Institute of Information
& Communications
Technology Planning & Evaluation

Network Innovation and the Future of Digital Transformation

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Contents

I

The Sophistication of Digital Transformation and the Role of Networks

01 Innovation process of wired & wireless networks

“Networks have evolved through expanding and refining space, speed and connectivity”

Network

- Space
- Speed
- Conn-ectivity
- Latency

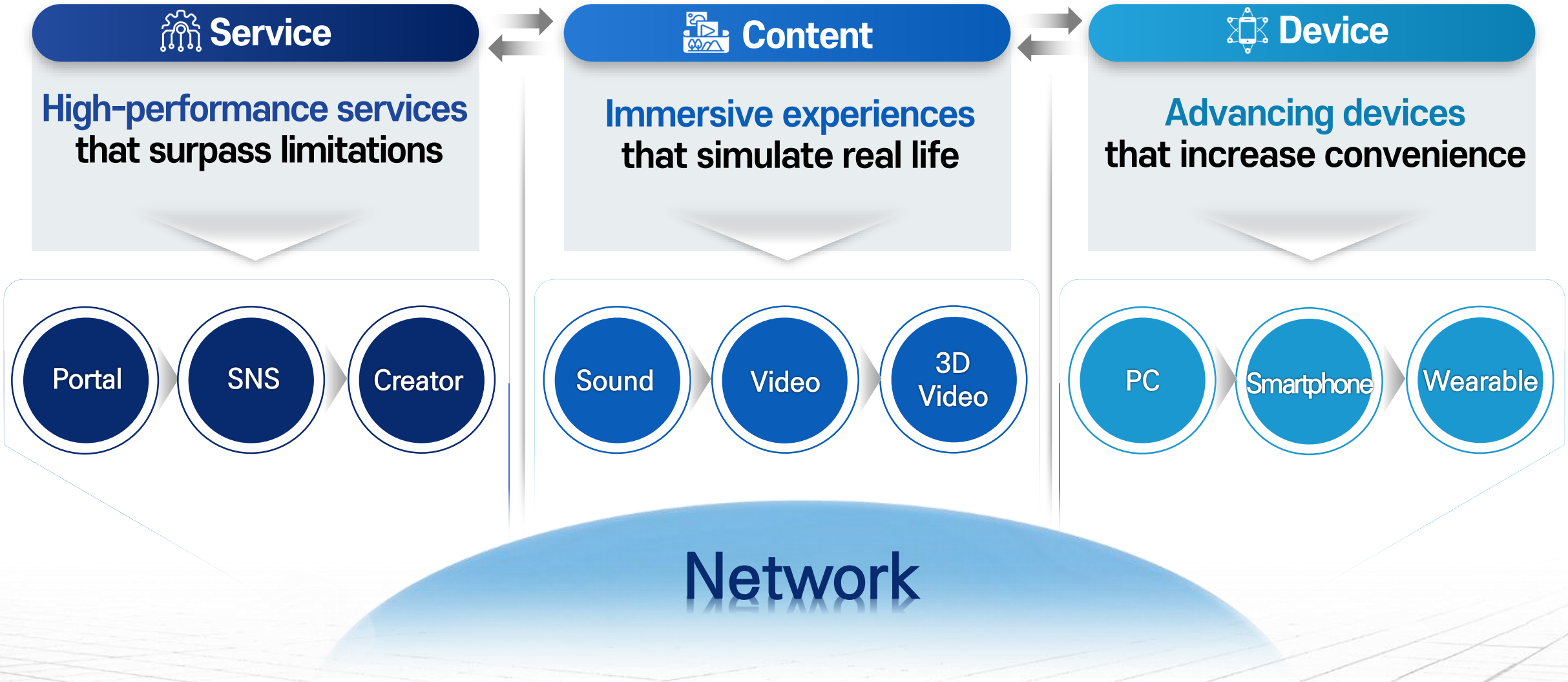
wired → wireless ⇢ satellite

wired	~56k	PSTN 1980s	~128k	ISDN Early 1990s	~52M	VDSL, HFC Late 1990s	~1G	FTTH Early 2000s	~10G	SDN, NFV 2010s
wireless	~2k	1G Year of 1983	~64k	2G 1991	~2M	3G 2001	~100M	4G 2009	~1G	5G 2019

