

Private 5G

Provision of Private 5G Infrastructure
for Smart Factory

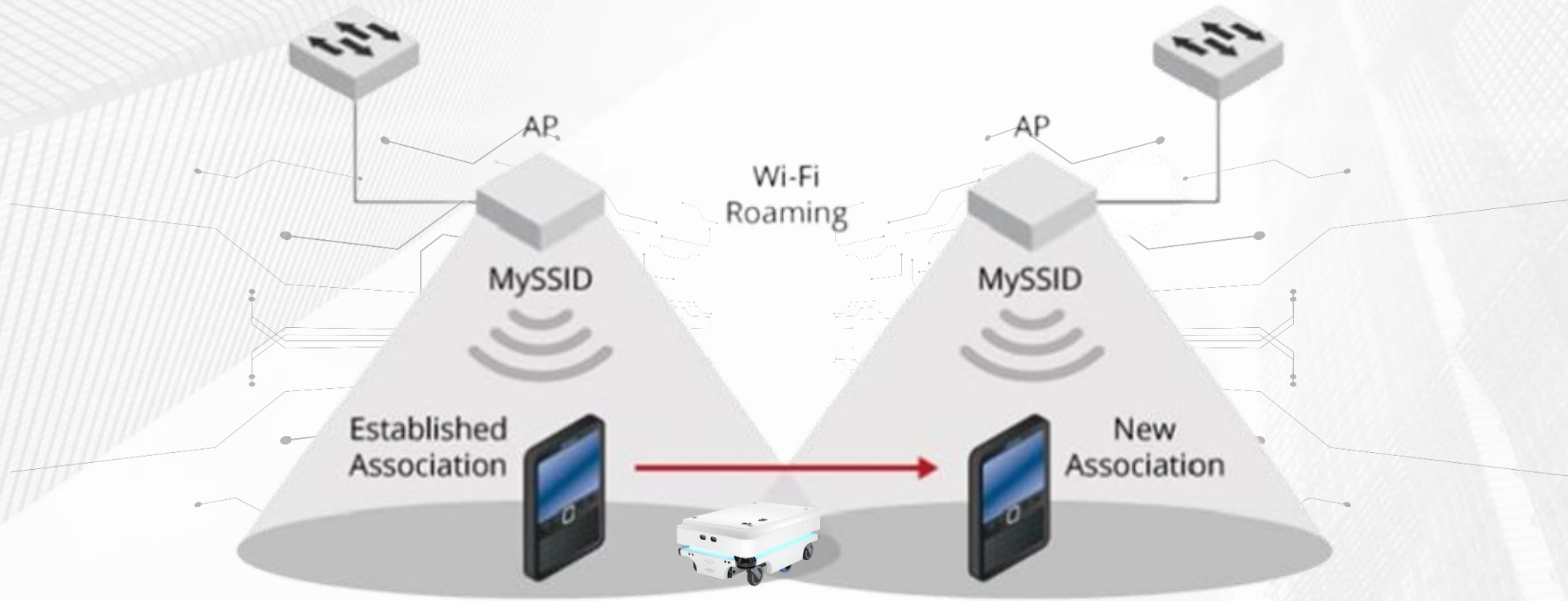


2025 . 02

5G

FLECTORY

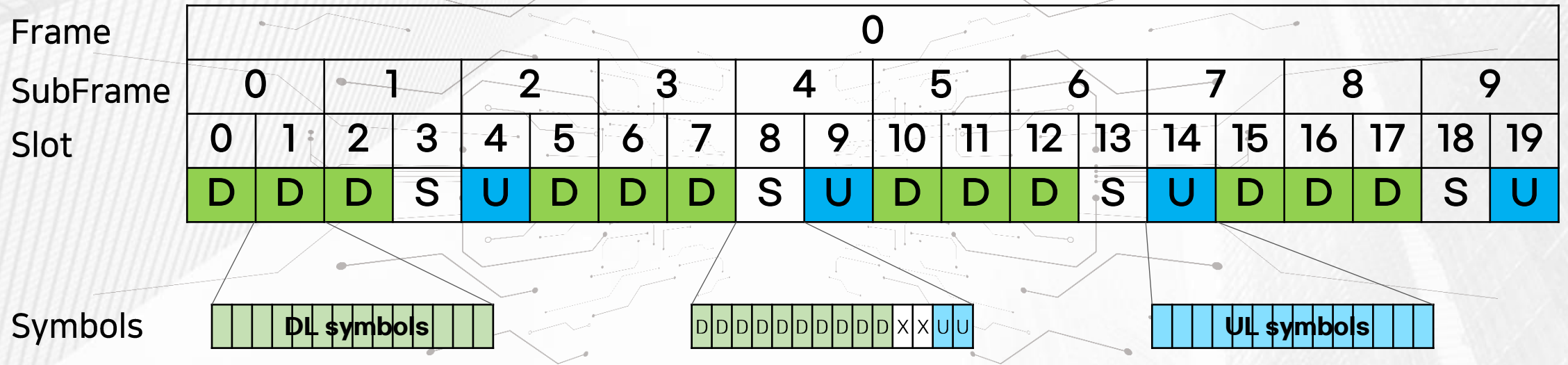
BACKGROUND ● ● ●



WiFi Roaming issue

BACKGROUND ●●●

Public 5G TDD (Time Division Duplexing) frame structures employed for South Korean mobile operators.



