

# Korea's research status on 6G security

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## 1. Korea's 6G R&D Promotion Strategy

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## 2. ETRI's 6G Security R&D

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## 3. 6G International Collaboration Project

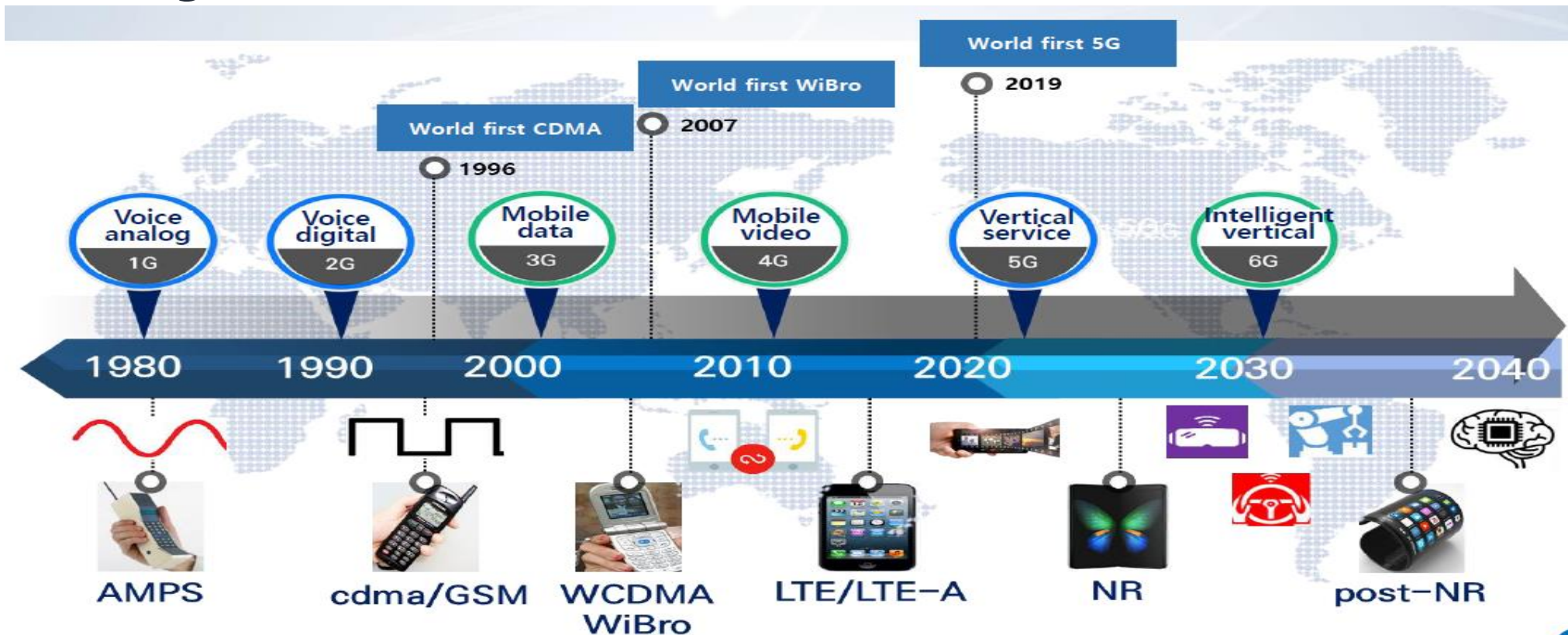
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# Korea's 6G R&D Promotion Strategy



## □ Communication Generation

Communications have become **essential infrastructure** through evolution to **voice -> mobile data -> vertical service**



