Panel Discussion on 6G Standardization

National Conference on 6G Spectrum, Technologies and Standardization by ITU

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ITU-APT Foundation of India (IAFI)

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Centre for Development of Telematics (C-DOT)

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CMMI Level-5 certified organization

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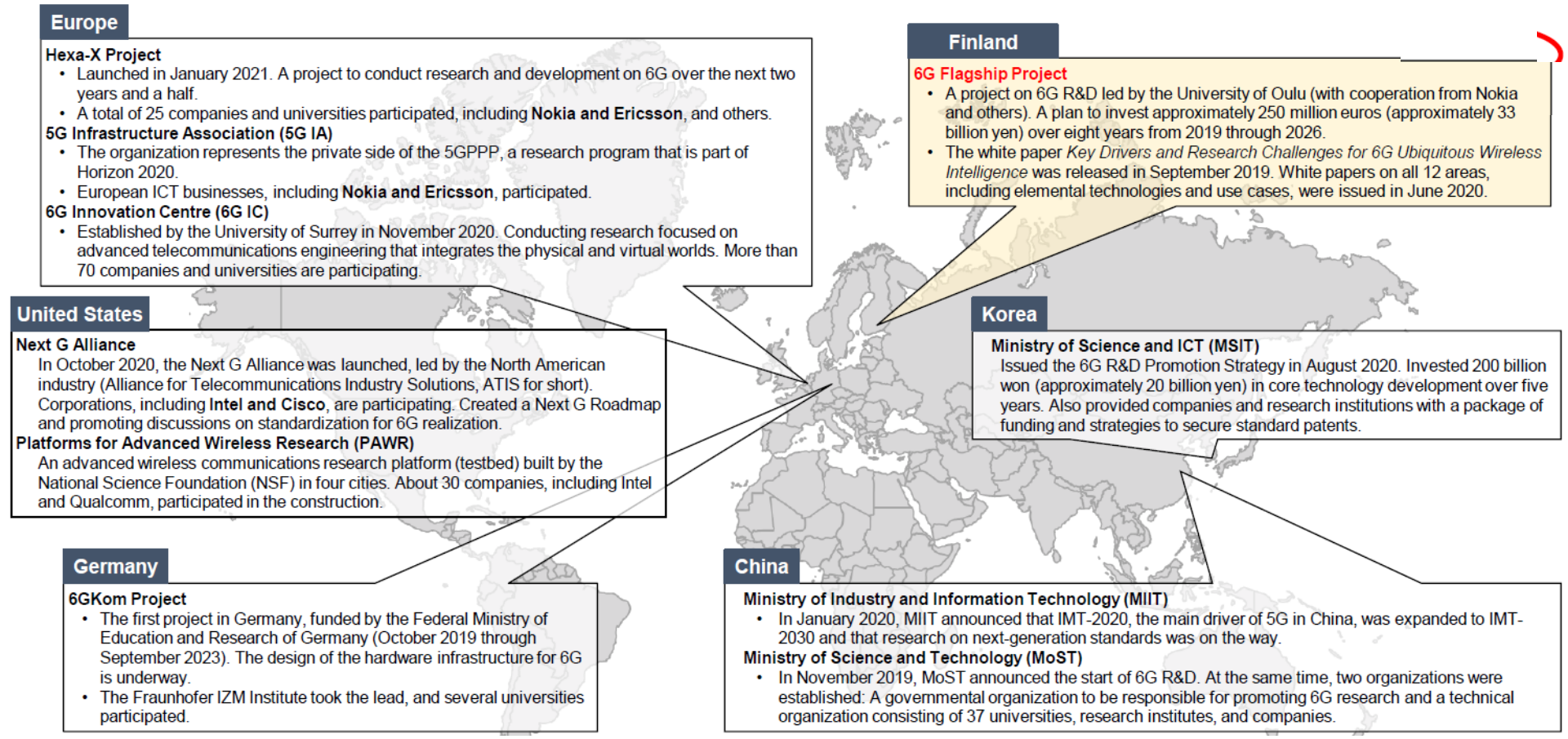
Survey of 6G roadmap across the World

6G Activities of interest around the World (Std & Pre-Std)



Europe

Hexa-X Project
- Launched in January 2021. A project to conduct research and development on 6G over the next two years and a half.
- A total of 25 companies and universities participated, including **Nokia and Ericsson**, and others.

5G Infrastructure Association (5G IA)
- The organization represents the private side of the 5GPPP, a research program that is part of Horizon 2020.
- European ICT businesses, including **Nokia and Ericsson**, participated.

6G Innovation Centre (6G IC)
- Established by the University of Surrey in November 2020. Conducting research focused on advanced telecommunications engineering that integrates the physical and virtual worlds. More than 70 companies and universities are participating.

Finland

6G Flagship Project
- A project on 6G R&D led by the University of Oulu (with cooperation from Nokia and others). A plan to invest approximately 250 million euros (approximately 33 billion yen) over eight years from 2019 through 2026.
- The white paper *Key Drivers and Research Challenges for 6G Ubiquitous Wireless Intelligence* was released in September 2019. White papers on all 12 areas, including elemental technologies and use cases, were issued in June 2020.

United States

Next G Alliance
In October 2020, the Next G Alliance was launched, led by the North American industry (Alliance for Telecommunications Industry Solutions, ATIS for short). Corporations, including **Intel and Cisco**, are participating. Created a Next G Roadmap and promoting discussions on standardization for 6G realization.

Platforms for Advanced Wireless Research (PAWR)
An advanced wireless communications research platform (testbed) built by the National Science Foundation (NSF) in four cities. About 30 companies, including Intel and Qualcomm, participated in the construction.

Korea

Ministry of Science and ICT (MSIT)
Issued the 6G R&D Promotion Strategy in August 2020. Invested 200 billion won (approximately 20 billion yen) in core technology development over five years. Also provided companies and research institutions with a package of funding and strategies to secure standard patents.

Germany

6GKom Project
- The first project in Germany, funded by the Federal Ministry of Education and Research of Germany (October 2019 through September 2023). The design of the hardware infrastructure for 6G is underway.
- The Fraunhofer IZM Institute took the lead, and several universities participated.

