Mirror Metaverses and networks of avatars

In the future, interaction between avatars will be greater than between people online

Joint Q4/1 and Q5/2 workshop on role and economic impact of artificial intelligence and metaverse in the digital transformation

October 7, 2026. Geneva, Switzerland

Prof. Andrey Koucheryavy

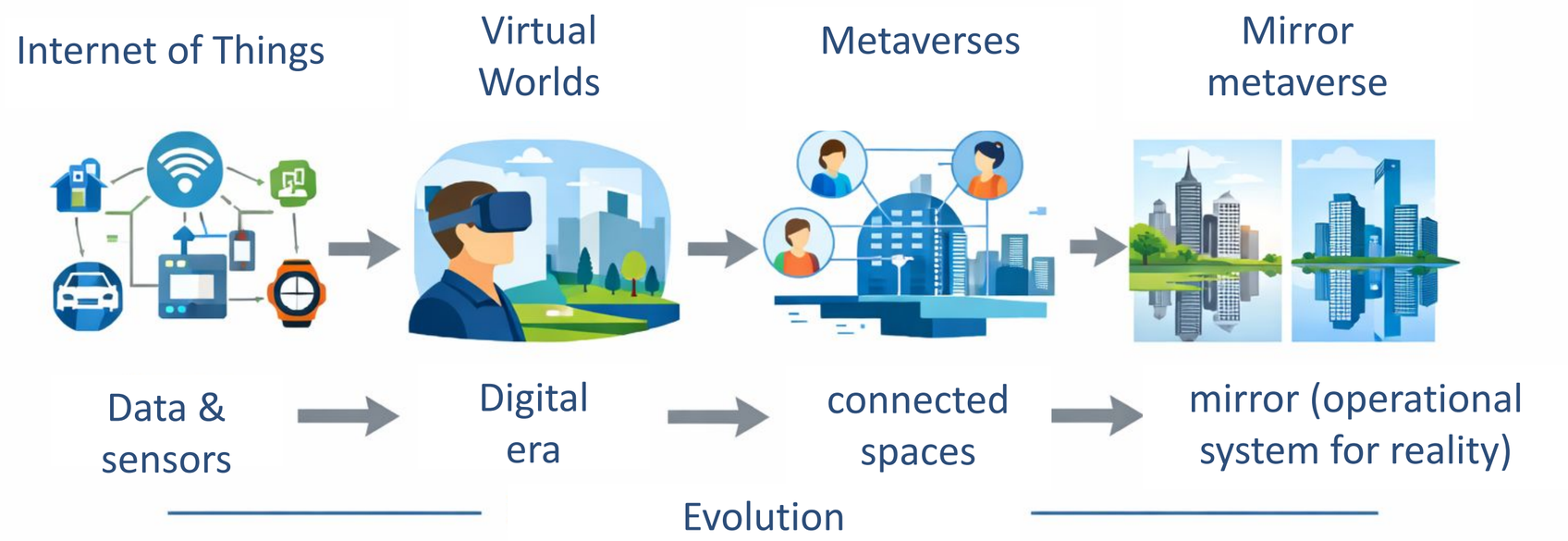
Head of Network & Data transmittion department (SPbSUT),

Regional ITU-R SG11 Chair (EECAT)

Content

- Metaverses evolution
- Metaverse 2.0 technologies
- Avatar’s communications
- A new model network and Avatar communication testing
- Central Eurasia Sandbox for AI Agents and Avatars testing
- Conclusions

Evolution to Metaverse 2.0



Metaverse 2.0 **does not reject physical reality**; instead, **it imbues it with "spatial artificial intelligence"**

Consequently, **users** do not retreat into virtual worlds (metaverses or networked universes) but rather **shape Metaverse 2.0 around themselves—creating that very "mirror"**

Thus, one might venture to say that mirror worlds represent a networked universe of the next order **(Metaverse 2.0)—in a sense, a "new cyber-physical operating system for the state."**

Mirror Metaverse (Metaverse 2.0). Technologies

Zawish M., Dharejo F.A., Khowaja S.A., Raza S., Davy S., Dev K., Bellavista P. IEEE Open Journal of the Communications Society. 2024. T. 5. C. 730-778.

AI AND 6G INTO THE METAVERSE: FUNDAMENTALS, CHALLENGES AND FUTURE RESEARCH TRENDS

Since Metaverse is coined to be the next frontier in multimedia after VR/AR, it will encompass multisensory network services such as haptic and holographic communications. Soon users will undermine the QoE delivered by VR/AR and demand new lifelike multimedia experiences, unlike today's not−real−enough VR/AR experiences. Metaverse applications involving avatar interactions aided with novel communication modalities such as avatar−to−avatar (A2A), avatar−to−human (A2H), and human−to−avatar (H2A) will drive the majority of the Internet traffic by 2030 [162]. Thereby, the services provided by B5G/6G have a crucial role in realizing the lifelike experiences in Metaverse.

FUTURE NETWORKS 2030: ARCHITECTURE & REQUIREMENTS.

