Co-ordinated Autonomous Network – prelude

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The research results were obtained from the commissioned research [No.01701] by National Institute of Information and Communication Technology (NICT), JAPAN.”

Contents

- Background of Beyond 5G research projects in Japan
- Co-ordinated autonomous network
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- Standardization activities
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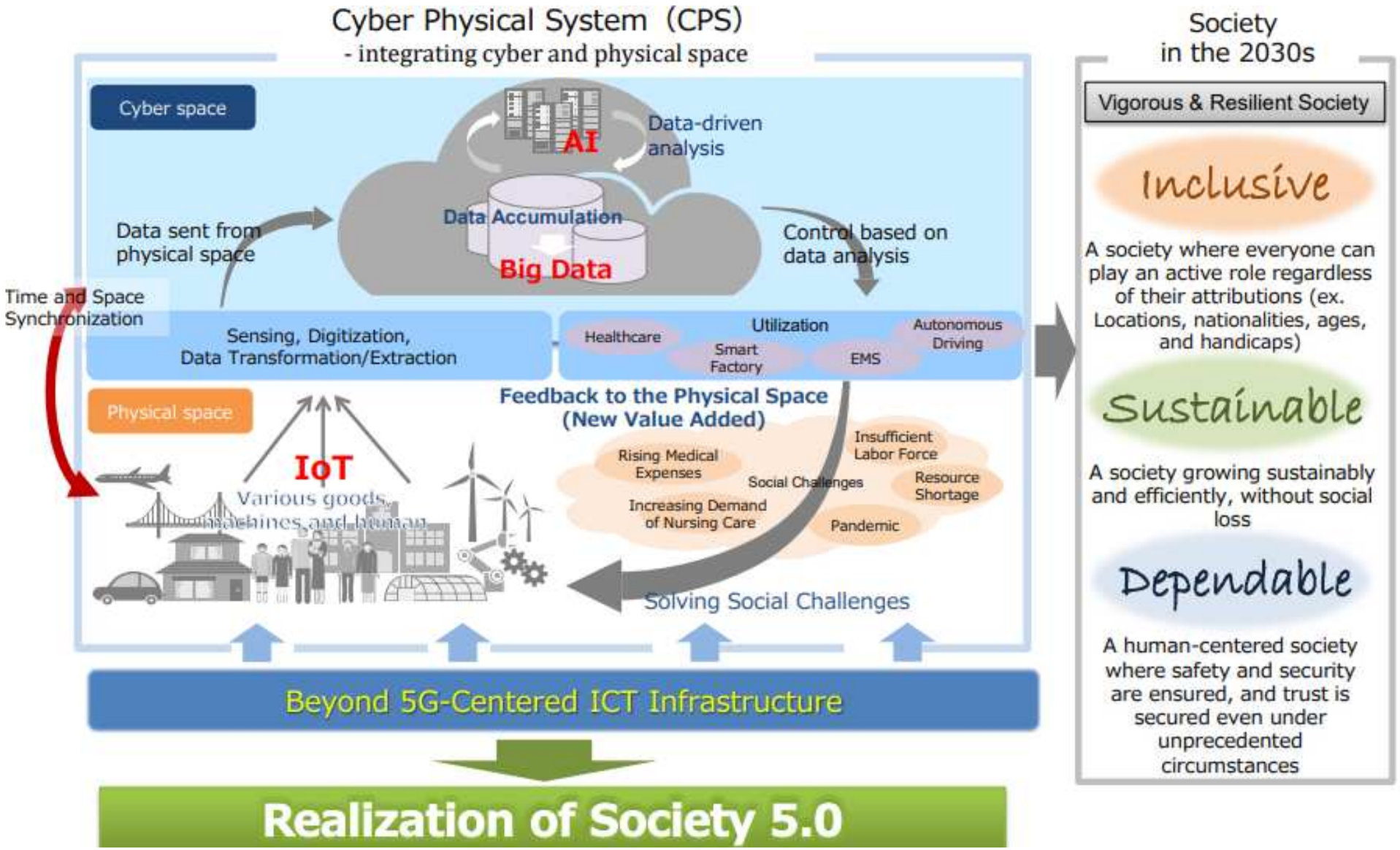
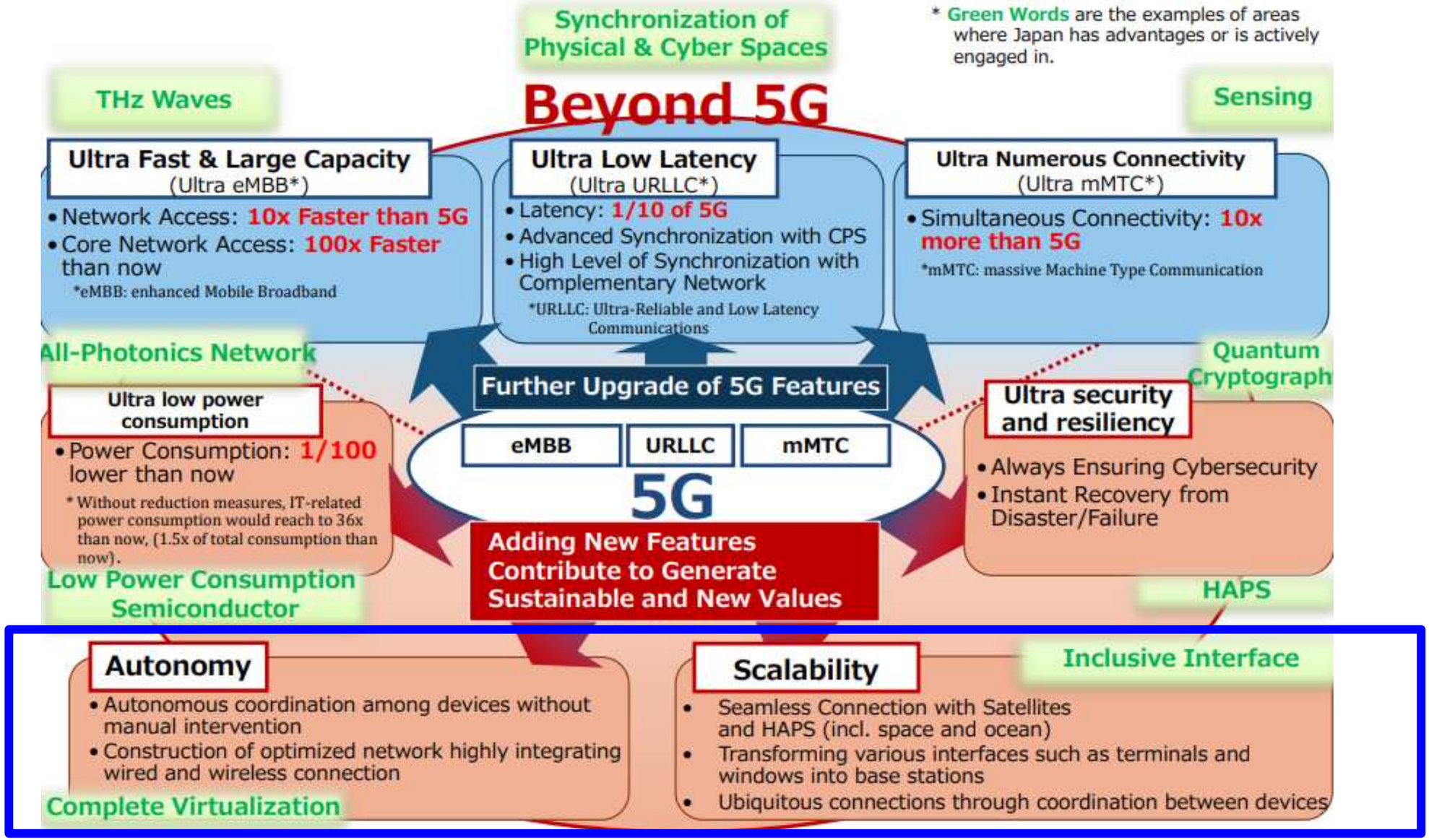
Society in the 2030s



