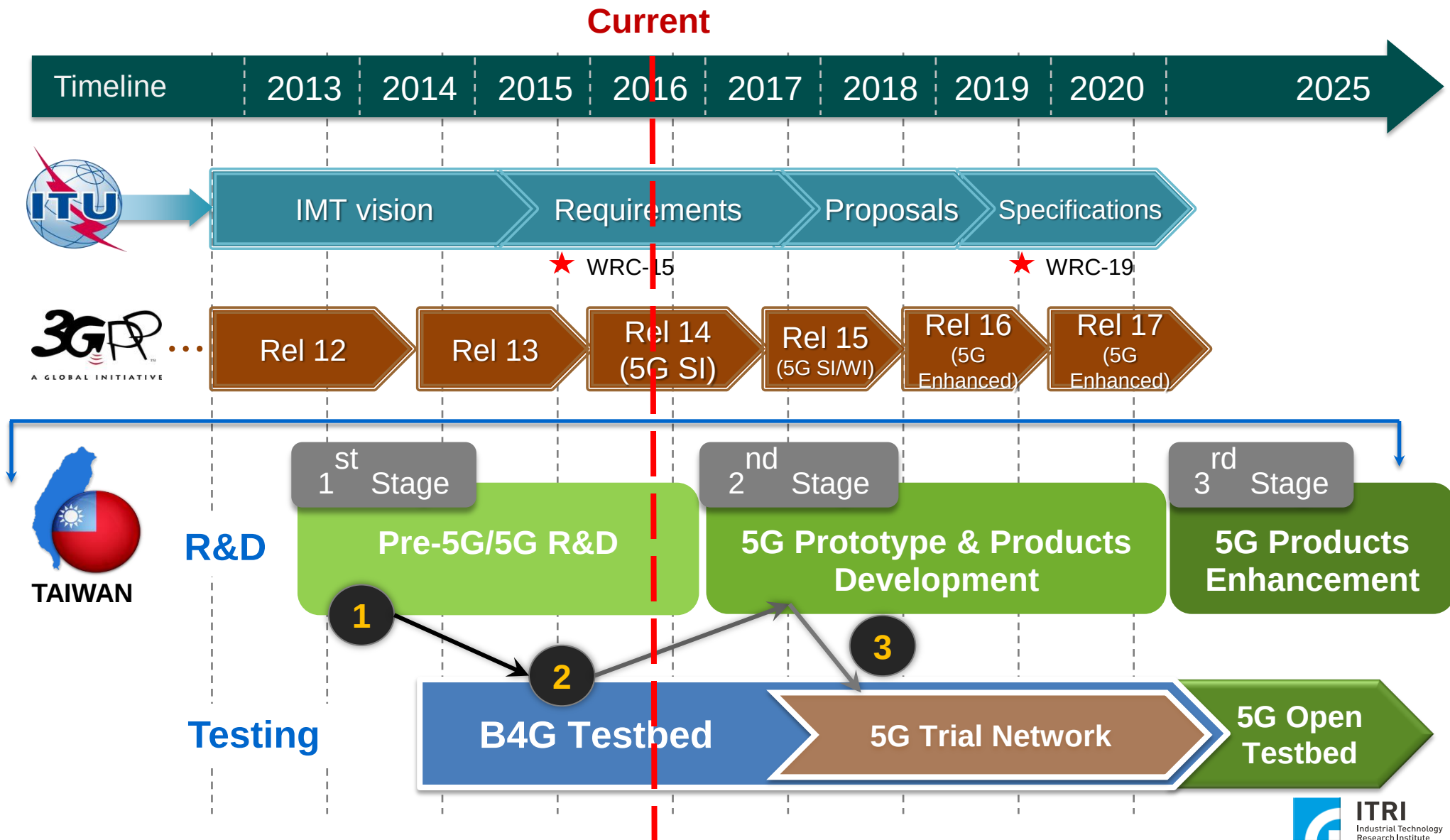




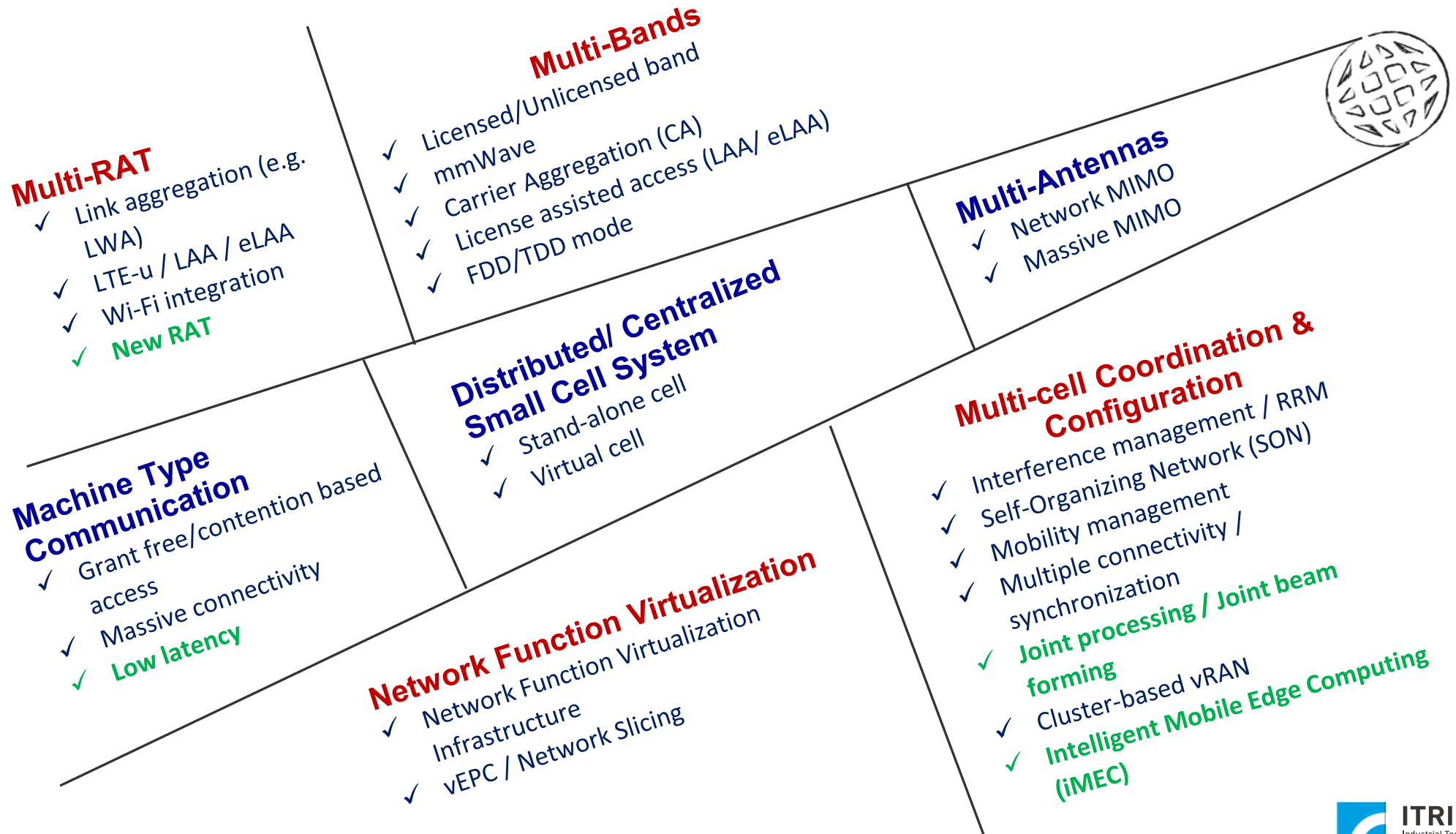
Taiwan ICT Current Status

Jonathan Lai
5G Program Office , MOEA , Taiwan
jlai@5g.org.tw

Taiwan 5G Program Timeline



Pre-5G/5G **Ongoing** R&D Efforts



B4G Testbed



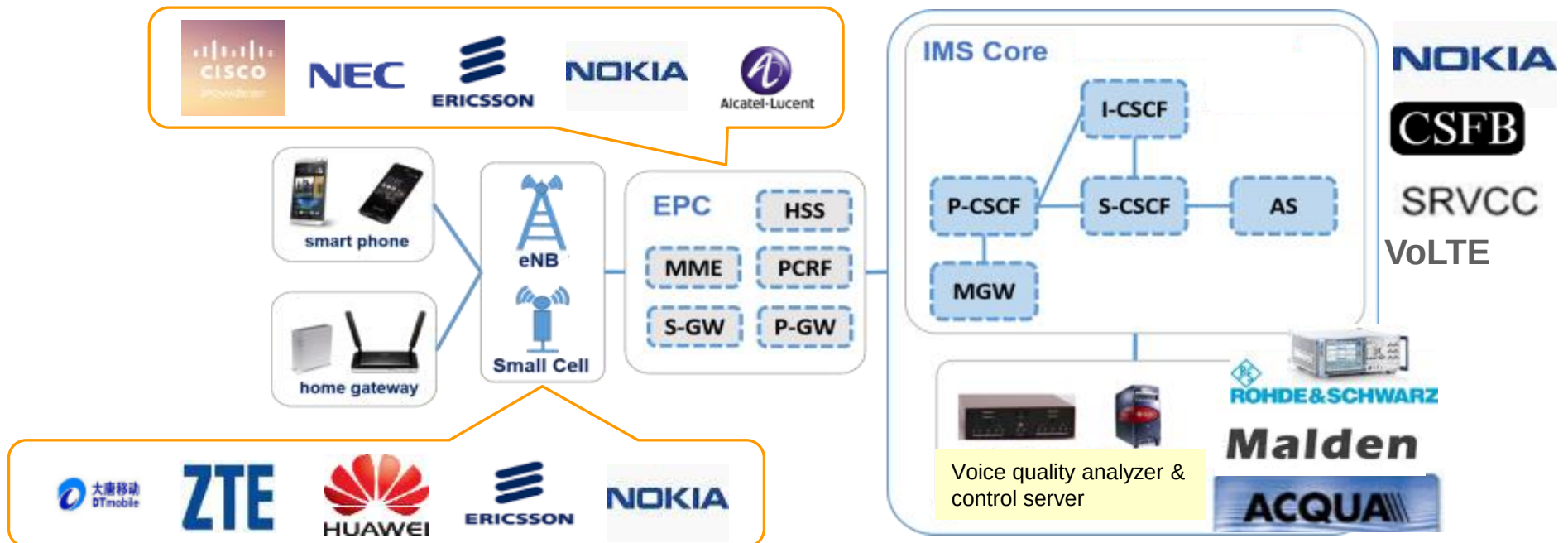
... Commercial Grade Multi-Band and Multi-Vendor B4G Network

5 EPCs, 20
eNBs/Small Cells

FDD/TDD/
WCDMA

17 Bands

IMS Core



Summary

■ Taiwan B4G testbed

- ✓ Support **global/domestic** ICT industry ecosystem partners to shorten product/service R&D, time to the market

■ Collaborate with global partner

- ✓ Offer the **opportunity** to work with NGMN members :
 1. B4G/5G use case POC/POS
 2. 5G Trial Network for NGMN TTI Field Trials
 3. 5G Open Test Network in long term