Yastrebova A., Kirichek R., Koucheryavy Ye., Borodin A., Koucheryavy A. В сборнике: 2018 10th International Congress on Ultra Modern Telecommunications and Control Systems and Workshops (ICUMT). 2018.

Mirror Metaverse (Metaverse 2.0). Technologies

The mirror universe does not compete for the user's time within the metaverse; it integrates into all of the user's work and life processes (the user is part of the system). Users don't simply "enter" it; they are constantly present within it. The ontological merging of worlds creates a new reality: not virtual worlds for escape, but a "reality management interface.“

Mirror universes are "metaverse 2.0" because they don't deny physical reality/world, but instead imbue it with "spatial artificial intelligence." Thus, users don't escape into virtual worlds (metaverses/network universes), but rather form a "metaverse 2.0" around themselves (creating the very same "mirror").

A key element of mirror universes are avatars, which create a new network—an avatar network—that possess the users' personal data and interact with them in various ways, primarily through telepresence suits.



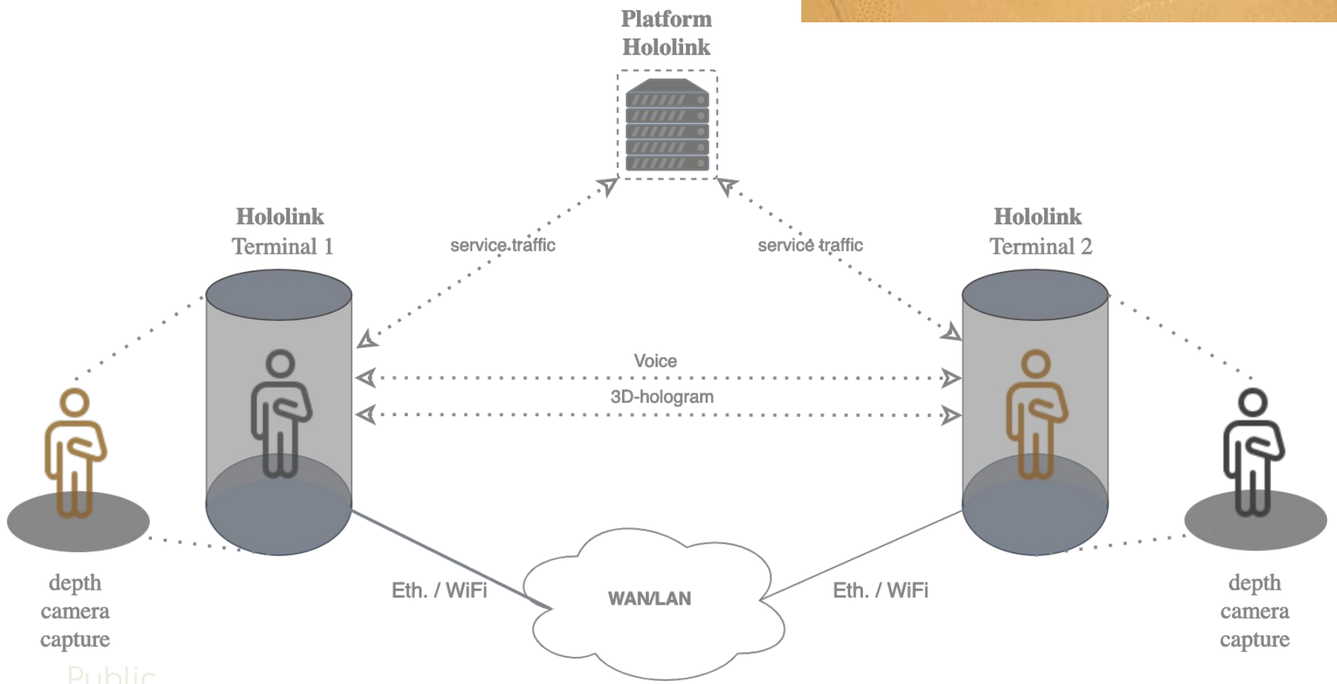
Holographic Type Communications



HoloLink platform with multiple access (user devices: holographic terminal, XR-dev., Holotar, Telepresence Suit);

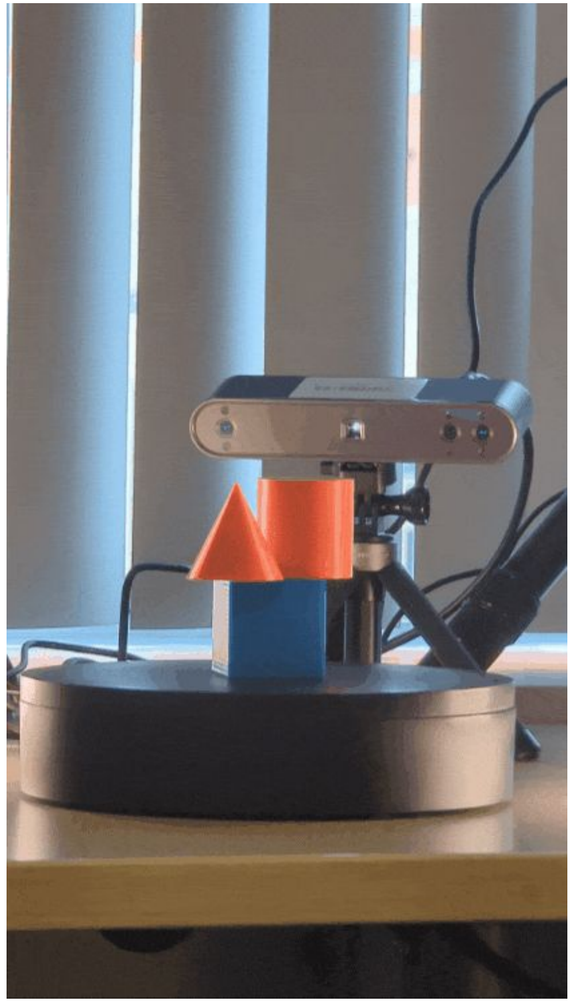
Holographic terminal with low network requirements;New methods for holographic communication with reduced traffic volume;