https://www.soumu.go.jp/main_sosiki/joho_tsusin/eng/presentation/pdf/Beyond_5G_Promotion_Strategy.pdf

Key features for Beyond 5G

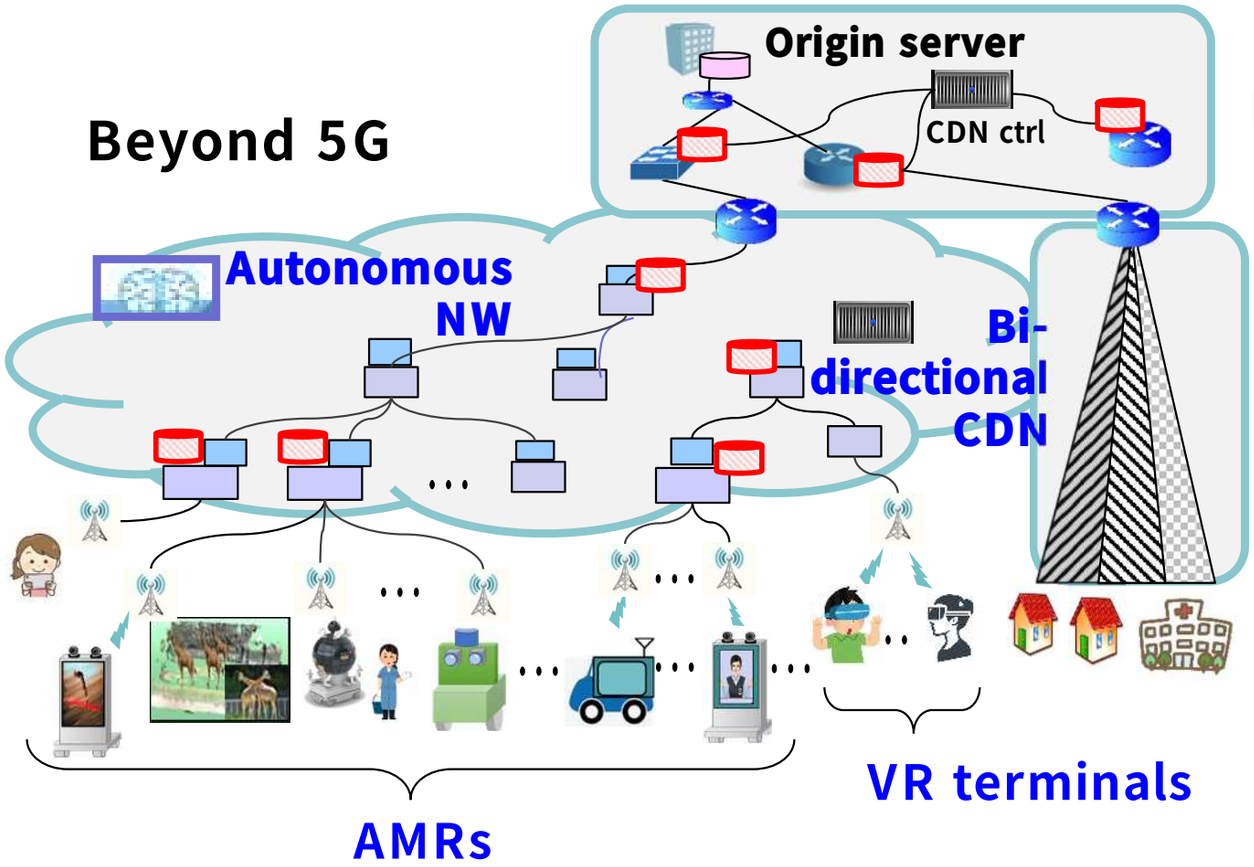


https://www.soumu.go.jp/main_sosiki/joho_tsusin/eng/presentation/pdf/Beyond_5G_Promotion_Strategy.pdf

Co-ordinated autonomous network

Overall architecture for coordinated autonomous network

- Co-ordinated AN is necessary to satisfy the future huge and complicated requests from new emerging services in B5G era.
- Coordination between autonomous network (NW provider) and bi-directional CDN (Service provider) is important.