Thank you for your Attention

JONATHAN LAI
JLAI@5G.ORG.TW

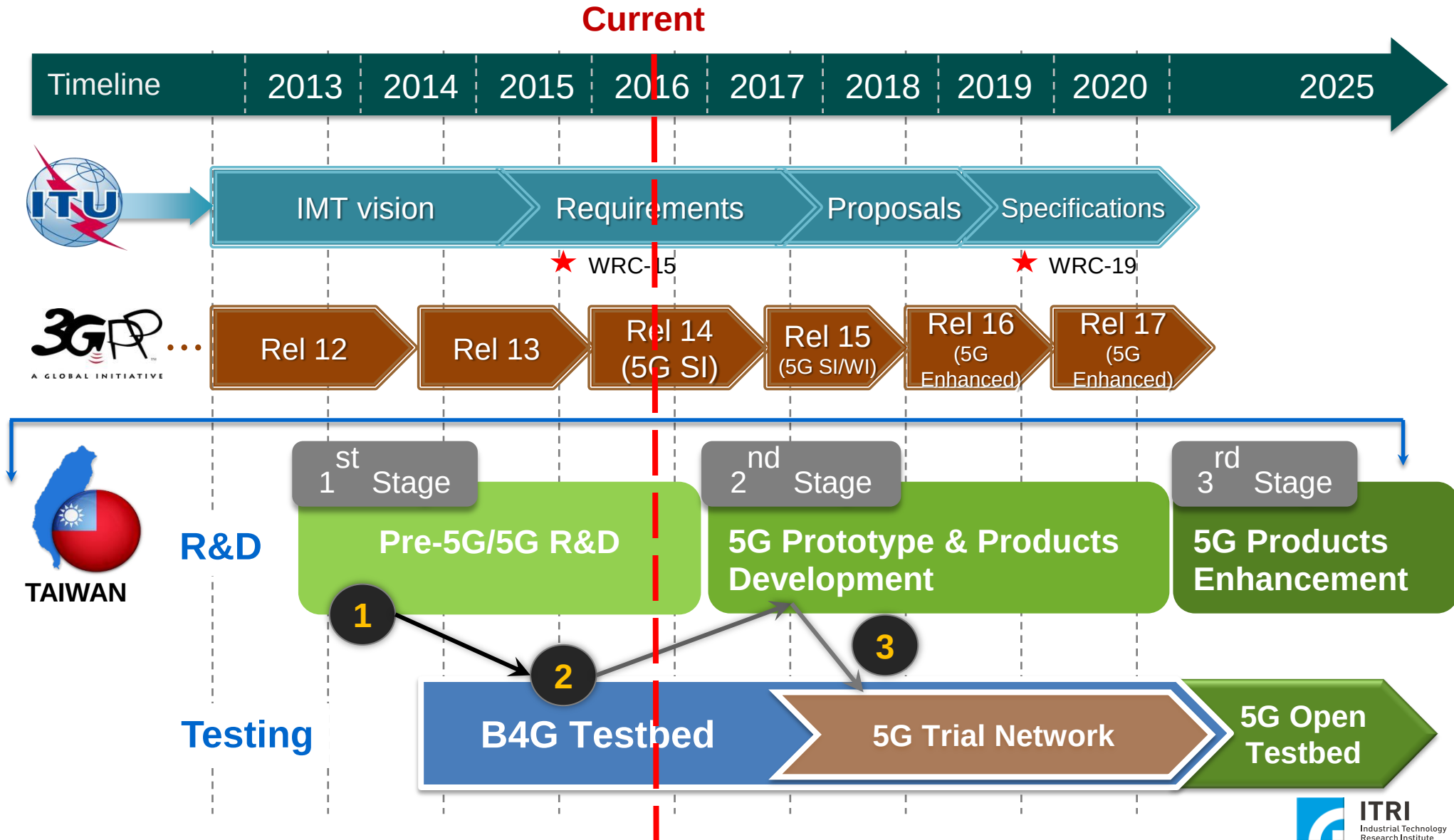
Appendix

Outline

- **What Have We Done**
 - Pre-5G/5G R&D Status
- **What Do We Have**
 - B4G Test Network Eco System
- **What Can We Offer**
 - 5G Trial Network
- **How Can It Be Done**
 - Open Collaboration