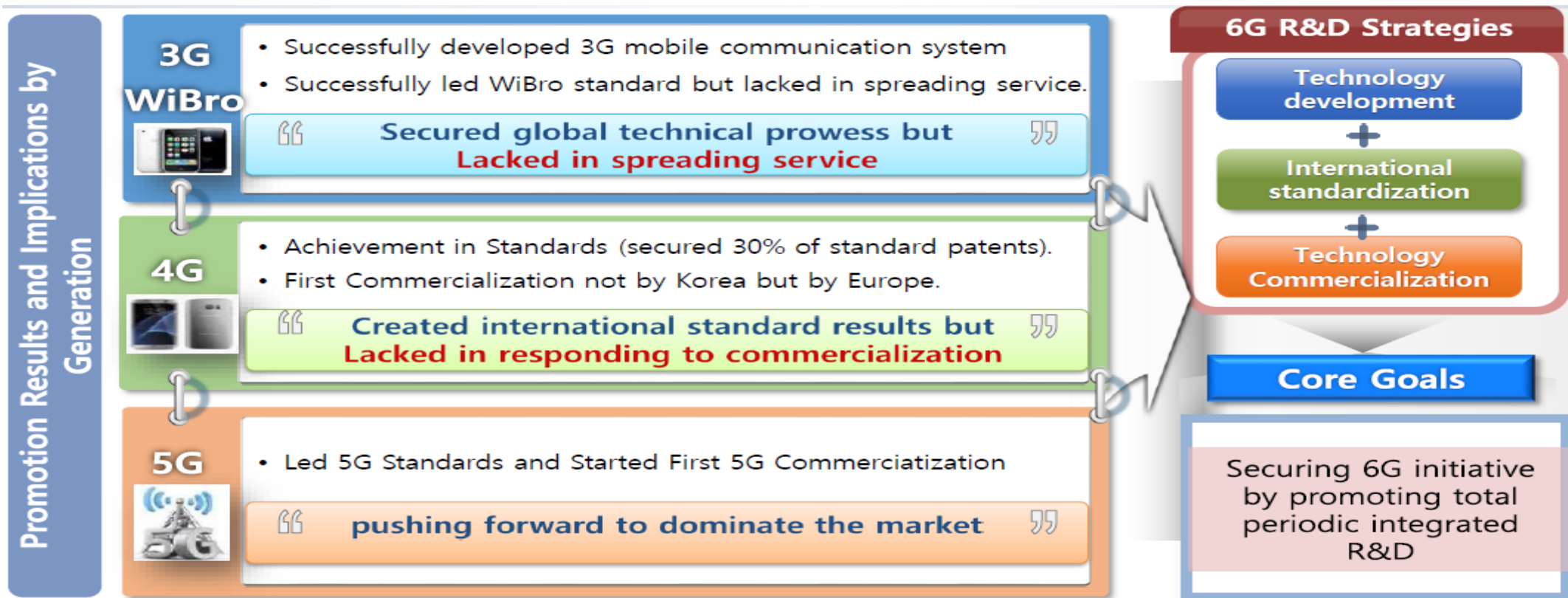
Ref: 6G core technology development, ICTC2019

# Korea's 6G R&D Promotion Strategy



## □ R&D Direction (1/2)

Leading **technology** development  
International **standardization** and technology **commercialization**



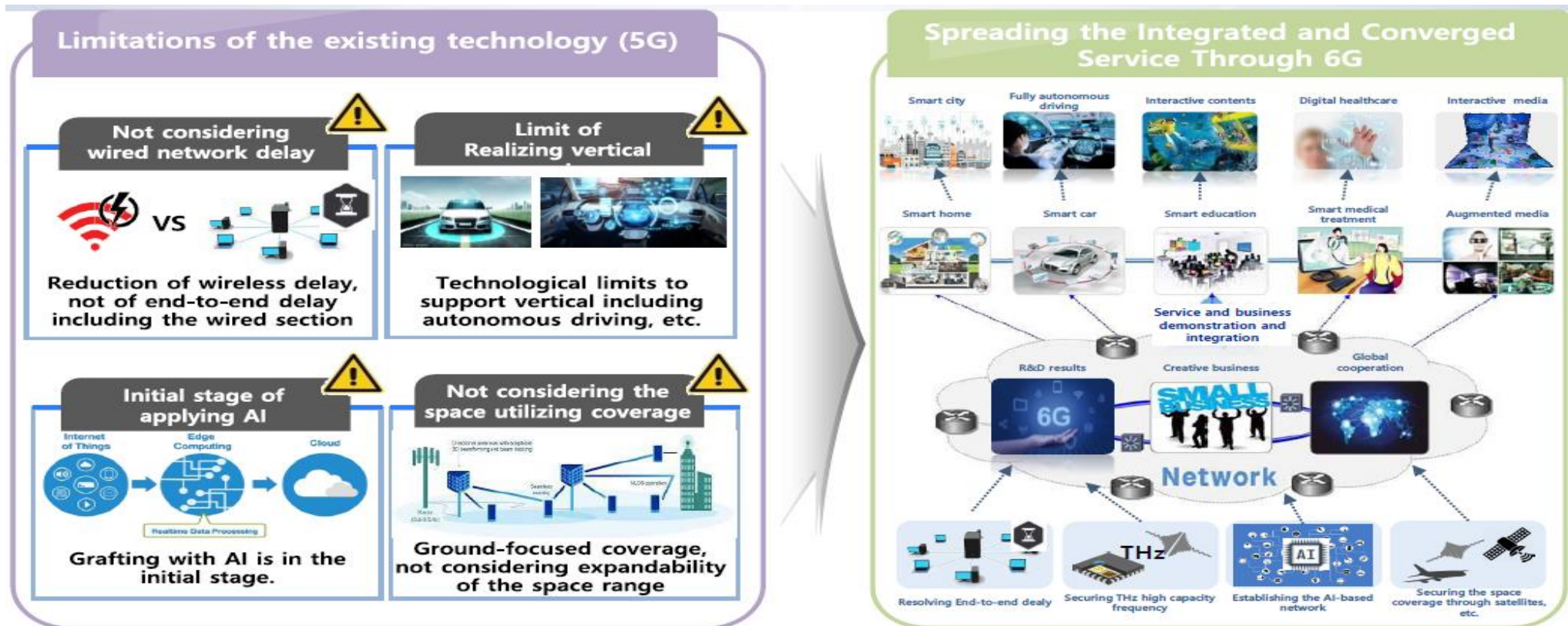
Ref: 6G core technology development, ICTC2019