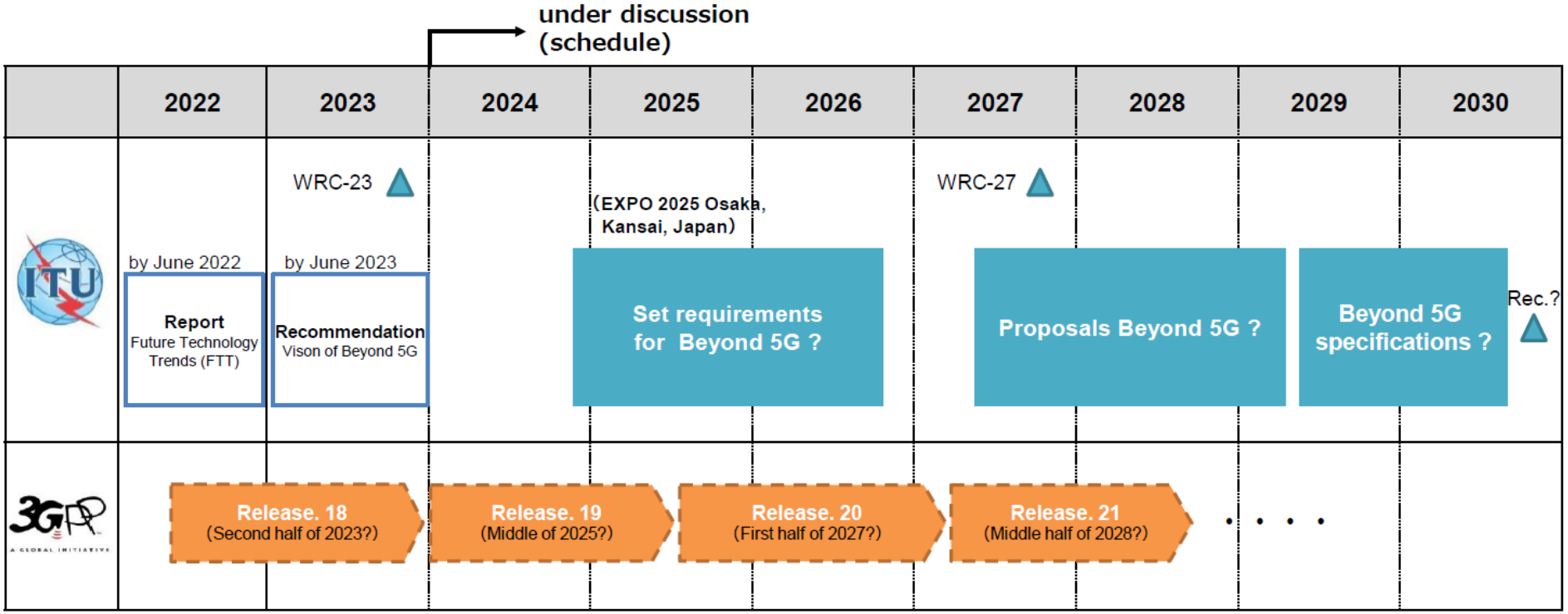
China

Ministry of Industry and Information Technology (MIIT)
- In January 2020, MIIT announced that IMT-2020, the main driver of 5G in China, was expanded to IMT-2030 and that research on next-generation standards was on the way.

Ministry of Science and Technology (MoST)
- In November 2019, MoST announced the start of 6G R&D. At the same time, two organizations were established: A governmental organization to be responsible for promoting 6G research and a technical organization consisting of 37 universities, research institutes, and companies.

ITU and 3GPP Standardization Beyond 5G

- In the ITU (International Telecommunication Union), international standardization of IMT-2030 (Beyond 5G) is ongoing.
- 3GPP's technical specifications will be proposed to the ITU.
- It is necessary for advancing R&D (Beyond 5G elemental technologies, etc.) and reflecting the results into international standardization process.



Source: ITU

EU: 5G-IA (Plan and achievements)

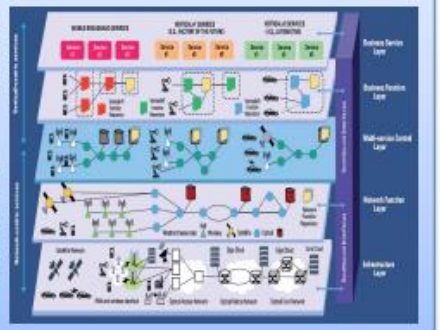
5G Research (5G PPP)

PHASE 1:
5G Core Research
main achievements:

- 5G System design & Evaluation aspects
- 5G Air interface innovations
- Network management & Security innovations
- Virtualization & Service deployment innovations
- 100s of contributions to standardization

PHASE 2:
5G Vertical Trials

PHASE 3:
5G Platforms



2015 2016 2017 2018 2019 2020

- 62 R&I projects since the beginning of the Program
- 800+ contributions to standardization activities (Phase II and Phase III)
- Over 1300 scientific publications (Phase II and Phase III)
- Design, evaluated and validated multiple technological breakthroughs

Source: 5GIA

EU: 5G-IA (Plan and achievements)

