DOCOMO's R&D Initiatives for Realization of a Sustainable Society and Well-Being

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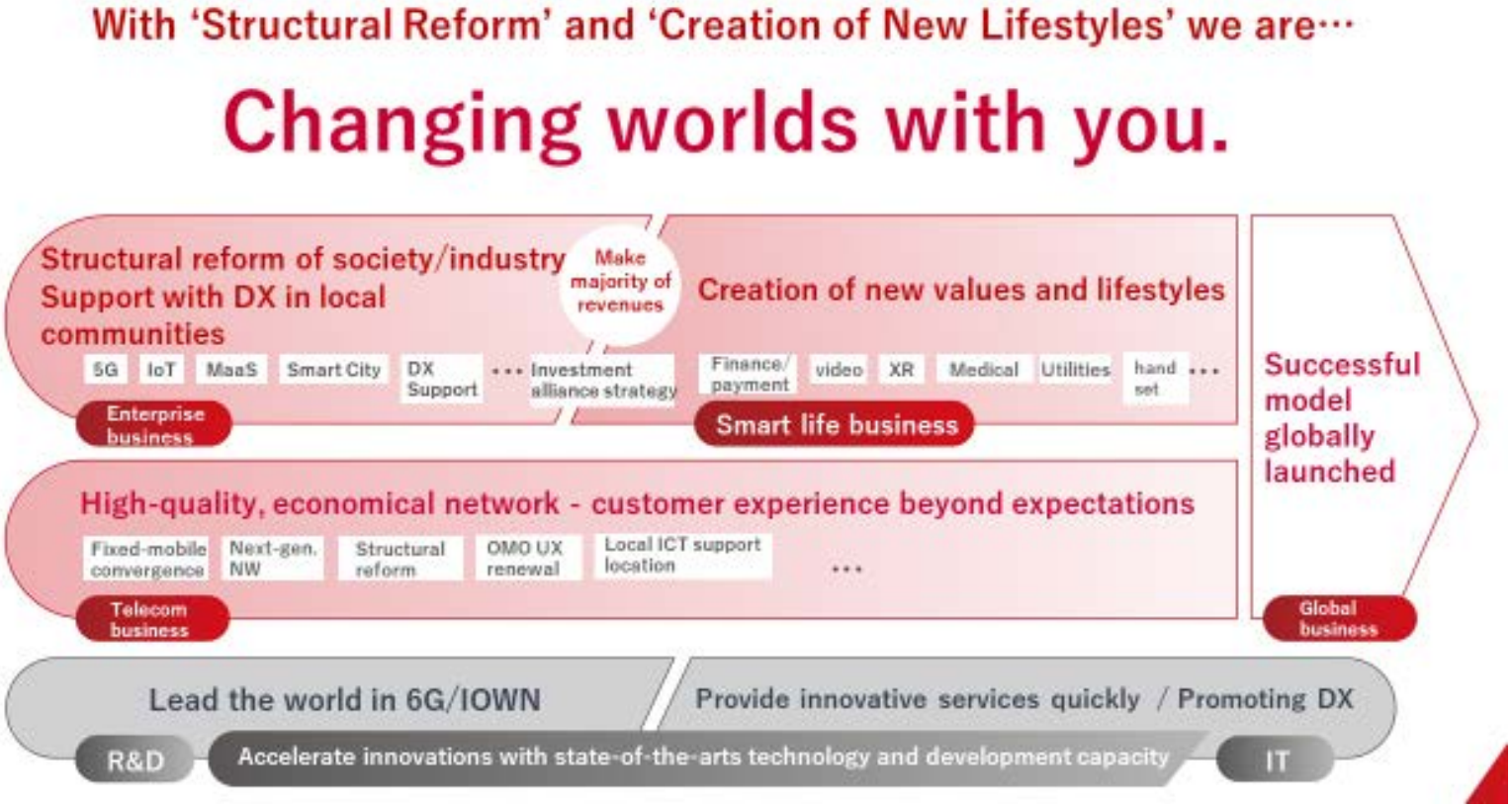
Today's Topics

- New DOCOMO Group Medium-Term Strategy and DOCOMO's R&D
- Promotion of Network Virtualization and Globalization
- Evolution to Flexible Networks
- People-Centric Value Creation Leveraging Innovation Co-Creation Platform and Lifestyle Co-Creation Lab
- 5G Evolution and 6G

New DOCOMO Group Medium-Term Strategy and DOCOMO's R&D

New DOCOMO Group Medium-Term Strategy: Overview

Announced October 25, 2021



DOCOMO R&D: Our Aspirations and Key Initiatives

A society where everyone can shine and pursue all possibilities, reaching out and connecting with each other.

Wellbeing Society

Customer-first R&D that can deliver new "customer delight"
by blending our strengths in network with advanced technologies

Evolution of network

- Virtualization and globalization
- Evolution to flexible network
- Advancement of OAM*
- Green network
- 5G Evolution and 6G

- Enhanced customer experience through data utilization
- Enhanced customer experience through behavior change
- Enhanced spatial value through XR
- Innovation co-creation platform/ Lifestyle co-creation lab
- Evolution of devices/UI
- Reinforcement of open innovation

Creation of new lifestyles

* OAM : Operation and Management

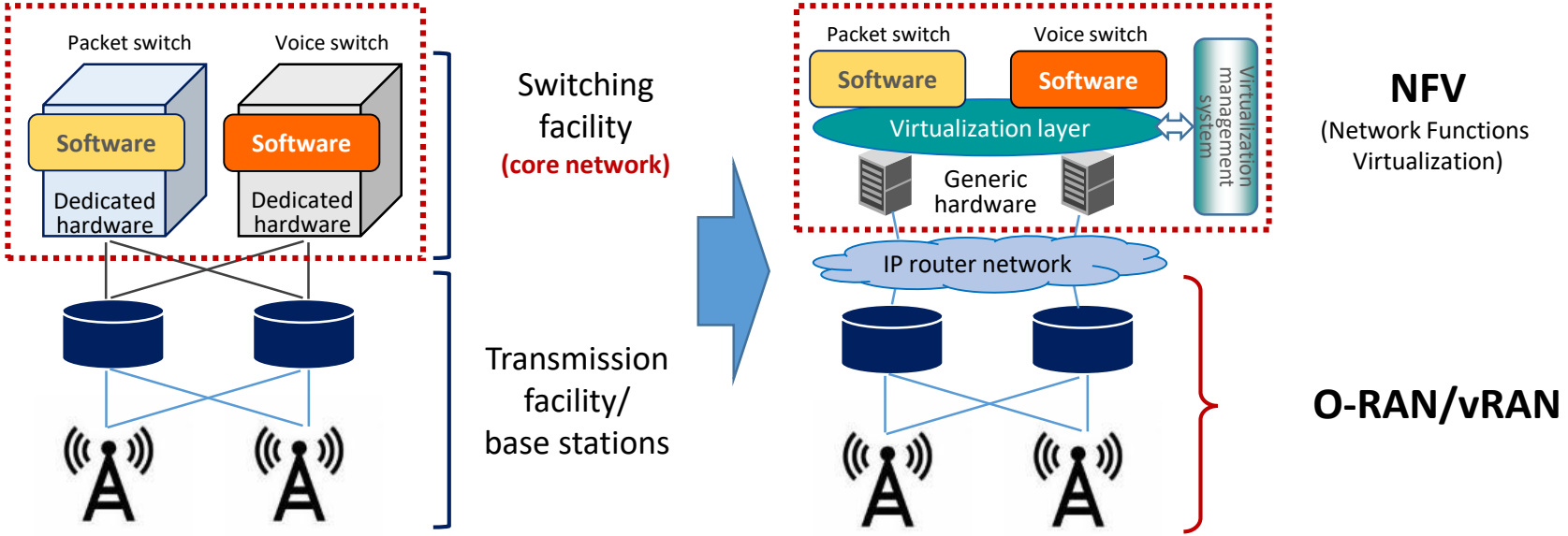
Network virtualization and globalization