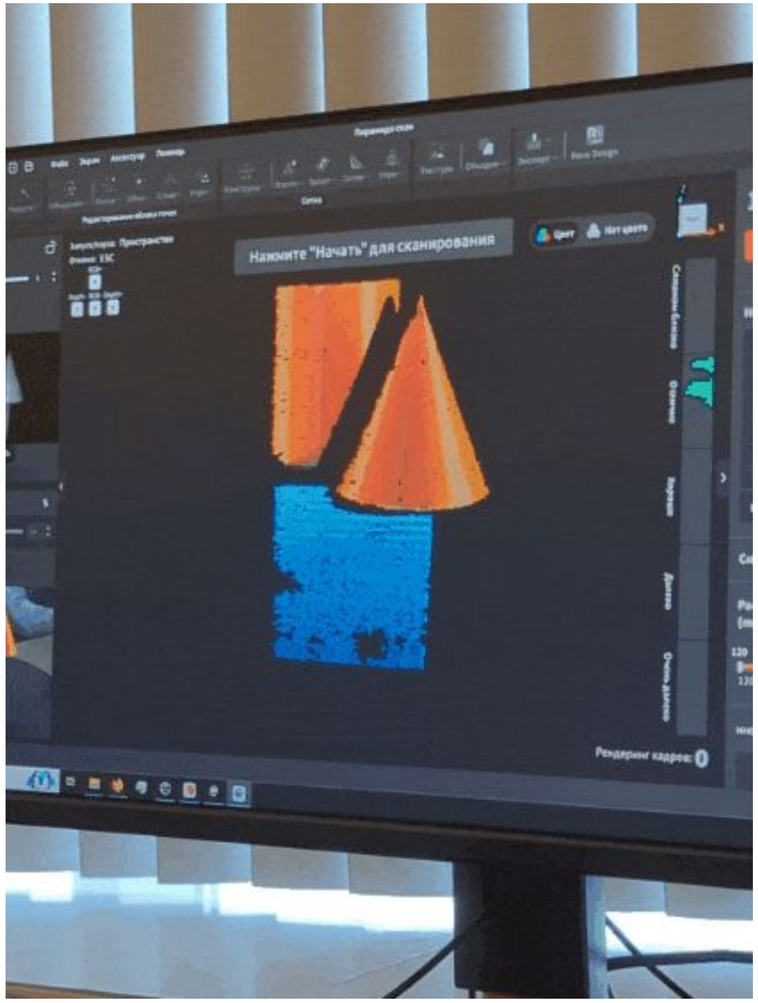




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Mirror Metaverse Research

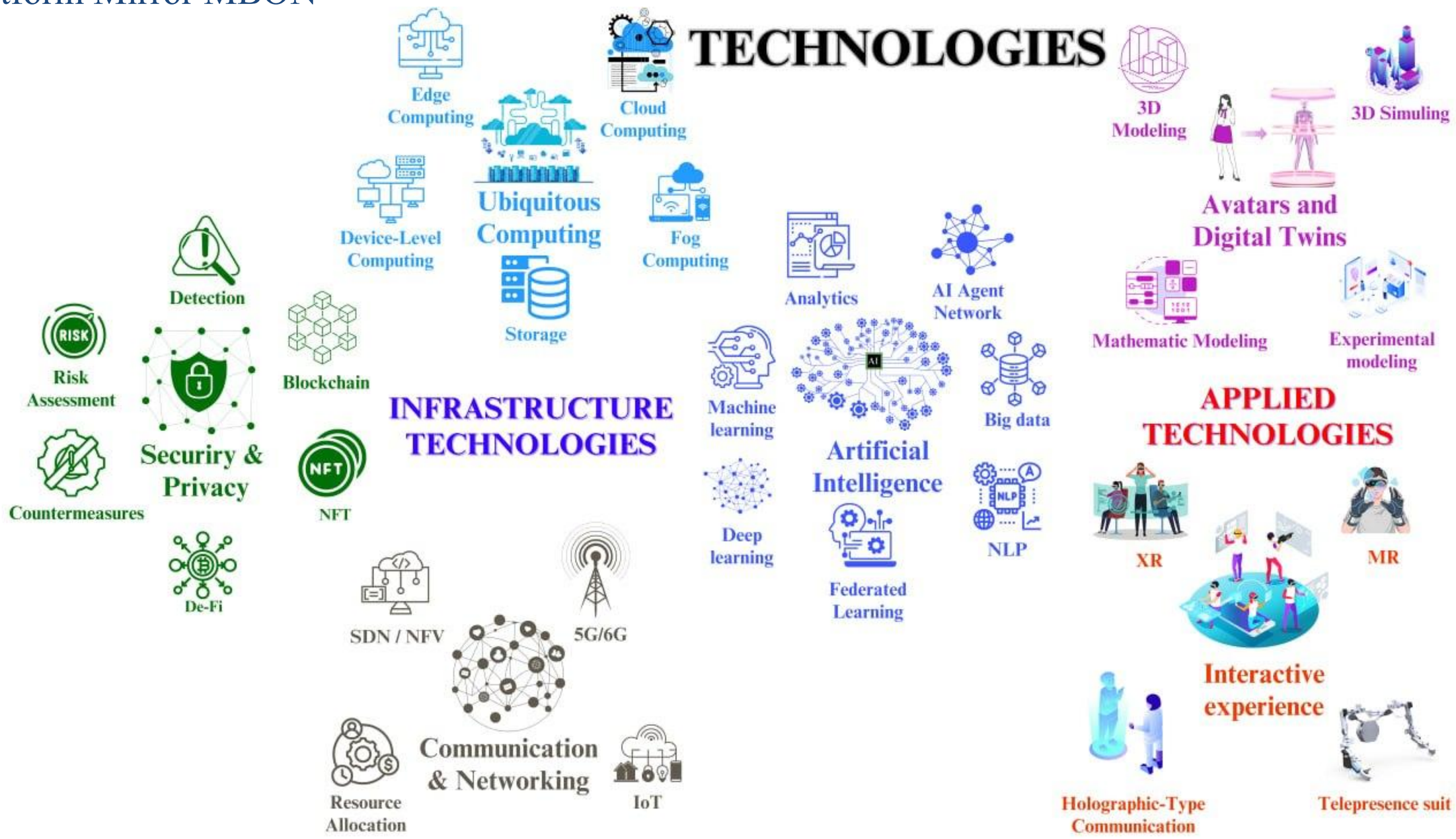






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Platform Mirror MBON



Avatar communications

avatar−to−avatar (A2A),
avatar−to−human (A2H),
and human−to−avatar (H2A)
avatar – telepresence suite (A2TS),