Data center with virtual machines
MEC (Multi-access edge computing)
Bi-directional CDN modules

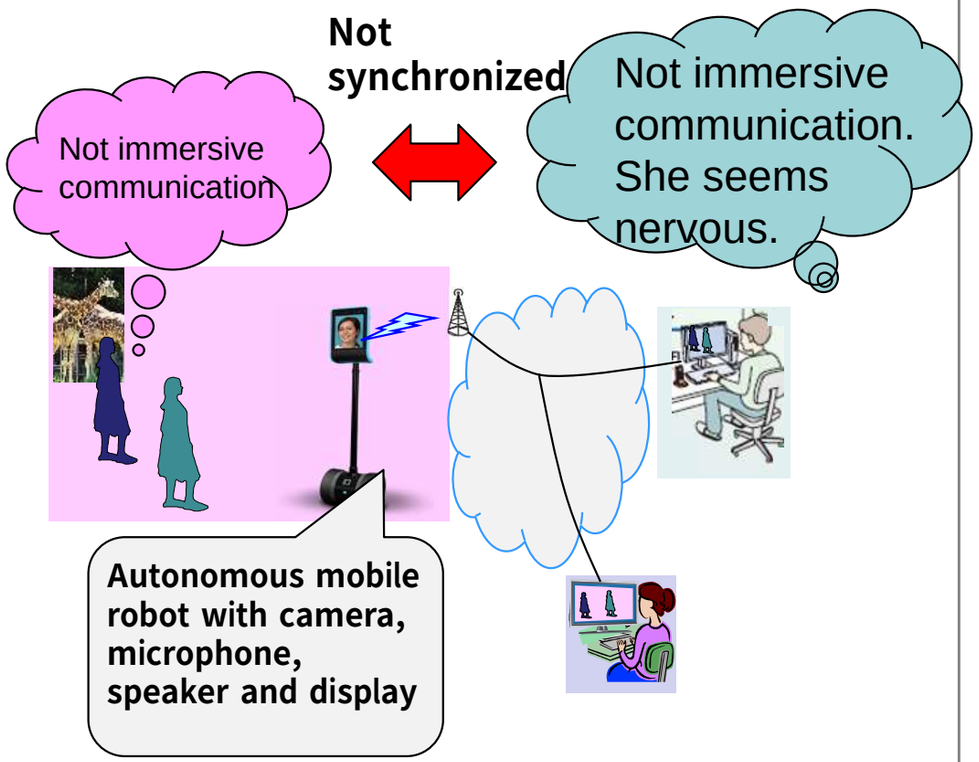
Fixed NWs

Research project	AI NW	Autonomous network
NW	5G	6G (Beyond 5G)
NW mgmt	ML,AI	Evolution, autonomy
Video cntl	Cache control	Bi-directional CDN
Terminal	Smart phone, tablet PC	Autonomous mobile robot, drone, …