Virtualization of DOCOMO Core Network (4G/5G)

Mar. 2016: First in world to introduce network virtualization techniques of multiple vendors to LTE packet service

Mar. 2021: Virtualization adoption rate in core network: 56%

FY2024/end: Aim to achieve 100% virtualization

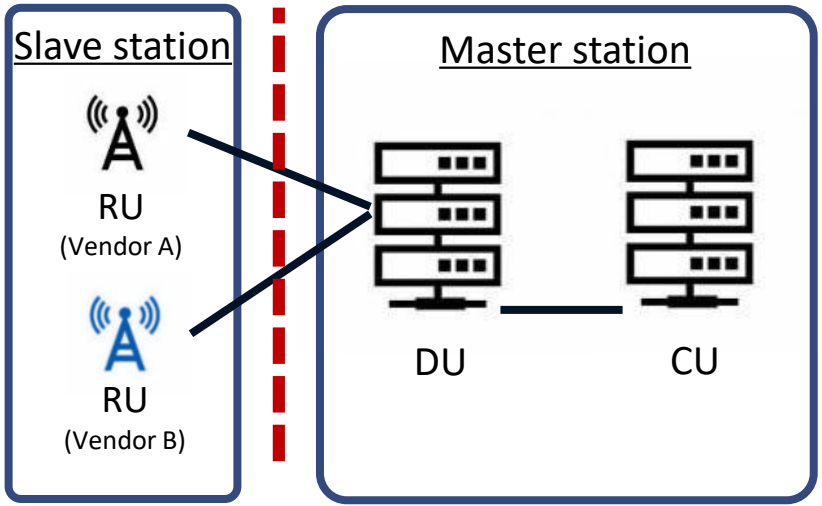


RAN : Radio Access Network

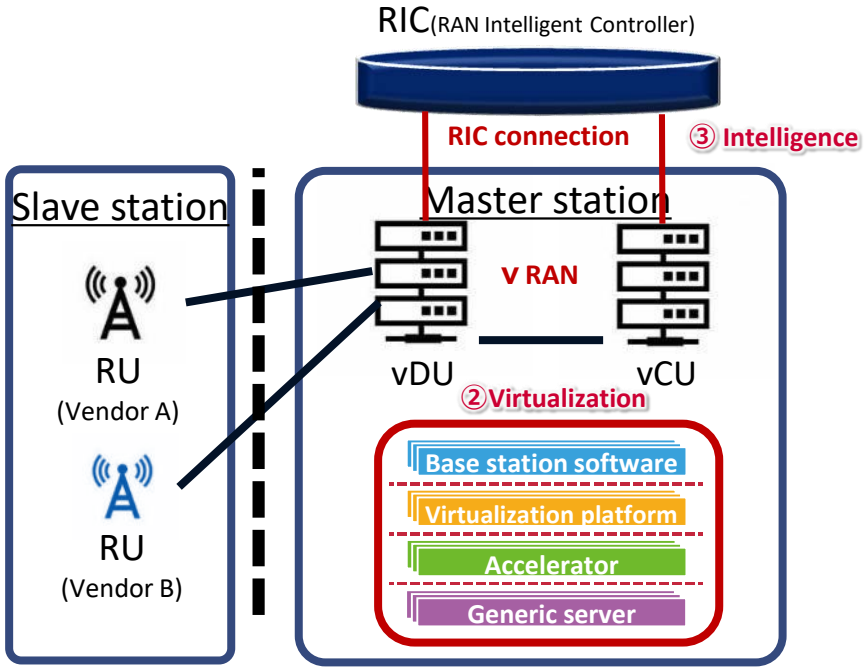
Introduction of O-RAN/vRAN, RIC at DOCOMO

STEP1: Commercial adoption in Mar. 2020

① Adoption of O-RAN compliant interface



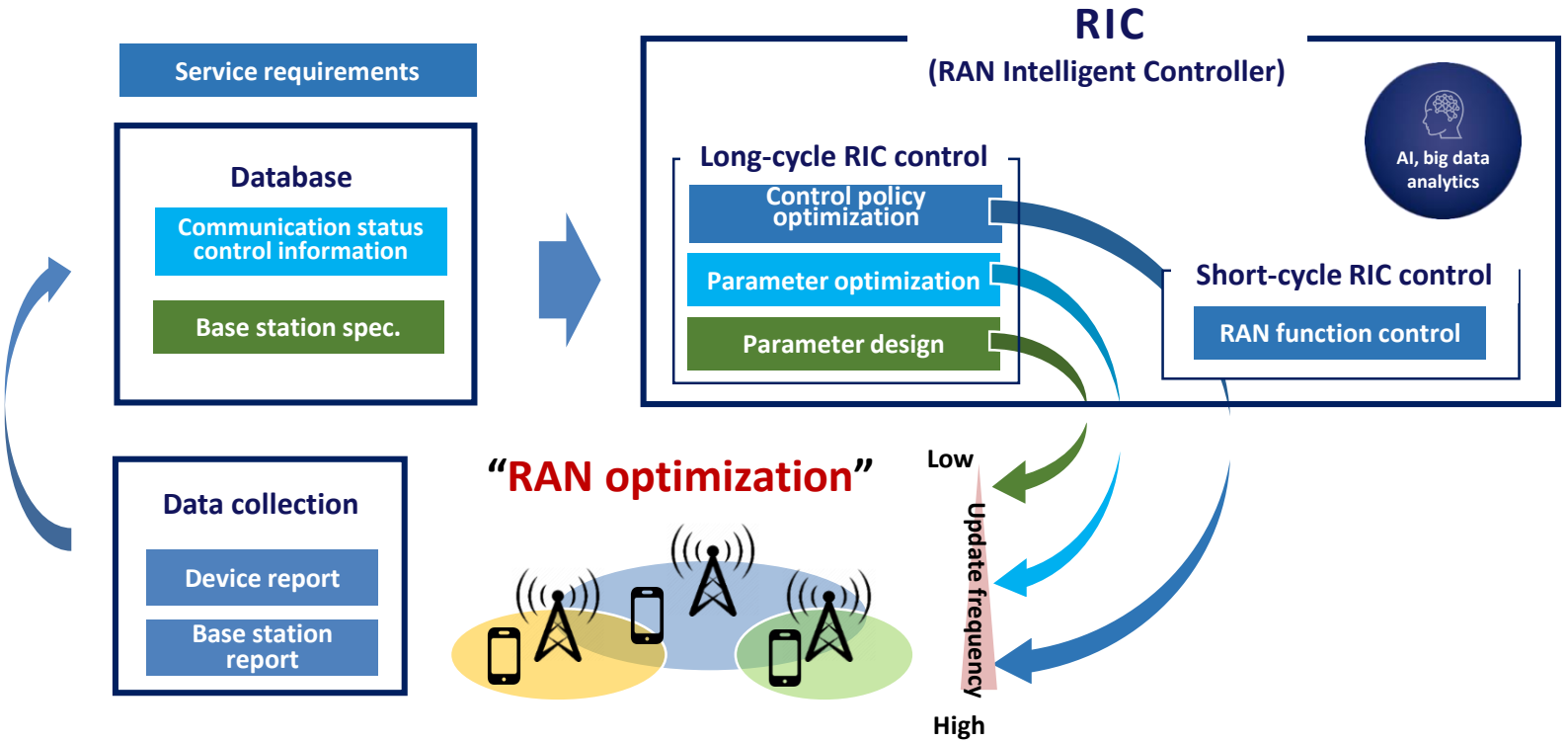
STEP2: Under review
(Aim for commercialization within FY2022)