# Korea's 6G R&D Promotion Strategy



## □ R&D Direction (2/2)

Overcoming **the limits** of and expanding the **application scope** of the existing technology (5G)

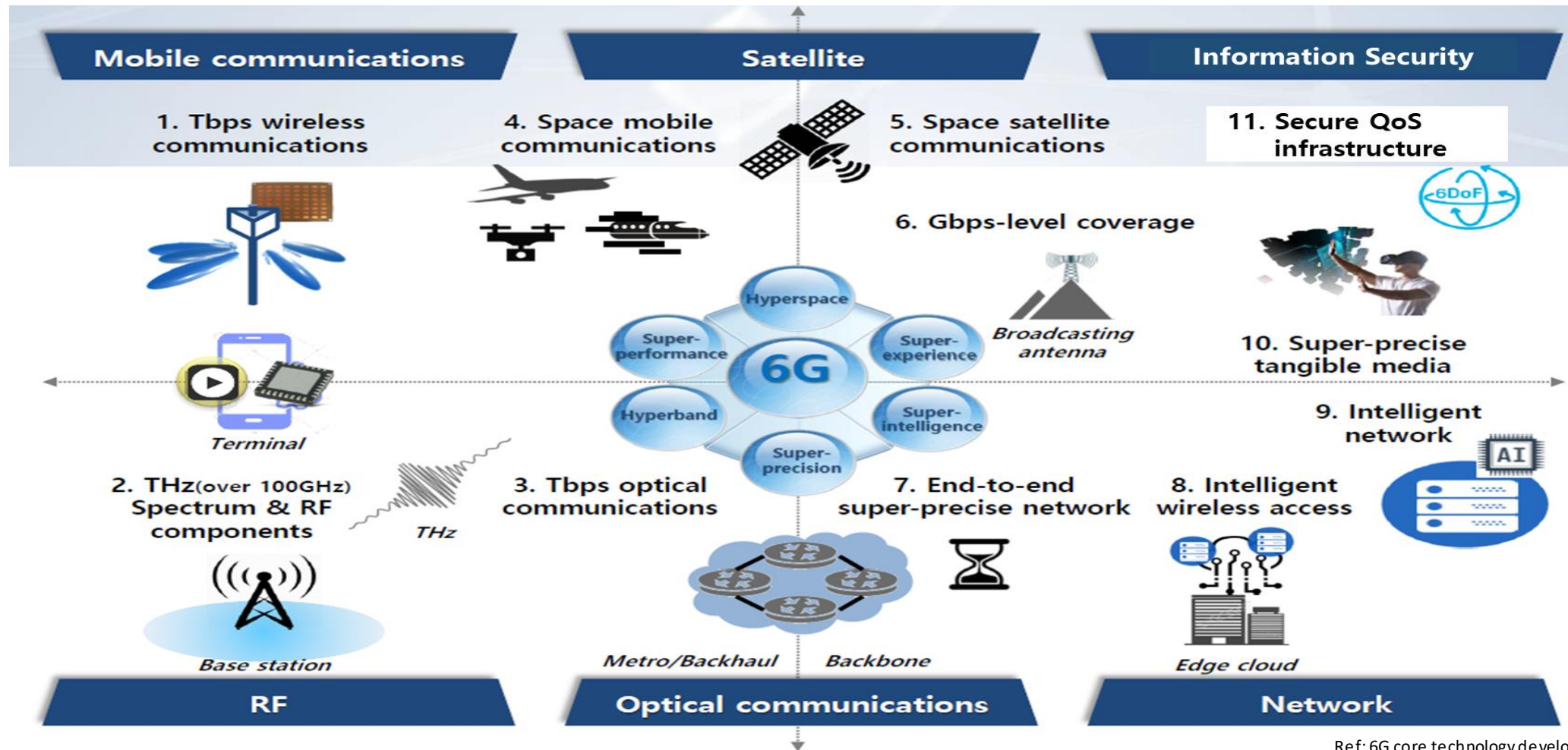


Ref: 6G core technology development, ICTC2019

# Korea's 6G R&D Promotion Strategy



## □ Development Scope and Targets

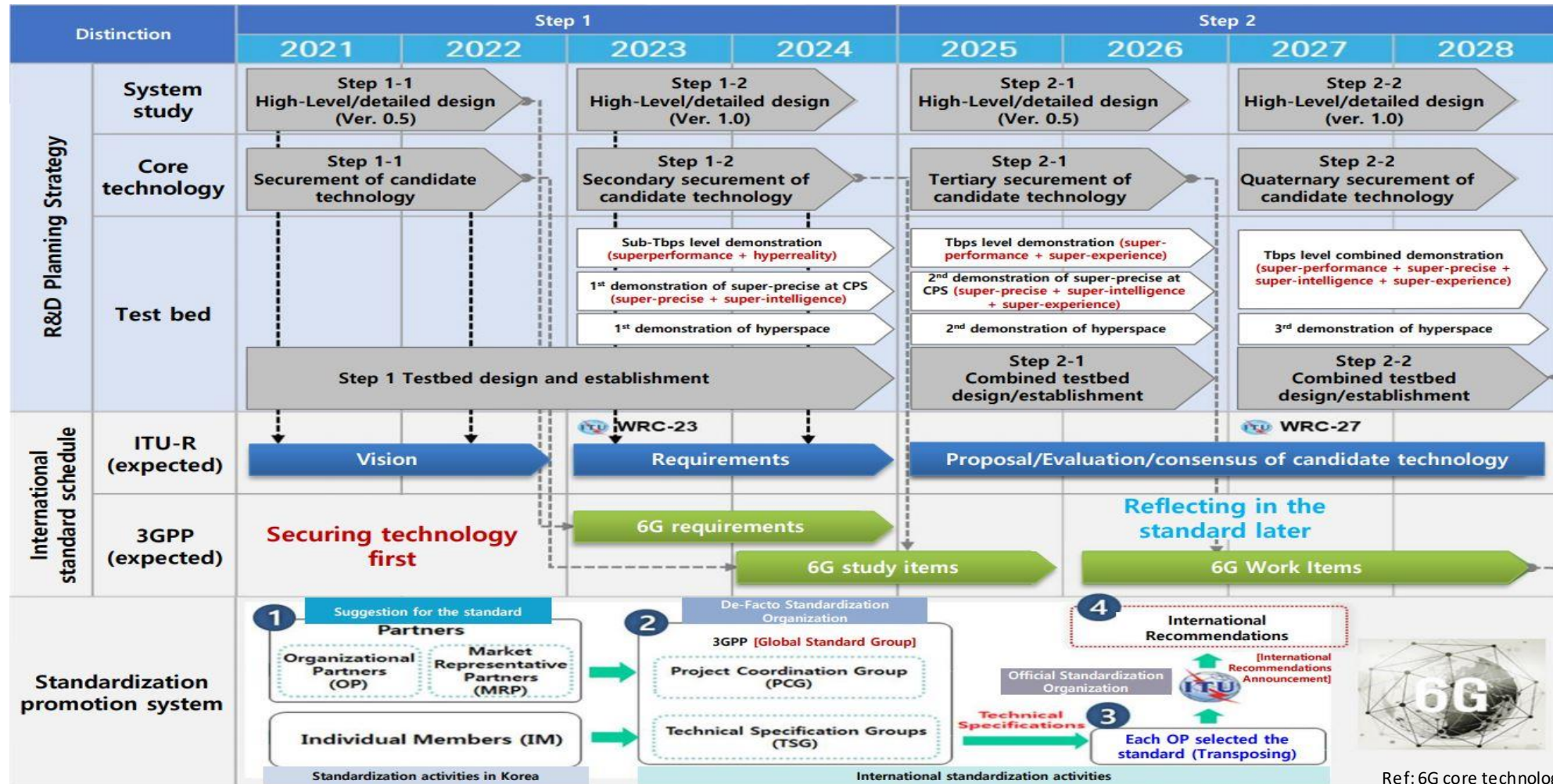


Ref: 6G core technology development, ICTC2019

# Korea's 6G R&D Promotion Strategy



## □ Leading International Standardization



Ref: 6G core technology development, ICTC2019

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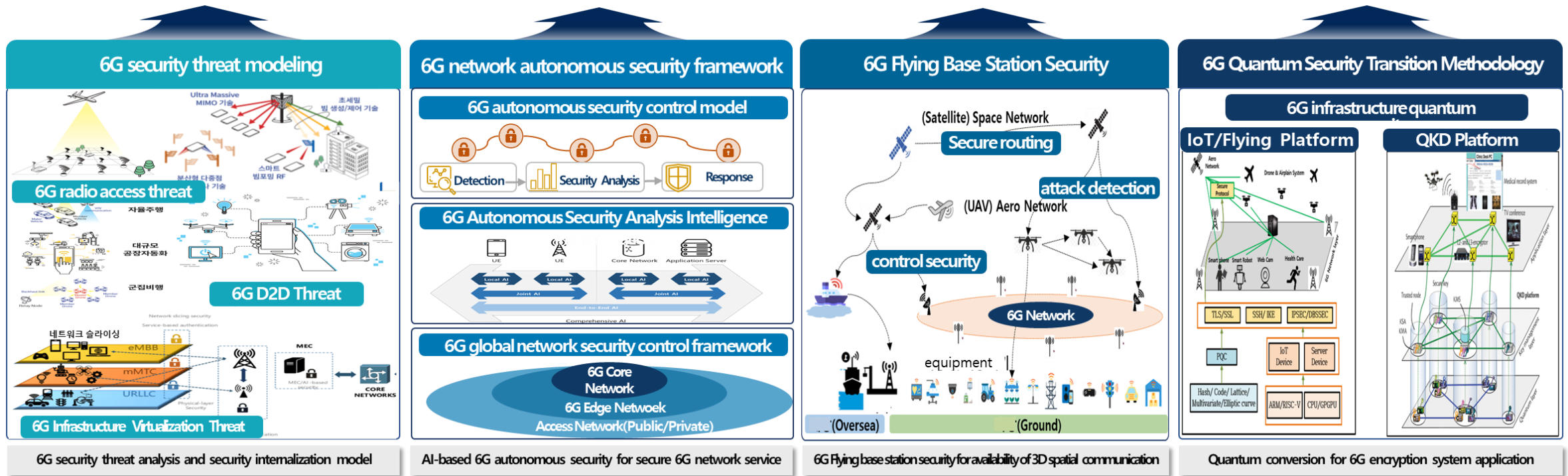


# 5G/6G Security R&D Activities



## □ Research on 6G autonomous Security-by-Design technology to guarantee constant security of quality

- ▶ Pursuing technical definition and underlying technology that enables security to be internalized throughout 6G infrastructure



