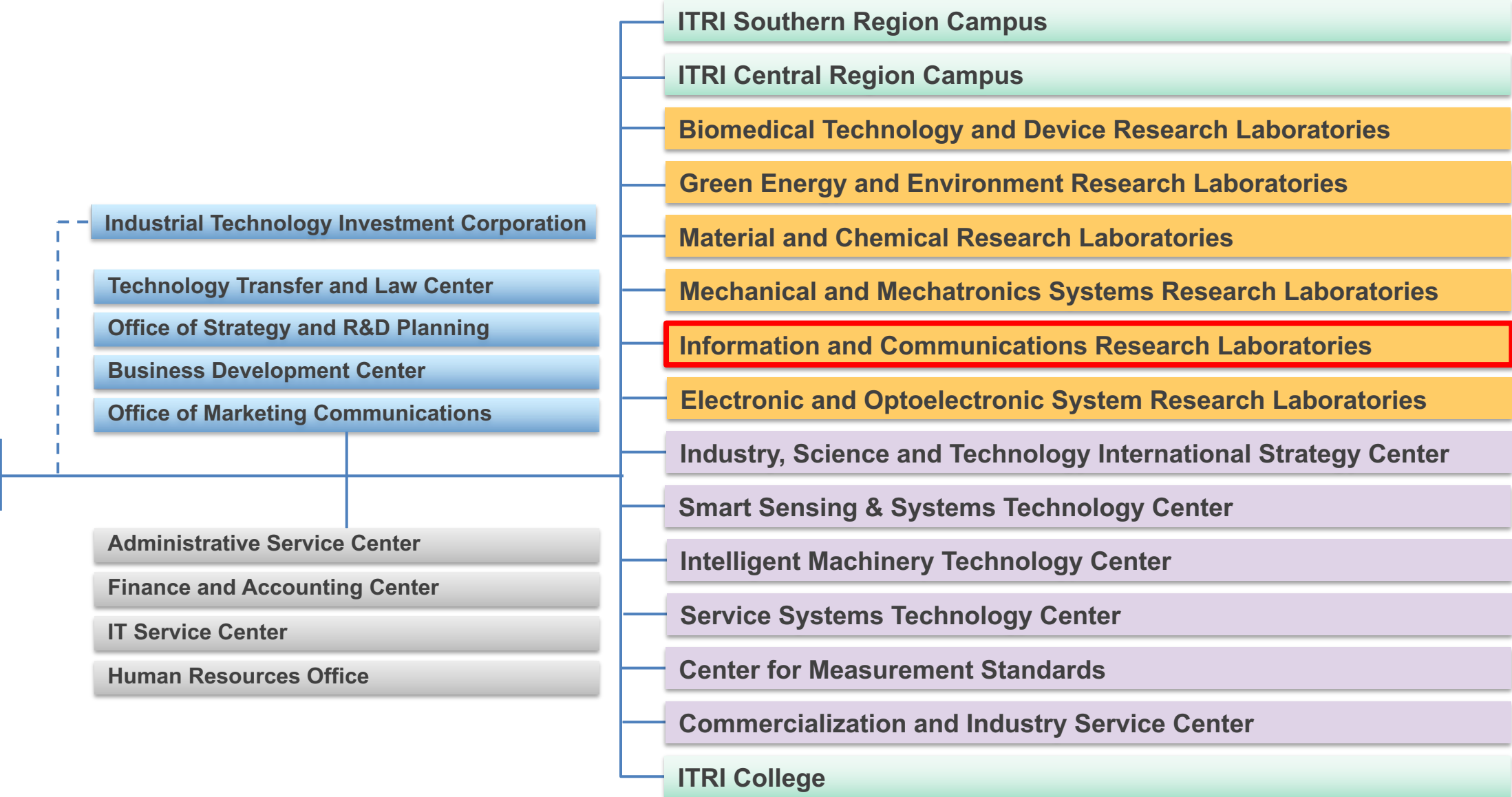
Industry Services (2022)

Provided Services: **17,464**
Transferred Technologies: **513**

Incubatees (~Q1/2023)