Analog Voice	Digital Voice	Mobile Data	Mobile Video	Convergence Service
			2.1billion (2013)	19.8 billion (2023)
			10ms	1ms

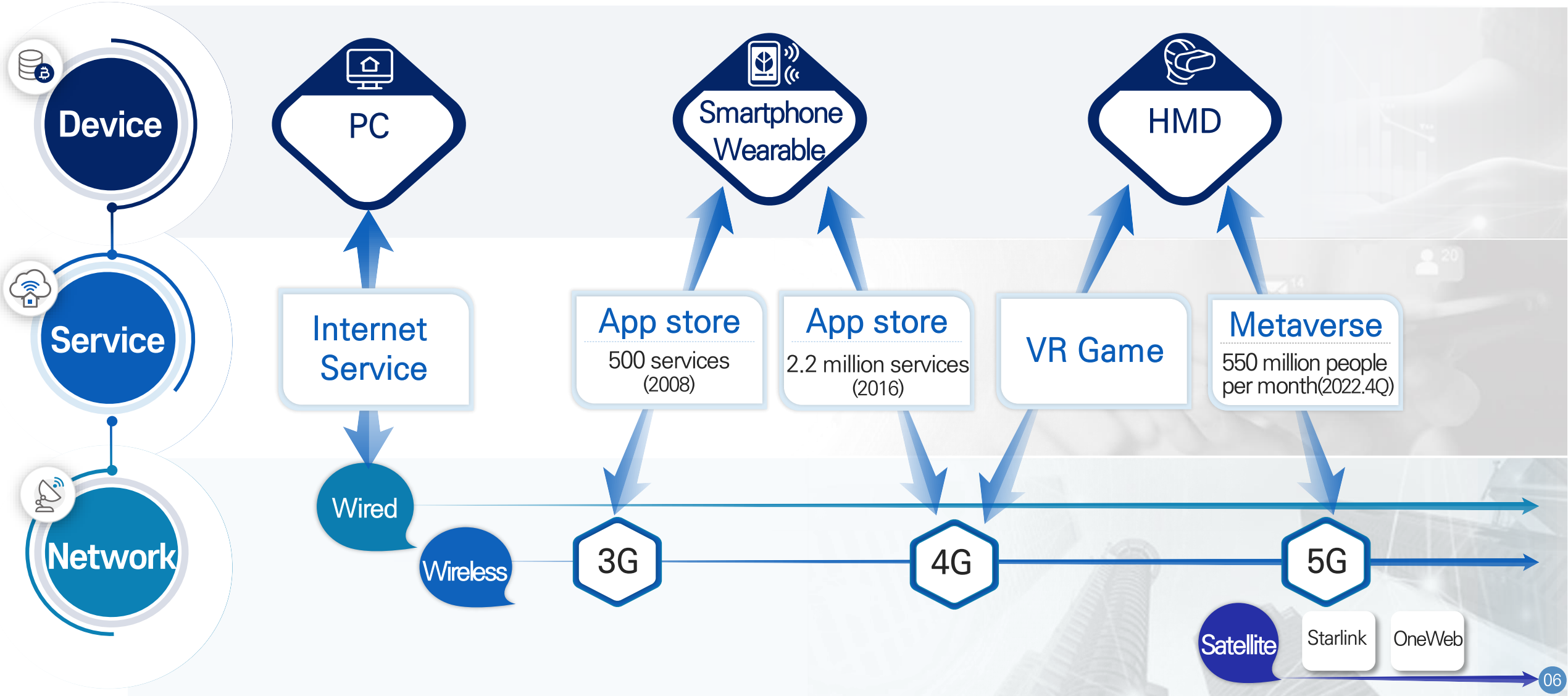
02 The significance of networks in the digital ecosystem

