Cities and communities in virtual worlds: the Citiverse

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CitiVerse: the concept

# Proposed definition based on ISO/IEC 23005 and IEEE 2888

- A CitiVerse can be composed of a series of interconnected distributed **virtual worlds** (i.e., sub-citiverses) representing their physical counterparts, and synchronized at a specified frequency and fidelity. Each world can offer certain kinds of **virtual goods/services** (e.g., gaming, social dating, online museum, and online concert) and **virtual environments** (e.g., game scenes and virtual cities) to citizens and other users represented as **digital avatars**.
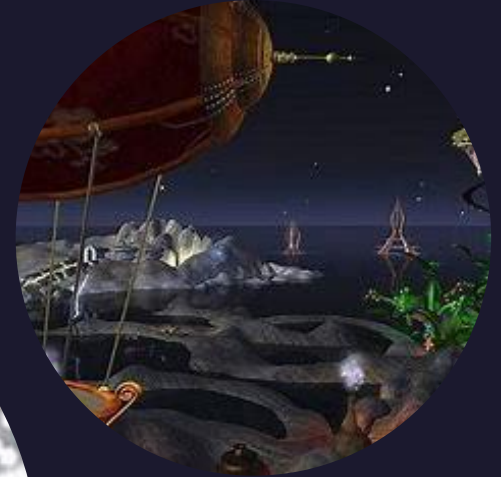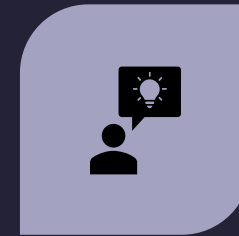
The citiverse ecology cycle

BIG DATA > **UPDATE THE VIRTUAL WORLD**
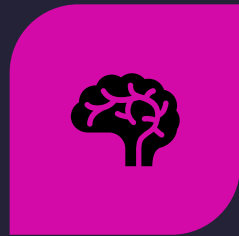
CITIZENS USE **XR AND HCI** (E.G. BRAIN-COMPUTER INTERACTION) TO **IMMERSIVELY CONTROL THEIR DIGITAL AVATARS IN THE CITIVERSE**

AI ALGORITHMS ENRICH THE **CITIVERSE ECOLOGY**.

THE **KNOWLEDGE DERIVED** PRODUCE VIVID VIRTUAL ENVIRONMENTS FOR USERS TO EXPERIENCE.

THE CREATED ACTIVITIES BUILD THE **CITIVERSE ECONOMY**

From physical to a blending of the two (the Citiverse) –not a pure virtual world
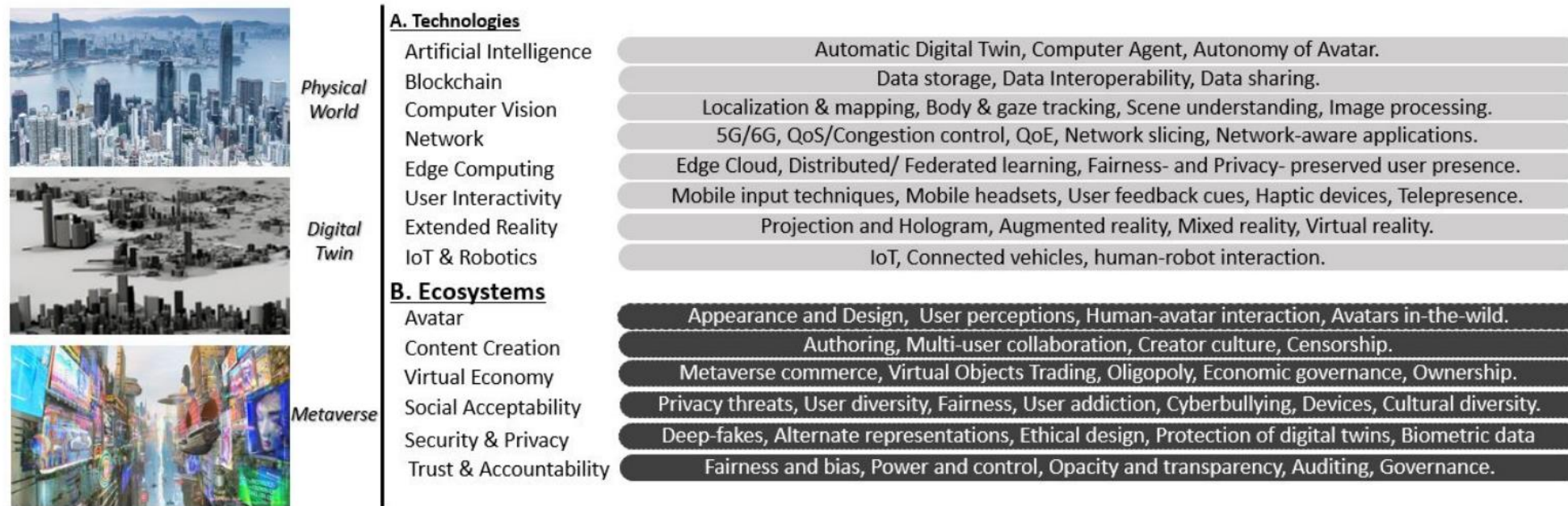
Fig. 3. Connecting the physical world with its digital twins, and further shifting towards the metaverse: (A) the key technologies (e.g., blockchain, computer vision, distributed network, pervasive computing, scene understanding, ubiquitous interfaces), and; (B) considerations in ecosystems, in terms of avatar, content creation, data interoperability, social acceptability, security/privacy, as well as trust/accountability.