## □ Research on 6G security threat modeling

- ▶ **(6G wireless access)** PHY layer technology analysis and security threat modeling
- ▶ **(Ultra-Density 6G D2D Communication)** MAC/Network Layer Security Technology
- ▶ **(6G infrastructure virtualization)** End-to-end network slicing and MEC security threat modeling

**Reconfigurable Intelligence Surface**

One element: Passive patch (sub- $\lambda$ -sized), Switch (e.g., diode), Programmable controller.

Means of reconfigurability: 1) Tuning impedances, 2) Tuning length of delay lines, 3) Phase-shifters.

Complete lack of authentication for RIS units!

RIS's reflection configuration can be leaked!

• 6G wireless access security threat modeling

**Secrecy Capacity**

Suppose that the CSI  $G, H$  are known to all the secrecy capacity turns out to be

$$C_s = \underbrace{\log(1 + |H|^2 P)}_{C_r} - \log(1 + |G|^2 P)_+$$

where  $[a]_+ = \max(0, a)$

Useful for protecting unencrypted & unauthenticated control messages?

Useful for providing confidentiality for large number of devices in D2D setting?

• 6G D2D communication MAC/network layer security threat modeling

• GW-U reselection to GW-U2

Central Cloud: MME, MEAO, MEPM, GW-C

UE Release

Edge Cloud 1: MEC App Server, MEP, GW-U1

Edge Cloud 2: MEC App Server, MEP, Encrypted Subscriber Info, DNS, GW-U2

MEC App @edge 1, Idle State (UE released), Edge resel. GW-U2, MEC App @edge 2

IP1, IP2

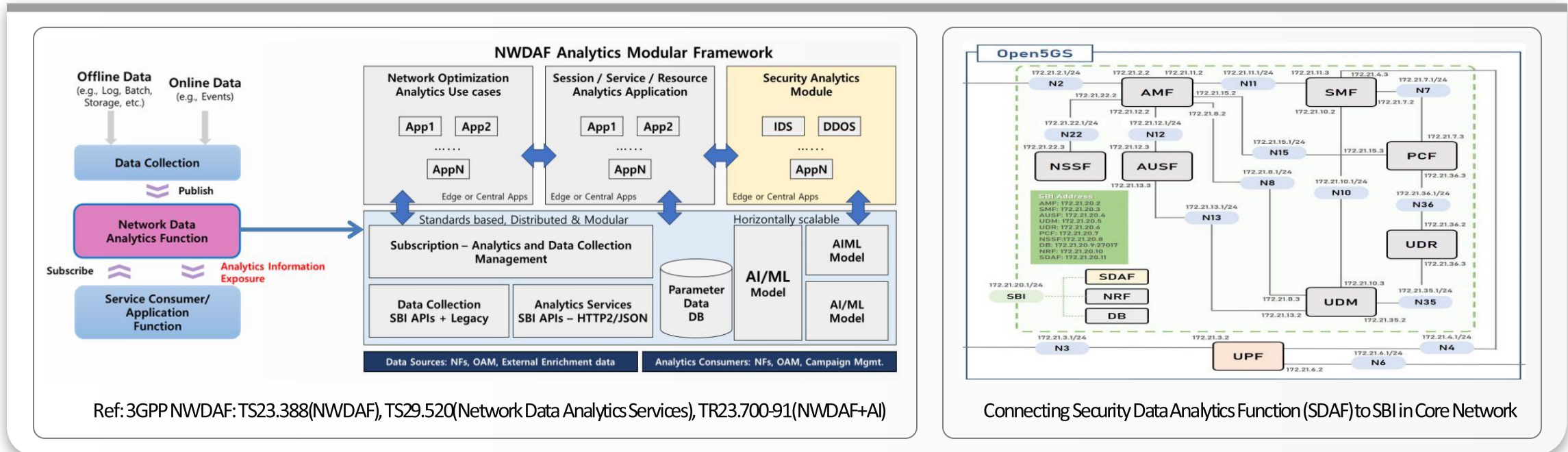
• 6G infrastructure virtualization security threat modeling