"Networks are enablers of digital innovation"



03 Networks, the starting point for digital innovation

“Evolving through interaction with devices and services”



04 The impact of networks

“The expansion of the digital economy and the core foundation of reshaping society”

Expanding of the digital economy

Creating & growing new industries

1. **Autonomous vehicles**
   with V2X for ultimate safety
2. **Autonomous cooperative robots**
   with precision control & mobility
3. **Digital manufacturing**
   maximizing productivity in advanced inds.
4. **Intelligent home**
   integrating & operating various smart devices

Reshaping SOC across society

Enhancing quality of life

Healthcare
Precision health care

Education
Immersive education

Transportation
Intelligent transportation systems

Safety
Digital safety nets

05 The foundation for digital co-prosperity

“Establishing a new digital order for co-prosperity pursued by the global society”

The Digital Bill of Rights

01	02	03	04	05
Guarantee of freedom & rights	Guarantee of fair access & equitable opportunity	Building safety & trustworthiness	Promotion of digital innovation	The well-being for all humankind

Network accessibility + Fair utilization of networks

Networks are shared values for humanity, enabling the realization of digital rights

II

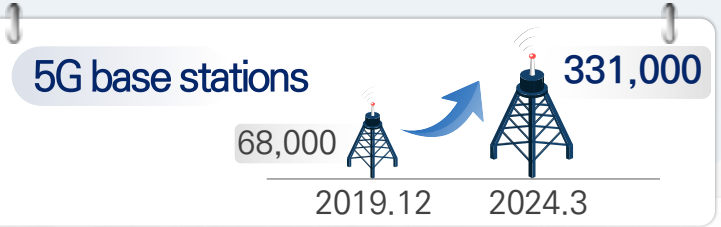
Features of Network Innovation

01 Why is network innovation so challenging?

“With features of Large Scale & Periodicity, demanding a high level of Reliability”

Large Scale

- Infrastructure on a national scale
- Considerable time for the diffusion of innovation