EU Policy context for the CitiVerse

European Commission approach

Sep. 22

Virtual and Augmented Reality Industrial coalition

Feb.–Apr. 23

the citizen's panel consultation

March 23

The DEP WP2023 and the call on CitiVerse pilots (Sep.–Jan 24).

July 23

A new Commission strategy on Web 4.0 and virtual worlds

Jan. 23

IFRAG report on CitiVerse use cases

March 23

outlook of the EU economy beyond 2030

June 23

Next Generation Virtual Worlds: Societal, Technological, Economic and Policy Challenges for the EU (study)

The Commission aims for a CitiVerse …

LEADERSHIP
COMPETITIVENESS
TECHNOLOGICAL SOVEREIGNTY

- that reflect **EU values and principles,**

- where European **businesses** can develop world-leading applications, scale up and grow,

- powered by **open and highly distributed technologies and standards** that enable **interoperability** between platforms,

- where **sustainability, inclusion** and **accessibility** are at the core of technological developments.

A robust, future-oriented legislative framework

Digital Services Act and the Digital Markets Act > accountability and obligations for online platforms.

The Data Governance Act and Data Act > rules for data-sharing and give users control over the data.

The proposed AI Act > artificial intelligence (AI) risks and trustworthy AI.

The General Data Protection Regulation > personal data in virtual worlds.

EU consumer law, in particular the General Product Safety Regulation, as well as the Unfair Commercial Practices Directive > consumer protection.

Markets in Crypto-Assets (MiCA) Regulation > covers crypto-assets not regulated by existing financial services legislation

The European Digital Identity > control over digital identities.

Directive on Copyright in the Digital Single Market, the Regulation on the EU Trade Mark and the Directive on the Protection of Trade Secrets > Existing EU legal framework on intellectual property rights and industrial property rights.

European Accessibility Act and the Web Accessibility Directive > access by persons with disabilities.

EU's labour standards, including the rules for health and safety at work, and social security systems > for EU workers.

Citiverse applications & use cases

Citiverse applications

- In terms of applications, the metaverse ecosystem allows human users to live and play within a self-sustaining, persistent, and shared realm.

- Possible citiverse applications:

  - Urban planning and citizen engagement

  - Policy scenarios (economic and political) and serious games

  - Public services distribution

  - Education

  - Shopping

  - Entertaining, tourism, travel, cultural heritage

Living-in.eu consultation on use cases

Prioritized Use Cases Proposition

Quick-Wins	Middle-term	Longer-term
Virtual tourism	Urban heat islands	Traffic control rooms
Real-time situational awareness	Public virtual safety	Evidence-based policy in real time (emergency services)
Gather feedback through virtual objects	(Show) Simulate urban floods, traffic patterns… (ldt)	Emergency training citizens
	Engage on adaptations to urban env.	

Citiverse Standardization

Pre-standardization elements

Addressing standards at this stage could be premature because technologies are not fully mature or existing yet.
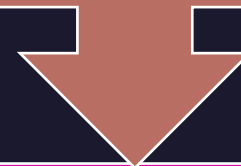
CitiVerse developments based on requirements from stakeholders + public interest elements

Also using existing frameworks such as the EIF4SCC' and the MIMs' can help accelerate the definition of standards when technologies are ready.

Citiverse pre-standardization roadmap

Developing standards enabling metaverse interoperability will be challenging (many applications, technology maturity, vendor-locking, etc.)

We need to resolve important policy aspects at the same time, e.g. to favour a particular citiverse typology or if we address any kind of virtualization in the city/community landscape

Our roadmap looks at very specific use cases and browses on the most important recommendations to start developing an EU CitiVerse that is citizen-centric, open and based on EU values.