SMART NETWORKS AND SERVICES
2021 - 2027

6G networks, new applications and end devices

5G IA INFRASTRUCTURE ASSOCIATION

Alliance for Internet of Things Innovation

CISPE.cloud

NETWORLD 2020

NESSI

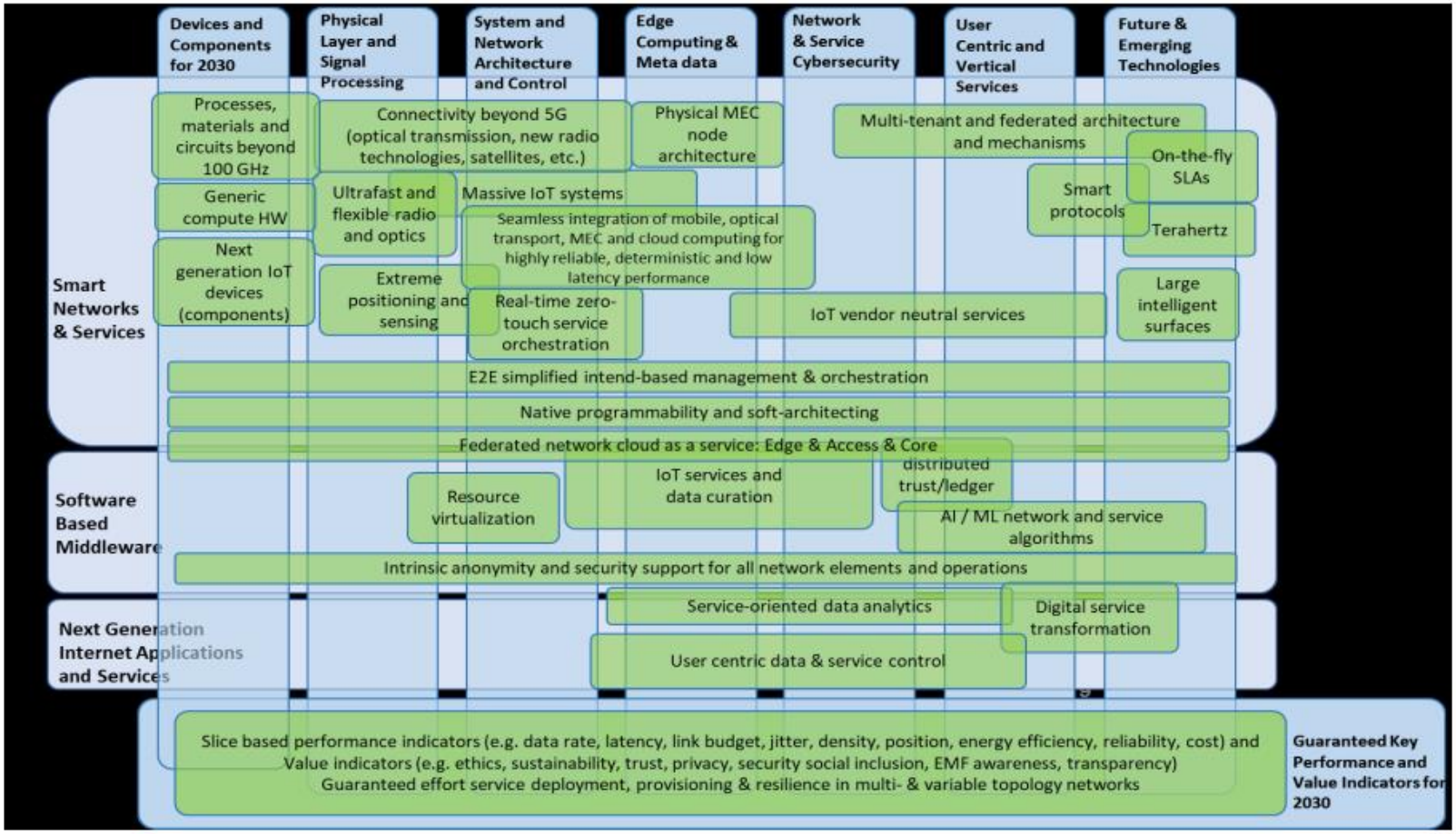
Proposal supported by more than 1.000 organisations: Industry, SMEs, R&D centers and Universities)

900 M€ public funding
+
900 M€ private funding

Source: 5GIA

EU: Smart Networks and Services

What do we have study and solve?



Source: 5GIA

EU: Smart Networks and Services

5G Evolution (40%)

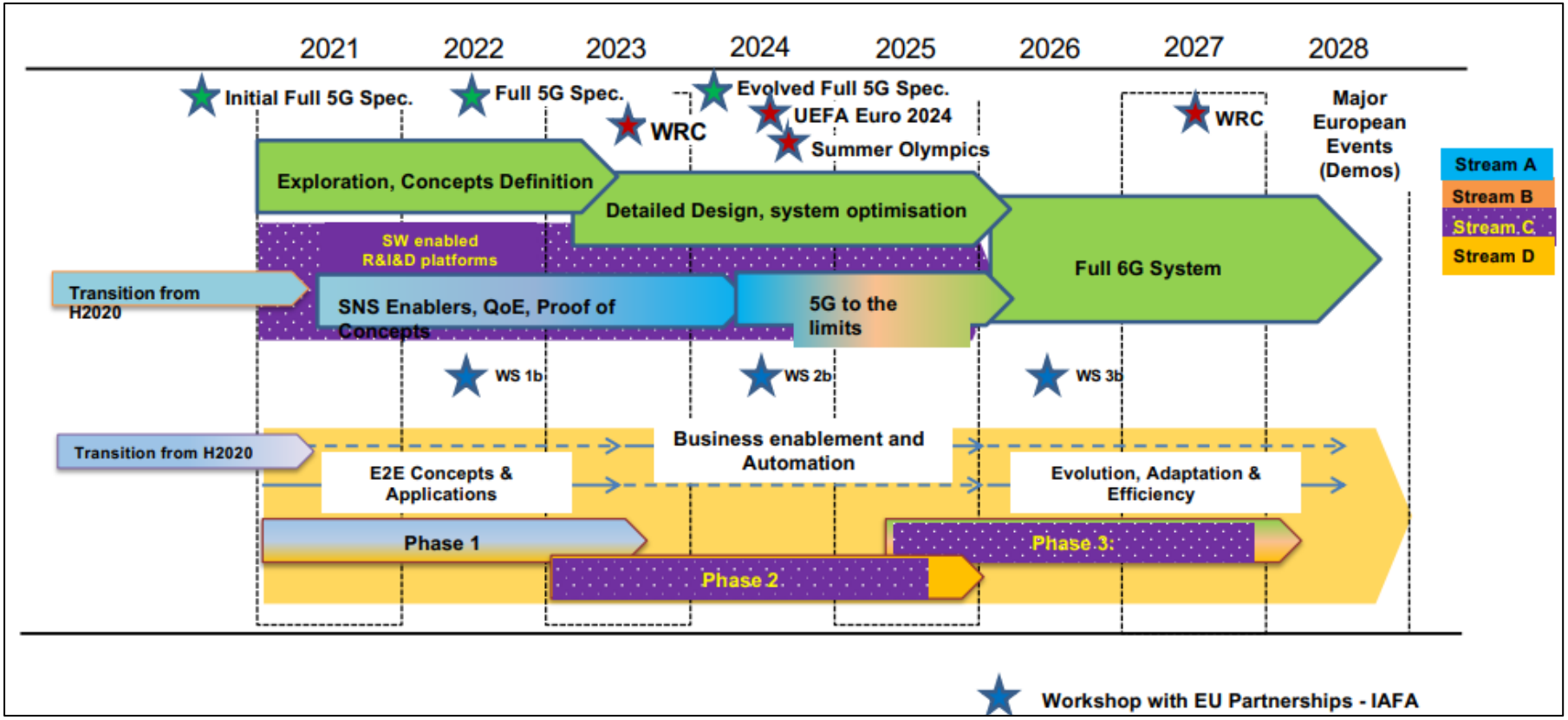
Stream A (20% - RIA): Smart communication components, systems and networks for 5G mid-term Evolution systems