Periodicity

- Innovation through generational transitions

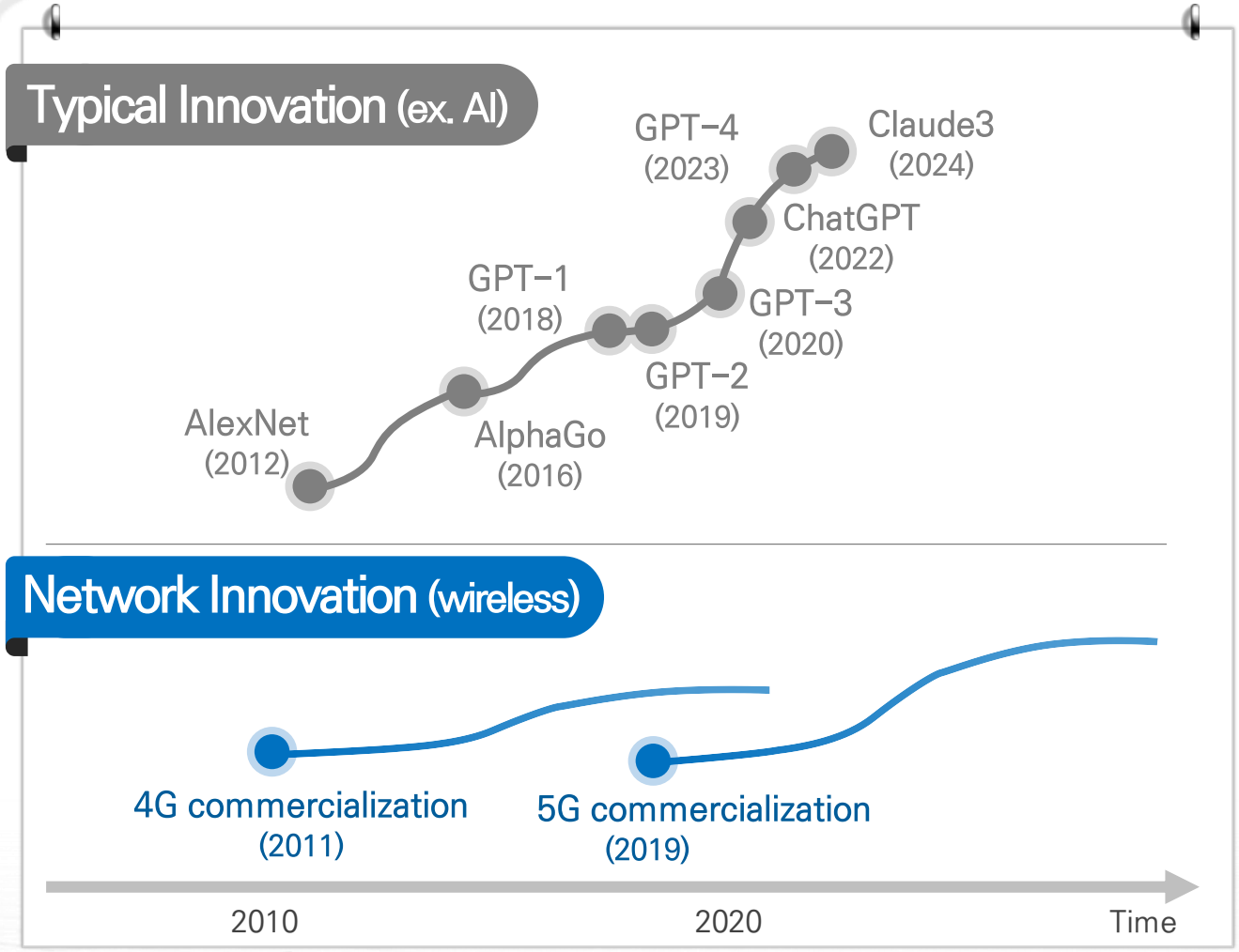
3G → (8 years) → 4G → (10 years) → 5G

Reliability

- Network security
- Network safety assurance

Interlinked with service innovation

02 Why is network innovation so challenging?



1. Elongated, “S”-shaped form
2. Generational transitions every 8 to 10 years
3. Coexisting with generations such as 4G and 5G

Solving the risks and uncertainties is the key of network innovation

Ⅲ

Korea's Network Innovation Process

01 Korea's network development

“Achieving the highest global levels in broadband and mobile”

Wired

PSTN (Year of 1984) → ISDN (1993) → VDSL (2002) → FTTH (2005)

Wireless

1G (Year of 1984) → 2G (1996) → 3G (2003) → 4G (2011) → 5G (2019)

2G CDMA	5G	5G Subscription rate	5G Quality evaluation
World's first Commercialization	**World's first Commercialization**	**#1 in the world**	**#1 in the world**
(1996.1)	(2019.4)	36.4% (OMDIA, 2023.9)	(Opensignal, 2023.12)

02 How was it possible to overcome challenges?

“ Effective interaction between R&D, telecom. competition & demand development ”

03 Proactive R&D and pilot projects

“Reducing risks and improving completeness, through R&D and pilot projects”

R&D

Wire-less	5G systems, etc
Wired	Optical transceiver, etc
Radio Satellite	Satellite multiple access, etc

Testbed

Test environment

- 5G commercial network level

Convergence service & O-RAN

- Core network, terminal
- O-RAN equipment

Leading network

National network

- 5G national network
- Disaster safety comm. network

Research network

KOREN

Pilot project

GIGA KOREA Project (2013~20)

Giga network & content, etc.