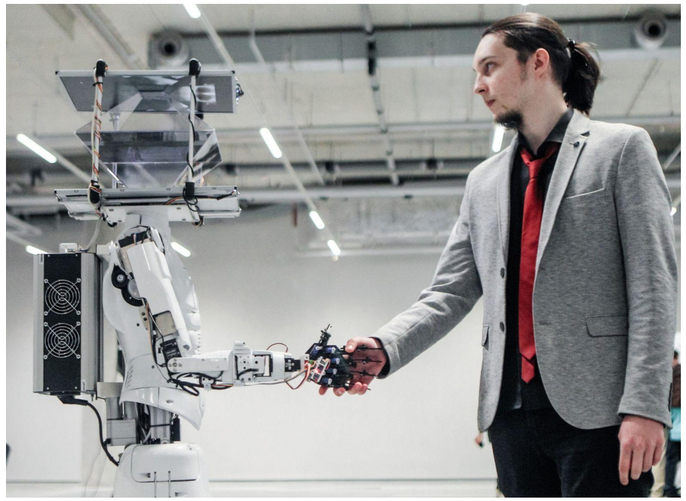
telepresence suite – avatar (TS2A),

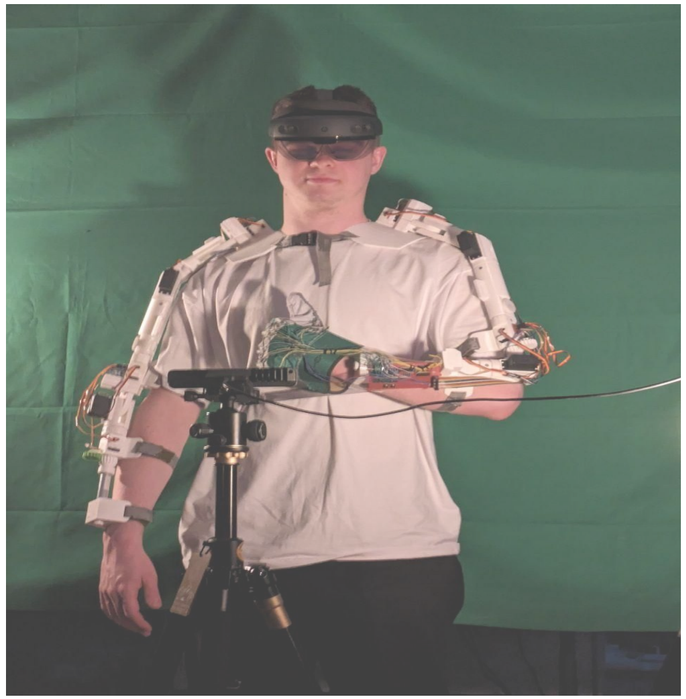
avatar – mirror metaverse hub (A2HB),