Development Timeline

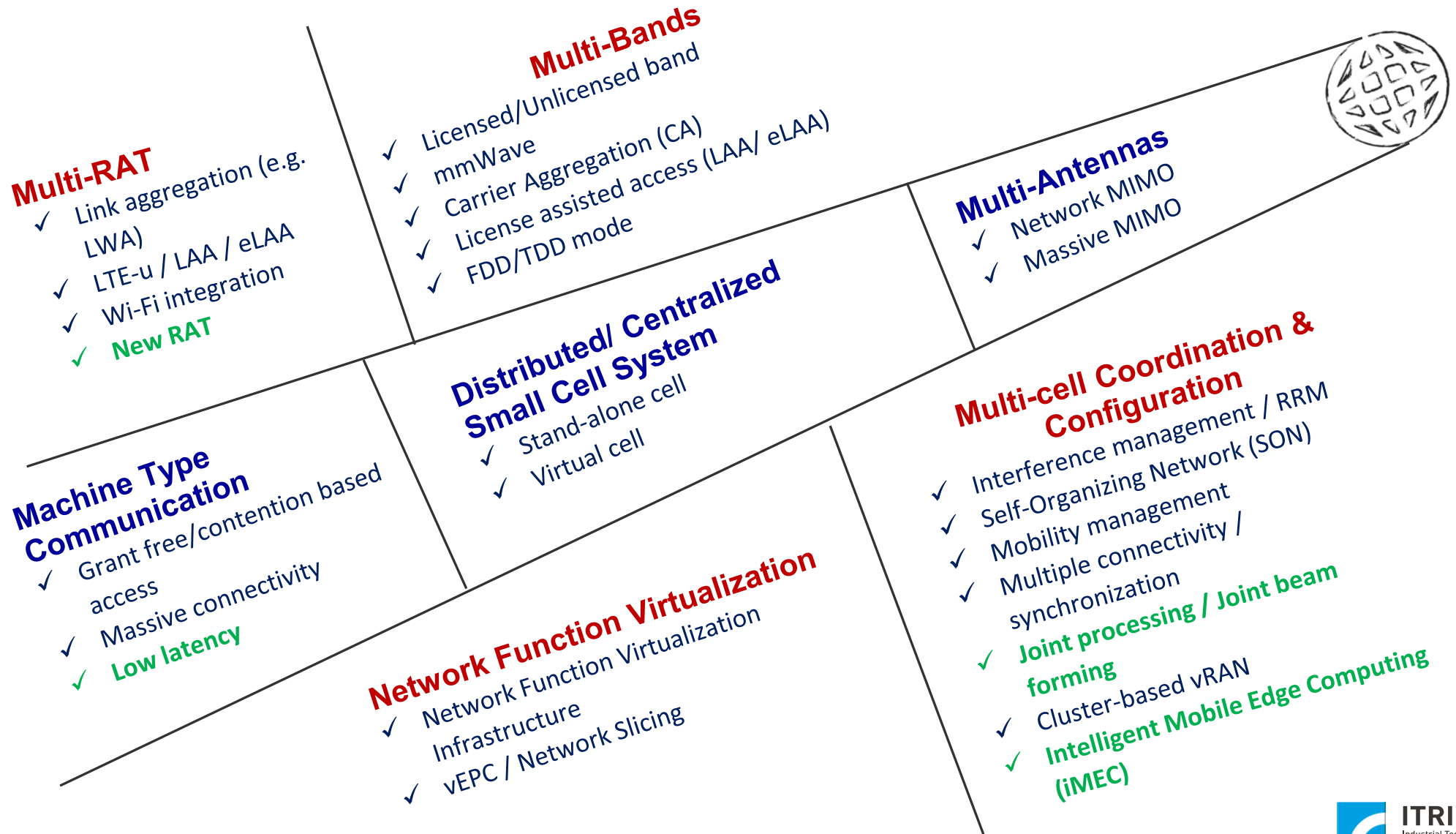
Taiwan 5G Program Timeline



What Have We Done

Pre-5G/5G R&D Status

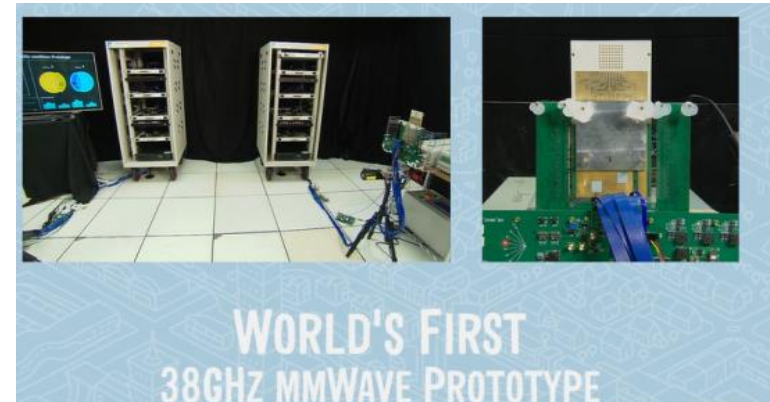
Pre-5G/5G **Ongoing** R&D Efforts



mmWave Prototype

MWC-2016 with MediaTek

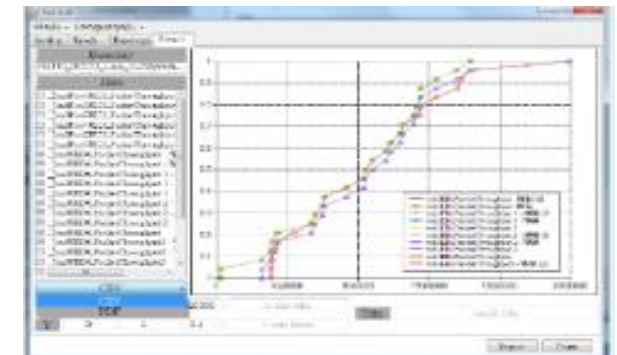
**1Gbps with 250MHz @38GHz
(BS:64, UE 32 Ant. elements)**



Channel Measurement



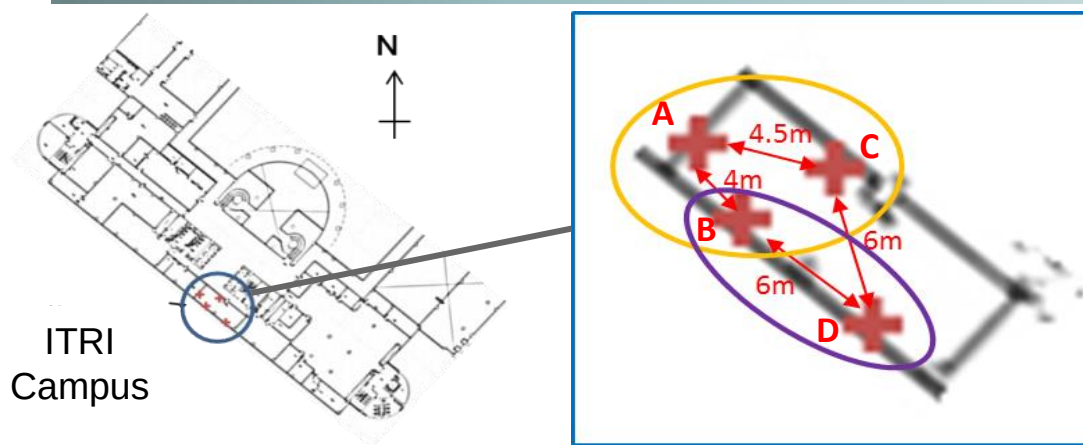
Channel Modeling



System Level Simulator

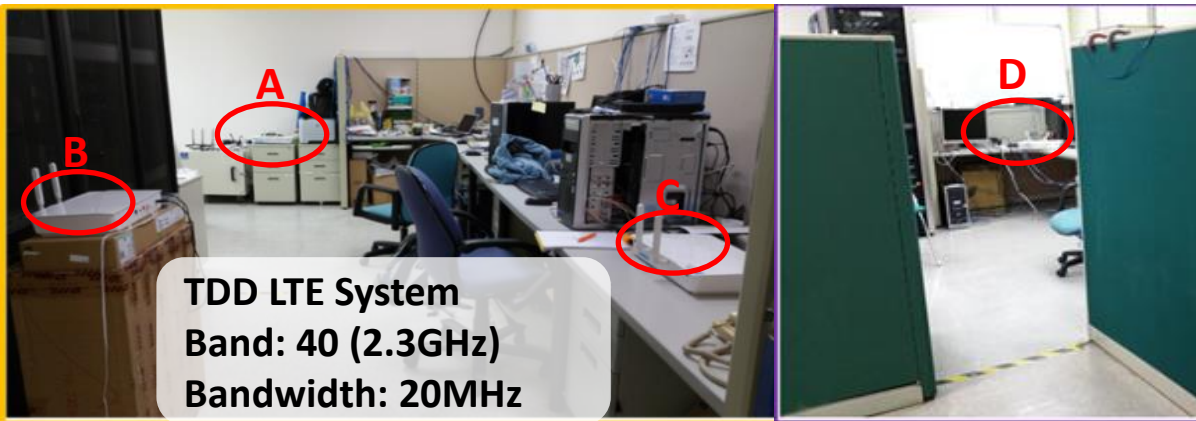
Demo video : <https://vimeo.com/fixationvideo/review/155875896/f149ef9327>

UDN With SON (coverage, capacity optimization)



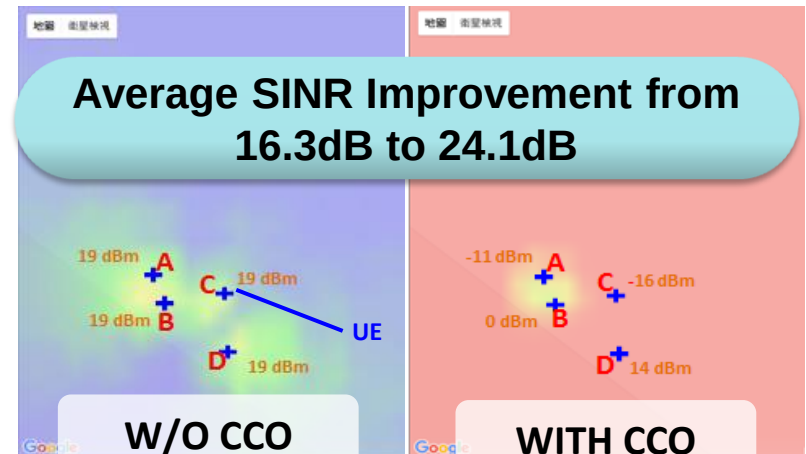
System Performance @2015:
SINR Improvement for Cell
Edge Users: 7.8dB