DL:UL=8:2

BACKGROUND

INDUSTRY 4.0 The optimal infrastructure for digital transformation is **Private 5G**

Private 5G

Security

A self-constrained and closed system that does not rely on telecommunication company system.



Construction cost for Facility changes

No need for equipment modification costs.



Speed of upload

Freedom to switch between UL and DL



Hand over

Same as the 5G network



Controllability

Ability to issue SIM cards, manage subscribers, and control all settings including network slicing



Mobility

Same as the 5G network



OUR BUSINESS

Flectory is

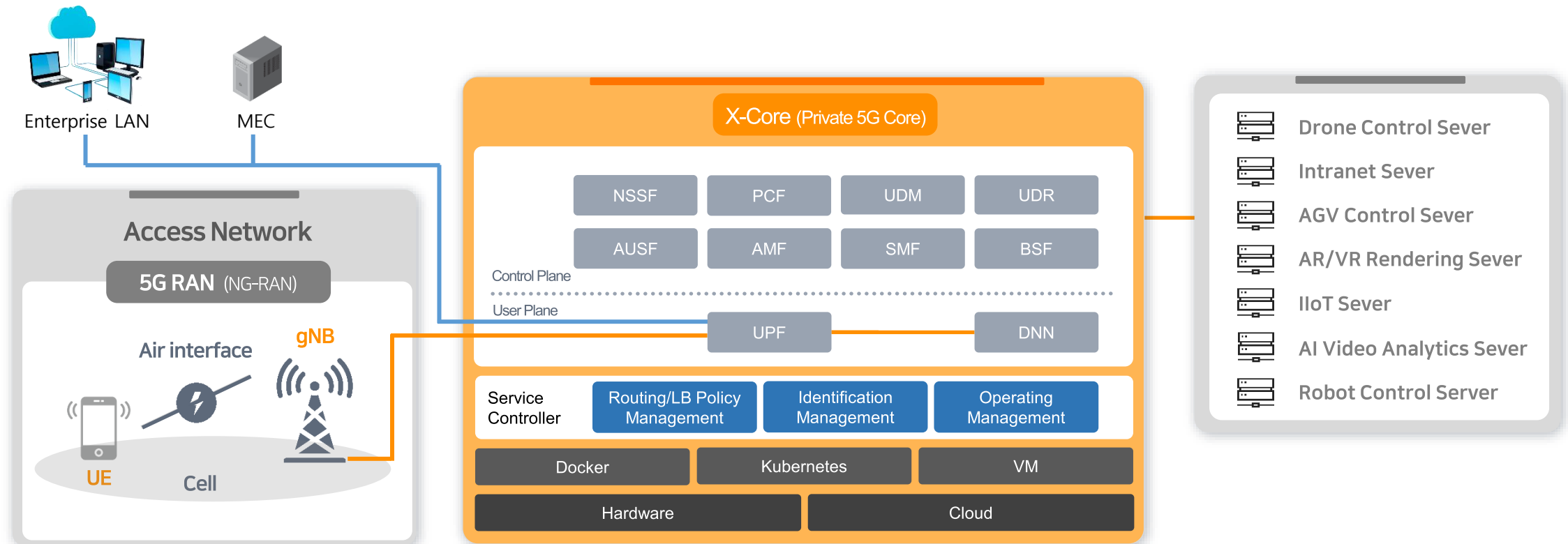
Private 5G Core specialty Company

Private 5G is an **Industry 4.0 core infrastructure** where consumers have control over communication, like WiFi.