Investment of B$4.2

Pyeongchang Olympics (2018.2)

04 Network expansion through telecom. competition policy

“Implementing facility-based competition first, and service-based competition later”

Facility-based competition

Government
- Nationalize (1981)
- Privatize (2002)
- kt
- Wired
- Wire-less
- Mobile

New local telephone operator
- Select (1997)
- M&A (2005)
- SK broadband
- SK telecom
- Mobile

Electric power company (KEPCO)
- Privatize (1999)
- (72,504km)
- LG U+
- Mobile

Service-based competition

MVNO

Penetration rate **19.1%**

16.27 million people

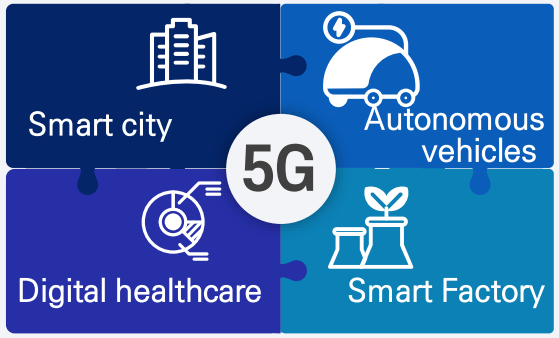
(2024.2)

05 Demand development to attract innovative networks

Supporting for demand development

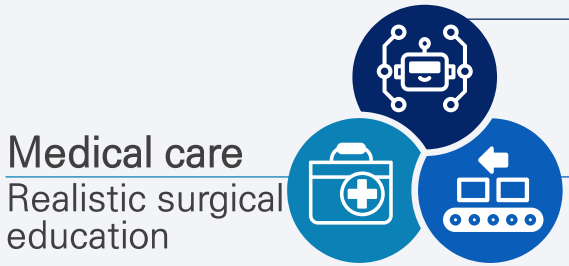
5G

Convergence services

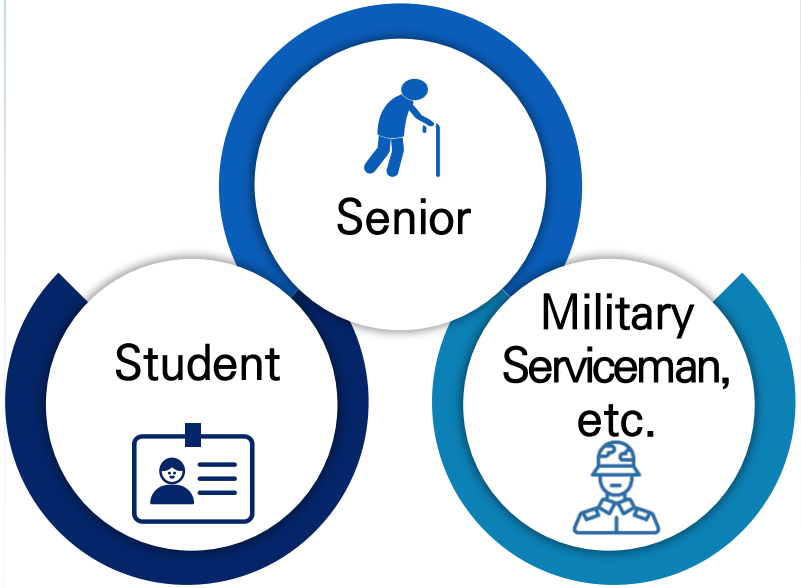


Private 5G

31 private operators, 59 sites (2024.3)



Enhancing service utilization



Creating a positive feedback loop of network innovation

Ⅳ

Prospects for the Future Networks

01 Future technology prospects for networks

Tech Direction

Networks tailored to services, etc.

Open
Radio access Net., etc.

Efficient distribution of network resources, etc.

Power reduction of network equipment, etc.