Small Cell Deployment



Coverage & Capacity Optimization

Average SINR Improvement from 16.3dB to 24.1dB



What Do We Have

B4G Test Network Eco System

B4G Testbed



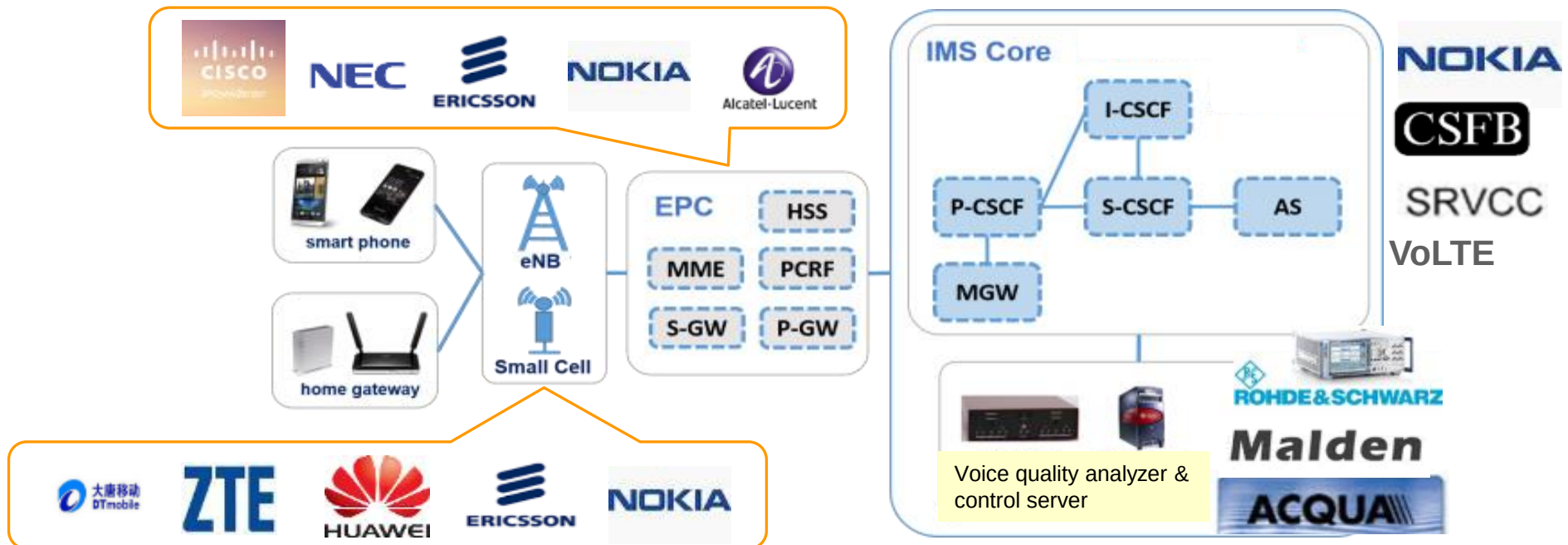
... Commercial Grade Multi-Band and Multi-Vendor B4G Network

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IMS Core



B4G Testbed

Field Deployment Environment

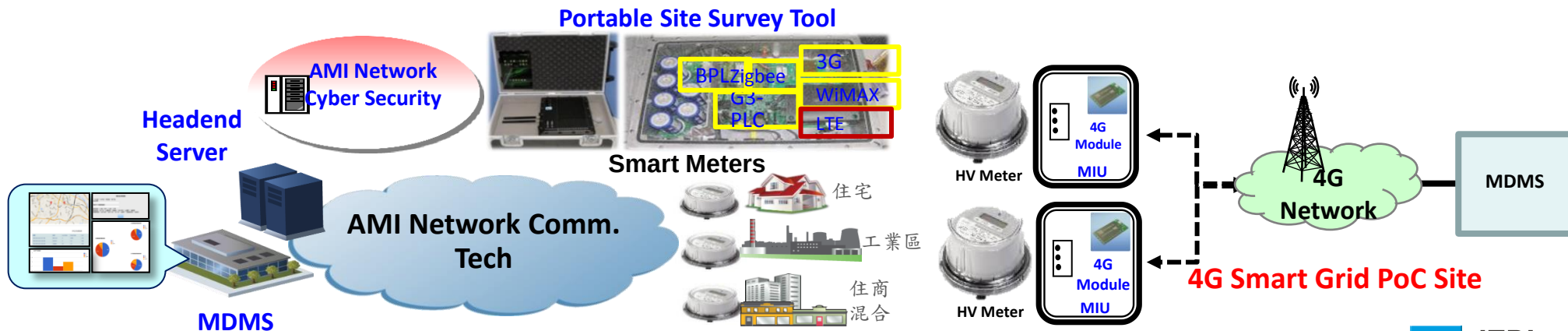
- ❑ ITRI Campus
- ❑ High-Way 68 (Chu-Tung<->Hsin-Chu)
- ❑ Hsin-Chu Sciences Park
- ❑ Campus of NCTU、NTHU、Ta-Tung University
- ❑ Taiwan Power Company(TPC) Research Center