ARCHITECTURE

Years of network operation experience

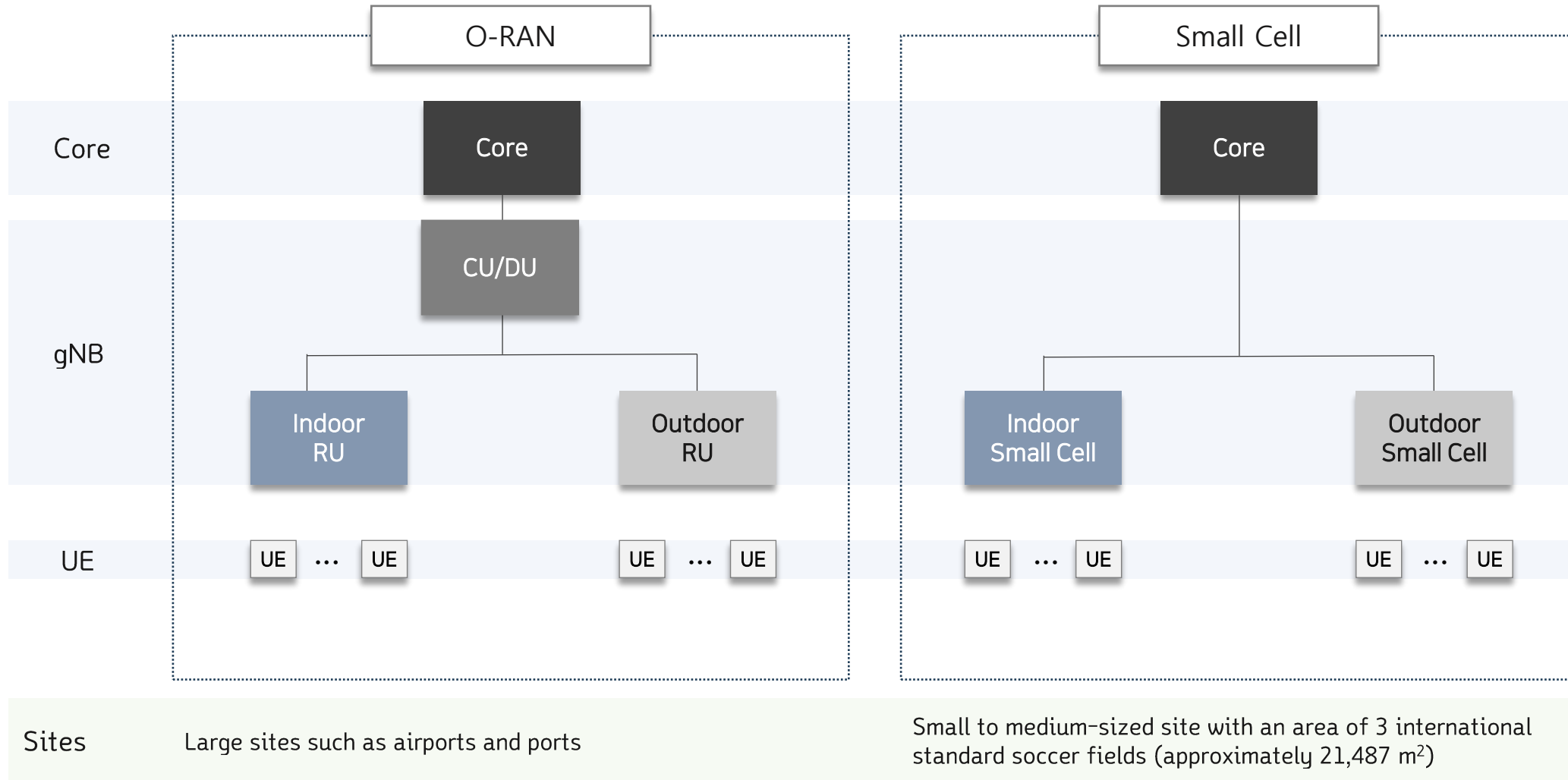
Collaborating with various 5G terminal/gNodeB manufacturers



- UE(User Equipment) : The equipment designed for consumer use
- gNB(gNodeB) : 3GPP-compliant implementation of the 5G-NR base station

- Access Network : The network which physically connects UEs to the routers.
- 5G Core : 5G Core is the heart of a 5G network, controlling data and control plane operations.

5G PRODUCT LINES



- CU(Central Unit) : User data transfer, mobility control
- DU(Distribution Unit) : Digital signal processing

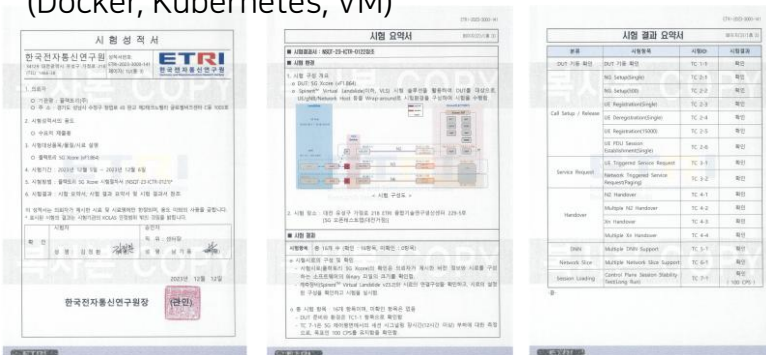
- RU(Radio Unit) : Acts as an antenna
- Small Cell : Small base stations covering areas of tens of meters

X-CORE(5G CORE)



[ThinkEdge SE450]

- Run all network functions of 5G Core on a single server
- Supports various deployment environments (Docker, Kubernetes, VM)



		Performance
Core	E2E data transmission latency	< 10ms
	Maximum number of subscribers	15,000
	Maximum number of small cells	500
	Concurrent Network Slicing per Subscriber	3
	Number of concurrently supported DNNs per subscriber	8
	User Plane Processing Performance	>= 20Gbps (one-way transfer rate)

※ The above performance is based on ThinkEdge SE450. Core performance may vary depending on H/W specifications.

Item	Specification
Size	445 x 87 x 383 (W x H x D mm)
CPU	40core Intel(R) Xeon(R) Silver
Memory	125GB
NIC	Intel 25G SFP28 * 2 Broadcom 10G Ethernet * 8 / I350 1G Ethernet * 4
Storage	1.8TB SSD
Available Small Cells	500

- User Plane : The User Plane is responsible for transmitting user data
- NetworkSlicing: A network architecture that enables the multiplexing of virtualized and independent logical networks on the same physical network.