213

ITRI Organization

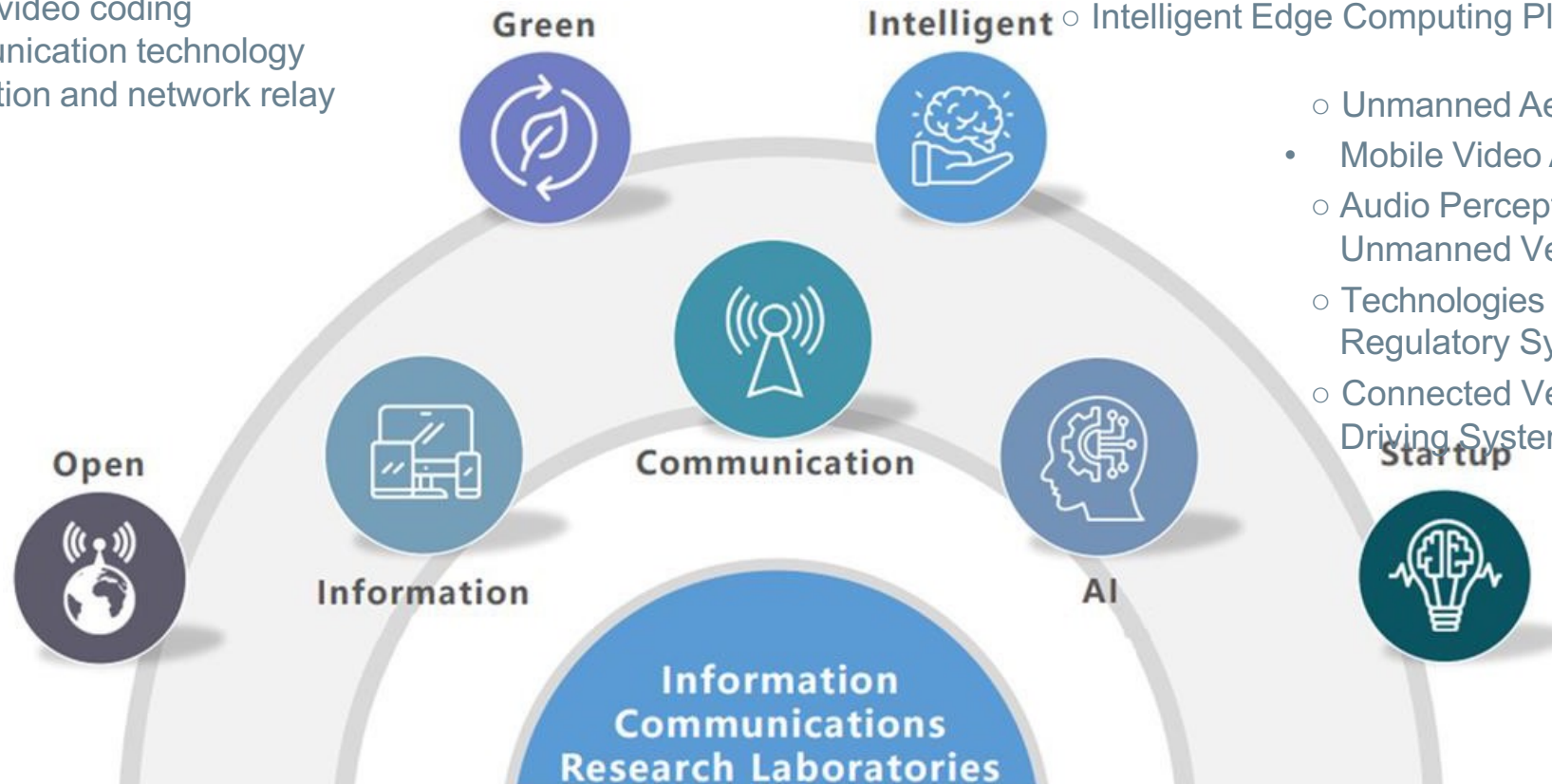


Information and Communications Research Laboratories (ICL)

- 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

- 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

- Unmanned Aerial Vehicle Systems and Mobile Video Applications
- Audio Perception and Processing for Unmanned Vehicles
- Technologies for Financial and Regulatory Systems
- Connected Vehicles and Autonomous Driving Systems