ITRI Campus & Hsin-Chu Sciences Park



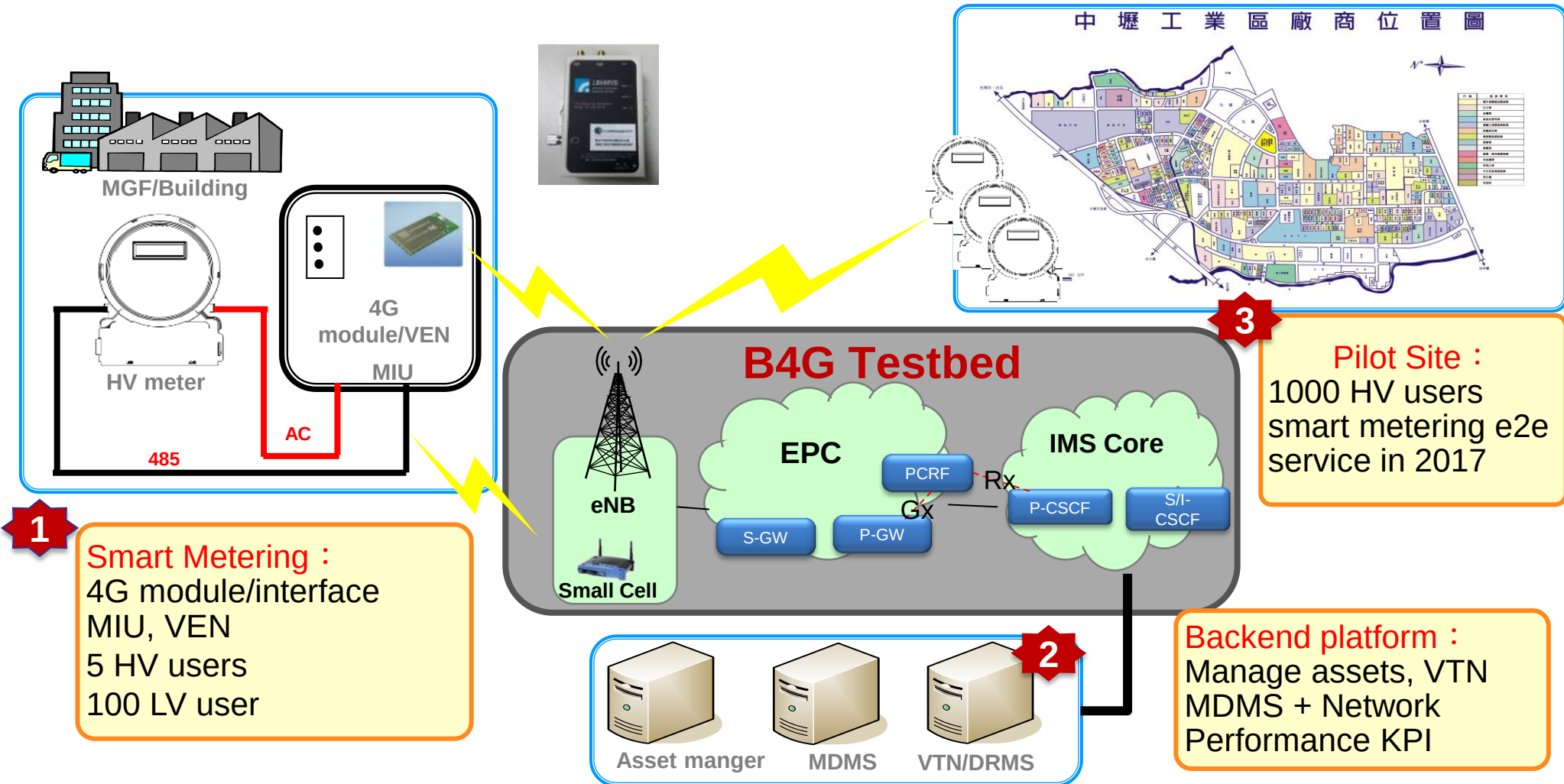
MTC (Smart Metering) Solution

- ❑ IEC-62056 DLMS/COSEM Comm. Protocol stack
- ❑ AMI Network Security, AES-GCM-128 (KM,IDS, KDC, UG server, DCU)
- ❑ AMI Backend System, **MIU/4G** API, comm. Module, HV
- ❑ MTC Services and Pilot Sites
- ❑ OpenADR 2.0b Comm. Protocol Stack/product, VTN/VEN certified
- ❑ **First IEC Conformance Testbed in Taiwan**
- ❑ AMI Site Survey Tool & Network Planning Tool



Use case : MTC Pilot

Smart Metering with TPC



Partner Reference

	2016 - 2017	2018 - 2020
Testing	• IoT solution POC/POS, M2M, D2D • HSR 4G/Wifi Access • SDN/NFV POC • SON/Small Cell • B4G Labs. (LTE TDD/FDD +WCDMA+Wi-Fi)	• NFV/SDN POS • UDN/SON • 5G Labs. (NEW RAT+ 4G LTE-AP + mmWAVE), Network Slicing • mmWAVE Small Cell
Customer & Partner	Telco : APTG, FET Chipset: Qualcomm, Realtek, MTK UE/Handset: Acer, ASUS, BenQ, Compal, hTC, Infocus, AzureWave, Zonebest, Quanta, Zcom... Small cell/Gateway/EMS/SON: Alphanetwork, Arcadyan, ASKEY, CyberTAN, Foxconn, Gemtek, Quanta, Sercomn, WNC, Zcom, ZyXEL, Mitrastar Application developer: AR/VR , On-line game developer... University: NTU, NCTU, NTHU, Ta-Tung University Government : TTC,III	