RU：Radio Unit
DU：Distributed Unit　CU：Centralized Unit

Intelligent RAN

Aim for RAN optimization, communication quality enhancement and lower operational costs



O-RAN Alliance

DOCOMO: One of 5 founding members

O-RAN ALLIANCE

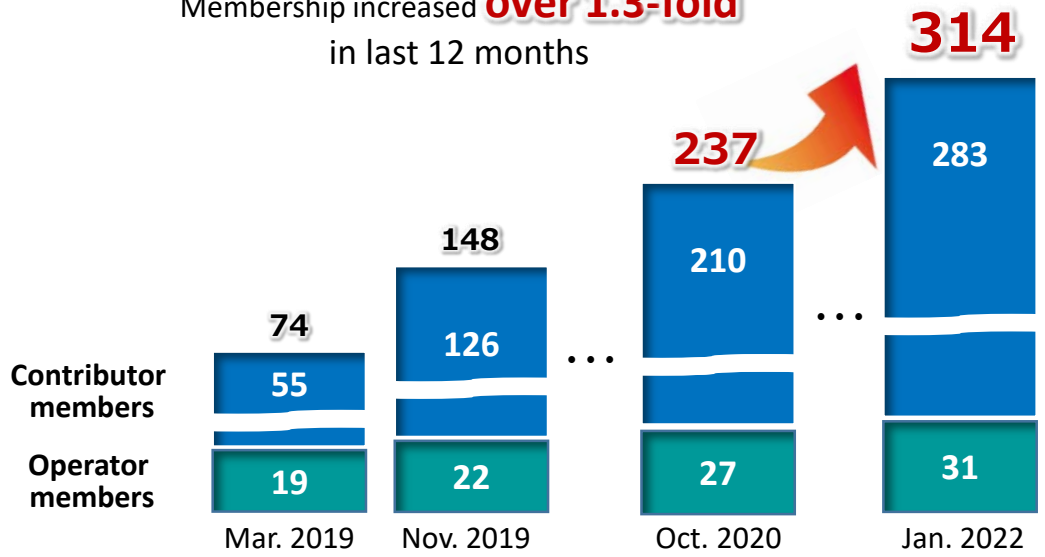
Founding members:

AT&T, NTT docomo, orange, T-Mobile, 中国移动 CHINA MOBILE

Established Feb. 2018

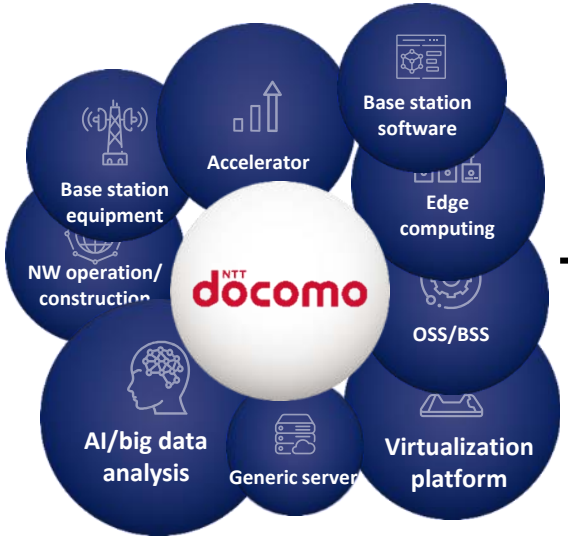
Heightened interest from operators/vendors