# 5G/6G Security R&D Activities



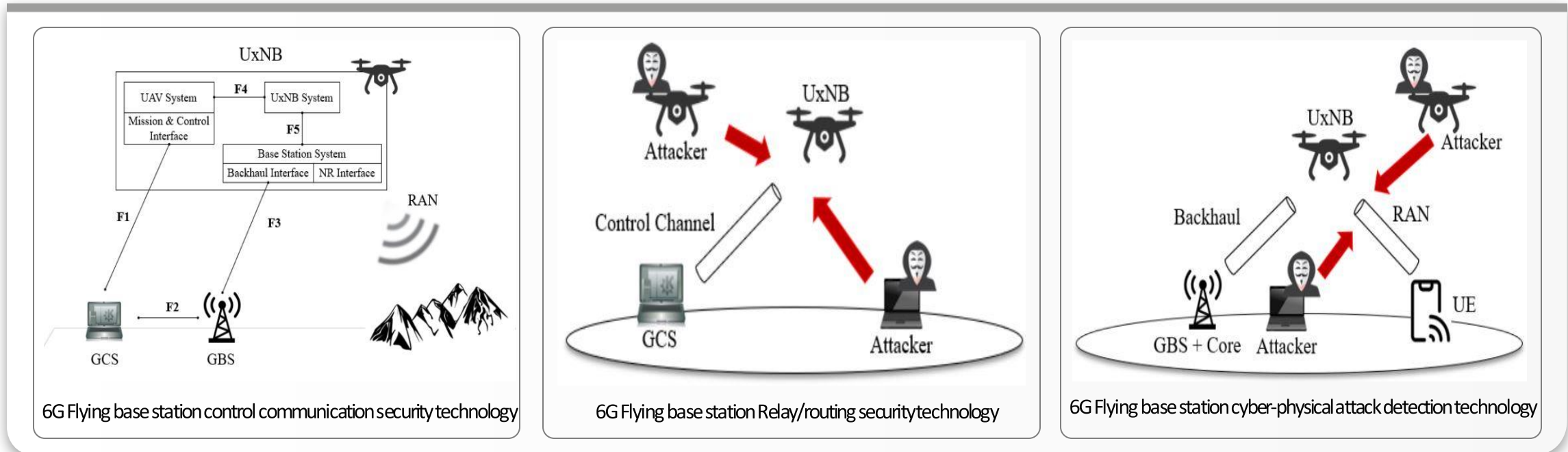
## □ Research on 6G network autonomous security framework

- ▶ **(Autonomous security control)** AI-based autonomous security control internalization technology
- ▶ **(AI security analysis function)** AI network-based 6G security analysis internalization technology
- ▶ **(PoC and standardization)** Development of PoC environment and International/domestic standard



## □ Research on 6G Flying Base Station Security

- ▶ **(Control security)** 6G Flying base station control communication security technology
- ▶ **(Routing security)** 6G Flying base stations' relay/routing security technology
- ▶ **(Attack Detection)** 6G Flying base station' cyber-physical attack detection mechanism