New service over coordinated AN including metaverse

Now

◆**Not immersive communication**

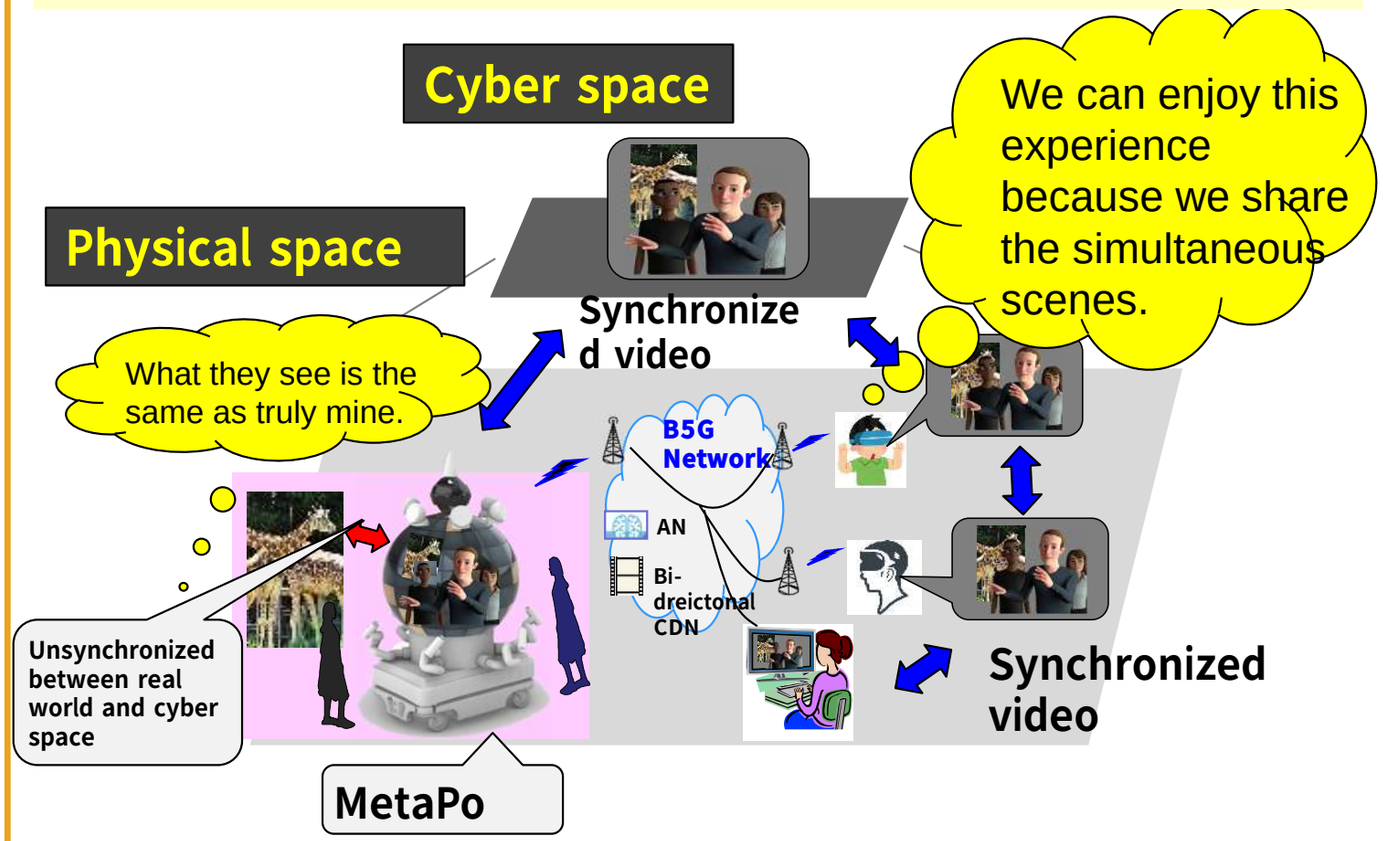


Future

◆**Participants in one party** can enjoy one virtual space.

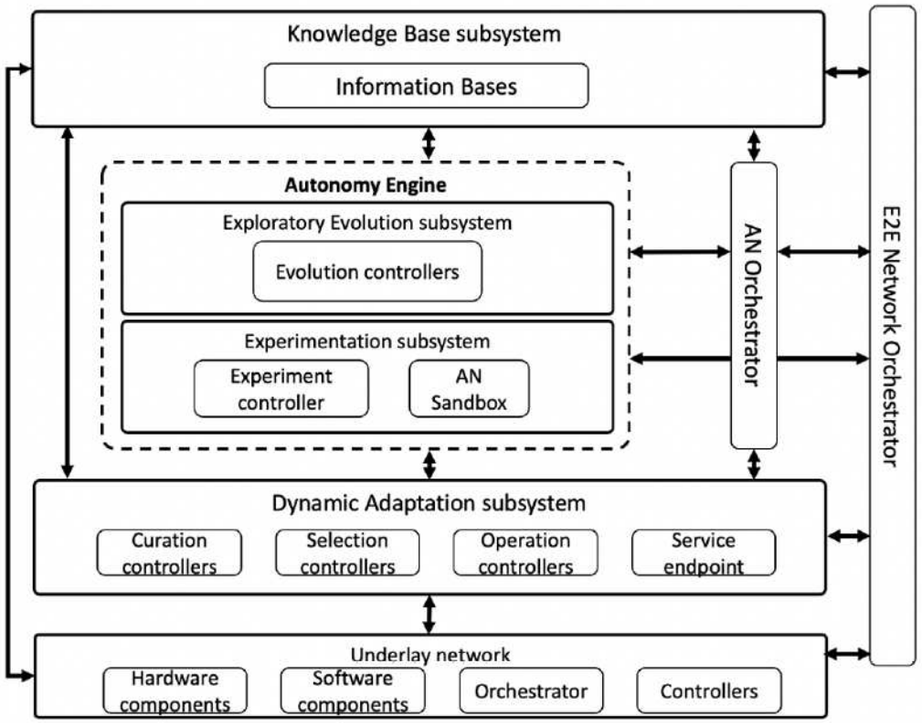
◆To do this, Coordinated AN provides functions to share the simultaneous scenes to all remote participants

◆Multiple video sources are available in one party.

