Beyond 5G Promotion Strategy
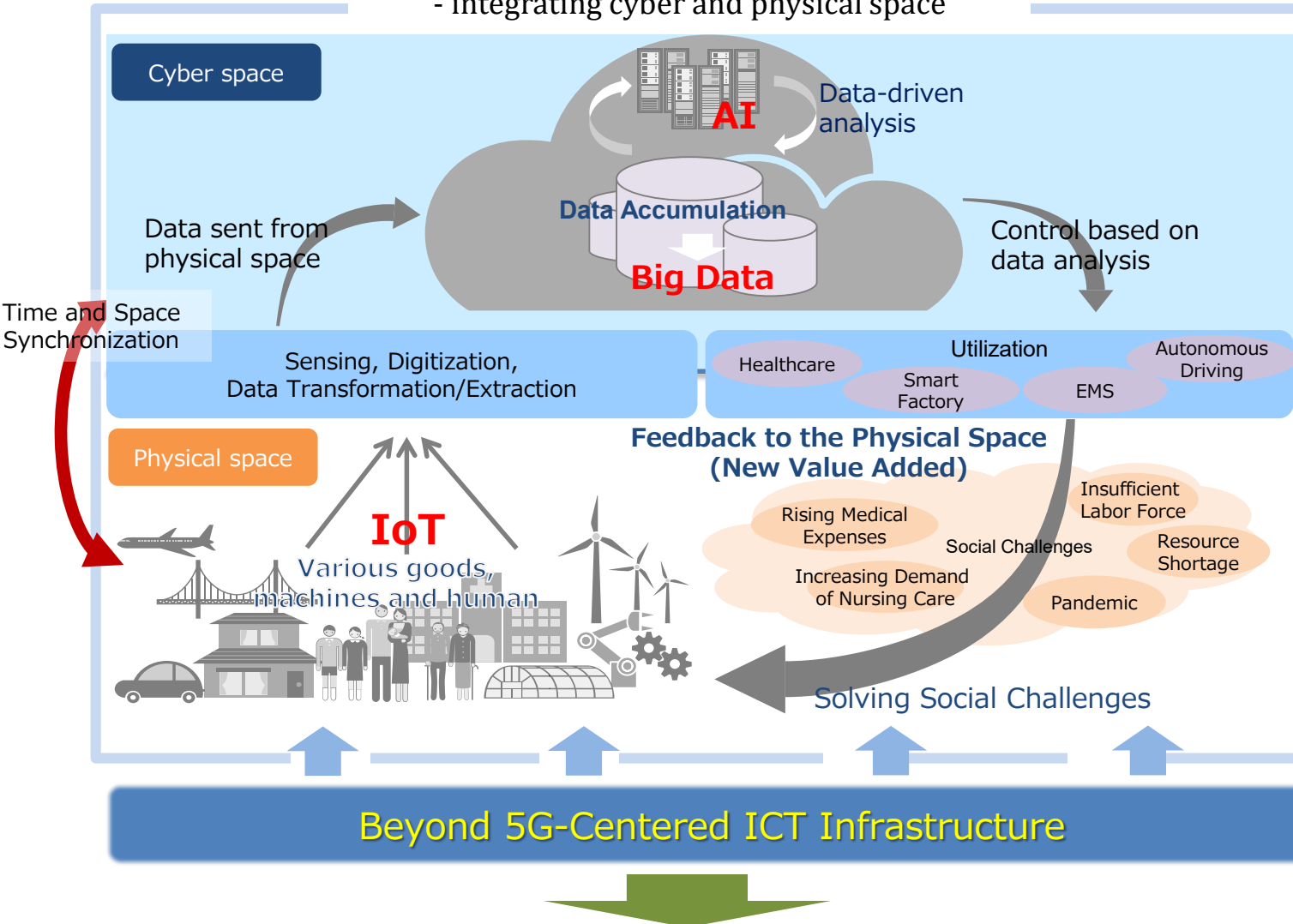
—Roadmap towards 6G—

June 2020
Ministry of Internal Affairs and
Communications, Japan

Cyber Physical System（CPS）
- integrating cyber and physical space

Cyber space

Data-driven analysis

AI

Data Accumulation

Big Data

Data sent from physical space

Control based on data analysis

Time and Space Synchronization

Sensing, Digitization, Data Transformation/Extraction

Utilization

Healthcare

Smart Factory

EMS

Autonomous Driving

Physical space

IoT

Various goods, machines and human

Feedback to the Physical Space (New Value Added)

Rising Medical Expenses

Insufficient Labor Force

Social Challenges

Resource Shortage

Increasing Demand of Nursing Care

Pandemic

Solving Social Challenges

Beyond 5G-Centered ICT Infrastructure

Realization of Society 5.0

Society in the 2030s

Vigorous & Resilient Society

Inclusive

A society where everyone can play an active role regardless of their attributions (ex. Locations, nationalities, ages, and handicaps)

Sustainable

A society growing sustainably and efficiently, without social loss

Dependable

A human-centered society where safety and security are ensured, and trust is secured even under unprecedented circumstances

Synchronization of Physical & Cyber Spaces

* **Green Words** are the examples of areas where Japan has advantages or is actively engaged in.