Research topics > future standards?
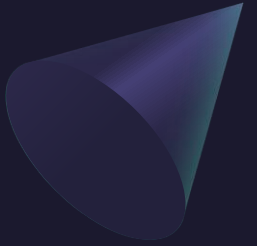
- Blockchain:

    - Faster proof of work for faster user verification

    - Strict anonymity

- Edge and cloud:

    - Improved latency for seamless user experience

    - Seamless security of access in distributed edge environments

- Computer vision:

    - Complex environments interaction (esp. for hybrid world integration), inc. virtual objects in physical world

    - Scene understanding, body and pose tracking algorithms

    - Better aesthetics (colour, texture, super resolution, etc.)

- Network:

    - Latency

- Avatars:

    - Ubiquutous and real-time control of avatars with mobile sensors, perception and influences, including with vastly diversified smart devices

    - Micro-expression of avatars

    - Ethical design of avatars, including identity and liability issues, long-lasting avatars, etc

- Virtual economy

    - Money, consumption behaviours

    - Sandboxing for policy evaluation

- Trust and accountability

    - Personal data new definitions

    - New rules for protecting vulnerable people

- Content creation

    - Co-design processes, participatory design

    - automatic and decentralised governance

- Social acceptability

    - Collective and individual judgements and opinions

    - Privacy and data threats

    - User diversity, addiction and disconnection

    - Fairness,

    - Strategies for fighting cyber criminality and reporting abuse

- Security and privacy

    - Protecting users and digital assets

    - Alternative modalities for authentication

    - Privacy issues (and privacy preserving machine learning)

    - Copyright, etc

What's coming next?

High-level timeline

Commission Communication on
Virtual Worlds

DEP WP 2023

EDIC

Adoption of ITU MIM framework
standard?

Pre-standardization roadmap on
the CitiVerse

WP24 call

| 1 semester 2023 | 2 semester 2023 | 1 semester 2024 | 2 semester 2024 | 1 semester 2025 |

DEP WP 2023-24 Call for
Citiverse Projects

Citiverse pre-standardization
roadmapping

First results of DS4SSCC, DEP
procurement actions, etc.

DEP Call on Developing the CitiVerse: 3 objectives

01

Defining the EU Citiverse

- Building on the <u>Smart Communities previous actions</u> (WPs 21-24)
- Bringing together EU CitiVerse industry (incl. SMEs) to **develop technologies to create virtual (hybrid) worlds for cities**
- Desire for interoperable, open solutions -> favor scaling-up and LDT toolbox
- Synergies with possible EDIC for Local Digital Twins and any other relevant future initiatives.

02

Expanding capabilities of existing urban digital twins

- Using VR/AR and metaverse technology to navigate and interact in urban spaces
- From basic sensory experiences to digital asset-enhanced XR merging the physical and virtual cities
- With data coming from public and private sources (notably EU DSs)
- Visualization and interaction with simulated scenarios

03

Fostering EU leadership

- Rich possibilities for EU industry, incl. virtual worlds and creative SMEs
- Contribute to & benefit from the VR/AR Industrial Coalition ecosystem, amongst others

DEP Call on Developing the CitiVerse: expected outcomes

Use cases for the CitiVerse

A roadmap

A recommendation for a CitiVerse platform

|	
Type of action	Simple grant – 50% costs
Indicative budget	EUR 15 million (several projects, 2-5 Million Euro)
Indicative time	2023 (11/5-26/9) – projects to start around April 2024 (tbc)
Indicative duration of the action	30 months
Implementation	European Commission
Type of beneficiaries	All entities
Security	Call restricted on the basis of art. 12(6) of the DEP Regulation