Stream D (20% - IA): Large Scale SNS Trials and Pilots with Verticals

6G (60%)

Stream B (50% - RIA): Research for radical technology advancement towards 6G

Stream C (10% - IA): SNS experimental infrastructures



Source: 5GIA

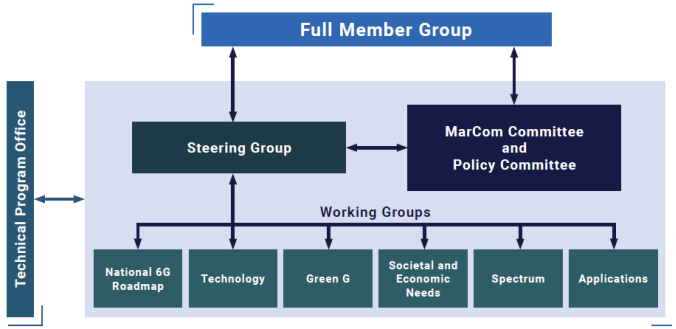
EU Funded Research Programmes

SN	Programme	Remarks
1	**Horizon Europe (FP9)**	**Research and Innovation 100B Euro. (2021-2027)**
2	**SNS JU**	Smart Networks and Services Joint Undertaking. (900B + 900B Euros.) • Stream A: Smart communication components, systems, and networks for 5G Evolution systems. • Stream B: Research for radical technology advancement (in preparation for 6G and radical advancements of IoT, • devices and software). • Stream C: SNS Enablers and Proof of Concept (PoCs), including development of experimental infrastructure(s). • Stream D: Large Scale Trials and Pilots with Verticals, including the required infrastructure to explore and • demonstrate technologies, advanced applications and services in vertical domains
3	**Digital Europe**	Bring digital technology to business, citizens and public administrators. In conjunction with other programmes **(2021-2027)**
4	**6G-IA**	**Voice of European Industry for the next gen networks** The 6G-IA brings together a global industry community of telecoms & digital actors, such as operators, manufacturers, research institutes, universities, verticals, SMEs and ICT associations. The 6G-IA carries out a wide range of activities in strategic areas including standardization, frequency spectrum, R&D projects, technology skills, collaboration with key vertical industry sectors, notably for the development of trials, and international cooperation
5	**Networld Europe**	NetworldEurope Strategic Research and Innovation Agenda (SRIA) provides a long-term view about the future of telecommunications in Europe and is developed in cooperation with the 5G-Infrastructure Association (5G-IA). It collects the views from industry and academia, and has received inputs from Alliance for Internet of Things Innovation (AIoTI) and from the Networked European Software and Services Initiative (NESSI).

19/04/2023 Source: 5GIA

Next G Alliance: Not

- **The Next G Alliance** is a initiative:
  - to **advance North American mobile technology leadership** over the next decade through **private sector-led efforts**.
  - With a strong emphasis **on technology commercialization**, the work will encompass the **full lifecycle of research and development, manufacturing, standardization and market readiness.**