THz Waves

Beyond 5G

Sensing

Ultra Fast & Large Capacity
(Ultra eMBB*)

- Network Access: **10x Faster than 5G**
- Core Network Access: **100x Faster** than now

  *eMBB: enhanced Mobile Broadband

Ultra Low Latency
(Ultra URLLC*)

- Latency: **1/10 of 5G**
- Advanced Synchronization with CPS
- High Level of Synchronization with Complementary Network

  *URLLC: Ultra-Reliable and Low Latency Communications

Ultra Numerous Connectivity
(Ultra mMTC*)

- Simultaneous Connectivity: **10x more than 5G**

  *mMTC: massive Machine Type Communication

All-Photonics Network

Quantum Cryptography

Further Upgrade of 5G Features

| eMBB | URLLC | mMTC |

5G

Ultra low power consumption

- Power Consumption: **1/100** lower than now

  * Without reduction measures, IT-related power consumption would reach to 36x than now, (1.5x of total consumption than now).

Ultra security and resiliency

- Always Ensuring Cybersecurity
- Instant Recovery from Disaster/Failure

Low Power Consumption Semiconductor

Adding New Features Contribute to Generate Sustainable and New Values

HAPS

Inclusive Interface

Autonomy

- Autonomous coordination among devices without manual intervention
- Construction of optimized network highly integrating wired and wireless connection

Complete Virtualization

Scalability

- Seamless Connection with Satellites and HAPS (incl. space and ocean)
- Transforming various interfaces such as terminals and windows into base stations
- Ubiquitous connections through coordination between devices

- **The Beyond 5G Promotion Strategy** features:
  ① **Measures to realize Society 5.0**, towards an Inclusive, Sustainable, and Dependable society expected in 2030s.
  ② **Emergency measures against COVID-19** and **measures for a post-COVID-19 growth strategy**, backcasting from Society 5.0.
- **Leading efforts based on this strategy** will be **shown to the world in 2025**, as a milestone year, when the OSAKA-KANSAI Expo is held.

Basic Principles

Global First
- Considering the **domestic market to be a part of the global market**; **Attract global talents**, aiming for interactivity of human resources.

Ecosystem driving Innovation
- Design systems that actively encourage **free and agile efforts by diverse players.**

Concentrate Resources
- Concentrate resources on prioritized measures to promote **effective participation in global collaboration**

Government and Private Sectors Collaborate Strategically under International Cooperation

R&D
Intensive Investment for Advanced Technology and Drastic Opening Spectrum will realize...
World-class R&D Environment

Establish Core Technologies from around 2025

IP & Standardization
Strategic Promotion of Openness/Defactization and Collaboration with International Strategic Partners will realize...
Game Change
Reducing Supply Chain Risk and Creating Market Entry Opportunity

Above 10% Share of Essential Patent to Beyond 5G

Deployment
Deploying 5G and fiber-optic networks throughout society and promoting industrial/public use through demonstration of 5G solutions will realize...
Beyond 5G Ready Environment

New Value Added of 44T JPY* by FY2030
* 400B USD (1USD=110JPY)

Speedy and Smooth Implementation of Beyond 5G

Strengthen International Competitiveness in Beyond 5G
✓ 30% of Share in Infrastructure Market
✓ Persistent Presence in Device/Solution Market

Vigorous Promotion through Industry-academia-government collaboration
Beyond 5G Promotion Consortium

①Share specific progresses, ②Support establishing demonstration projects,③Host International Conference

* Cross-department taskforce in MIC will manage the progress of the Strategy. Progress report will be published annually, and the Strategy will be reviewed when necessary.

R&D

- Aim for the **early development of advanced technologies** that hold the key to the realization of Beyond 5G, and **concentrating government resources at the stage of seeds technology.**
- Develop **a world-class R&D environment** by establishing R&D bases and drastic opening up the spectrum.

Specific Measures

Promote R&D for Cutting-edge Core Technologies through R&D Platform

- Establish "Beyond 5G R&D Platform", where industry, government and academia jointly working on R&D. This platform will provide emulators and testbeds, collaborate with other R&D platforms (e.g. SINET) and funding programs for young researchers.
- Intensive R&D on advanced core technologies for Beyond 5G for a limited period of time, in collaboration with related government organizations.

Strengthen Manufacturing Bases

- Strengthen manufacturing bases by developing core technologies for ICT systems to enhance 5G functions.
- Introduce accreditation schemes by the government for development and supply of devices that satisfy criteria for safety, reliability, supply stability and openness.

Review Special Tax Incentives for R&D

- Check whether special tax incentives are sufficient to promote R&D in the digital field and amend if necessary.

Ease Spectrum Regulation on R&D

- Develop a scheme to enable the free use of high frequency spectrum, including terahertz waves, for a limited period of time.
- Mitigate license procedures for experimental use provided certain conditions are satisfied.