Thank You

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European Commission
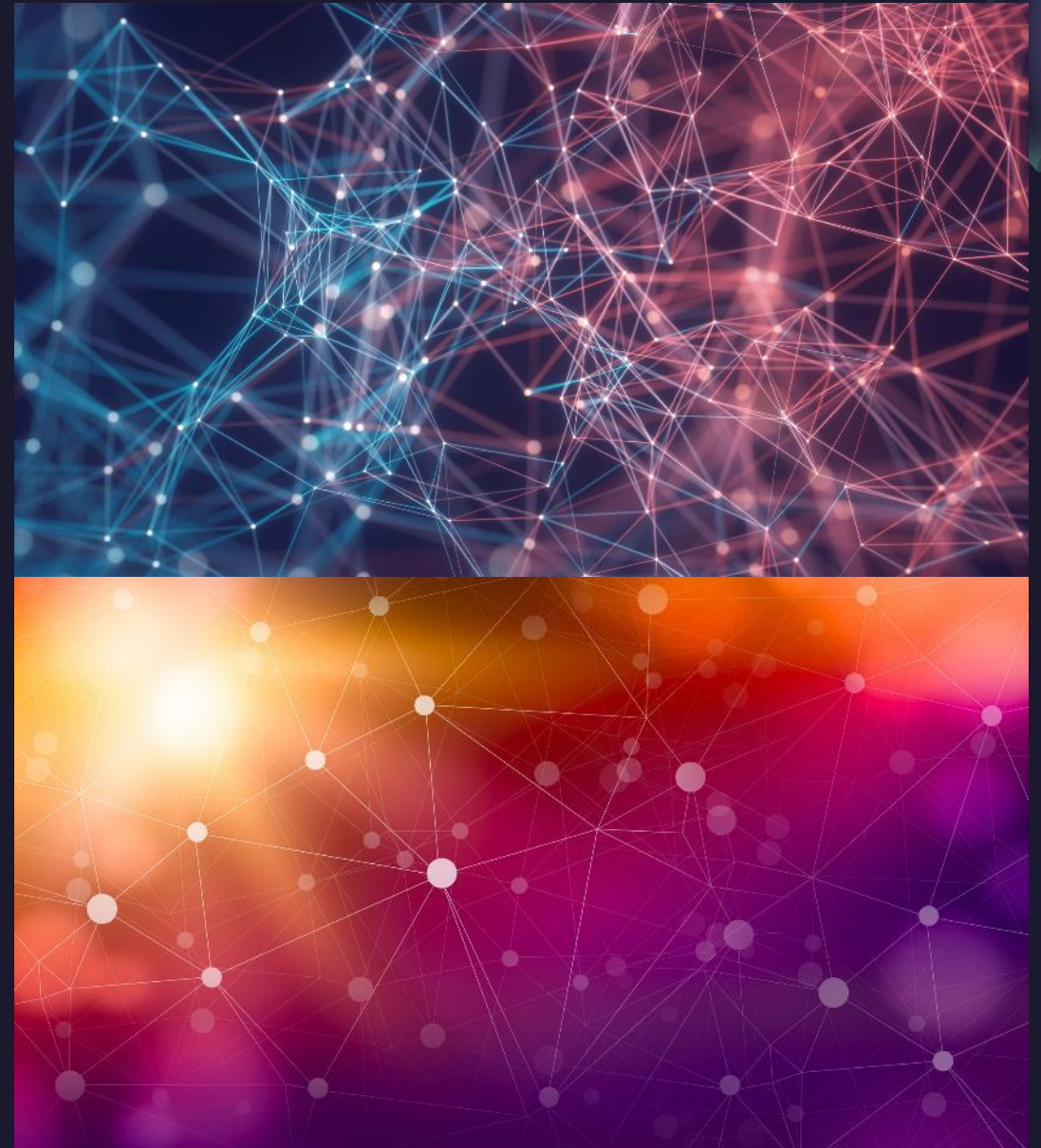
Spare slides

Pre-standardization mapping: existing MV-standards frameworks

ISO/IEC 23005

- ISO/IEC 23005 standards are applicable for a variety of metaverse-related business services, where the association of audiovisual information, rendered sensory effects, and characteristics of virtual objects (e.g., avatars and virtual items) can benefit the interactions between virtual and real worlds
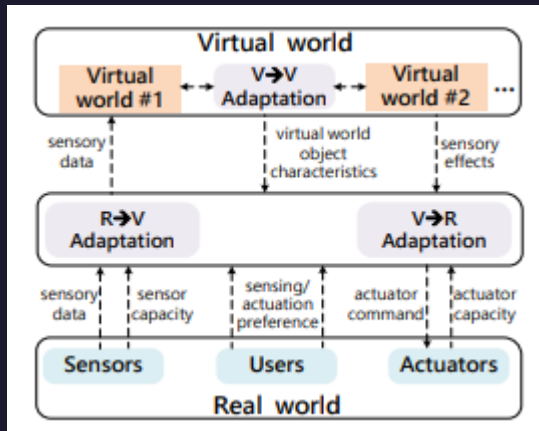
IEEE 2888

- IEEE 2888 project launched in 2019 aims to define standardized interfaces for synchronization of cyber and physical worlds. IEEE 2888 standards offer foundations for building metaverse systems, where both virtual and real worlds can affect each other.