

Jan. 17, 2022

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

#### **Naoki Tani**

Executive Vice President
Chief Technology Officer
Executive General Manager of R&D Innovation Division
NTT DOCOMO, INC.

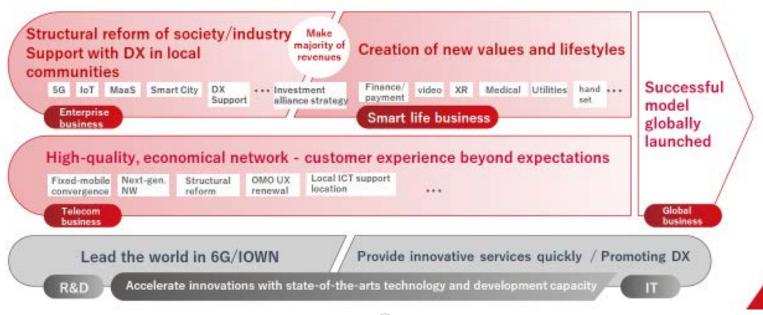
### **Today's Topics**

- 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
- **J** 5G Evolution and 6G

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

With 'Structural Reform' and 'Creation of New Lifestyles' we are...

### Changing worlds with you.

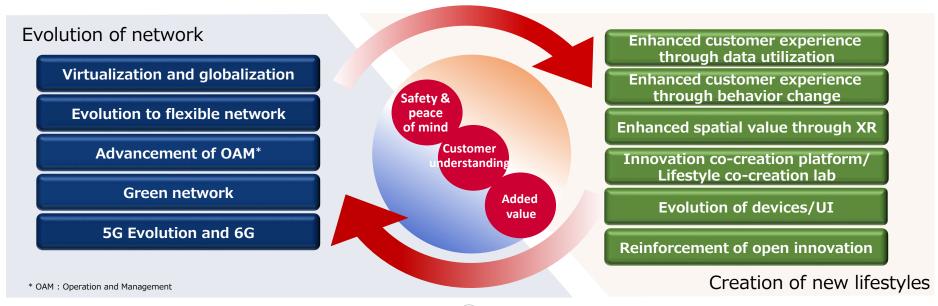


#### DOCOMO R&D: Our Aspirations and Key Initiatives

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



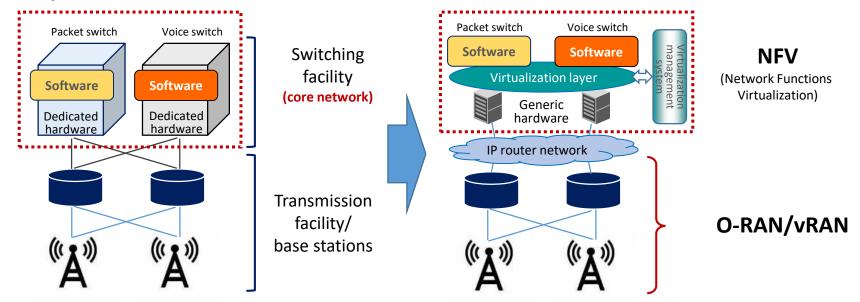
# Network virtualization and globalization

#### 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%

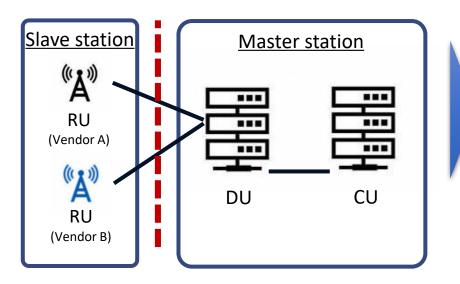
FY2024/end: Aim to achieve 100% virtualization



#### ) Introduction of O-RAN/vRAN, RIC at DOCOMO

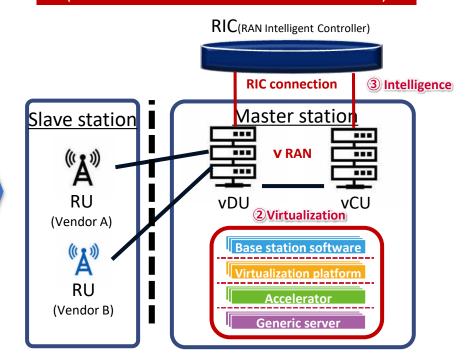
STEP1: Commercial adoption in Mar. 2020

**1** Adoption of O-RAN compliant interface



**STEP2: Under review** 

(Aim for commercialization within FY2022)