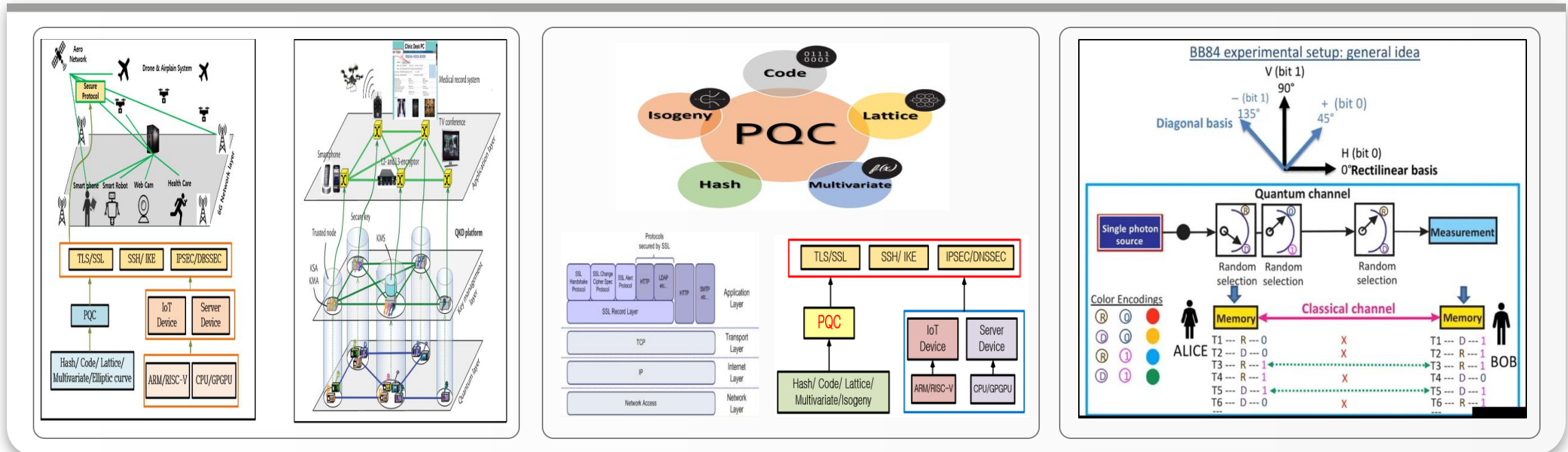


# 5G/6G Security R&D Activities



## □ Research on 6G Quantum Security Transition Methodology

- ▶ **(6G QKD conversion)** Quantum key distribution scenario study for 6G quantum security transition
- ▶ **(6G Core PQC conversion)** Quantum resistant cipher interlocking modeling within 6G Core
- ▶ **(6G Device PQC conversion)** Quantum resistant cipher interlocking modeling of wireless equipment



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# 6G International Collaboration Project



## □ Korea-Finland collaborative research on 6G Security-by-Design and standardization-based International cooperation




### ETRI



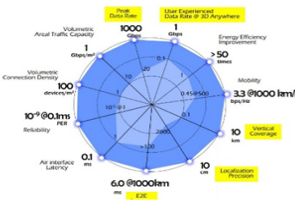
**6G**

- 1 6G Security-by-Design Use Case
- 2 6G-based trust network modeling
- 3 6G Security Standardization and Cooperation

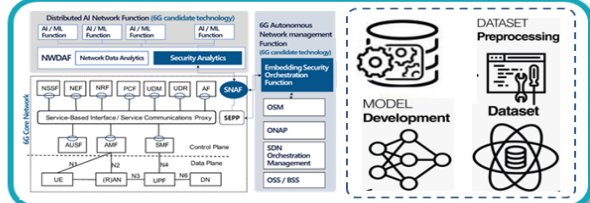


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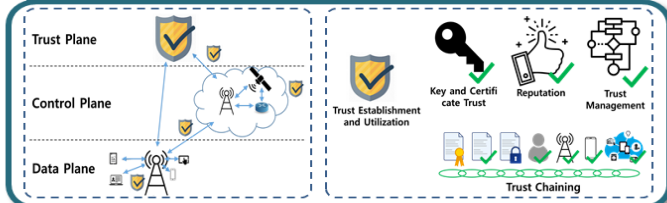
- I 6G Intrusion Detection Use Case and Dataset
- II 6G Trust Network Model and Privacy Protect
- III 6G Collaboration on Global Standardization