What Can We Offer

5G Trial Network

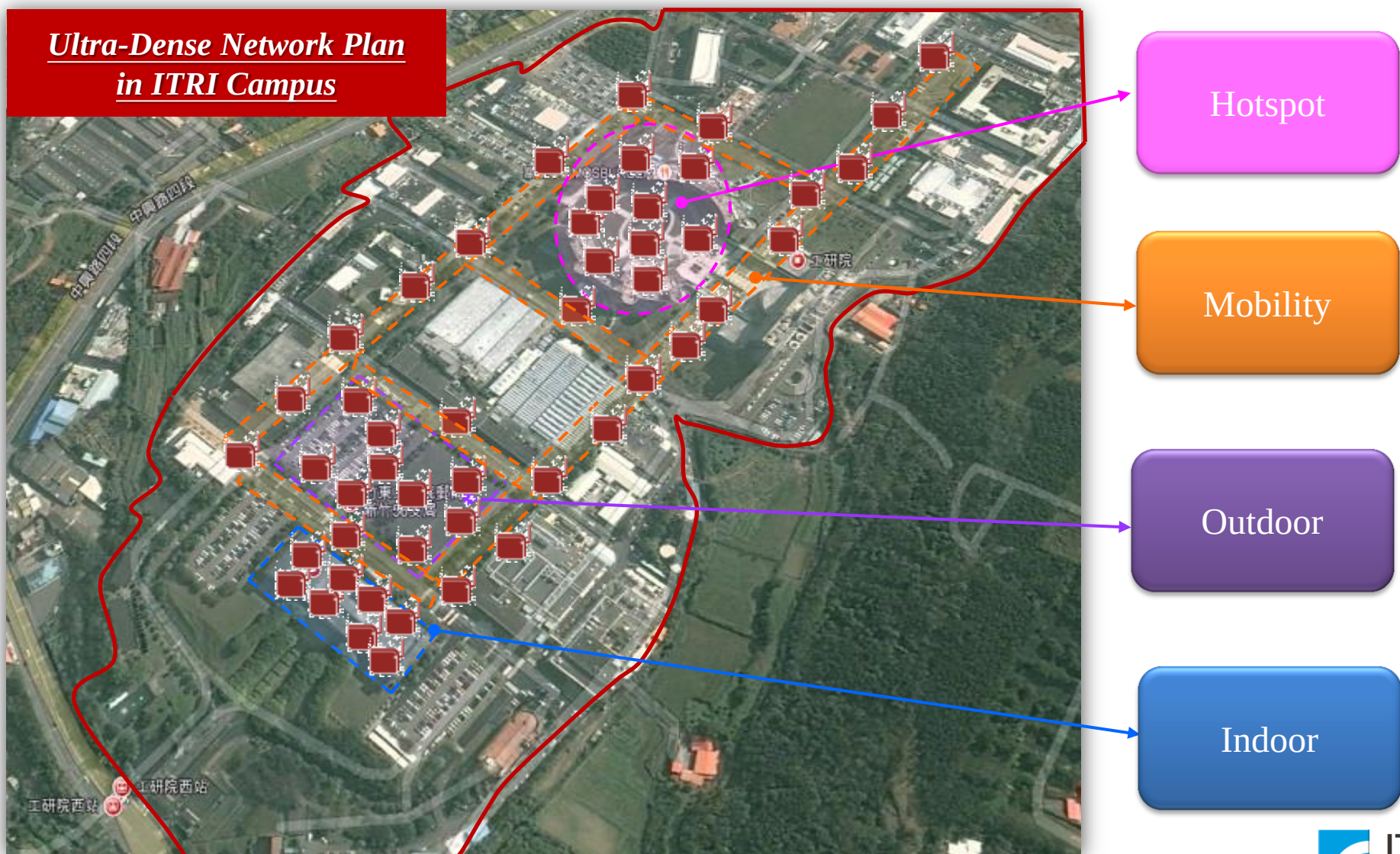
End-to-End UDN Testbed

■ Build from the B4G testbed with

- ✓ Indoor/outdoor/hot spots/mobility environment
- ✓ Distributed/centralized RAN subsystem
- ✓ Sub 6GHz small cells with distributed antennas
- ✓ mmWave small cells with massive antenna array
- ✓ iMEC for traffic offload, SON, latency reduction, UDN mgmt. function...etc
- ✓ vEPC and NFV/SDN

■ Capable to support selected vertical applications

Planned UDN Testbed Deployment



Use case: UDN Testbed for SON

Enterprise small cells with smart antenna solution to improve capacity and coverage in ultra-dense network