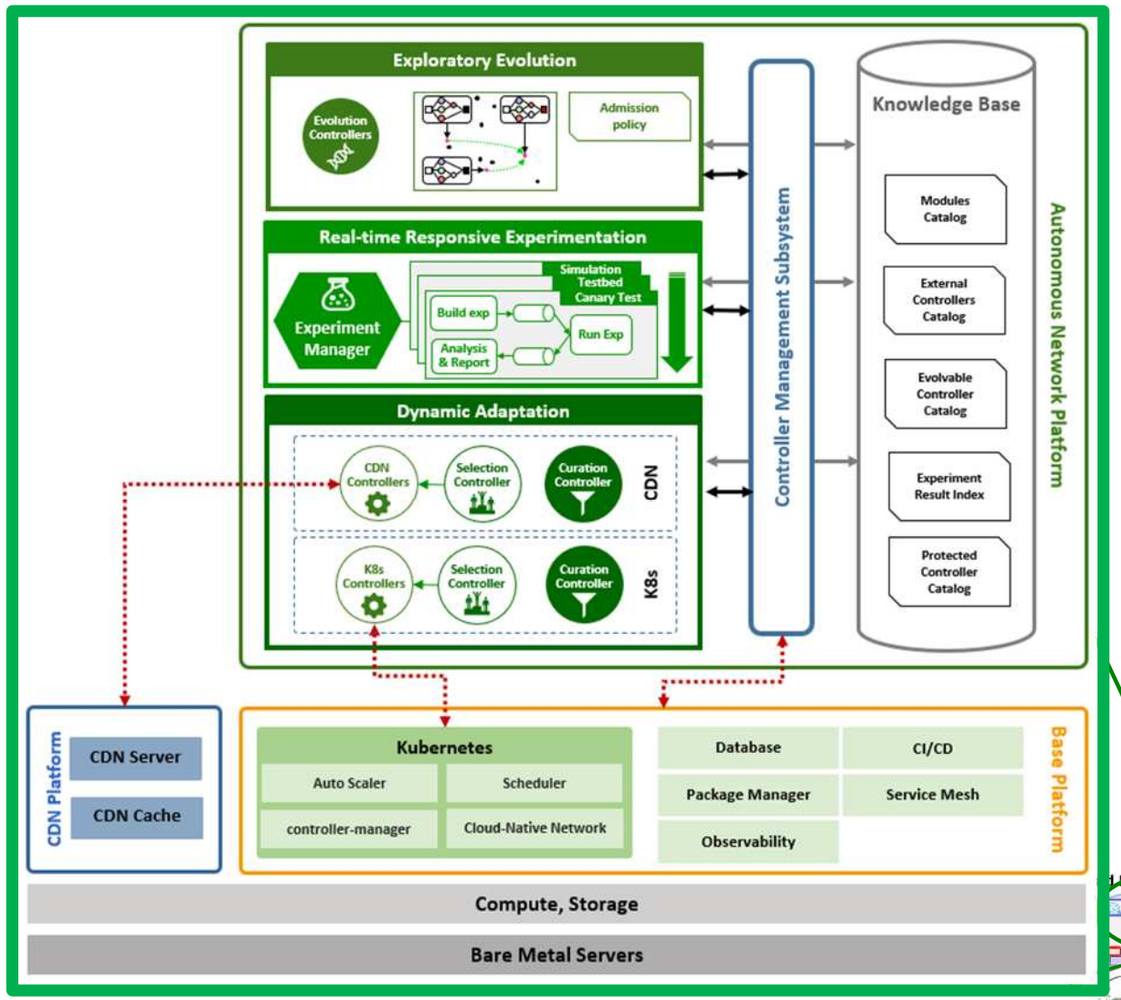


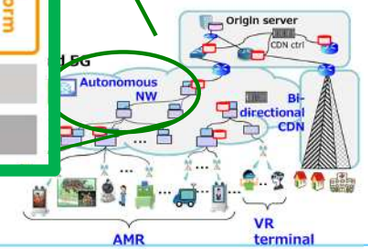
Autonomous Network Platform

- Based on ITU-T FG-AN Technical Specification: Architecture Framework for Autonomous Networks.
- Through this research project, the details will be implemented and evaluated.



Source:
ITU-T FG-AN Technical Specification: Architecture Framework for Autonomous Networks
https://www.itu.int/en/ITU-T/focusgroups/an/Documents/Architecture-AN.pdf

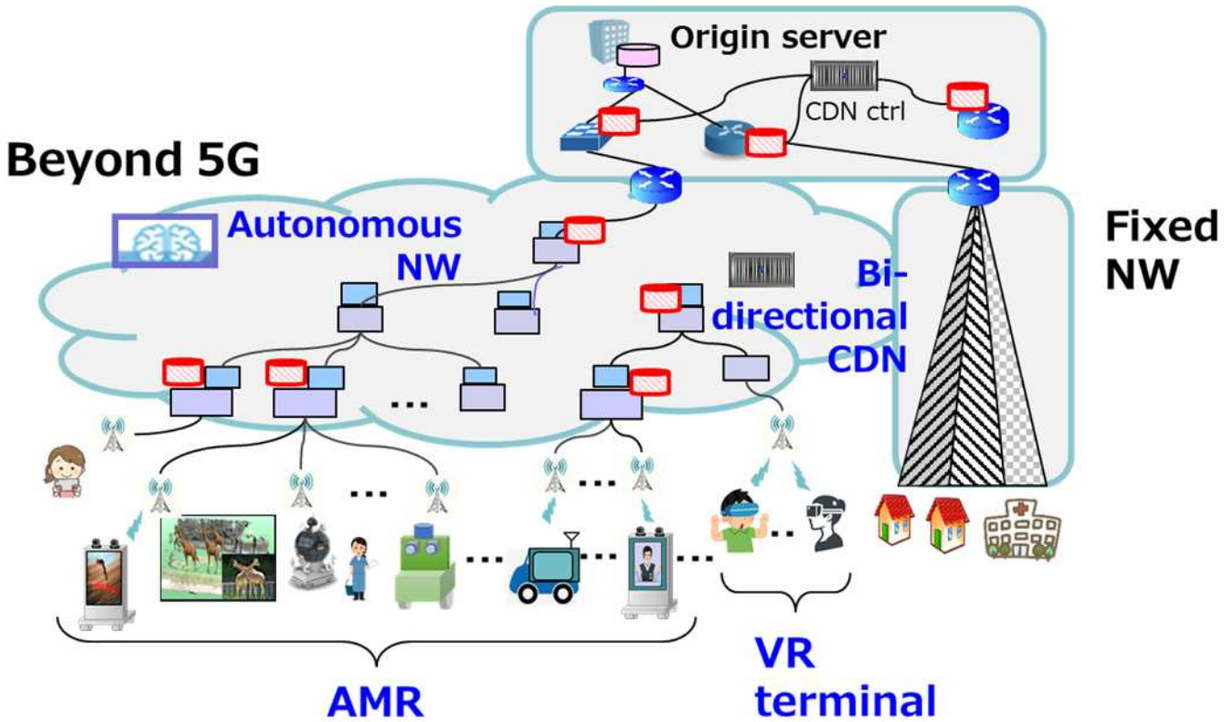




Bi-directional CDN(*)