mirror verse hub – avatar (HB2A),

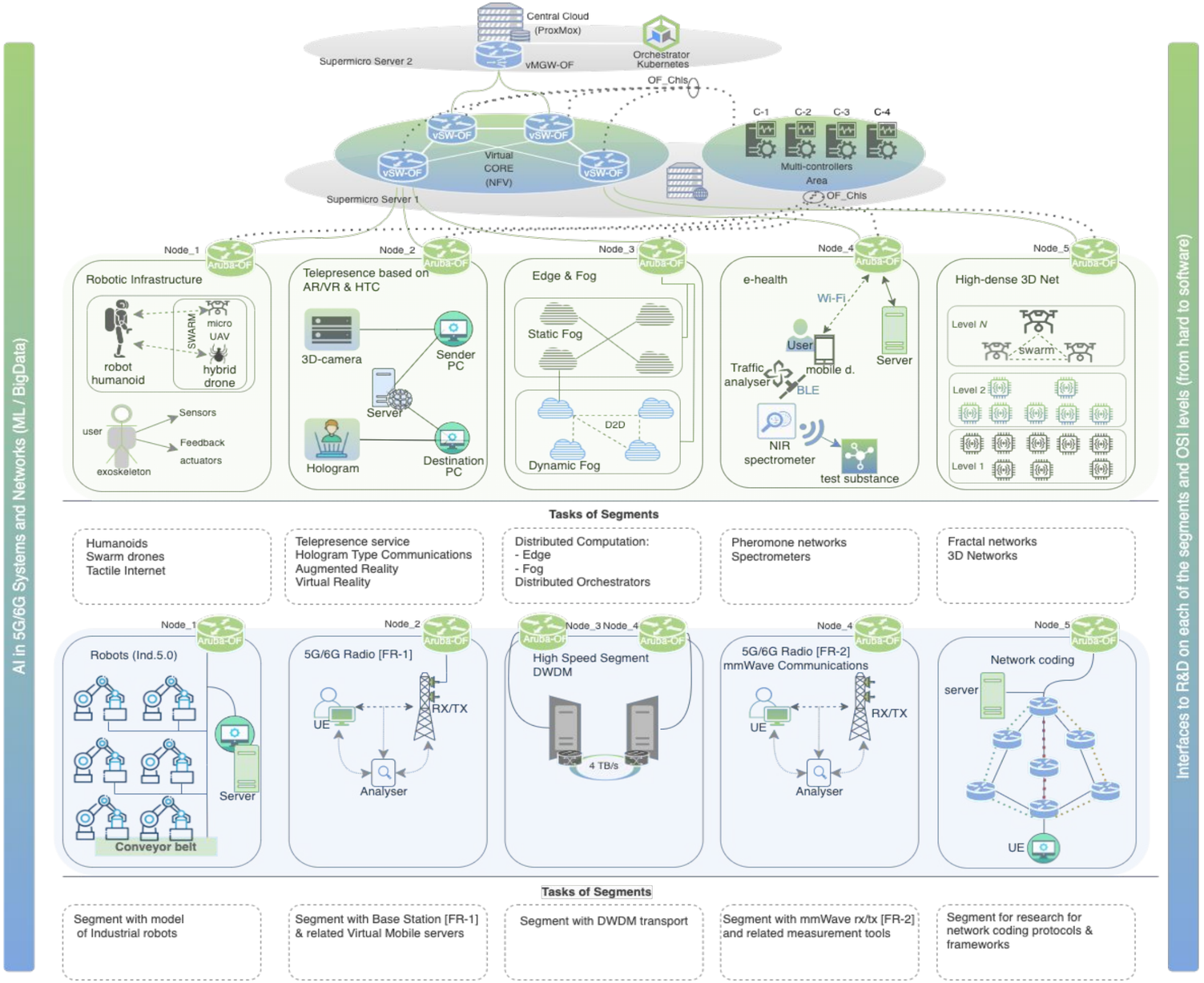
home avatar – roaming avatar (HA2GA),

roaming avatar – home avatar (GA2HA).