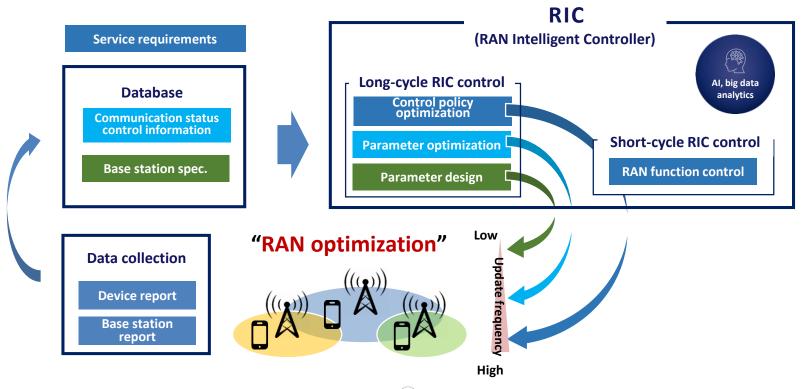
RU: Radio Unit

DU: Distributed Unit CU: Cer

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

#### **Heightened interest from operators/vendors**

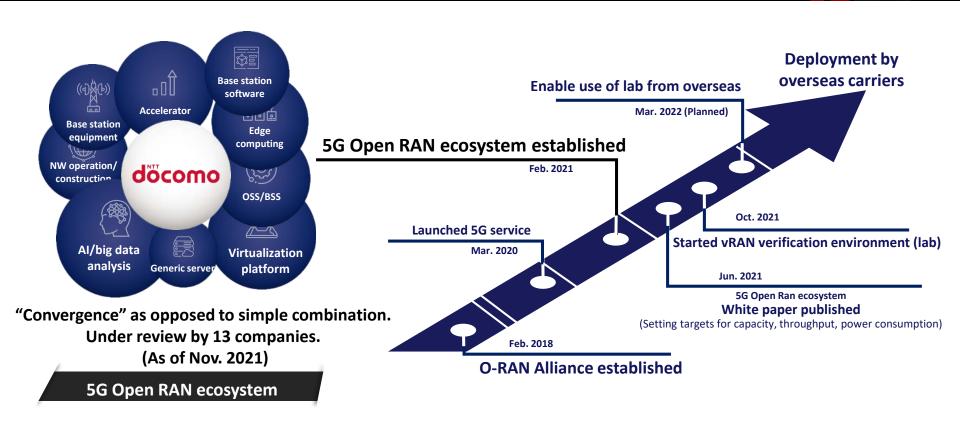


Established Feb. 2018



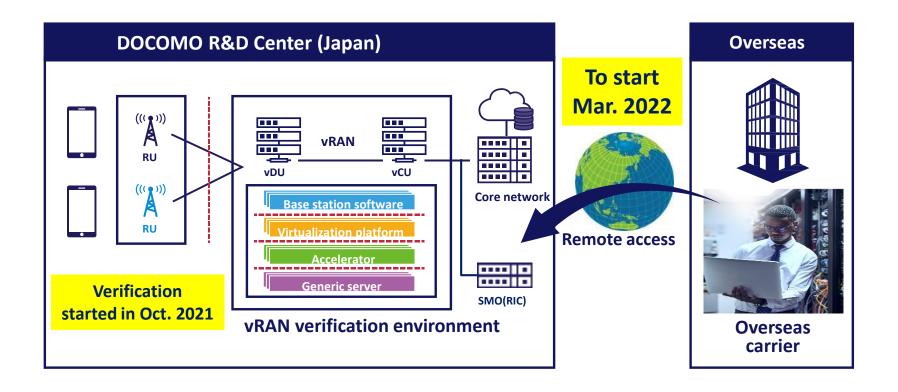
**O-RAN Alliance members** 

#### Provision of 5G Open RAN to Overseas Carriers



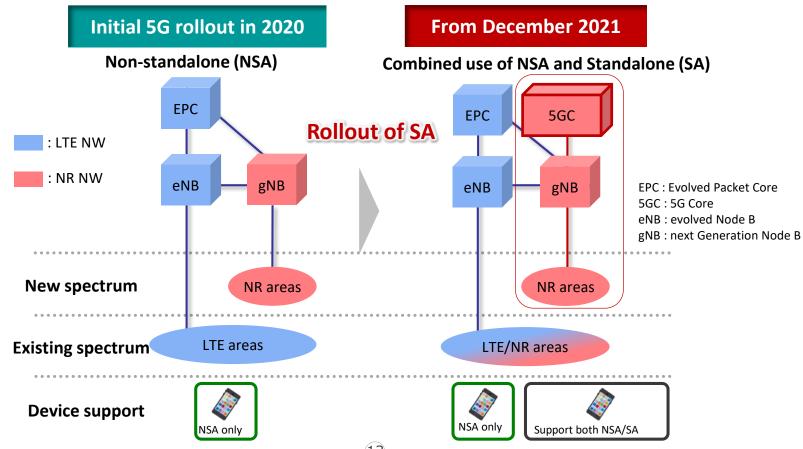
#### **>>**

## **Provision of vRAN Verification Environment Accessible from Overseas**



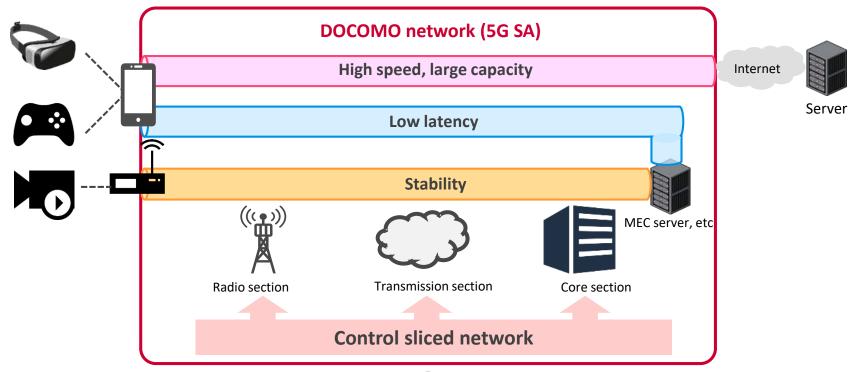