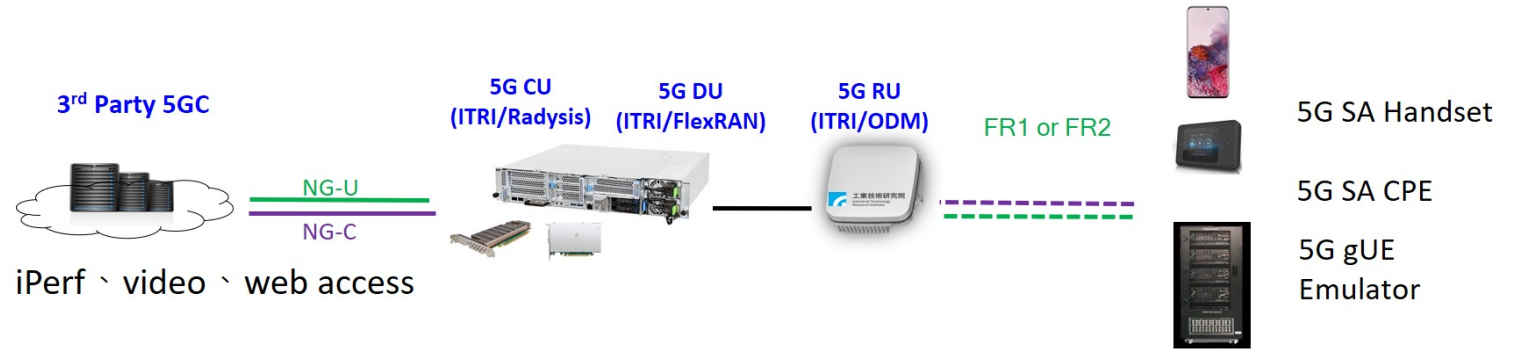


Division for Emerging Wireless Applications Technology

ITRI ICL-M Div

- Expertise

- 3GPP standard
- RF/Baseband/Protocol software
- System integration
- System simulation

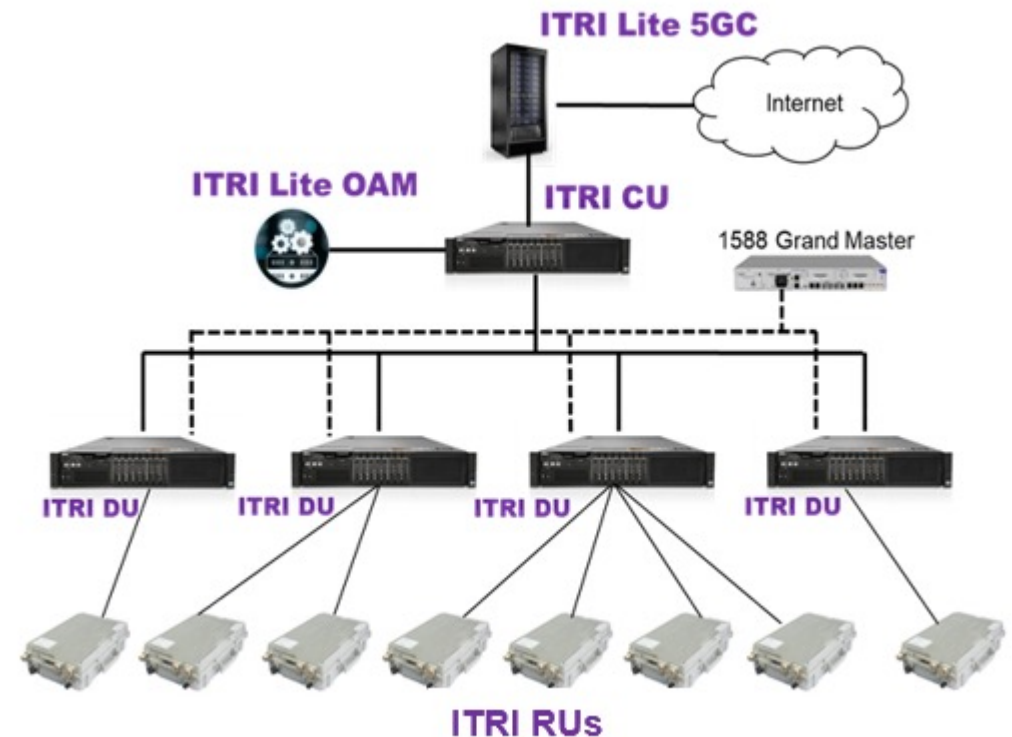


- What we developed for 5G O-RAN systems

- ORAN Compliant RU/DU/CU & Lite 5GC & OAM
 - Max Throughput 1.6 Gbps per RU
 - Support 128 Active UEs
 - Support Both FR1 and FR2
- Pass OTIC and 7x24 long run testing

- Our achievement

- provided technology to over 30 Taiwanese companies
 - semiconductor IC design \ components and systems