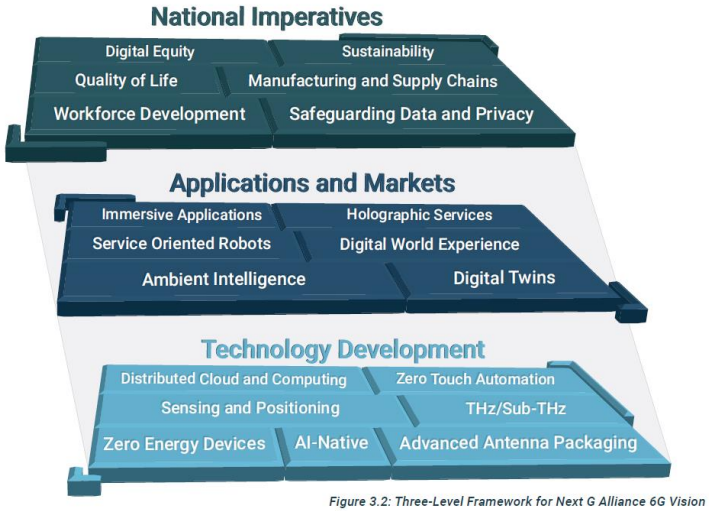


Figure 3.2: Three-Level Framework for Next G Alliance 6G Vision

Source: NextG Alliance

Japan: B5G

Key Features for Beyond 5G

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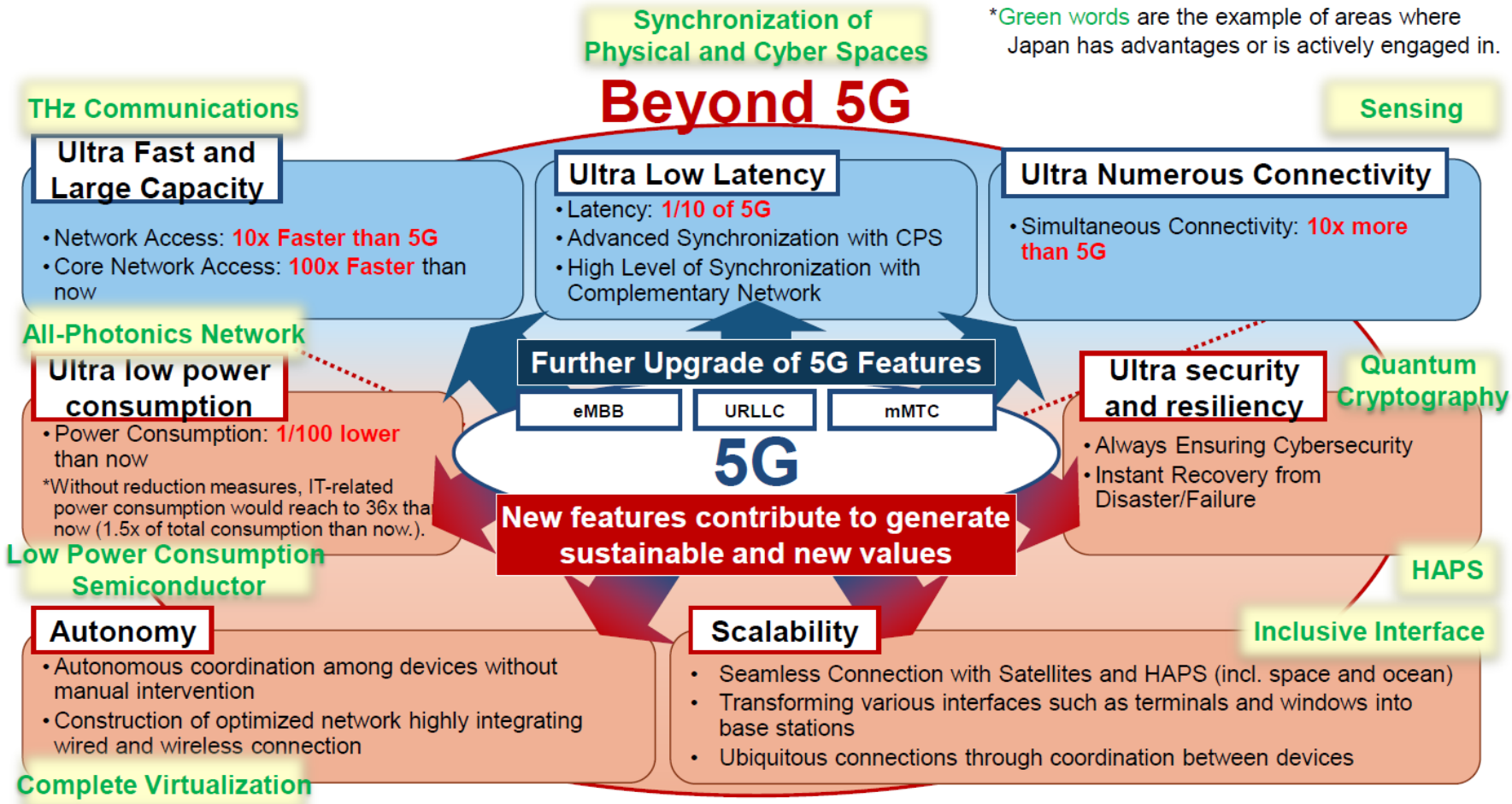

Source: Japan B5G Promotion Group

Japan: B5G Promotion Strategy

Beyond 5G Promotion Strategy

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Mission

Early and Smooth introduction of Beyond 5G

Strengthen the international competitiveness of Beyond 5G

Basic Principles

Global First

Ecosystem Driving Innovation

Focused Resource Allocation

Three pillars

R&D
Intensive investment for advanced technology and drastic opening spectrum
World-class R&D Environment

IP & Standardization
Strategic promotion of openness/defactization and collaboration with international strategic partners
Game Change
Reducing supply chain risk and creating market entry opportunity

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

Establish Core Technologies from around 2025

Above 10% Share of Essential Patent to Beyond 5G

New Value Added of 44T JPY* by FY2030

*400B USD (1USD=110JPY)

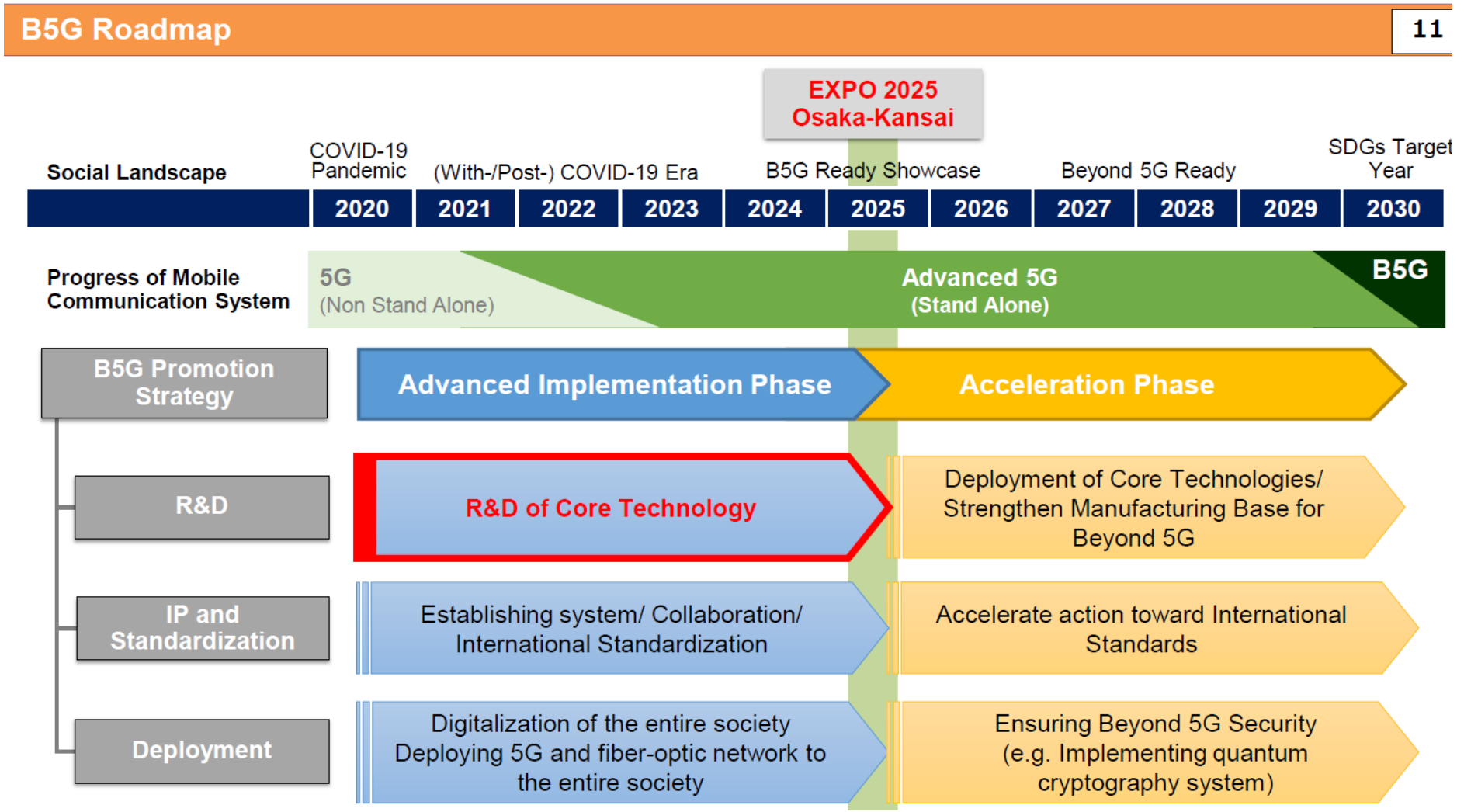
Promoting through industry-academia-government collaboration

Beyond 5G Promotion Consortium

Holding an international conference for international cooperation, Discussing among stakeholders to create the vision for Beyond 5G, etc.