# **Evolution to Flexible Network**

#### >> 5G Network Migration



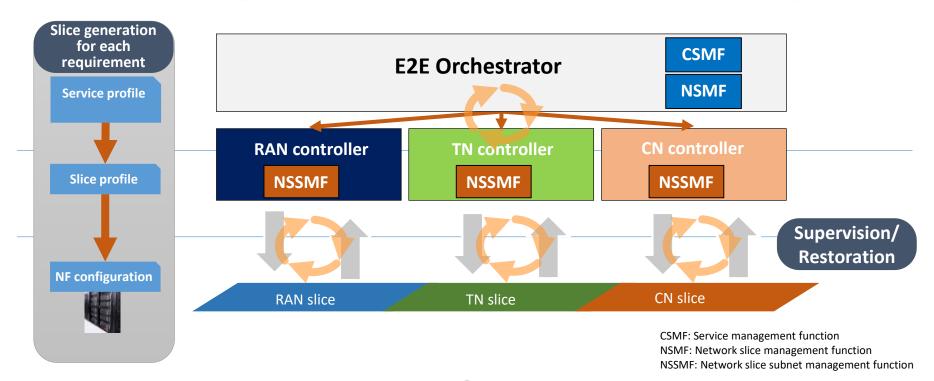
#### >> E2E Slicing

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



#### >> E2E Orchestrator

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

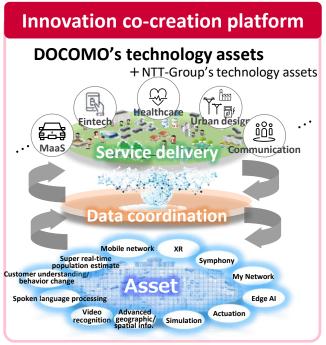


# Human-Centric Value Creation Leveraging Innovation Co-Creation Platform/ Lifestyle Co-Creation Lab

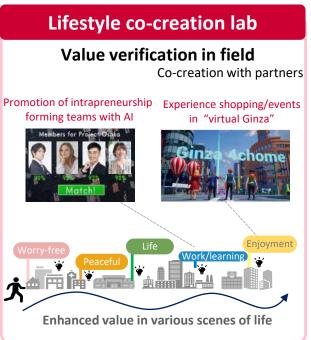
#### Human-Centric New Value Creation through Digital