X-CORE MINI



[ThinkSystem SE350]

item	Specification
Size	400mm x 215mm, 1U high.
CPU	One Intel Xeon D-2100 Series processor
Memory	64GB
NIC	2x 10GbE SFP+, 2x 1GbE RJ45 (support 10/100 Mbps), 2x dedicated ports for remote management
Storage	SSD 1TB



[PL64 S7012MN]

item	Specification
Size	119.7mm x 199.7mm, 33.9mm high.
CPU	Intel alder lake core i7-1255U
Memory	64GB
NIC	Intel I225V LAN, 2.5Gbps Intel I219V LAN 1Gbps
Storage	SSD 1TB

5G SMALL CELL(gNB)



[QUCELL AIO]

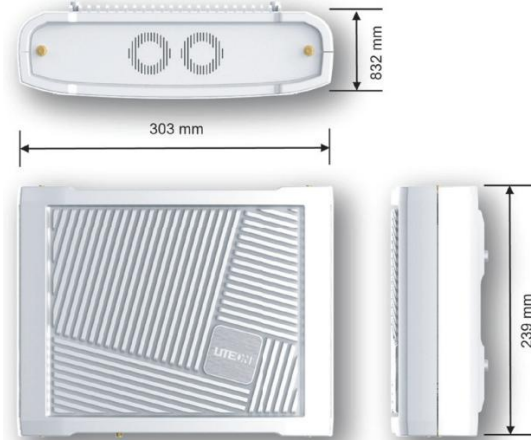
- 5G+LTE(option) Support
- All-in-One Type (CU+DU+RU, DU+RU)
- Plug and Play Support
- Reduce installation costs with PoE++ support
- NSA, SA network option support
- IEEE1588v2/GPS support as synchronization source

Item	Specification
Frequency	5G Sub-6 GHz (n79)
Max Transmit Power	30dBm (EIRP)
Bandwidth	100MHz (Max)
RF Antenna	Internal : 2T/2R
Max. Modulation	256QAM (Max)
Cell Capacity / Layers	1 cell / DL 2 layers, UL 2 layers
Max Connected Users	32(NSA*) / 64(SA)
Synchronization	IEEE1588v2/GPS (Optional)
Interface	Backhaul - 1G/2.5Gbps Ethernet x 1 port - SFP+ (for optical) x 1 port (Option) Management - 1Gbps Ethernet x 1 port
Power Input	External 19~24VDC, PoE++
Size/Weight	260 x 260 x 55 (W x H x D, mm)/<2.5kg
Operating Temperature	-5~40℃
IP Grade	IP30
Mount Type	Ceiling / Wall Mount

- Sub-6 : Frequency in band below 6 GHz
- N79 : 4.72 - 4.82 GHz bandwidth

- PoE(Power Over Ethernet) : A technology that uses UTP cables to transmit data and power

5G SMALL CELL(gNB)



[LITEON FlexFi AIO]

- 5G n77,n78, 79 support
- All-in-One Type (CU+DU+RU, DU+RU)
- Plug and Play Support
- 4x4 MIMO
- Support for SA network options
- Supports IEEE1588v2/GPS as a synchronization source

Item	Specification
Band	n77: 3.7~3.98 /n78: 3.3~3.8GHz / n79: 4.4~5.0GHz
RF Tx Power	24dBm (250mW) /ANT
Bandwidth	Customized Bandwidth : 100Mhz,80MHz, 60MHz etc.
Tx/Rx Path	4T2R(HW)
Modulation	DL: 256QAM / UL: 64QAM
MIMO Order	DL: 4 Layers UL:2 Layers
Active Users	64
Synchronization	GPS, IEEE 1588v2, Sync-E
Interface	Backhaul: 10G SFP+, 10G RJ45
Power Supply	54 Vdc
Power Consumption	90W
Temperature	-5~45°C
Humidity	5% ~ 95%
Dimensions	303 x 239 x 83 mm
Ingress Protection	Indoor: IP30
Mounting	Wall mount or ceiling mount

5G gNB (SmallCell - Out Door)



[Qucell AIO]

- 5G n79 support
- 5G Outdoor SmallCell
- Size 300 x 370 x 145 (W x H x D mm)
- Weight < 18.2 kg (TBD)

Item	Specification
Frequency	5G Sub-6 GHz n79
Bandwidth	100MHz
MIMO	4T x 4R
Maximum Tx Power	5W (37 dBm) / Port
RF Port	RF 4.3-Type Connector x 4
Users	64 UEs
TDD Configuration	4:1 / 6:4
Modulation	DL 256 QAM, UL 256 QAM
Interface	<ul style="list-style-type: none"> - 1G / 2.5G / 10 Gbps Ethernet port * 1 - SFP+ (10Gbps) interface for optic * 1 - 1 Gbps Ethernet port for management/debug * 1
Synchronization	PTP / GNSS
Power Input	AC 100 - 200 V (50 / 60Hz)
Size/Weight	300 x 370 x 145 (W x H x D mm) / < 18.2 kg
IP Grade	IP67
Mount Type	Pole / Wall Mount

5G SMALL CELL(gNB)

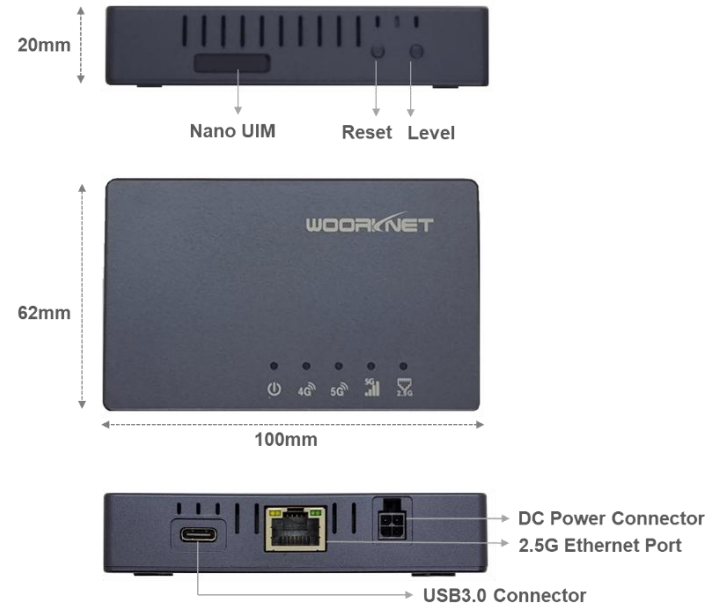


[LITEON FlexFi O-RU]