Source: Japan B5G Promotion Group

Japan: B5G Roadmap



Source: Japan B5G Promotion Group

Korea

- Ministry of Science of ICT (MSIT) of Korea announces 220B KRW (190M USD) investment from 2021-2026. (6G R&D Implementation Plan).
  - Goals: 1) Secure next-generation key original technologies, 2) Gain dominance in international standards and patents, and 3) Lay the foundation for 6G research and industry.
- Koreans in leadership positions in ITU and 3GPP standardization bodies.

Pilot projects by area

- Remote surgery
- Quantum biometric encryption
- Digital twin
- Control of logistical and transport entities
- Holographic conference
- Non-contact, real-time immersive content
- Big-data based, safe, optimized, and automatic control of industrial sites
- 6G satellites for flying cars, drones and ultra low latency communication with autonomous vehicles

Source: Provisional R&D Strategies of Future Mobile Communications to lead the 6G era/MSIT

The 10 Strategic Technologies in 6 Focus Areas of 6G R&D

Category	ultra-performance	ultra-band	ultra-space	ultra-precision	ultra-intelligence	ultra-reliability
Focus Area	Maximum 1Tbps speeds	100-300GHz (to realize 1Tbps speeds)	Expand support altitude to 10km above ground (Flying cars and drones using LEO satellites)	1/10 latency compared to 5G	Apply AI to all sections of network (core network+wireless section)	Embedded security technology
Strategic Technologies	1. Tbps wireless communication 2. Tbps optical communication	3. THz RF components 4. THz spectrum model	5. Space mobile communications 6. Space satellite communications	7. End-to-end ultra-precision network	8. Intelligent wireless access 9. Intelligent network	10. Constant network quality monitoring technology for 6G

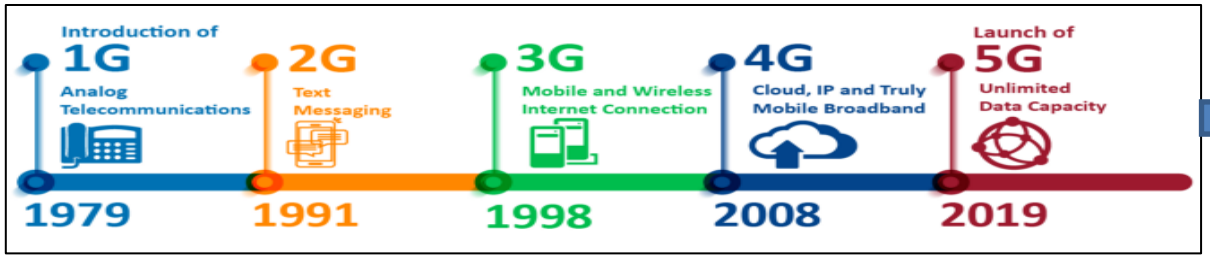
6G Research Centers in Universities selected in 2021

No.	Project name	Implementing agency	Period	Budget(Total)
1	(Ultra-high performance) Develop candidate elementary technology in Tbps wireless communication	KAIST	5 years	Total 4.8B
2	(Ultra-band) Develop candidate elementary technology for RF components in THz band	Sungkyunkwan University	4 years	Total 2.3B
3	(Ultra-intelligence) Develop candidate elementary technology for intelligent wireless access	Korea University	5 years	Total 2.9B

 Source: MSIT

Roadmap for India for 6G Standardization Leadership

Getting Ready for 6G well in time



Aggr. Freq Reuse
THz
Positioning
Higher Speeds
SDR + Reconfigurable HW
VLC
Quantum
New Verticals
Open Source
City NW
PPDR NW
In-Body NW
Private NW
Satellite NW
Personal Area NW
Rural NW
Aerial NW