Create new lifestyles with state-of-the-art technologies.

Co-create richer everyday life experience through virtual/physical convergence.

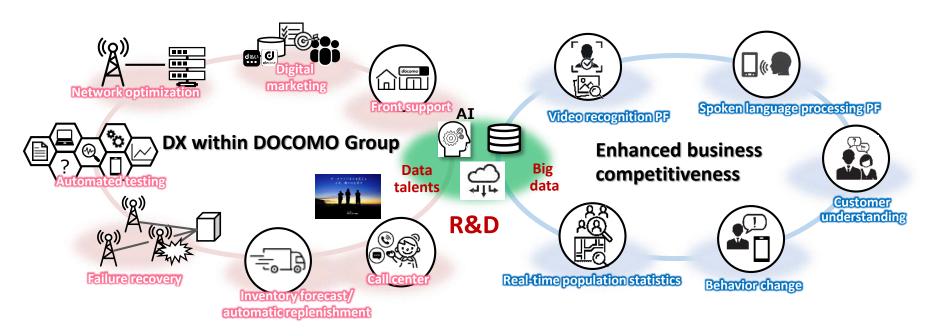






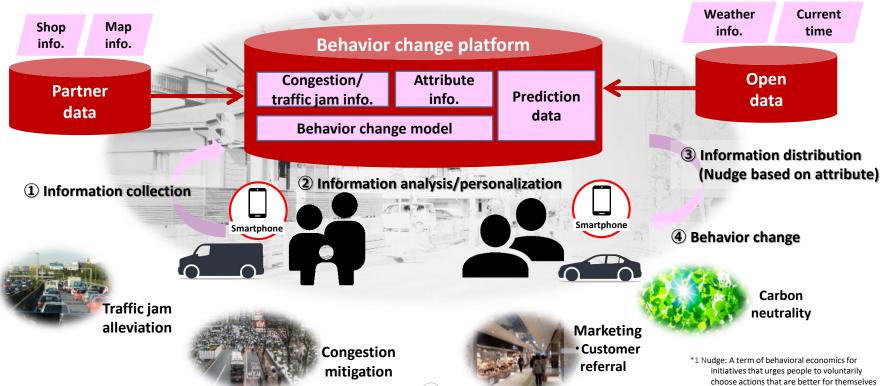
#### >>> Expansion of AI/Data Use Cases

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.



(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**



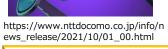


8KVR video distribution system, etc.

#### **Device/UI**

#### XR experience on next-generation device replacing smartphones







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**

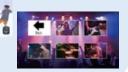
#### Multi-device PF



#### 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.



©Tsuburaya Productions, Co. Ltd.

#### [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 kev
- Easy connectivity with external XR services via API.

Announced Jan. 11, 2022

#### Al 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 Al agent API®" is used for natural dialogue.

Announced Nov. 17, 2021

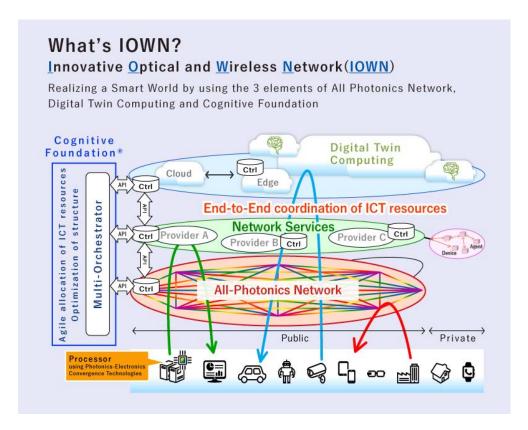
### **5G Evolution and 6G**

#### >>> 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.

\*2: Target communication capacity per fiber.