Membership increased **over 1.3-fold** in last 12 months



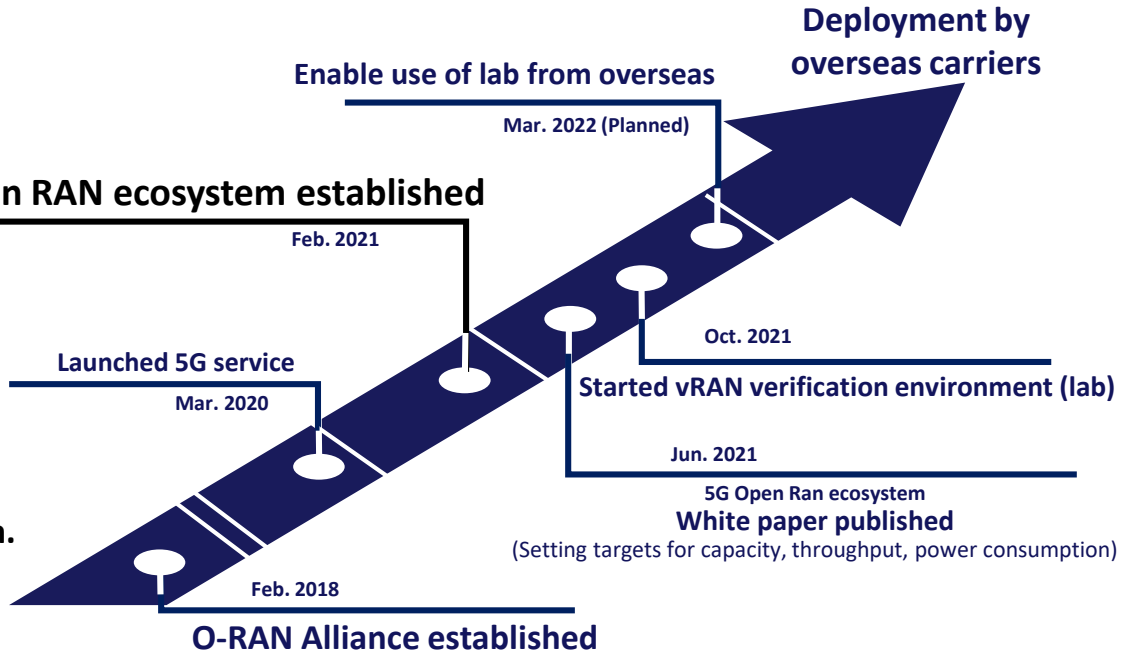
O-RAN Alliance members

Provision of 5G Open RAN to Overseas Carriers

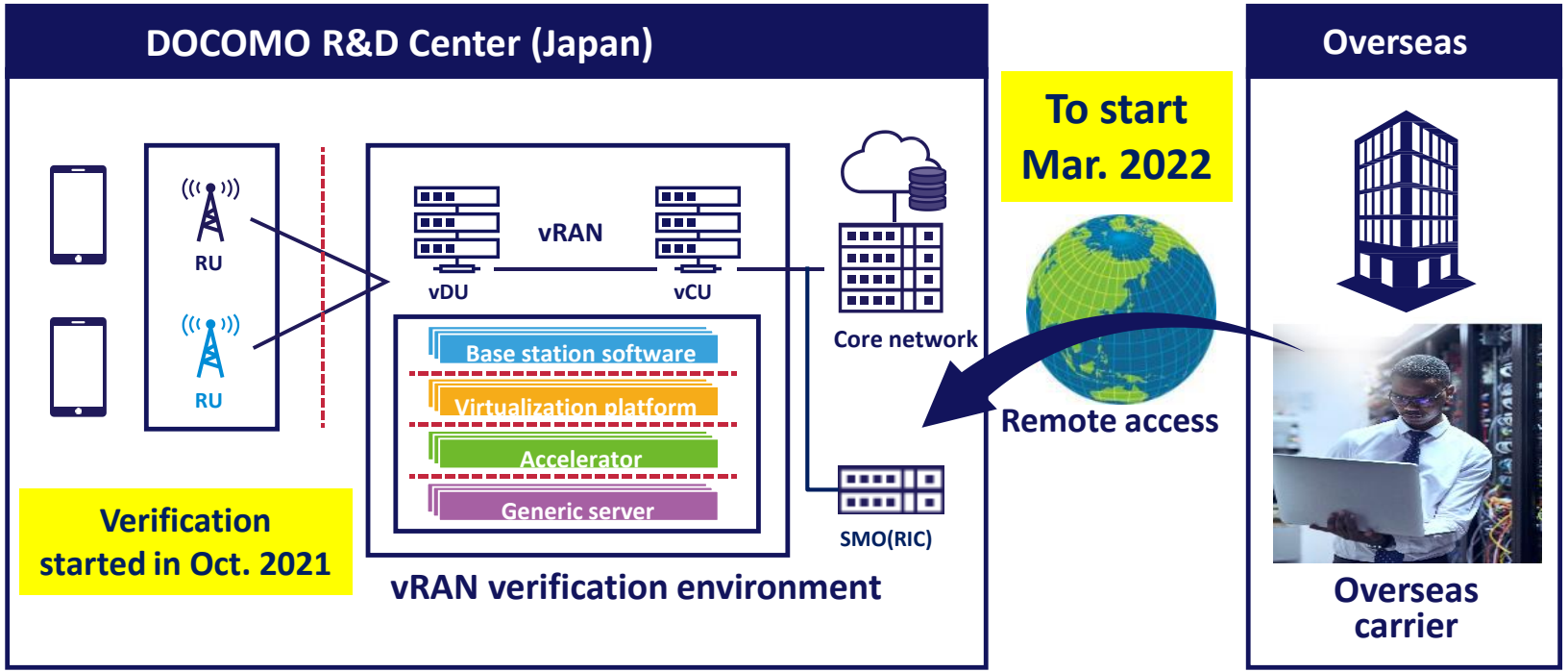


“Convergence” as opposed to simple combination.
Under review by 13 companies.
(As of Nov. 2021)