6G

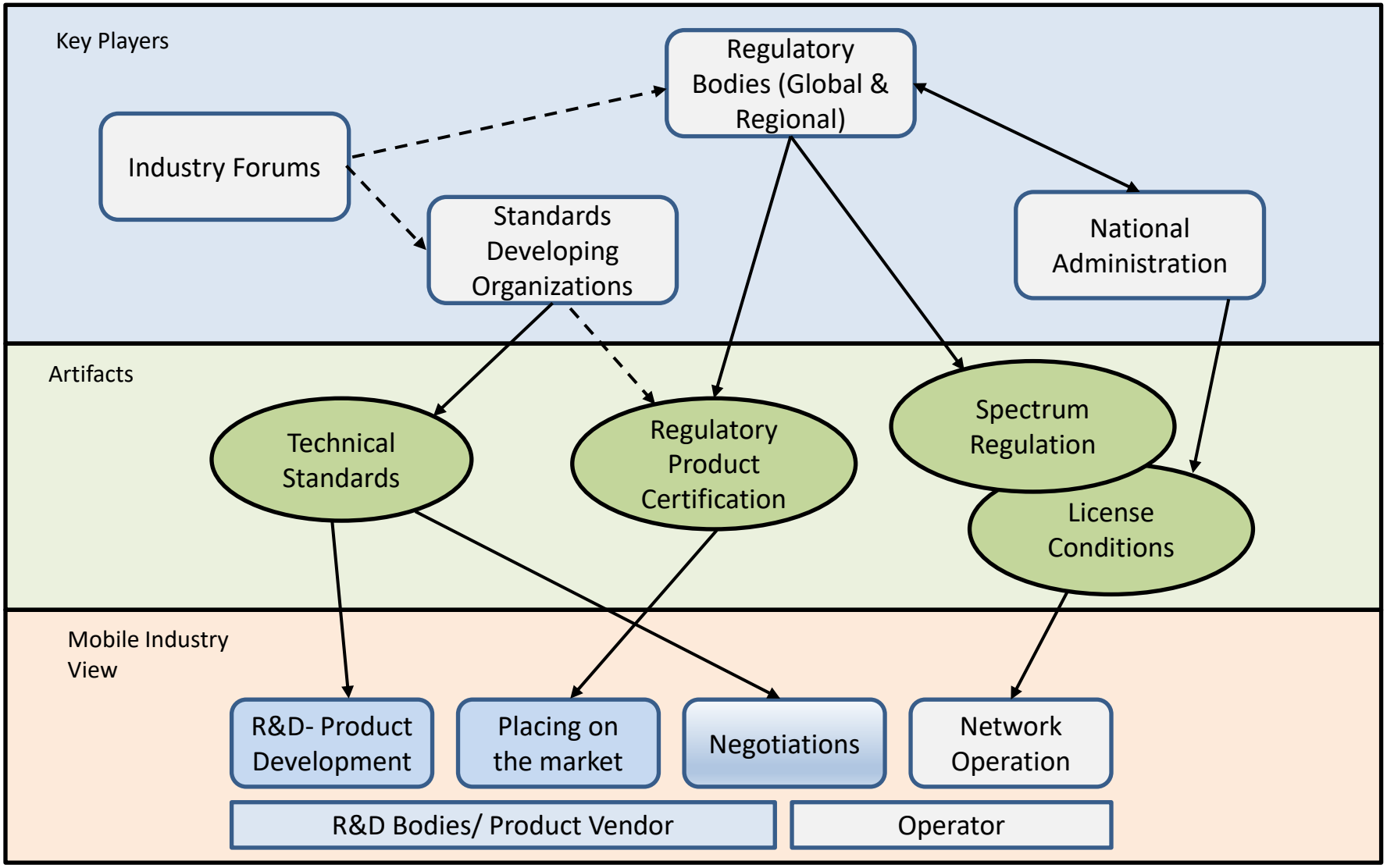
Network-of-Networks, E2E Trustworthy Network

2028?

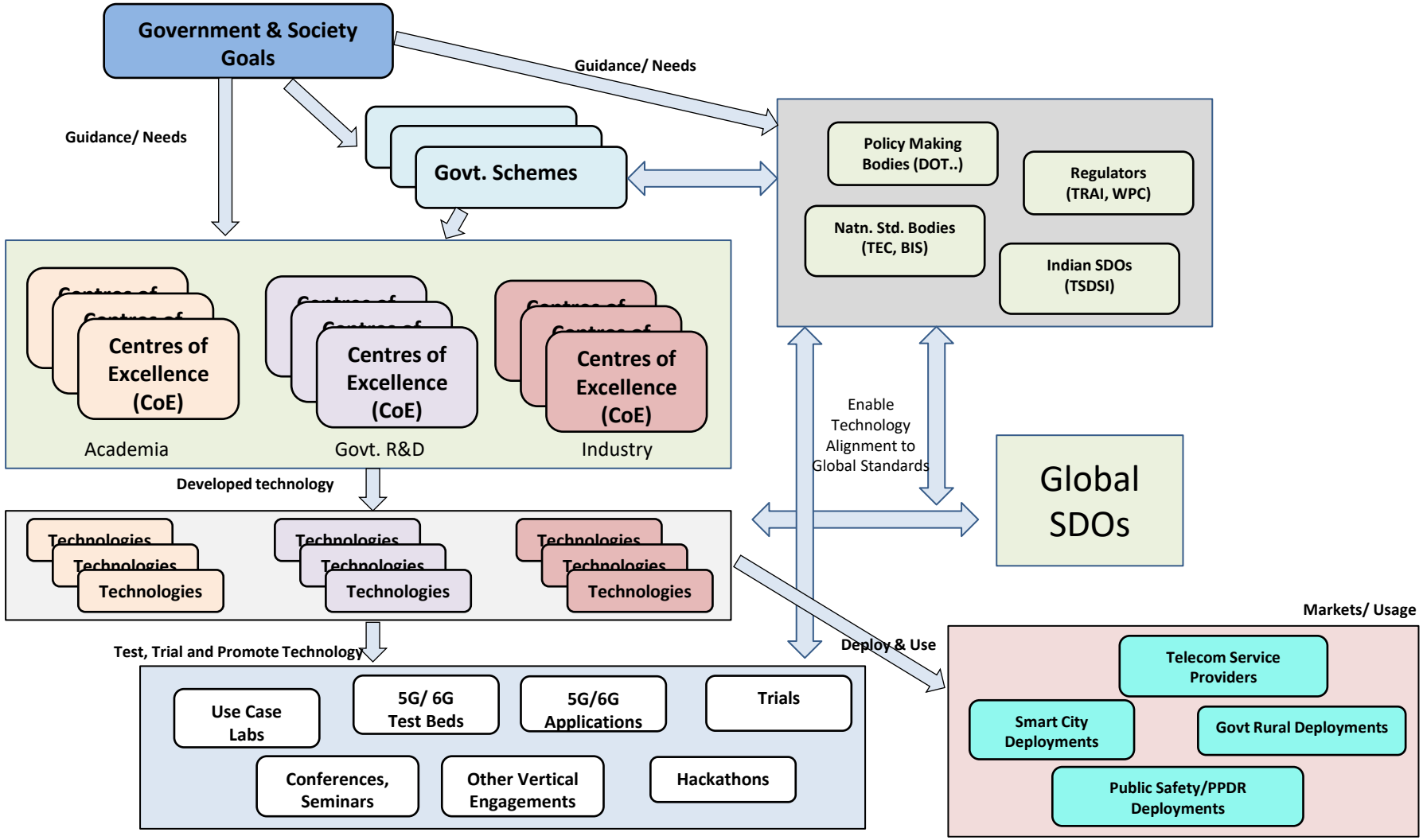
Stakeholder engagement Framework
Trust Framework
"Protection of the vulnerable" Framework
Privacy Framework
Ethics Framework
Global Use Case Framework
Transparency Framework
Responsibility Framework
Regulation Framework