Competitive Structure

Legacy

HW-centric

Equipment vendors VS Equipment vendors

Future

SW & Platform-centric

Equipment vendors VS SW & Platform Enterprises

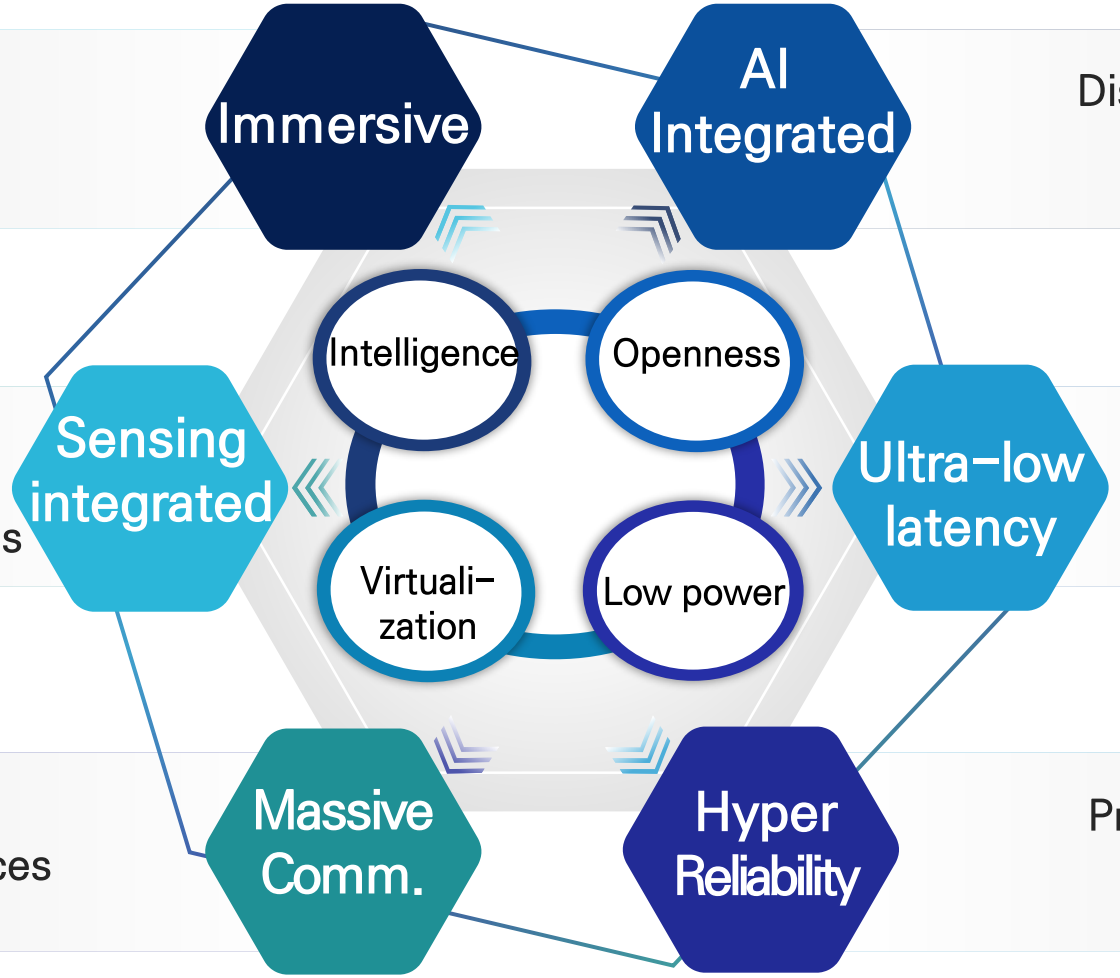
02 Role of future networks in the era of digital sophistication

“AI + Network, accelerator of digital transformation”

Immersive services in urban & rural areas

Multidimensional sensing-based spatial information services

Massive device & sensor connectivity-based services



Distributed computing & AI-based services

High-reliability & low-latency Instant response services

Proactive response services against cyber threats

Preparing for the future network

Preparing Next-gen network technologies to lead the future

6G — Parallel R&D for core & commercialization tech.