5G Open RAN ecosystem

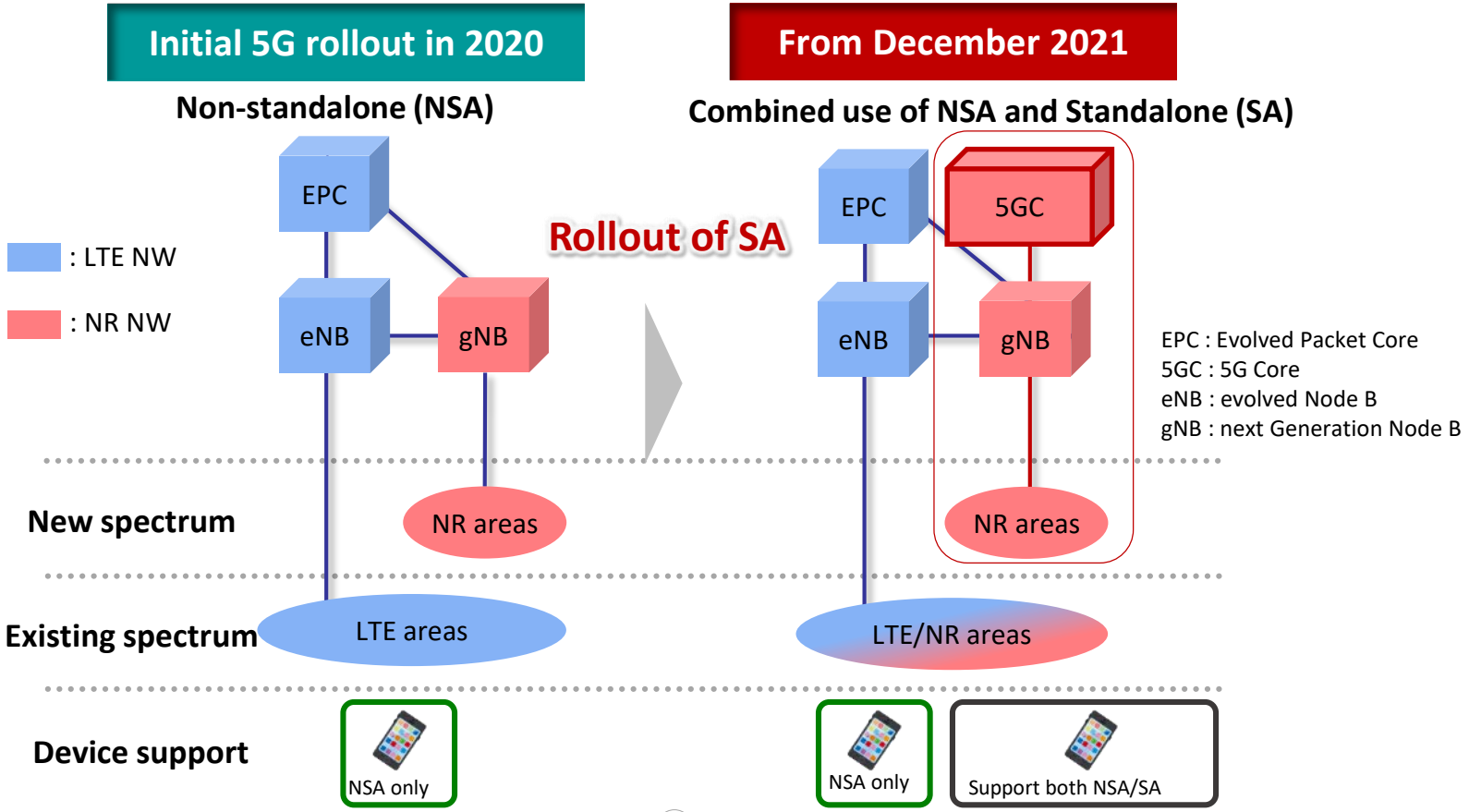


Provision of vRAN Verification Environment Accessible from Overseas



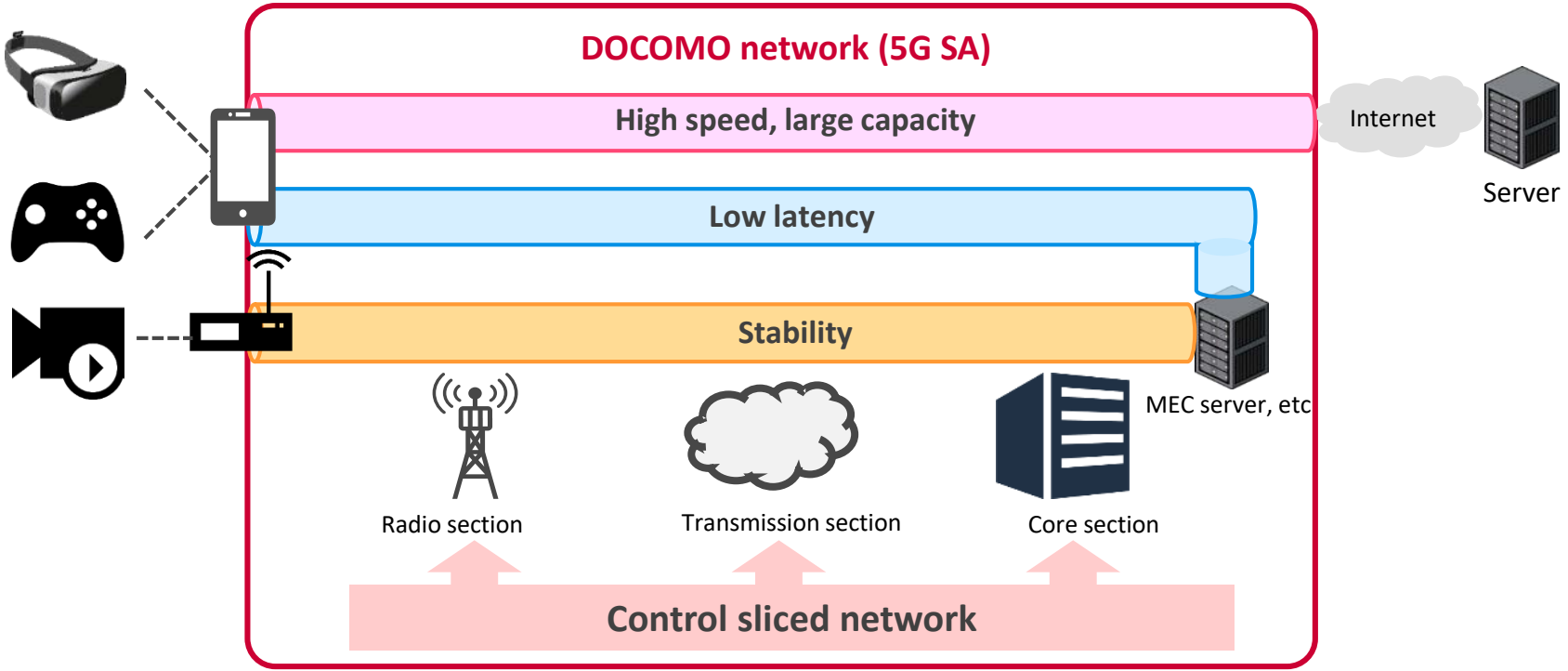
Evolution to Flexible Network

5G Network Migration



E2E Slicing

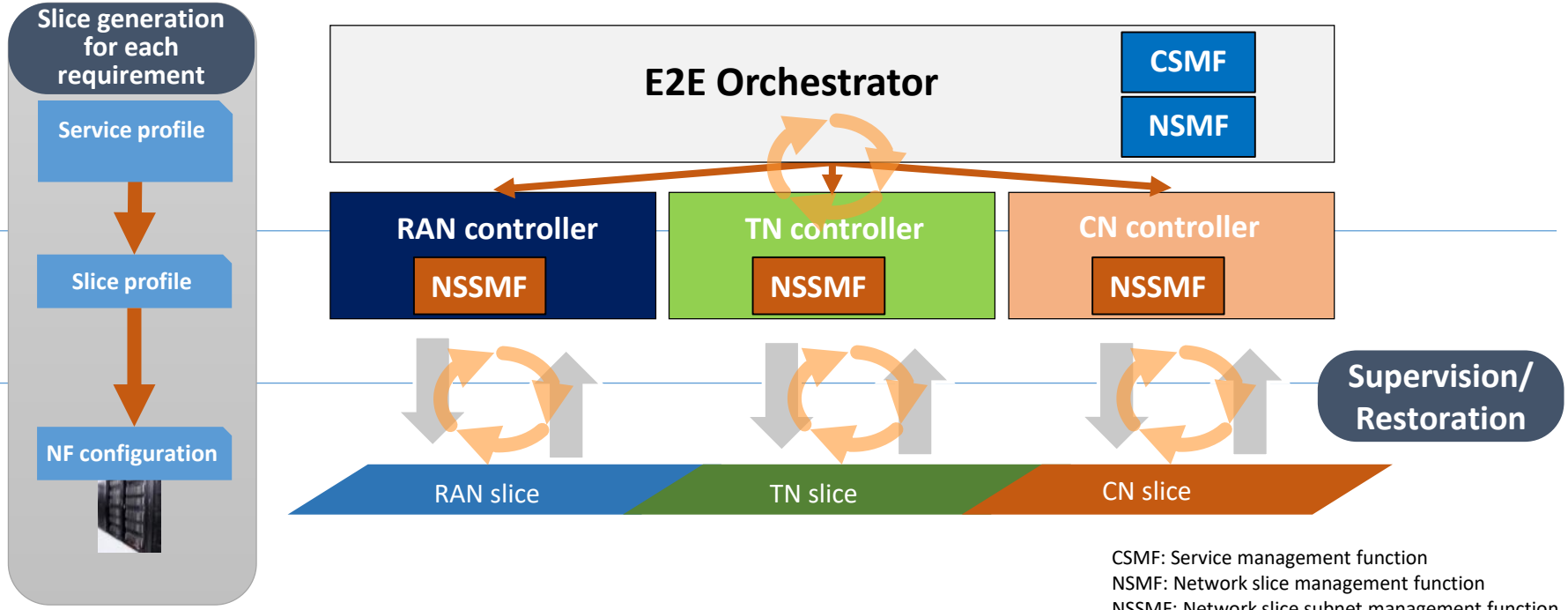
In the future, DOCOMO aims to control the entire network through slices to offer a communication environment that can respond to diverse needs



* Conceptual image of NW to be realized in the future

E2E Orchestrator

Break down into network slice/resource requirements for each domain to realize E2E requirements and automate construction/operation management.



CSMF: Service management function
NSMF: Network slice management function
NSSMF: Network slice subnet management function

Human-Centric Value Creation Leveraging Innovation Co-Creation Platform/ Lifestyle Co-Creation Lab

Human-Centric New Value Creation through Digital

Create new lifestyles with state-of-the-art technologies.
Co-create richer everyday life experience through virtual/physical convergence.

Innovation co-creation platform

DOCOMO's technology assets
＋NTT-Group's technology assets

Verify base technologies in field

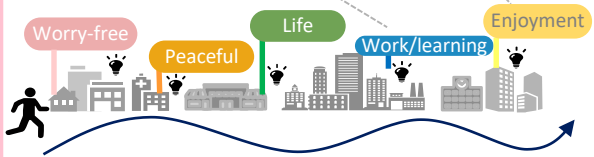
Feedback data/insights

Lifestyle co-creation lab

Value verification in field
Co-creation with partners

Promotion of intrapreneurship forming teams with AI

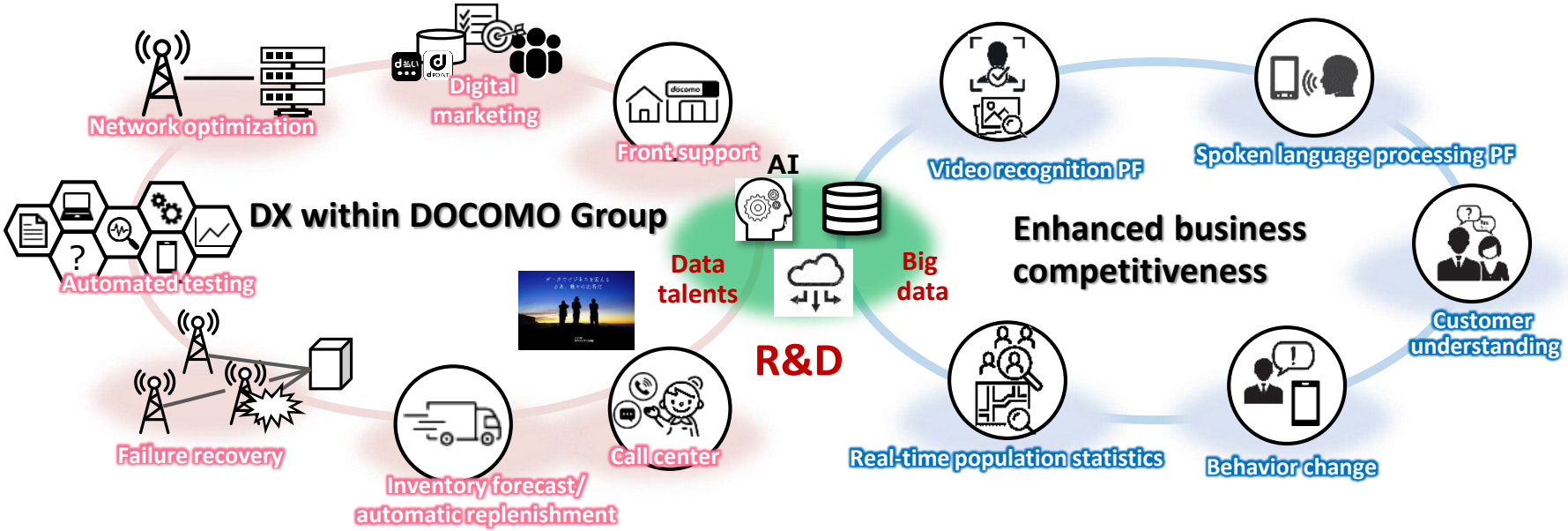
Experience shopping/events in "virtual Ginza"