- It communicates with AN and compensate AN limit by application layer information
- It will store contents not only from origin in Internet but also from video in AMR.
- It provides short cut path to B5G mobile network users and provide synchronized communication even over heterogeneous networks

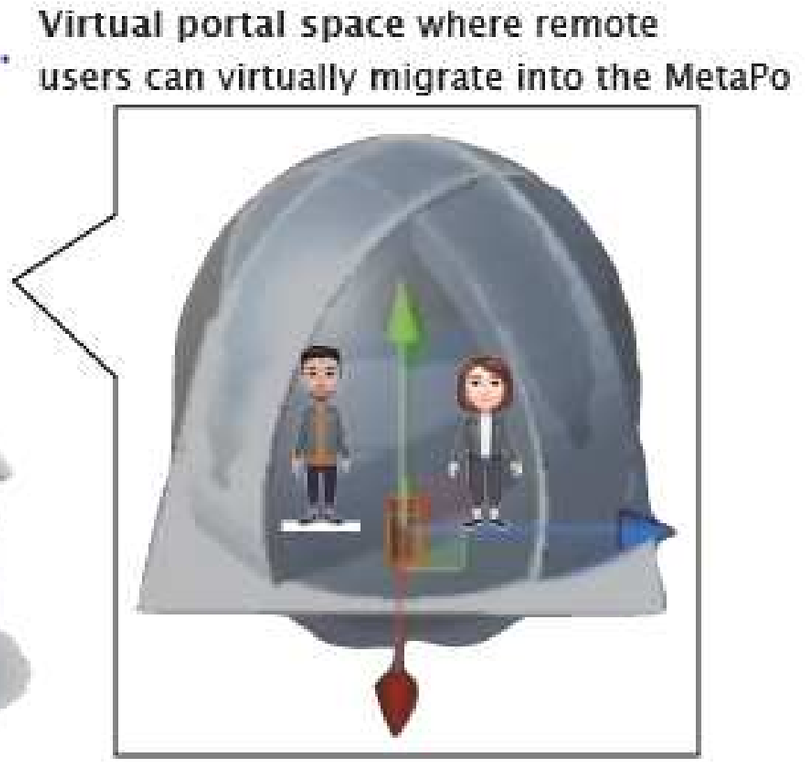
Bi-directional CDN
= Videoo service platform in B5G era
= Cache server control,
+ delay management for synchronized comm.
+ video transcoding for old terminals,
+ AN communication..



(*) Hideki Yamamoto, et.al.,"Study on enabling video services with the use of an autonomous mobility robot connected to an autonomous network", IEICE Technical Report IN2022-32(2022-09) (in Japanese)

Autonomous Mobile Robot as Metaverse terminal: MetaPo(*)

- MetaPo is a portal that connects distributed physical and cyber spaces.
- Four-wheel, 360° camera, spherical display, microphone, directional speakers, and robotic hands.
- Virtual portal space for remote users to virtually migrate into the MetaPo.



(*) Takuro Yonezawa, Nozomi Hayashida, Johanners Przybilla, Yutaro Kyono, Kenta Urano, and Nobuo Kawaguchi: “MetaPo: A Robotic Meta Portal for Interspace Communication”, SIGGRAPH Johanners’22 Posters.(2022)

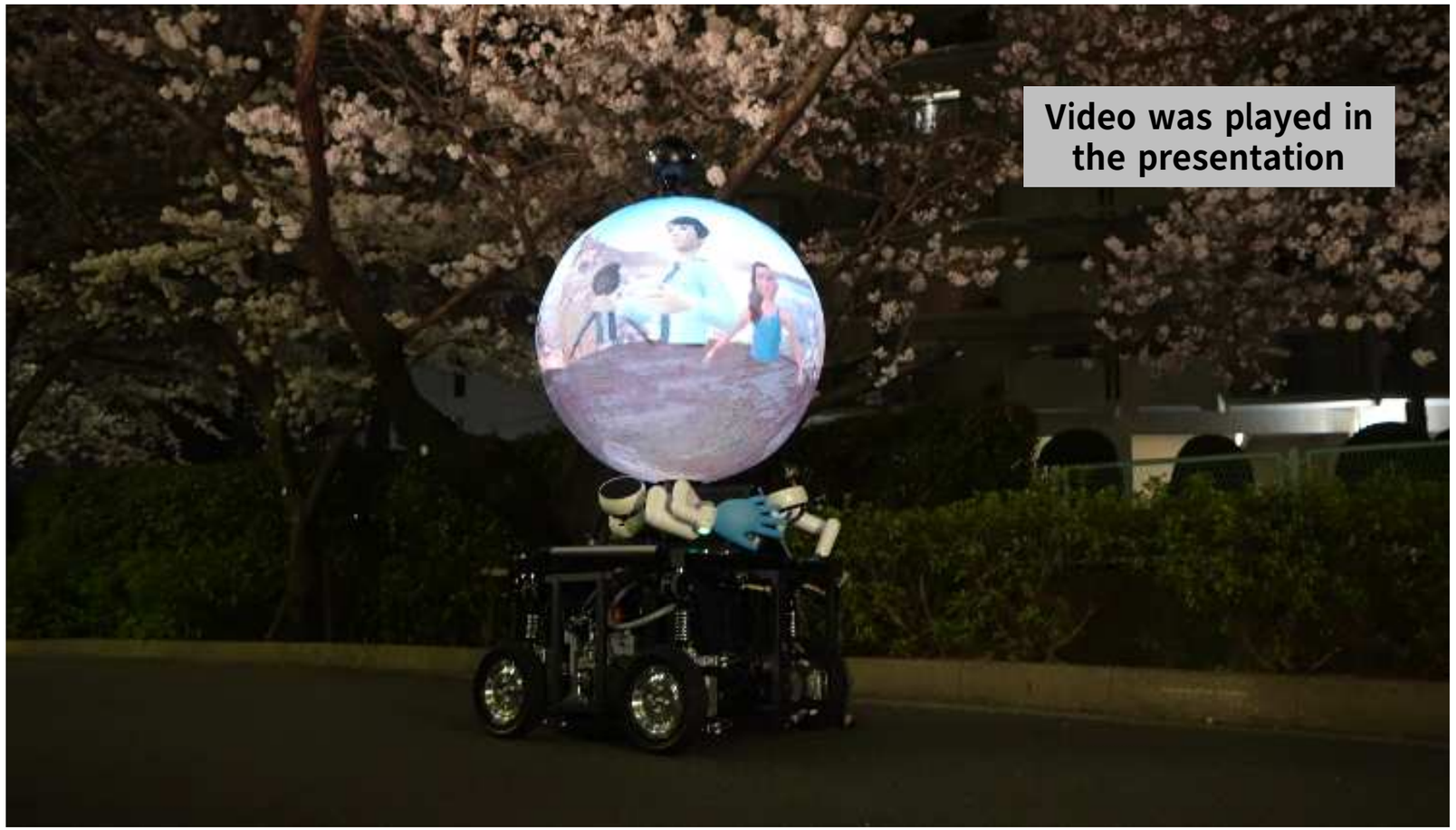
MetaPo: A Robotic Meta Portal for Interspace Communication (*)