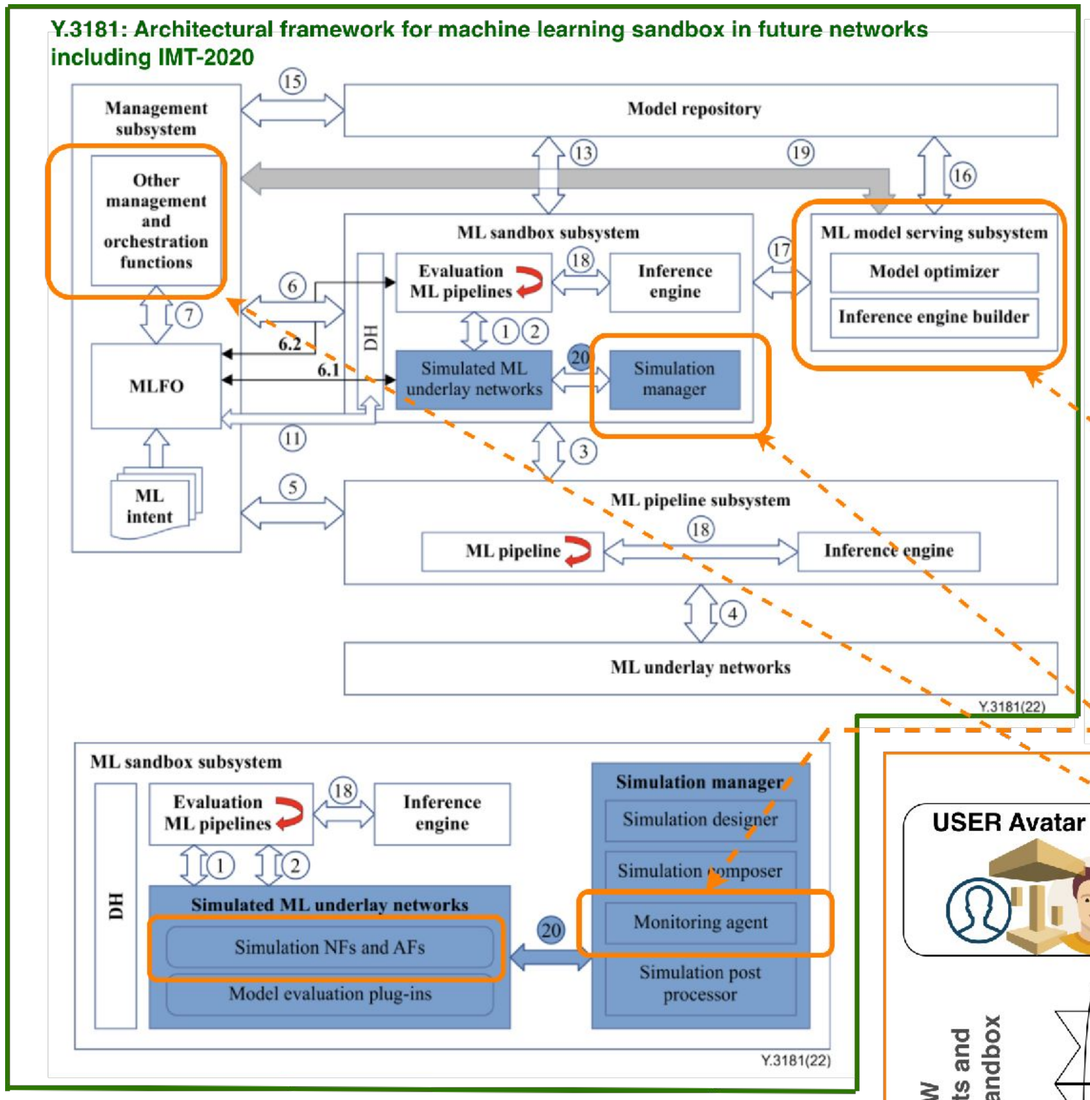
Model Network for 5G/6G

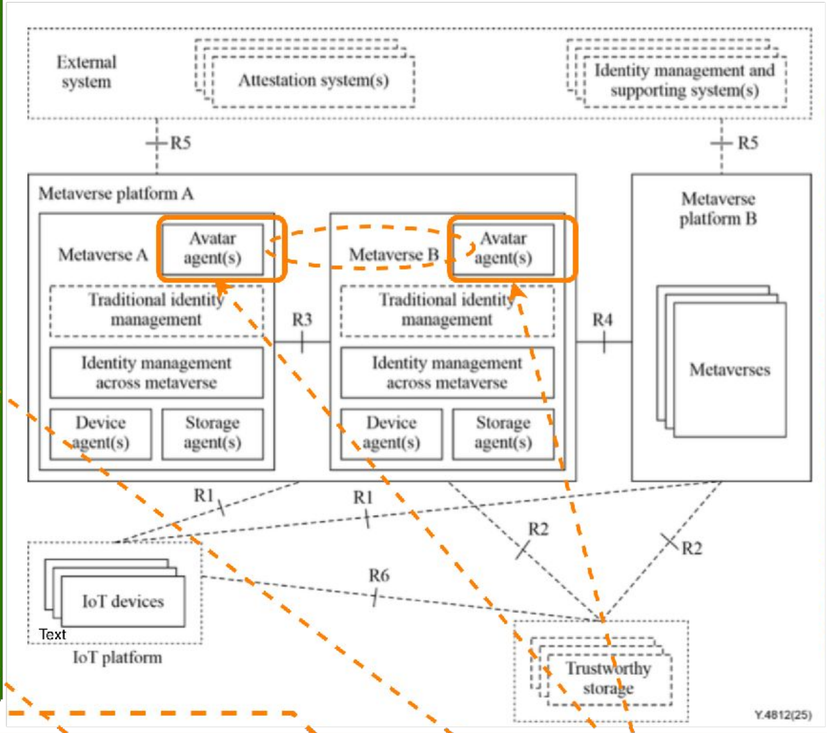


Basic Testing Types

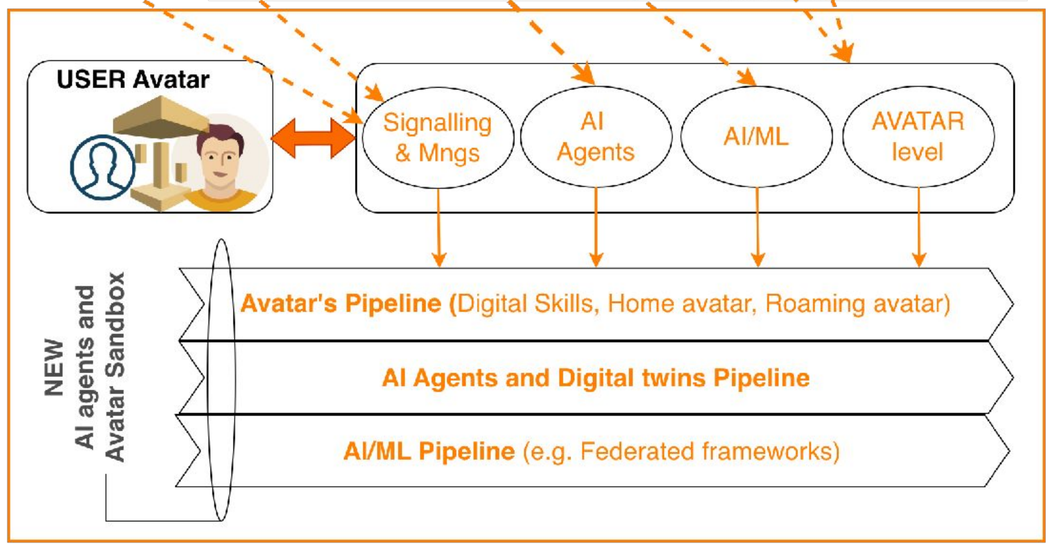
- Conformance (1995, ITU-T X.290, ETSI 300406)
- Interoperability (ETSI TR 101667, ITU-T Q.3900)
- Benchmarking (Q.3931, Q.3932, Q.3933)

AI Agents and Avatars Sandbox Testing. Structure of Central Eurasia Sandbox for AI Benchmarking





Y.4812: Interoperability of the identity of Internet of things devices across metaverse platforms



Metaverses frameworks and architectures:
- H.MV-MAMA: Metaverse framework
- Q.FITSM (interoperability of telepresence suits and avatars)
- Q.SR-TSM (Signalling requirements between telepresece suits and metaverse)
- Y.4240, Y.4239, Y.4238, e.t.c

Avatar Benchmarking Testing

The emerging concept of various forms of avatar-based communication requires a structured AI agents sandbox testing framework, along with corresponding avatar benchmarking scenarios.