Enhanced value in various scenes of life

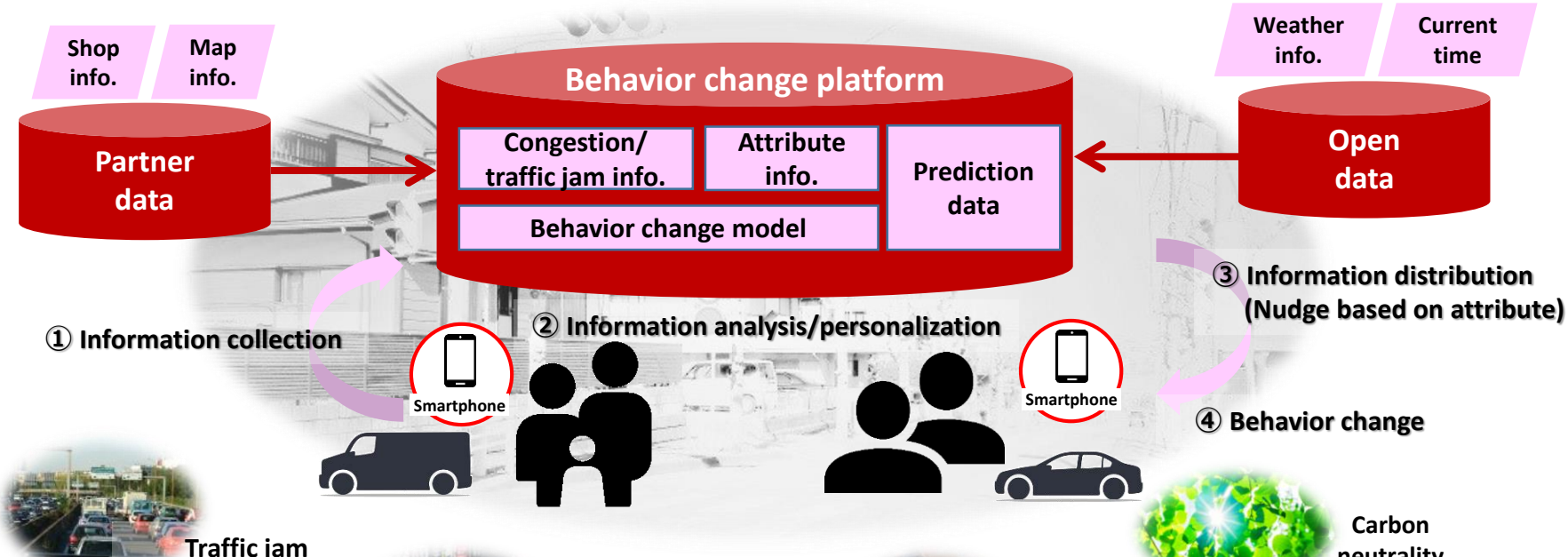
Expansion of AI/Data Use Cases

Tackle the challenge of developing data talents and expansion of use cases that employ AI/data toward the realization of data-driven society.



Behavior Change Technologies

Develop technology that strongly urges behavior change of people with personalized "nudges" * leveraging behavioral economics insights.



*1 Nudge: A term of behavioral economics for initiatives that urges people to voluntarily choose actions that are better for themselves (e.g., health promotion, disease prevention).

Technical Development and Ecosystem Creation for XR

Front portal

New “digital” experience

Virtual Event Platform（VEP）

3D Content

Inexpensive and high-quality 3D content

8KVR video distribution system, etc.

Device/UI

XR experience on next-generation device replacing smartphones

https://www.nttdocomo.co.jp/info/news_release/2021/10/01_00.html

Solutions for compact, light-weight AR glasses

XR Space platform

Easily realize the world of XR

Development/verification trial of space AR service development tools

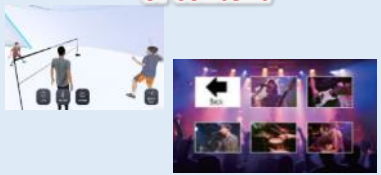
Front Portal: Virtual Event Platform (VEP)

【VEP overview】

Multi-device PF

Easy avatar creation

Support for rich variety of content

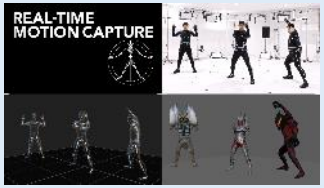


【Track record of supply】

【New features】

3D motion capture solution

Technique that reflects motion data in real time on a 3D model in VR space.



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【Advantages】

- Provides more immersive experience compared to conventional solutions
- Possible to simultaneously distribute motion data of multiple people.
- Enables large-scale distribution at low cost

Announced Jan. 11, 2022

DOCOMO avatar portal

Technique that creates and manages customer's avatar and make it commonly usable in multiple services

【Advantages】

- Enables easy creation from just one photograph of a photo-real avatar that can be identified at a glance.
- Enables common use of avatar for multiple services using "d Account", etc., as a key
- Easy connectivity with external XR services via API.

Announced Jan. 11, 2022

AI avatar

A technique that enables non-developers to easily create avatars that can communicate in natural dialogue.

【Advantages】

- Casual authoring of motions and dialogue scenarios.
- Avatars created can be used in various services including XR.
- "DOCOMO AI agent API®" is used for natural dialogue.