RIS use cases brings challenges

- Commercial Challenges

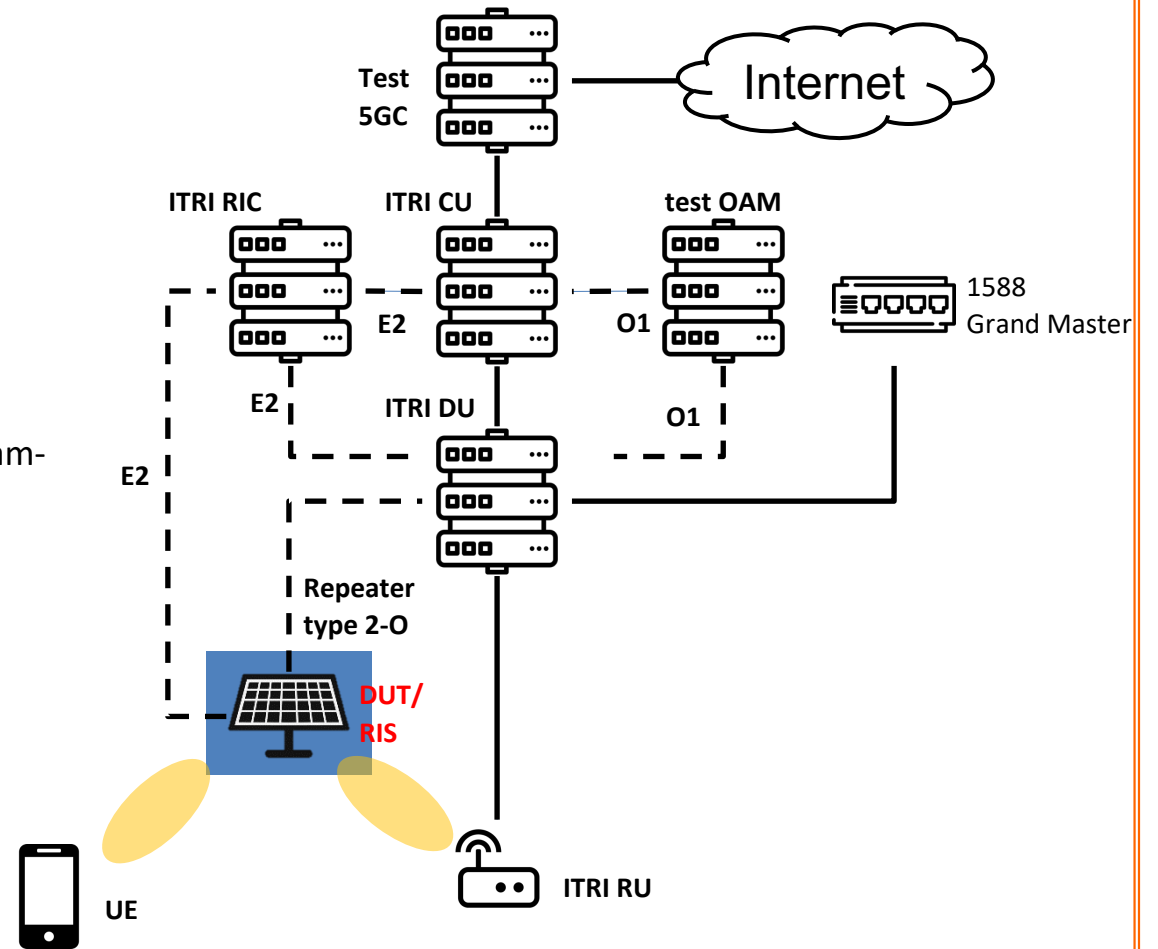
- Assured gains on key performance indicators while integrated with commercial O-RAN infrastructure
 - Explore best use case among combinations of exercise scenarios and spectrum bands options
- Need an OTA testbed to verify the performance via system-wide data collection & analysis
- Choice among RIS meta-surface options: Liquid Crystal (refraction/reflection), Electronic (PIN diode/CMOS Cap Array IC), and others
 - Trade off between phase control precision, beam switching speed & manufacturing cost

- Deployment Challenges

- The RIS deployment scenarios.

RIS end-to-end testbed

- RIS module and O-RAN network integrated system
- Testing framework, scenario, procedures, items & tools
 - Ongoing RIS testing
 - Frequency band: 4.5GHz and 28GHz
 - RIS Type: PIN diode/CMOS Cap Array IC RIS
 - Measurement items:
 - RIS module
 - Measurement of RIS signal gain, signal attenuation, 3D beam-pattern, etc.
 - Frequency band : 28GHz
 - E2E system
 - First level- SNR
 - Second level- App Throughput/ Error Rate



Bridge O-RAN ecosystem into RIS testbed