Promote Disruptive Innovation and Develop Human Resources

- Support disruptive ideas and innovative people through prizes and incentives (e.g. the "wireless challenge").

IP & Standardization

- Aim for the realization of Beyond 5G and real **game change**, commit to IP acquisition and standardization activities.
- Particular emphasis on **(1) all-photonics; (2) open architecture; (3) maximum virtualization; (4) expansion to the air and sea; and (5) drastic enhancement of security.**

Specific Measures

Encourage Open/Close Strategy and IP & Standardization Activities

- Discuss target setting and encouraging open/close strategy on technologies, which are strengths for Japan, in national R&D projects.
- The government to provide testbeds and emulators for interconnection and interoperability in order to reduce industry burden and encourage the development of devices which are open and of a de-facto standard.
- Support the private sector's international initiatives for promoting implementation and standardization of the above (open, virtualized and all-photonics network, etc.).

Collaborate with Strategic Partners

- Promote international joint R&D and strengthened international collaboration from an early stage.

Develop Mechanism for Strategic Activities on IP & Standardization

- Establish the Beyond 5G IP & Standardization Strategy Center, where major players from industry, government and academia, strategically work on standardization, and utilize the center as a core to implement strategies.
- Consider the adoption of open standards, such as contributions to international standardization, etc. as conditions to adopt R&D projects and spectrum assignments in order to enhance the effectiveness of IP and standardization strategies.

Deployment

- Aim for the **early realization of a "Beyond 5G ready" environment**, where 5G is available at all areas and locations, and fully utilized in order to deploy Beyond 5G both speedily and smoothly.
- Promote the development of 5G and optical fiber networks throughout society and the industrial and public use of 5G.

Specific Measures

Deploy 5G and Fiber-optic Network

- Promote the deployment of 5G and fiber-optic networks and the introduction of private 5G; develop base station 3 times over than originally planned, available in all municipalities and promoting infrastructure sharing.
- Develop technology to integrate rural data centers into a virtual, massive cloud.

Realize Continuous Cybersecurity Functionality

- Promote standard setting based on security by design; introduction of technologies that automatically detect falsification and vulnerability; and the implementation of quantum cryptography systems in society.

Establish Use Cases for Solving Challenges

- Establish 5G solutions for solving social challenges through demonstration projects; Establish schemes for the 5G Solution Provision Center that enables the use of various functions such as smart cities on a common cloud platform (SaaS).
- Develop systems for community-based solutions to social issues in collaboration with local universities, etc., to flexibly conduct demonstration projects using whole towns as "Living Testbeds".
- Intensively conduct demonstration projects for IoT, agricultural ICT, telemedicine in cooperation with other countries for about three years; Support the commercialization of ideas and develop human resources.
- Promote digitalization of all of society to realize a society where ICT smoothly sustains people's lives and economic activities, even in emergencies.

Beyond 5G Promotion Strategy Roadmap

- Taking the current crisis as an opportunity, promote the digitization of the entire society at once, including the development of resilient and secure ICT infrastructure.

- The first five years is critical, as such promoting intensive efforts and utilizing Japan's strengths in the Advanced Implementation Phase must be done with a sense of urgency.

- The results of the leading efforts will be shown to the world as the "Beyond 5G Ready Showcase" at the OSAKA-KANSAI Expo 2025 in order to accelerate global deployment.

Social Landscape

COVID-19 Pandemic | (With-/Post-) COVID-19 Era | Expo 2025 / B5G Ready Showcase | Beyond 5G Ready | SDGs Target Year

| 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |

The 6th Science and Technology Basic Plan

Progress of Mobile Communication System

5G (Non Stand Alone) — Enhanced 5G (Stand Alone) — B5G (6G)

B5G Promotion Strategy

Advanced Implementation Phase
▲Est. Beyond 5G Promotion Consortium — Acceleration Phase

Reducing Supply Chain Risk; Creating Market Entry Opportunity

IP & Standardization
Establishing system/ Collaboration/ International Standardization
▲Est. Beyond 5G IP & Standardization Center — Accelerate action towards International Standards

Reflect — Reflect

World-class R&D Environment

R&D
R&D of Core Technologies
▲Est. Beyond 5G R&D Platform — Deployment of Core Technologies

- Super-realtime optimization
- Super-autonomous security
- Super-telepresence

Strengthen Manufacturing Base for enhanced 5G — Strengthen Manufacturing Base for Beyond 5G

Collaboration — Collaboration

Establishing variety of use case
▲Est. 5G Solution Provision Center — Realizing Beyond 5G ready environment

Deployment
Global Deployment

Beyond 5G Ready Environment

Digitalization of the entire society — All activities are digital-based

Ensuring 5G Security — Ensuring Beyond 5G Security (e.g. Implementing quantum cryptography system)

Deploying 5G and fiber-optic network to the entire society — Communication available for everyone and everywhere, incl. sky, ocean, and space