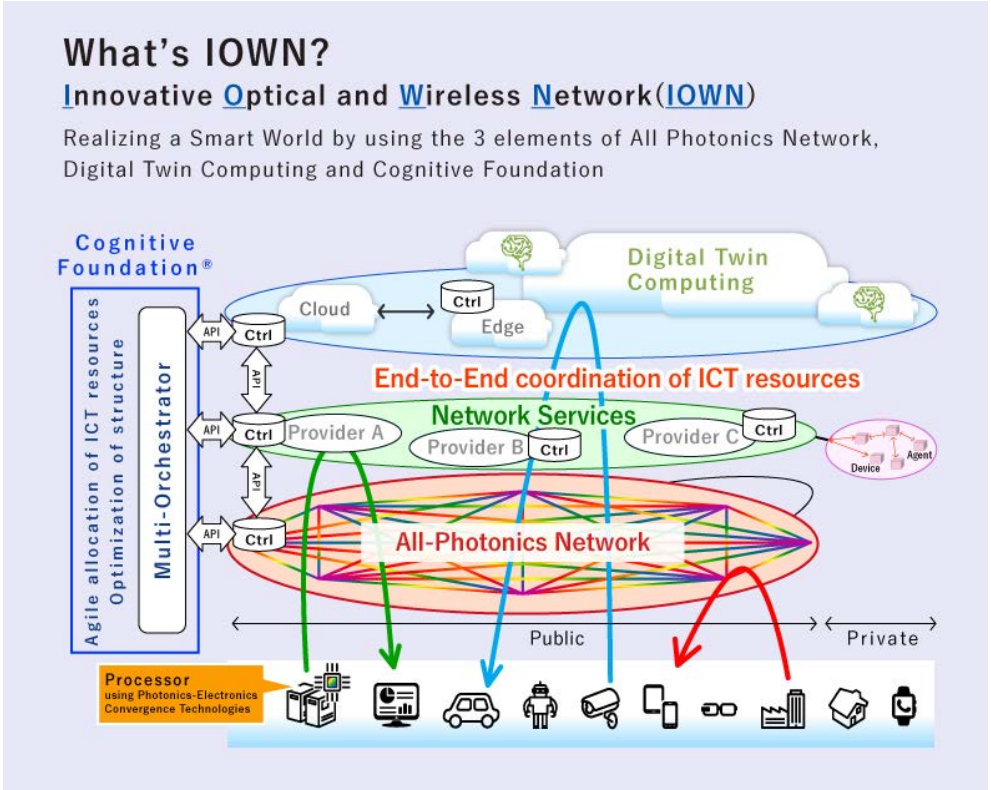
Announced Nov. 17, 2021

5G Evolution and 6G

5G Evolution and 6G Powered by IOWN

5G Evolution and 6G will evolve into a next-generation information/communication infrastructure that can deliver a diverse set of values end-to-end, organically blending optical and other innovative network and information processing technologies characterized by IOWN's ultra-large capacity, ultra-low latency transmission and ultra-low power consumption.

» Ref.) NTT's IOWN Concept



Target performance of an all-photonics network

(1) Low power consumption

Power efficiency*1
100 times higher

- **No need for optical-electrical conversion**
- **Optical processor (photonic-electronics convergence), etc.**

(2) Large capacity, high quality

Transmission capacity*2
125 times higher

- **Wavelength allocation by service**
- **IP-agnostic, etc.**

(3) Low latency

End-to- end delay*3
1/200

- **Data compression not required**
- **Waiting processing not required, etc.**

*1: Target power efficiency of the part applied with photonics technology.
*2: Target communication capacity per fiber.
*3: Target latency of uncompressed video traffic within the same prefecture.

Source) NTT R&D IOWN concept introduction site

Element Technologies and DOCOMO's Actions

Coverage improvement

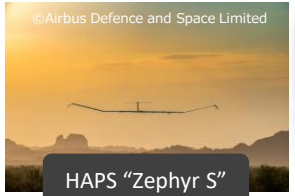
"Drop-n-Prop Antenna"

Metasurface lens

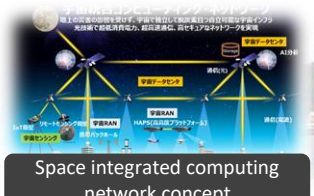
OAM-MIMO radio multiplexing

Radio/device technologies that can broaden millimeter wave coverage more easily, in addition to conventional base station installation.

Coverage expansion



HAPS "Zephyr S"



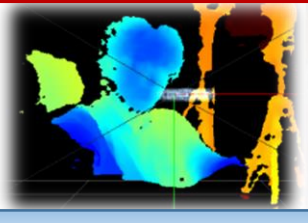
Space integrated computing network concept

Underwater acoustic communication technology

Coverage expansion to sky, sea and space using satellites, HAPS and underwater drones

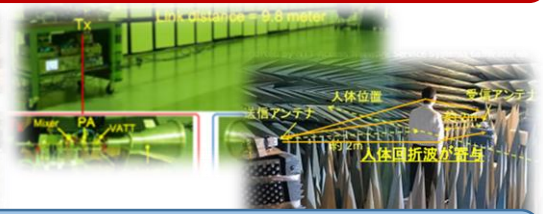
Industrial application

Comprehensive evaluation by connecting to actual factories and machines



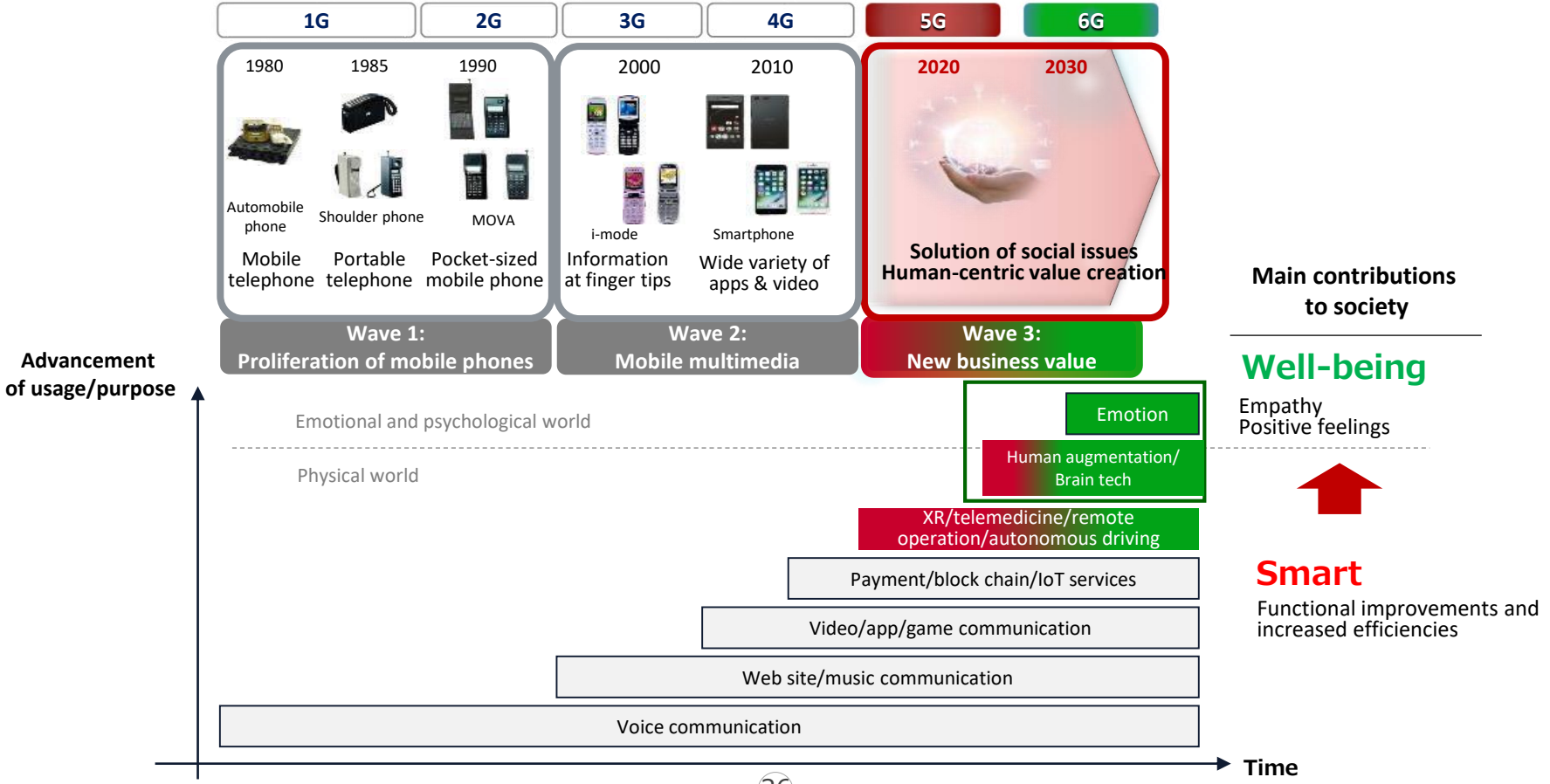
Secure low latency and high reliability required for industrial use cases