- 5G n78, 79 support
- 5G Radio Unit
- Plug and Play Support
- 4x4 MIMO
- Support for SA network options

Item	Specification
Band	FR1 Sub-6GHz : n78, n79
RF Tx Power	24dBm(250mW) /ANT
Bandwidth	Customized Bandwidth : 10 ~ 100Mhz.
Tx/Rx Path	4T4R(HW)
Modulation	DL: 256QAM / UL: 64QAM
MIMO Order	DL: 4Layers UL: 4Layers
Active Users	32
Synchronization	GPS, IEEE 1588v2, Sync-E
Interface	Backhaul: 10G SFP+, 1G RJ45
Power Supply	54 Vdc
Power Consumption	65W
Temperature	-5~45°C
Humidity	5% ~ 95%
Dimensions	252 x 252 x 62.7 mm
Ingress Protection	Indoor: IP30
Mounting	Wall mount or ceiling mount

5G CPE



[WOORINET WD-H810P]

- 5G-NR Modem
- FR1(Sub6) + FR2(mmWave) Dual Connectivity
- 3gpp Rel16 support
- PoE support

Item	Specification
Cellular technology	5G: FR1(Sub 6G), optional FR2(mmWave) 4G: CAT. 20 (2Gbps) on DL, CAT. 13 (150Mbps) on UL
4x4 MIMO	5G: n1/2/3/66/7/41/77/78/79 4G: B1/25(2)/3/66(4)/7/30/40/41(38)/42/48
Diversity/2nd Rx	4G: all operating bands
USIM port - dual voltage	Support for SIM Class B and Class C support Clock rates up to 4 MHz
Application processor	Application processor to run customer application code 32 bit ARM Cortex-A7 up to 1.5 GHz 4Gbit NAND Flash + 4Gbit LPDDR4 MCP is supported
Port	USB type-C Connector RJ45 Connector

- mmWave(Millimeter Wave) : A band of about 20 to 100 GHz with very short wavelengths in the radio frequency spectrum
- MIMO(multiple-input and multiple-output) : Multi-antenna technology, minimizing channel loss and user-to-user interference

5G CPE



[WOORINET WD-H880P]

- 5G USB Dongel
- FR1 : n77/n78/n79/n48
- 3gpp Rel16 support
- Power supply and Ethernet connection via USB type-C

Item	Specification
Cellular technology	5G: FR1(Sub 6G), optional FR2(mmWave), Rel 15 4G: CAT. 20 (2Gbps) on DL, CAT. 13 (150Mbps) on UL
4x4 MIMO	5G: n1/2/3/66/7/41/77/78/79 4G: B1/25(2)/3/66(4)/7/30/40/41(38)/42/48
Diversity/2nd Rx	4G: all operating bands
USIM port - dual voltage	Support for SIM Class B and Class C support Clock rates up to 4 MHz
Application processor	Application processor to run customer application code 32 bit ARM Cortex-A7 up to 1.5 GHz 8bit NAND Flash + 8bit LPDDR4 MCP is supported
Port	USB type-C Connector

- mmWave(Millimeter Wave) : A band of about 20 to 100 GHz with very short wavelengths in the radio frequency spectrum
- MIMO(multiple-input and multiple-output) : Multi-antenna technology, minimizing channel loss and user-to-user interference

5G CPE



[BLUEBIRD EF551]

- Industrial 5G Specialized Network Terminal
- 5.45 inch display
- 4350mAh battery (6160mAh when expanded)
- NSA, SA network option support

Item	Specification
CPU	2.7 GHz Octa Core Processor (QC6490)
Operating System	Android 12(Upgradeable to Android 16)
Memory	4GB RAM/ 64GB UFS Flash 8GB RAM/ 128GB UFS Flash (Optional)
Radio Frequency Band	Worldwide - 5G FR1 : n1/2/3/5/7/8/12/13/14/20/25/26/28/29/38/40 /41/48/66/71/77/78/79 - 4G : B1/2/3/4/5/7/8/12/13/14/17/18/19/20/25/26/28 /38/39/40/41/42/43/48/66/71- 2G : 900/1800/850/1900
Data Rates	6GHz: 802.11a/n/ac/ax (WIFI 6E) >160MHz — up to 2400 Mbps; 5GHz: 802.11a/n/ac/ax >20MHz, 40MHz, 80MHz — up to 1201 Mbps; 2.4GHz: 802.11b/g/n/ax4 >20MHz — up to 286.8 Mbps
Interface	USB Type C Connector (USB 3.1) Docking Connector (Charging) Rear 10-pin connector