- **MetaPo is designed to work as a portal that connects distributed physical and cyber spaces**

(*) Takuro Yonezawa, Nozomi Hayashida, Johanners Przybilla, Yutaro Kyono, Kenta Urano, and Nobuo Kawaguchi: “MetaPo: A Robotic Meta Portal for Interspace Communication”, SIGGRAPH Johanners’22 Posters.(2022)

Autonomous Mobile Robot as Metaverse terminal MetaPo(*)

Mixed link and immersive link are provided by MetaPo.

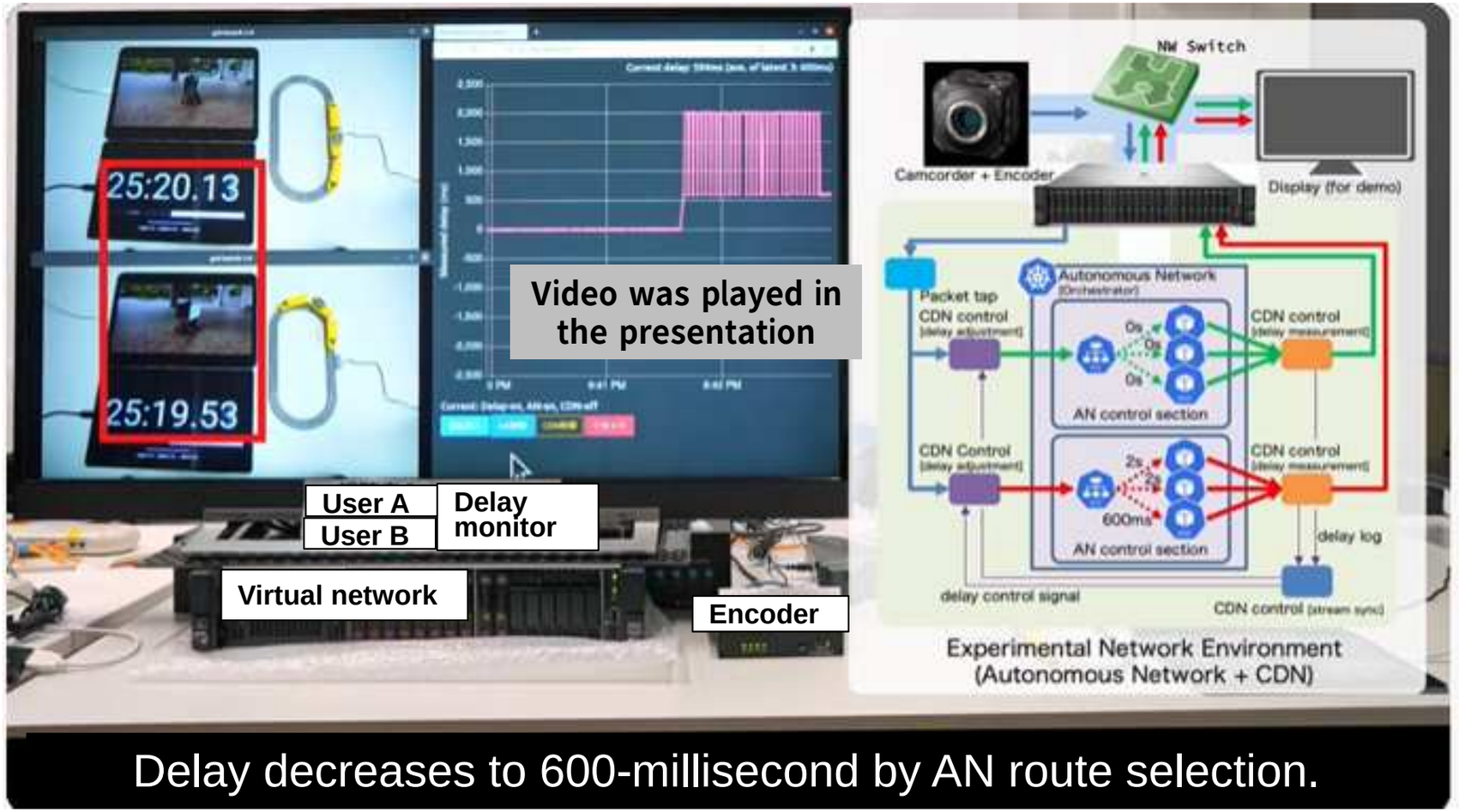


- **Mixed Link** connects remote spaces by treating them as equal. Users in each space can communicate with users in another space using the panoramic audiovisual media
- **Immersive link** means that MetaPo platform provides additional "warp" mode.