Terahertz



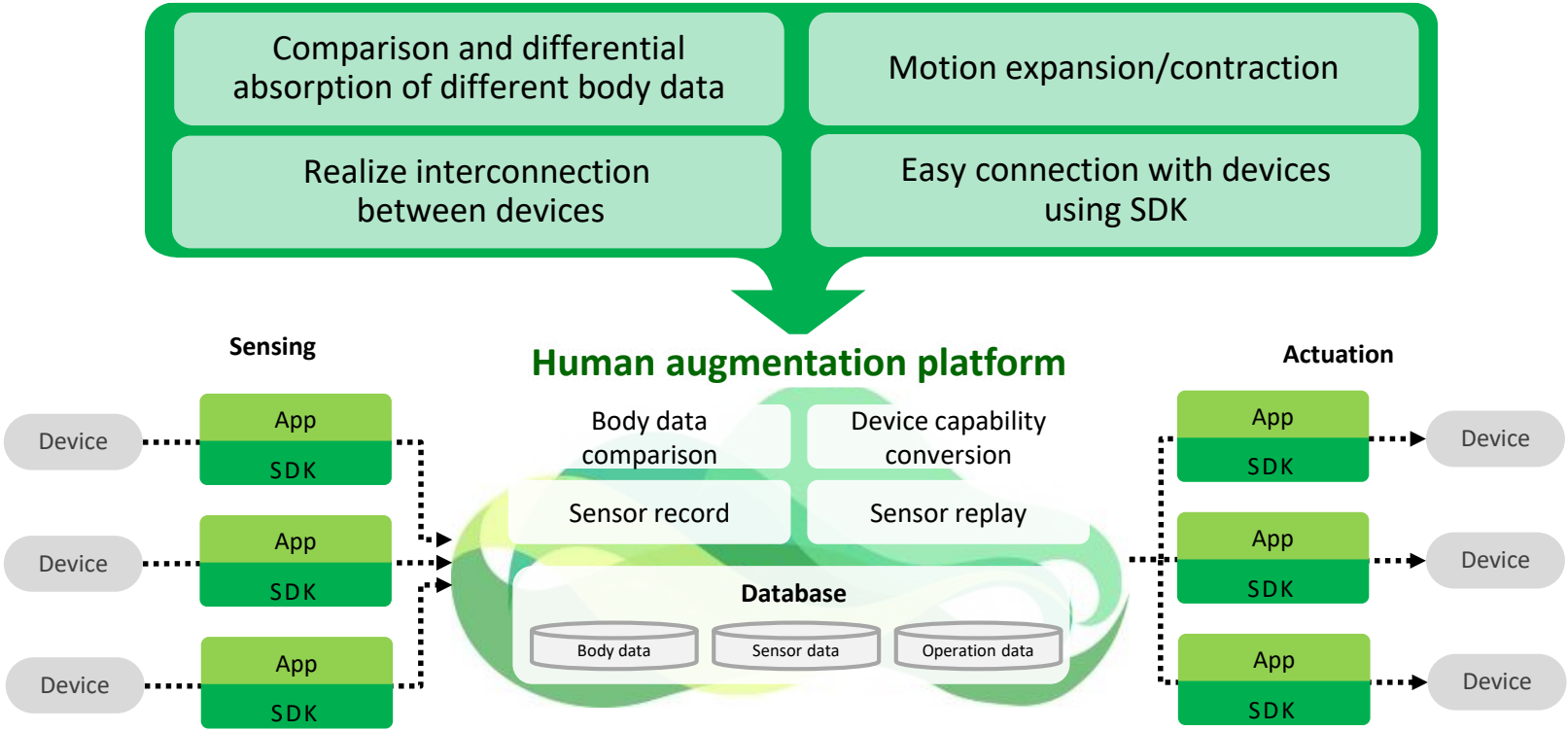
Technology advancement for use of wide band frequencies toward commercialization of ultra-high speed, large capacity transmission with 6G

Studies on New Use Cases of 6G Era



Development of Human Augmentation Platform

A platform for realizing “human augmentation” where the network augments human feelings.

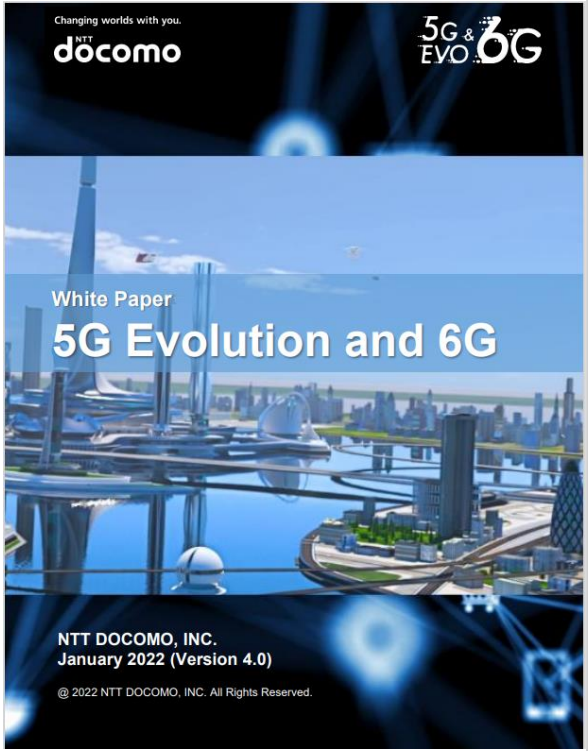


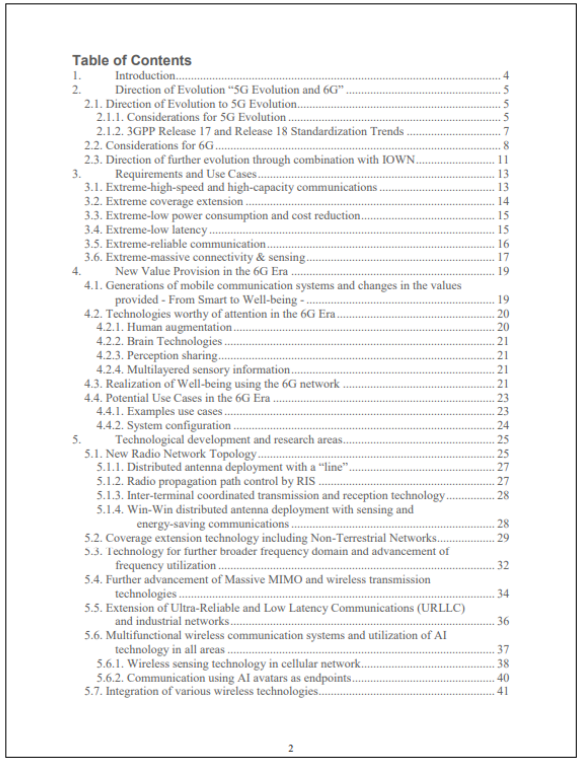
Technology partners: H2L Inc., FCNT Limited, Fujitsu Limited.

Announced Jan. 17, 2022

DOCOMO White Paper “5G Evolution and 6G”

Published white paper (version 4) on Nov. 8, 2021, adding new descriptions:
“Direction of further evolution through combination with IOWN” and “New value creation of 6G era”.





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DOCOMO White Paper
5G Evolution and 6G

V. 1.0 (Published Jan. 22, 2020)
V. 2.0 (Published Jul. 17, 2020)
V. 3.0 (Published Feb. 2, 2021)
V. **4.0 (Published Nov. 8, 2021)**

For more details, search below:

DOCOMO 6G White Paper 検索

Changing worlds with you.