5G CPE

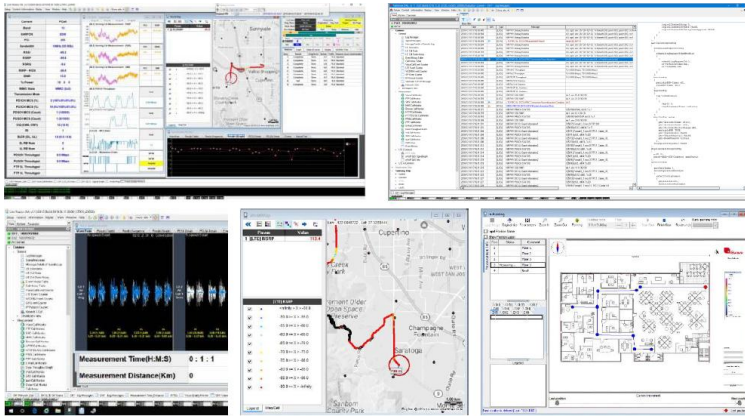
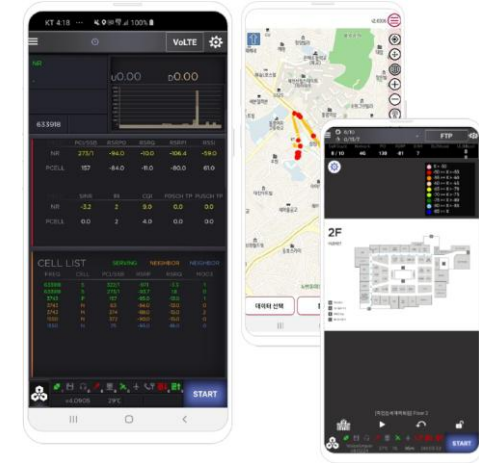
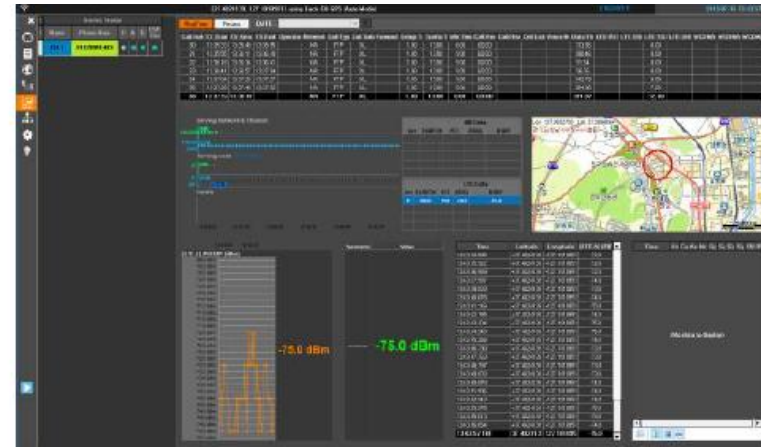
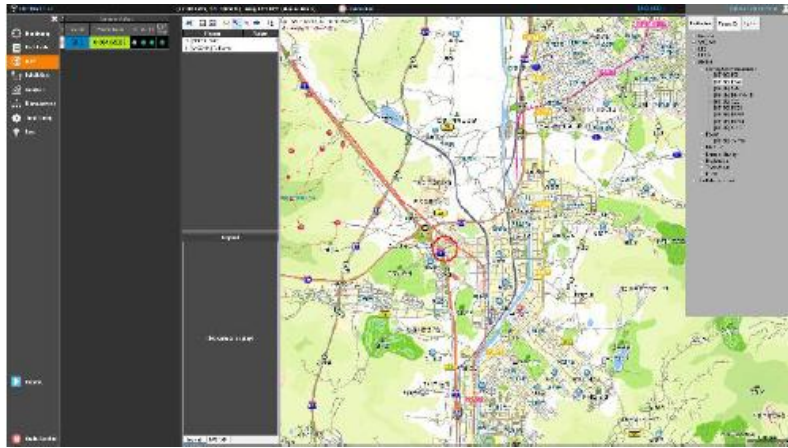


[Compal CAT Q10]

- 5G Mobile Internet Hotspot
- Receives 5G frequency as input and converts it to WiFi
- Better performance than existing Tethering

Item	Specification
Cellular Connectivity	5G, 4G LTE (Cat 19)
EMEA / Rest of world	5G: n1, n2, n3, n5, n7, n8, n12, n20, n25, n28, n34, n38, n39, n40, n41, n48, n77, n78, n79 4G: B1, 2, 3, 4, 5, 7, 8, 12, 17, 18, 19, 20, 25, 26, 28, 34, 38, 39, 40, 41, 42, 43, 48
Rugged	IP68 DUSTPROOF + WATERPROOF, MIL-SPEC 810H, DROP TESTED
Dimensions	127.8 x 80.8 x 26.3mm
Weight	~280g
Battery	User swappable 5300mAh Li-ion Battery, 10 hours usage, 1000 hours standby Usables as an emergency power bank
WiFi	WiFi 6, 802.11 a / b / g / n / ac / ax 2x2 MIMO Connect up to 32 client devices Security modes supported: WPA-PSK, WPA2-PSK Support for private networks
Chipset	MTK 5G T750

CELL PLANNING



- Cell Planning Using Professional Measurement Tools for Efficient System Configuration
- Automatically collect/parse measurement results and DM Logs in real time to analyze where and why service quality deteriorates
- Various quality measurements such as smartphone (Android) voice calls, data calls, etc.