#### 6G security internalization and dataset

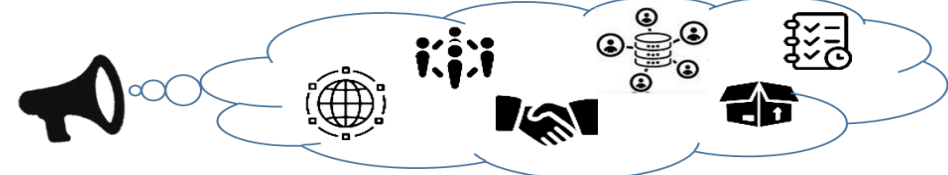


#### Trust Network Model




#### International standardization





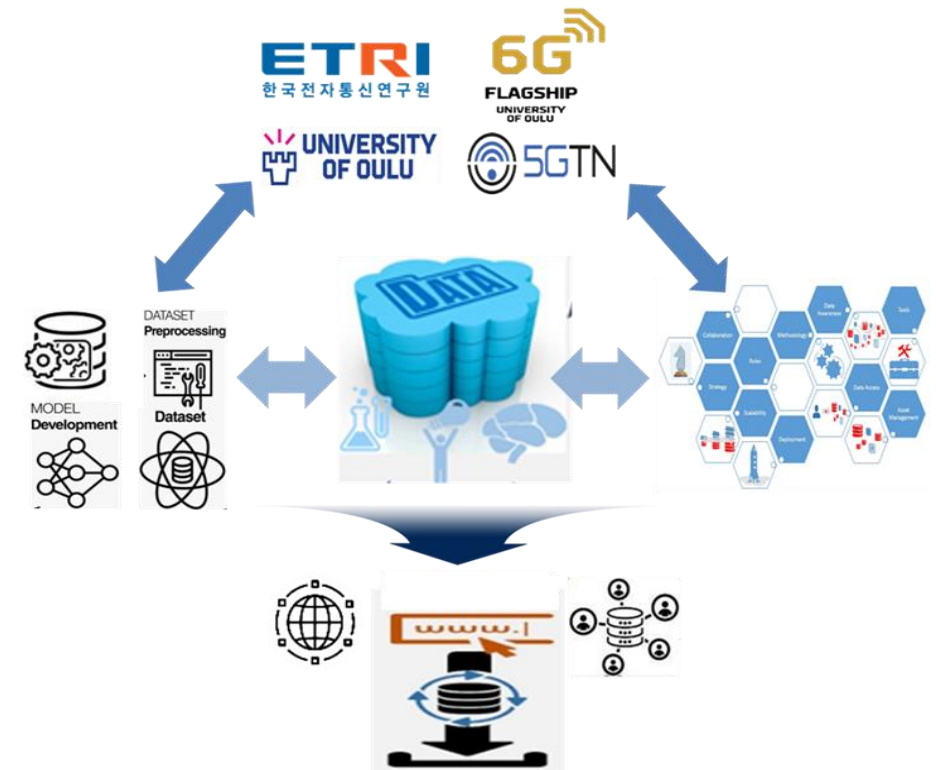
International cooperation to disseminate 6G security research results

< International forums, conferences, symposiums, workshops, etc. >



## □ (6G Security-by-Design) Developing the use cases and security datasets for embedded security in 6G network

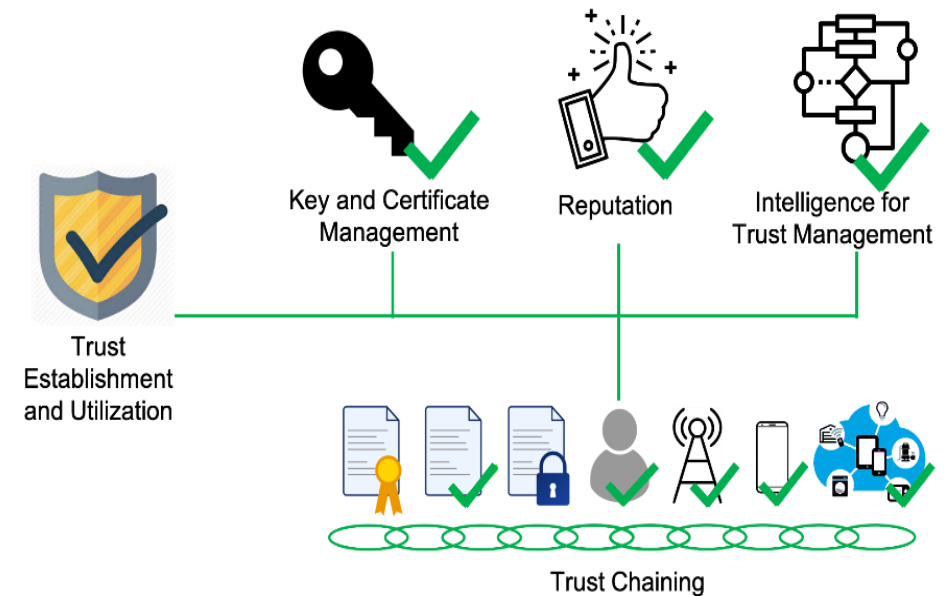
- ▶ Defining the concept of security-by-design according to the applicable security methods for the 6G network
- ▶ Developing the use cases and intrusion detection datasets for automated AI based security operations in next generation mobile networks





## □ (Trust Network Model) 6G network security architecture models on the embedded trust for 6G security

- ▶ Modeling trust network, analyzing the foundational technologies and requirements for enabling trustworthy networking in 6G
- ▶ Developing the security mechanisms for establishing, utilizing, and managing trustworthy networking based on credentials and reputation
- ▶ Privacy preservation and requirements in 6G networks



## □ (Standards) Collaboration on global standardization

- ▶ Collaboration on proposal of the international standardization items and new technology report about 6G security technology
- ▶ (Dissemination) Bilateral collaboration for sharing, promotion and dissemination of joint research project outcomes



< International forums, conferences, symposiums, workshops, etc. >



ITU Workshop on Security for 5G and beyond  
(Geneva, Switzerland, 22 August 2022)

# Thank you