The benchmarking scenarios may include different metrics (e.g., avatar capacity, home/roaming ratios, and traffic characteristics). There is a need to extend the existing AI/ML sandbox defined in ITU-T Recommendation Y.3181 to address emerging avatar-based communication paradigms and the necessity to develop standardized benchmarking scenarios and methodologies tailored to these new communication environments.

New specific avatar testing type

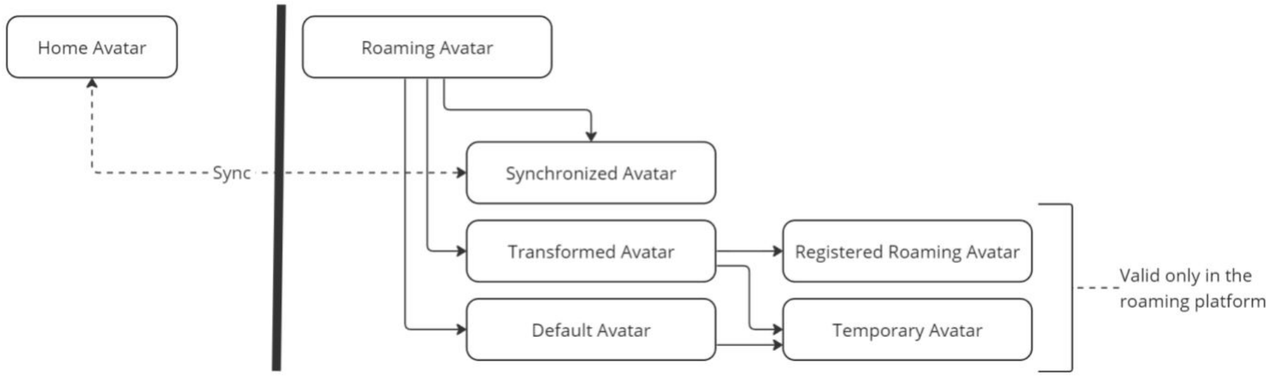
avatar [b-ISO/IEC 23005-4:2018(en)]: Entity that can be used as a(visual) representation of the user inside the virtual environments.

metaverse [ITU-T H.770.1]: An integrative ecosystem of virtual worlds offering immersive experiences to users, that modify pre-existing and create new value from economic, environmental, social and cultural perspectives.