Green/ Energy efficiency
Cost Aspects
UN SDG Framework
eWaste/ Environment

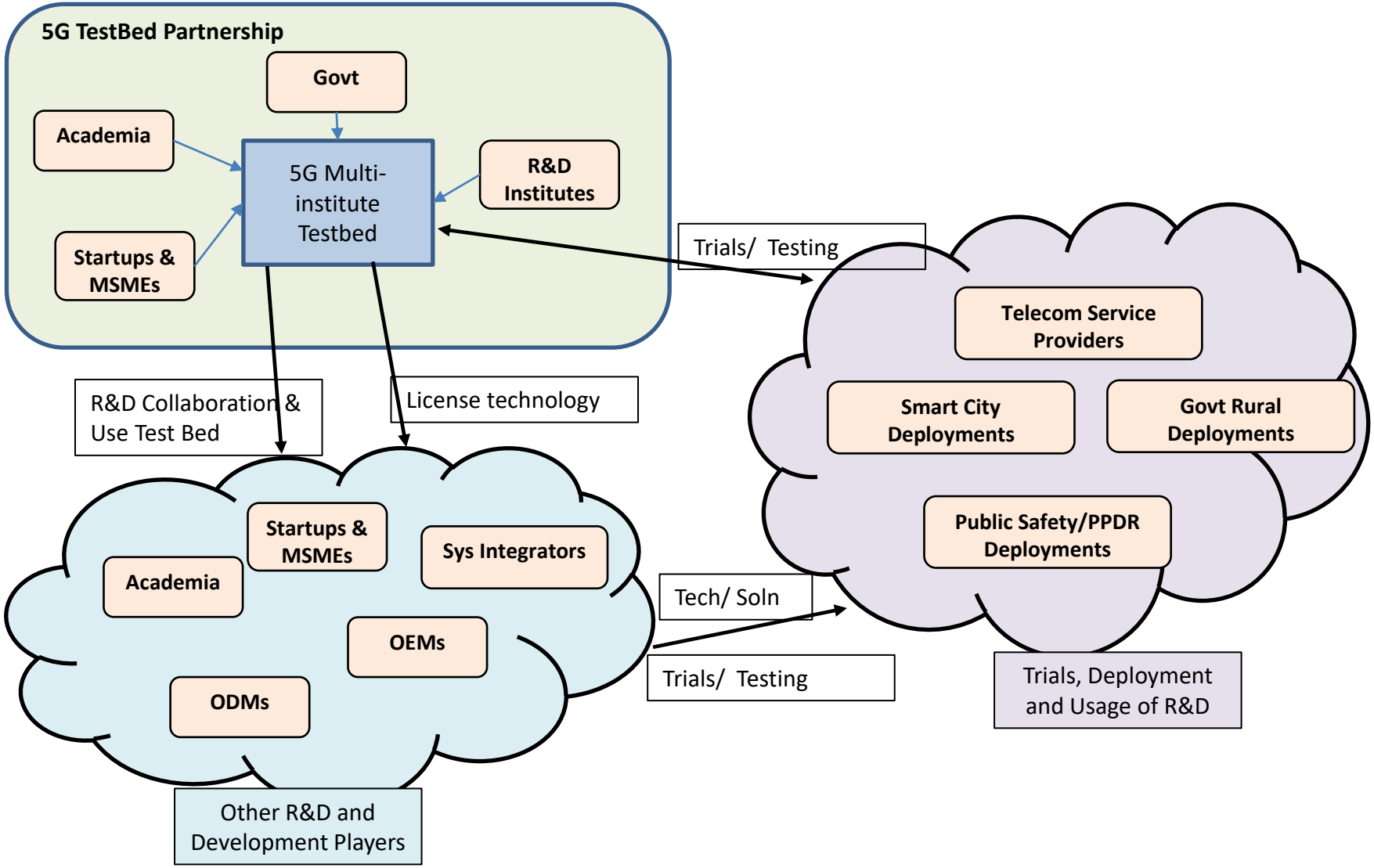
Wireless Technology R&D Ecosystem



Process of Discovery to Industry/Market Deployment



Interactions between R&D, Innovation & Standardization



Need to Create "India Technology Stacks"

- India's Unified Payment Interface (UPI) is a highly successful multi-party mission.
- Designed, developed in India and now an example to be followed.
- Similar examples can be followed for Telecom/Communication Stacks

- Architecture/Stack/API created using Public Infrastructure/funding.
- Allow private players to use this open system to create next level services/infrastructure.
- Similar aspects to be done for:
  - Smart Cities Stack (TSDSI Smart Cities Standards Stack)
  - IoT Stack (TSDSI IoT Standards Stack)
  - TSDSI Data Centre Standards Architecture/Stack
- Condition: Should allow for the supply chain also to be open
  - Push for leveraging open systems (RISC-V, OCP, FSF/GNU, Linux)
  - The stacks should also support usage of open tools.
    - Example: Stack is open, Tools used to create is closed – Not acceptable.
- Data Ownership/Control is primary
  - Need to evolve and create open systems/protocols/procedures to track manage
- Open Standards/Stack should also result in Open Platforms.

Summary

- Standards are results of “Double/Triple Derivative” activities of the ecosystem. Need to have
  - **Interested Parties**: ODMs/OEMs/Institutes/Academia conducting R&D/technology development with long staying capability and having IP/technology/product portfolio
  - **Need to engage with others**: Multiple stakeholders needing/willing to discuss/negotiate,
  - **Framework to engage**: SDOs to evangelize, meet, discuss, debate and build standards,
  - **ROI on Standards Activities**: End-users willing to use the standards etc.
- India needs focus/invest on the complete lifecycle of Standardization (R&D, SDO, Encouraging end-users to use Standards, Standardization Skill enhancement, Active participation)
- Need sophisticated engagement at all levels between Government, Academia, Industry, Startups, SDOs, Regulators and other bodies to bring in a “Standardization” culture.
- Increase participation in various standards activities from all stakeholders (100s -> 1000s)
- B5G/6G India Mission to have Standards participation, contribution, targets as key charter.
- Take active leadership positions in various National and International Standard bodies.
- Host International Standardization meetings in India on a regular basis. Make India the hub for Standardization meetings. Build enough infrastructure for the same.
- Take active leadership in bringing together African and ASEAN countries into Standardization.
- Next Phase for Indian Ecosystem: “IT Services” -> “Design Engg Services” -> “R&D oriented industry” -> “Standards-driven R&D” or “R&D resulting in Standards along with profits”.
- “Standards-As-A-Service”?

Discussion/Questions

Thank you

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