<sup>\*1:</sup> Target power efficiency of the part applied with photonics technology.

<sup>\*3:</sup> Target latency of uncompressed video traffic within the same prefecture.

#### >> Element Technologies and DOCOMO's Actions

#### **Coverage improvement**





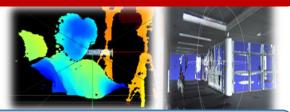


Radio/device technologies that can broaden millimeter wave coverage more easily, in addition to conventional base station installation.

#### **Industrial application**







Secure low latency and high reliability required for industrial use cases

#### **Coverage expansion**







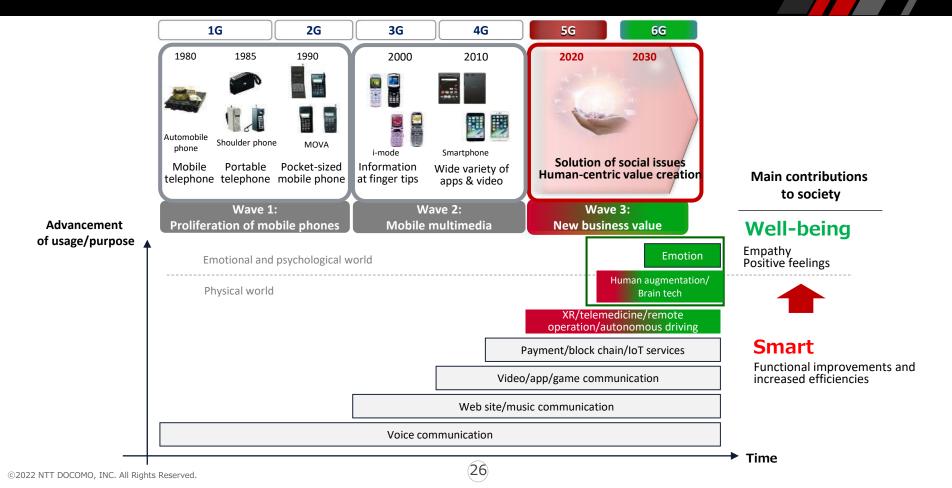
Coverage expansion to sky, sea and space using satellites, HAPS and underwater drones

#### **Terahertz**



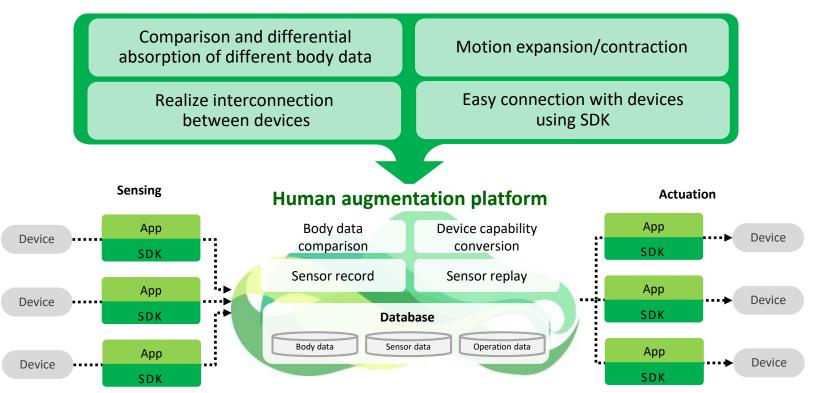
Technology advancement for use of wide band frequencies toward commercialization of ultra-high speed, large capacity transmission with 6G

#### Studies on New Use Cases of 6G Era



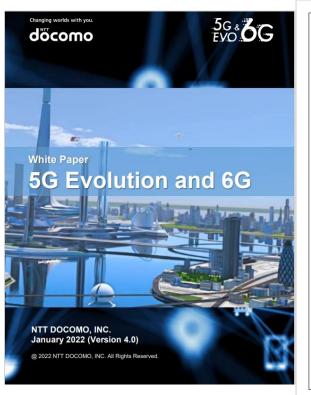
#### >> Development of Human Augmentation Platform

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



#### 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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