(*) Takuro Yonezawa, Nozomi Hayashida, Johanners Przybilla, Yutaro Kyono, Kenta Urano, and Nobuo Kawaguchi: “MetaPo: A Robotic Meta Portal for Interspace Communication”, SIGGRAPH Johanners’22 Posters.(2022)

Co-ordinated autonomous network – prelude implementation

- PoC shows linkage between AN and CDN to synchronize videos in two remote terminals.
- PoC AN platform objective to find best suitable route for B5G service
- Achieved through finding combination of different weighted metrics modules and experimenting on these combinations



Delay decreases to 600-millisecond by AN route selection.

Standardization from Coordinated autonomous network research outputs

- **To implement the research output in the real world around 2030, we study what to standardize.**
- **We started to propose new work items in SG13 (*1) , SG16 (*2) and ASTAP.**
- **Some coordinated autonomous network service will be metaverse use-cases.**
- **We add to submit contributions if a standardization group (FG-metaverse) will be established in ITU-T.**

AMR as Multimedia terminals

Use case and architecture of AN

Gap analysis to coordinated AN

(*1) [ITU-T SG13 RGM-C209] Proposed updates to the base text of a new work item "Architecture framework for Autonomous Networks" (Y.AN-ARCH) (Geneva, 15-25 November 2022).

(*2) [ITU-T SG16 TD46/WP1] H.AMR-ARCH "Requirements and architecture for multimedia functions for autonomous mobile robots connected with network " (New): Initial draft (Geneva, 17-28 October 2022)

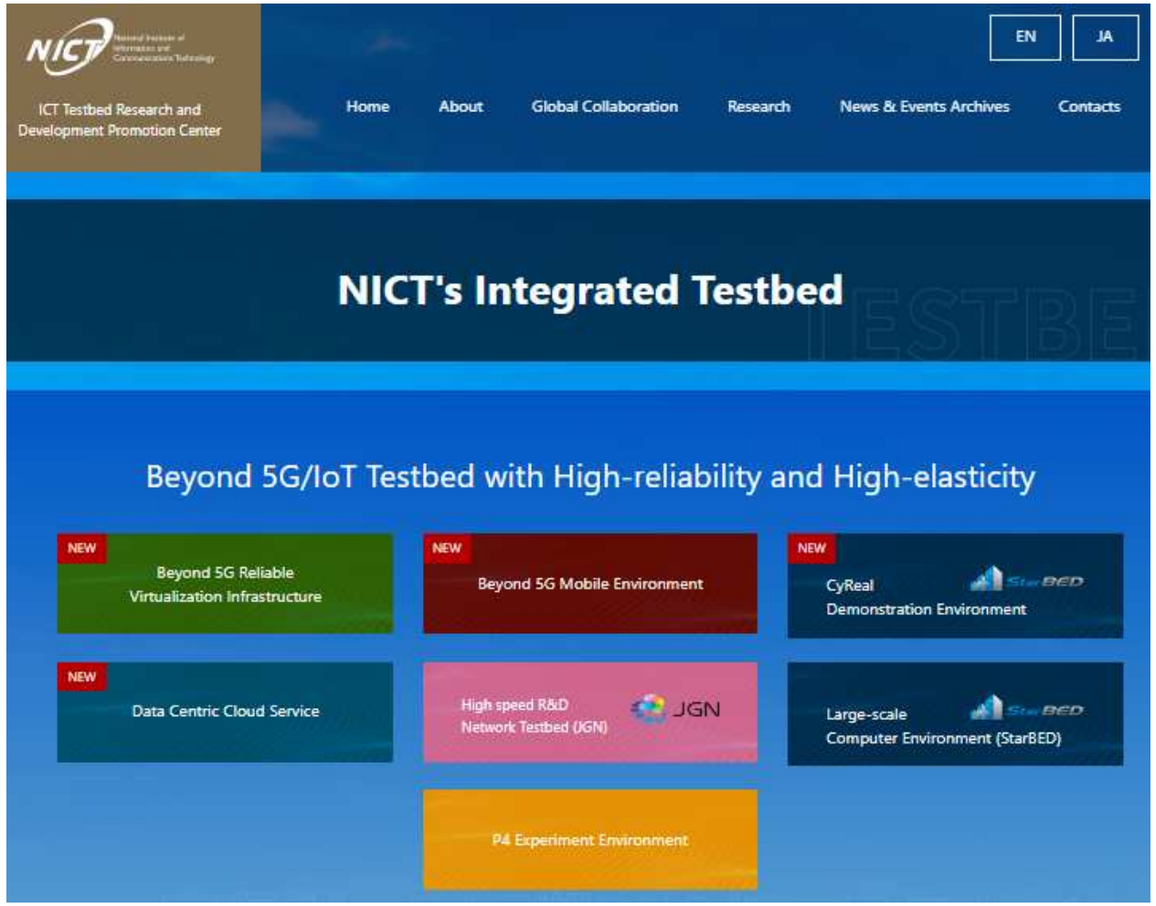
Future plan

Social implementation:

- **Standardization:** Requirements, architecture, functional architecture of components, APIs, testing specifications… for AN, B-CDN, Robot. (SG13, SG16, …)
- **Finding business partners:** AN,CDN,Robot, total services.

Technical research:

- Each component needs further development (AN, CDN, Robot)
- Experiment in the big test bed (NICT's integrated testbed) towards social implementation in 2025



https://testbed.nict.go.jp/english/

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