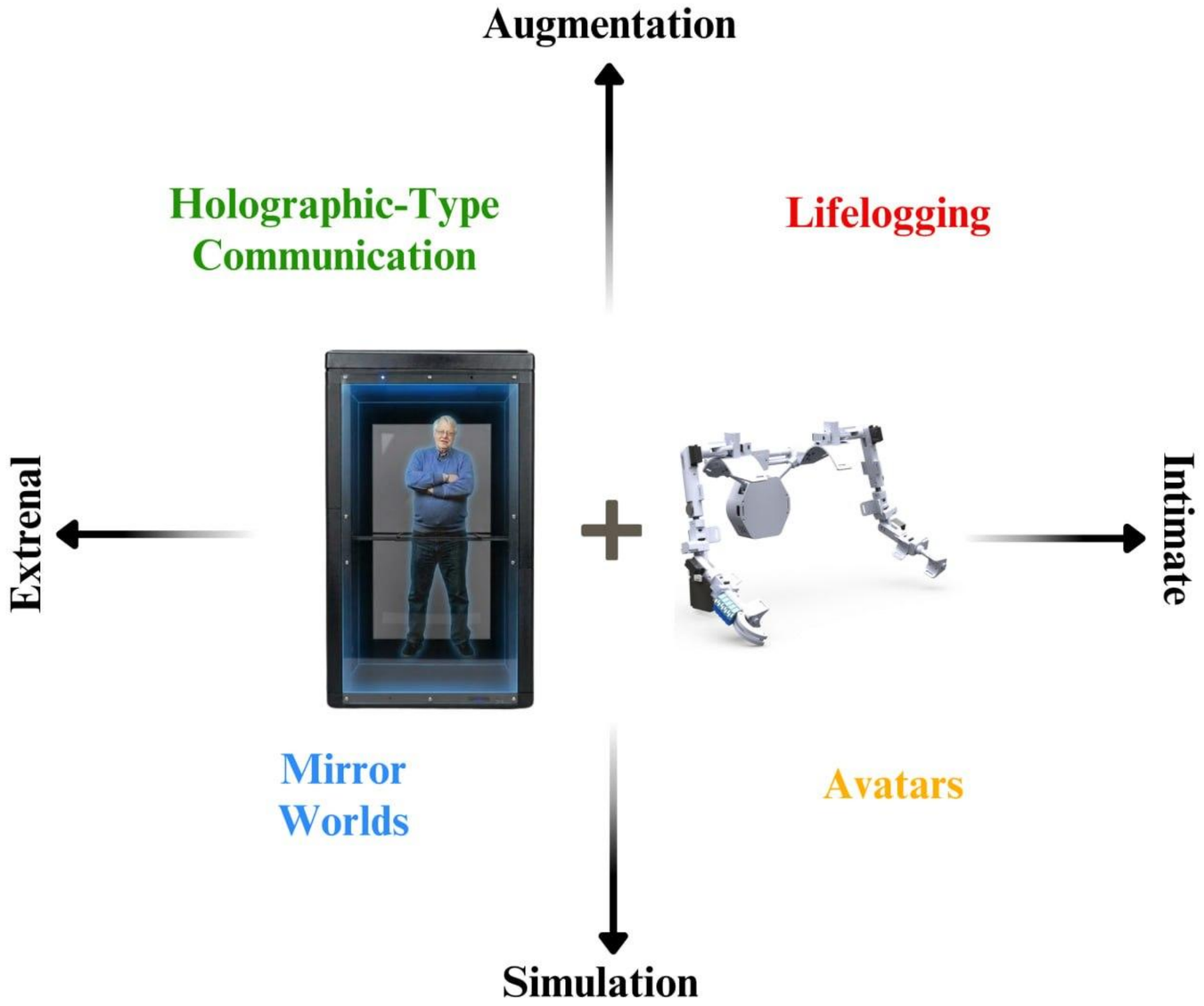
NOTE – A metaverse can be virtual, augmented, representative of, or associated with the physical world.

home avatar [ITU-T ITU-T H.770.]: The avatar which exists within original metaverse platform, remaining customizable for its corresponding entity. This primary version of an avatar in the metaverse resides exclusively within a specific metaverse platform or avatar service. NOTE – The entity includes users, IoT devices, robots, digital humans, AI, system components, etc.

roaming avatar [ITU-T ITU-T H.770.]: The avatar transitioning across various metaverse platforms from original metaverse platform, potentially undergoing alterations or transformations aligned with the destination platform's compatibility and features.



New specific avatar testing type



Conclusions

Mirror Worlds — the most promising scenario for network universe (metaverses) and digital space development.

Key Domains: Transportation, urbanization, healthcare, industry, education, and emergency management.

Core Advantages: Efficiency & Accuracy: Precise digital replication minimizes time and labor costs.

Proactive Modeling: Predicts potential risks and delivers solutions before problems arise.

Ultimate Impact: Process optimization and a tangible increase in quality of life.

That’s a new Era!

Thank You!