Small Cell



Small Cell with Smart Antenna

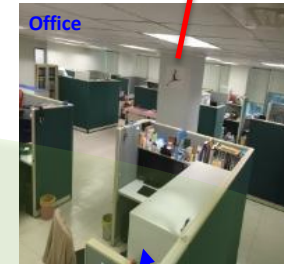
SON Server



Dynamic smart antenna beam selection for capacity and coverage optimization



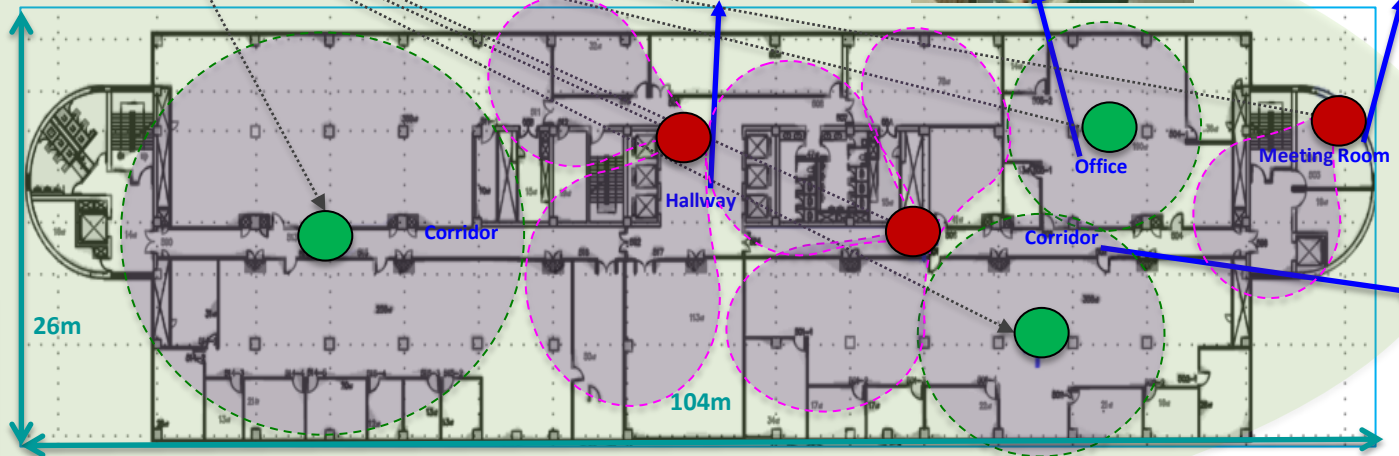
LTE Small Cell with Smart Antenna



Outdoor Macro BS

ITRI's Campus

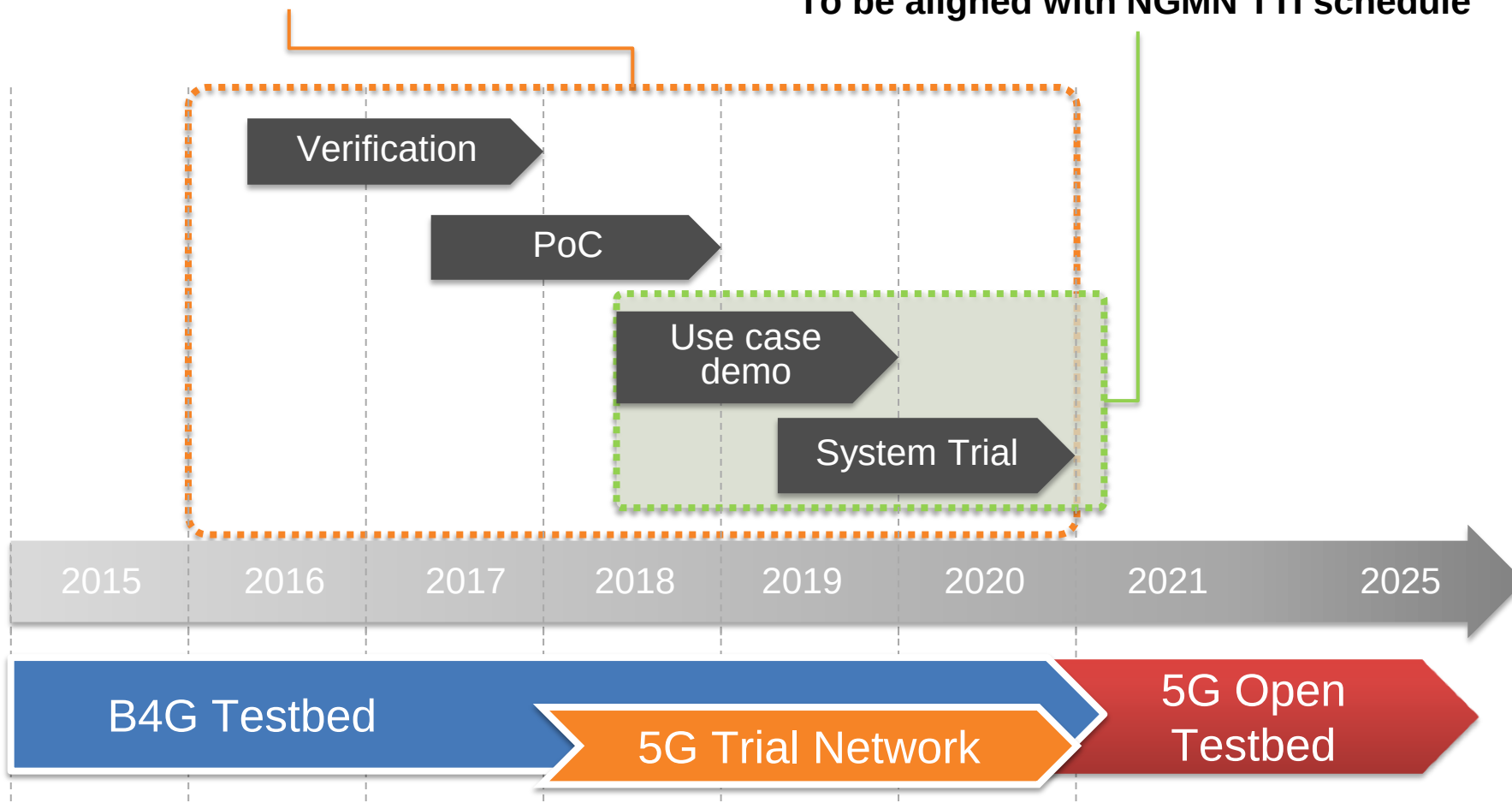
Small Cell Density is equal to 2200 BSs/Km²



Taiwan 5G Trial and Testing Plan

Technical Trials Phase (2016~2020)

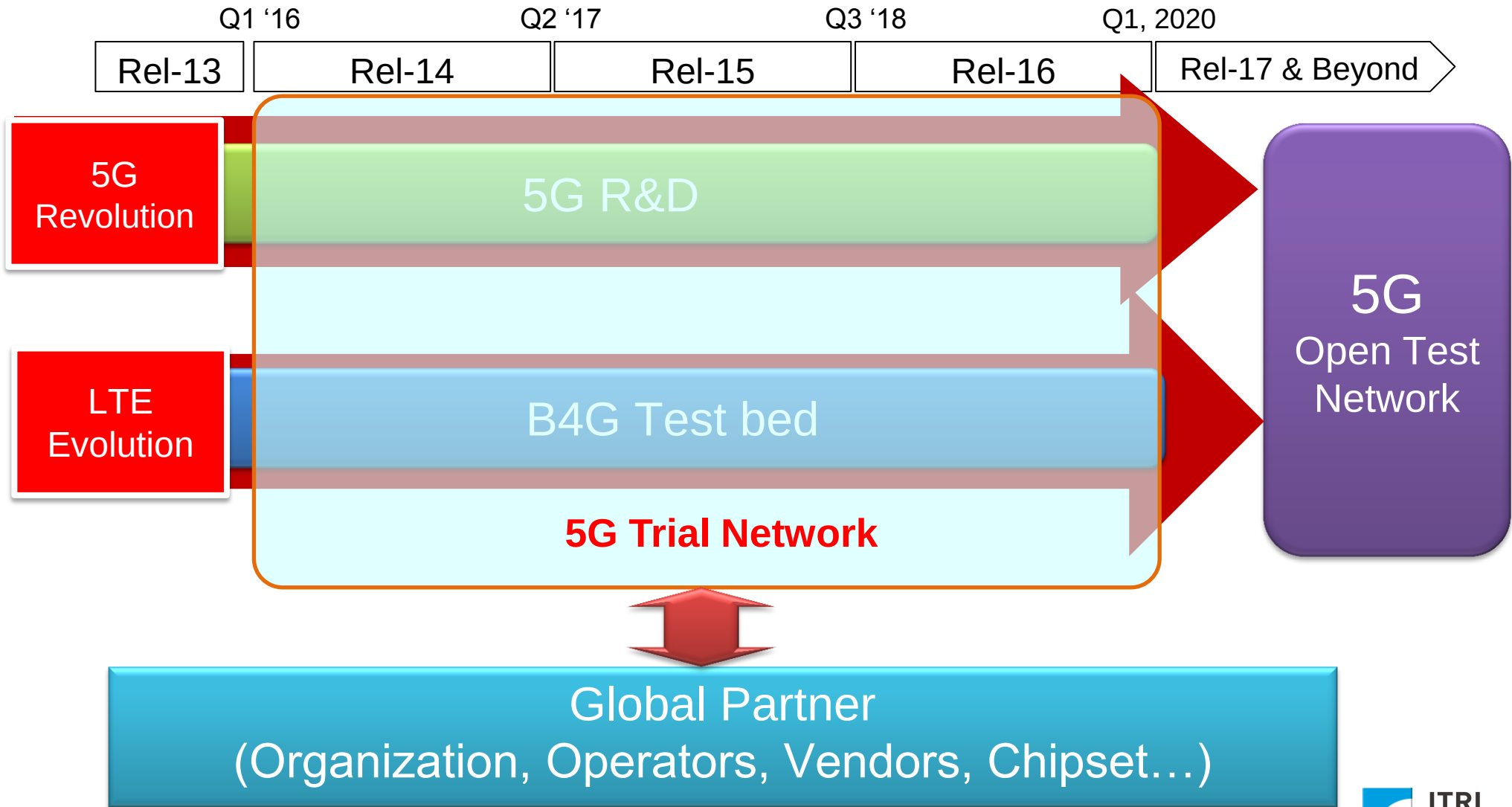
Product Verification Phase
(2018/06~2020)
To be aligned with NGMN TTI schedule



How Can It Be Done

Open Collaboration

Open Collaboration



Summary

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