6G Extreme massive MIMO

Highly integrated & efficient

192 → Antenna element x10 → 2,000 ↑

Cloud-Native

Virtualization + Automation + Modularization + Lightweight

· Mobile Core Network ·

AI-Native

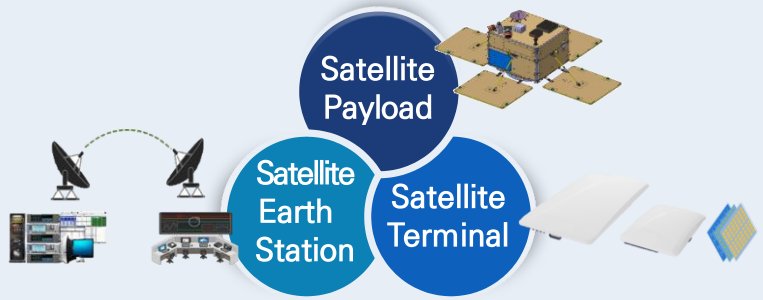
Base Station + Mobile Core

AI Semiconductor

AI Technologies

Satellite — Hyperspace service preparation

Global Standard-based LEO

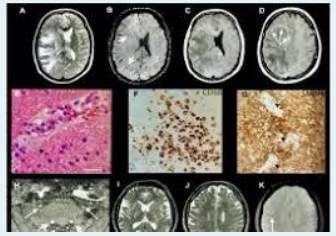


Quantum — New challenges for network: quantum technology

QKD(size ↓, distance ↑) ➡ Quantum Network

Non-satellite Navigation

Quantum MRI



Quantum Microscope

Preparing for the future network

“Preparing innovative technologies for network advancement”

Evolving O-RAN

Openness — Open interfaces between RAN nodes

Softwari-zation — SW & virtualization of base stations

Intelligence — AI-based radio resource management & power saving

Expanding coverage

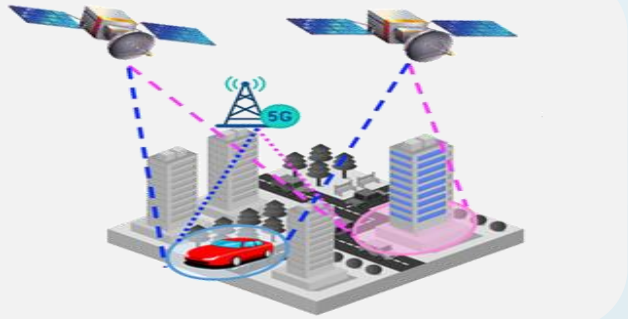
Dense Area — Intelligent low-cost small cells
* 5G NR-based open small cell tech.

In-building — In-building coverage solutions
* DAS(Distributed Antenna System), etc.

Shadow Area — Expanded connectivity (UAM, vehicle & indoor, etc.)
* RIS(Reconfigurable Intelligent Surface), etc.

Advanced Public Safety Comm.

Precise Positioning — Hybrid positioning in case of emergency
* Utilization of 5G· multiple GNSS etc.



Mobile Base Station — Flying BS & backhaul for emergency using drones, etc.

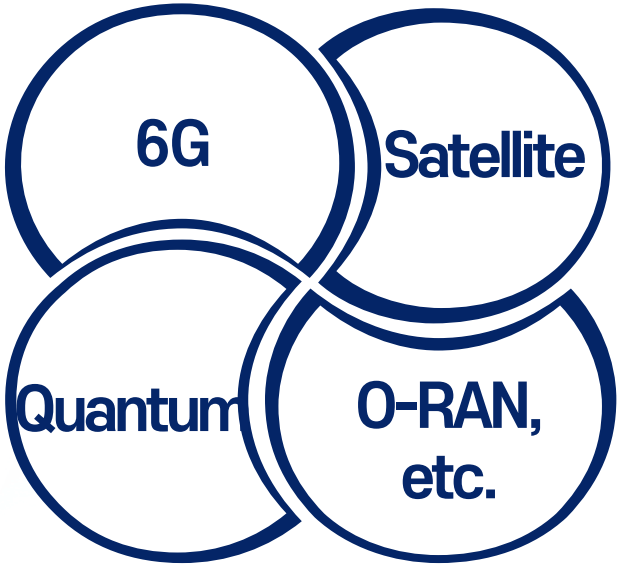
V

Direction to Move Forward Together

01 Activating a collaborative global digital ecosystem

"Innovating future network and sharing achievements through collaboration of the global society"

Conducting joint research



Supporting mutual growth

Digital Co-prosperity Society

"A dream you dream together is reality"