- USIM : Universal Subscriber Identify Module
- Small Cell : A miniature radio access point

- Network Slicing : A network architecture that enables the multiplexing of virtualized and independent logical networks on the same physical network.

MANAGEMENT

Network Management



- Real-time terminal UE status monitoring
- Automatic status reporting and alarm
- Data visualization
- Various widget functions such as capacity and ping check
- Data Collection: SNMP, IPMI, etc.
- Supported OS: Window, Linux , Mac OS, etc.
- Network status alarm
- PDU Session monitoring

Subscriber Management

Num	IMSI	APN	IPv4	SST	SD
1		FLECTORY		1	
2		FLECTORY		1	
3		FLECTORY		1	
4		FLECTORY		1	
5		FLECTORY		1	
6		FLECTORY		1	
7		FLECTORY		1	
8		FLECTORY		1	
9		FLECTORY		1	
10		FLECTORY		1	
11		FLECTORY		1	
12		FLECTORY		1	
13		FLECTORY		1	
14		FLECTORY		1	
15		FLECTORY		1	
16		FLECTORY		1	
17		FLECTORY		1	
18		FLECTORY		1	
19		FLECTORY		1	
20		FLECTORY		1	

- User status information management
- USIM registration management

Modem Management



- Terminal setting and status information inquiry
- APN settings
- NAT/Port Forwarding configuration
- Modem AT settings

Small Cell Management

The interface shows a 'Device Monitoring' section with a table of device status. The table has columns for 'Device Name', 'Status', 'Group', 'Device Name', 'Software version', and 'VendorName'. The status is categorized into 'Service On', 'Service Ready', 'Out Of Service', and 'Disconnected'.

- Small Cell registering
- Status monitoring
- Uplink/Downlink ratio settings
- Network Slicing settings
- Tx Power control

- USIM : Universal Subscriber Identify Module
- Small Cell : A miniature radio access point

- Network Slicing : A network architecture that enables the multiplexing of virtualized and independent logical networks on the same physical network.

OPERATION STRATEGY

Flectory Private 5G System

Simplifying and miniaturizing system structure to minimize operational complexity



CASE STUDY



CASE #1

FOOD CLUSTER



CASE #2

ROBOTLAND



CASE #3

Changwon



CASE #4

Vietnam



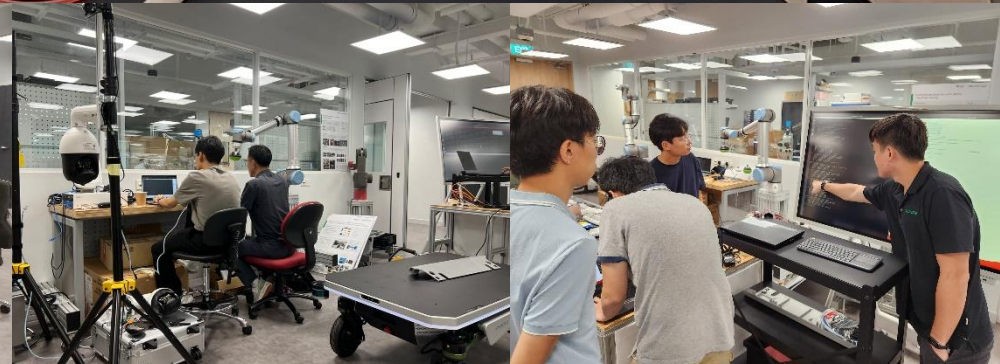
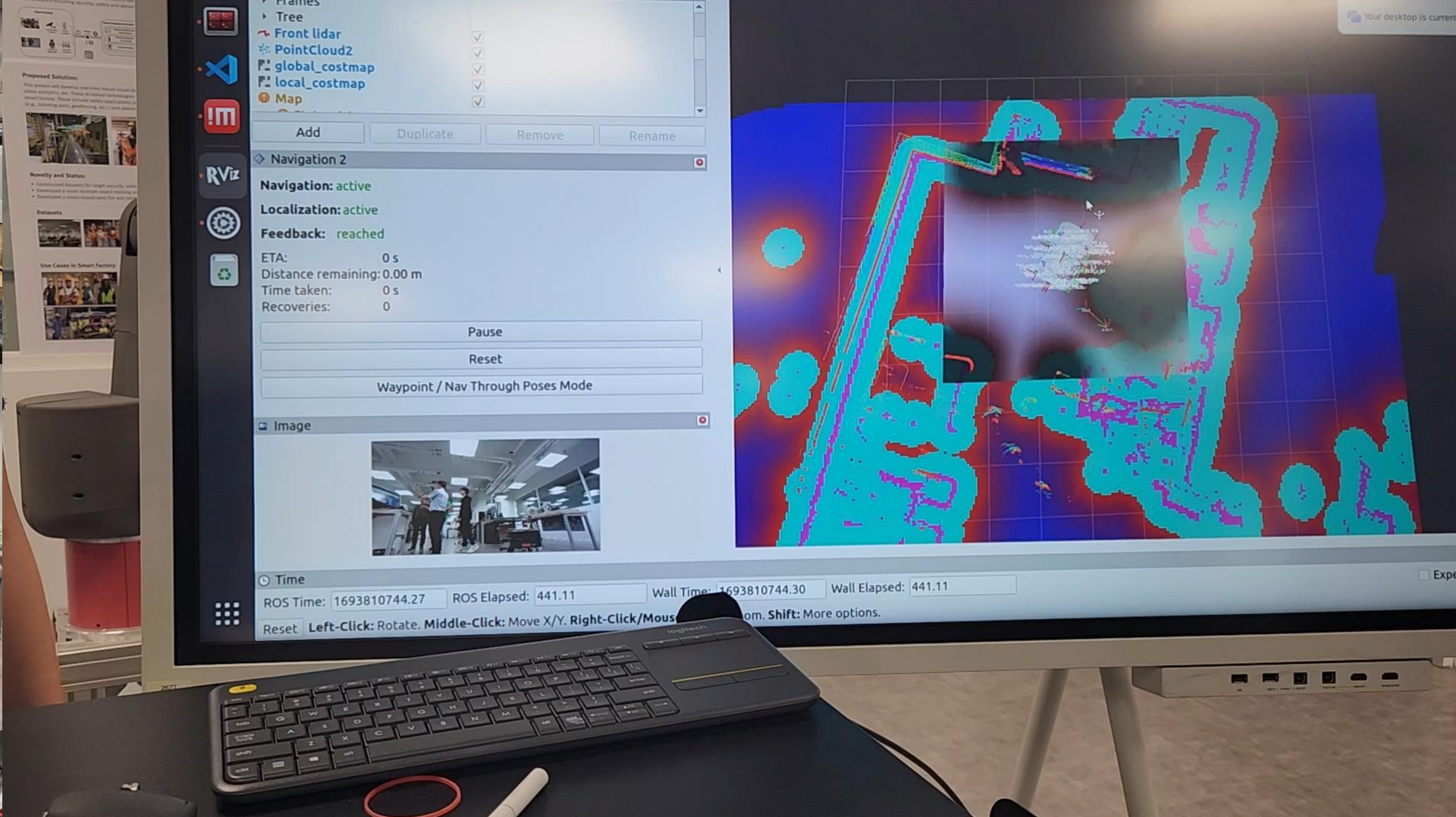
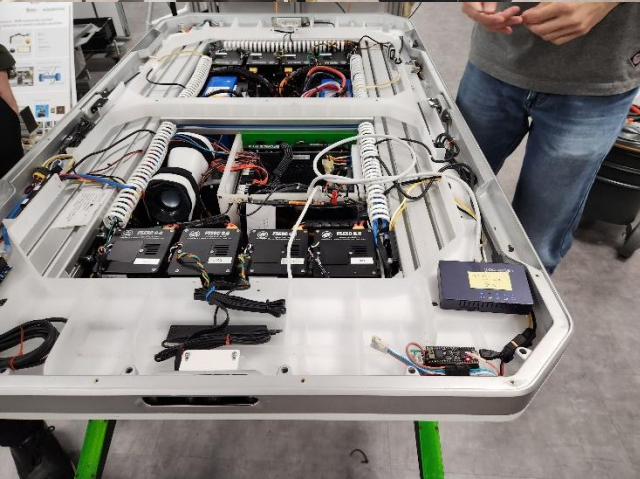
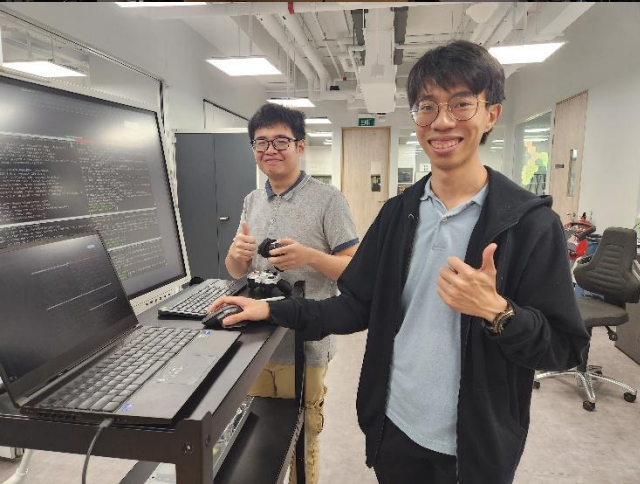
CASE #5

Taiwan



CASE #6

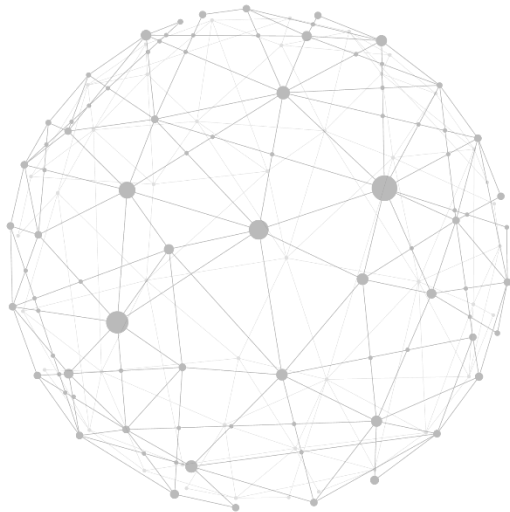
Singapore



FLECTORY

**THE NEXT
BIG THING
WILL START OUT
LOOKING LIKE A TOY**

-CHRIS DIXON





FLECTORY

FLEXIBLE FACTORY

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