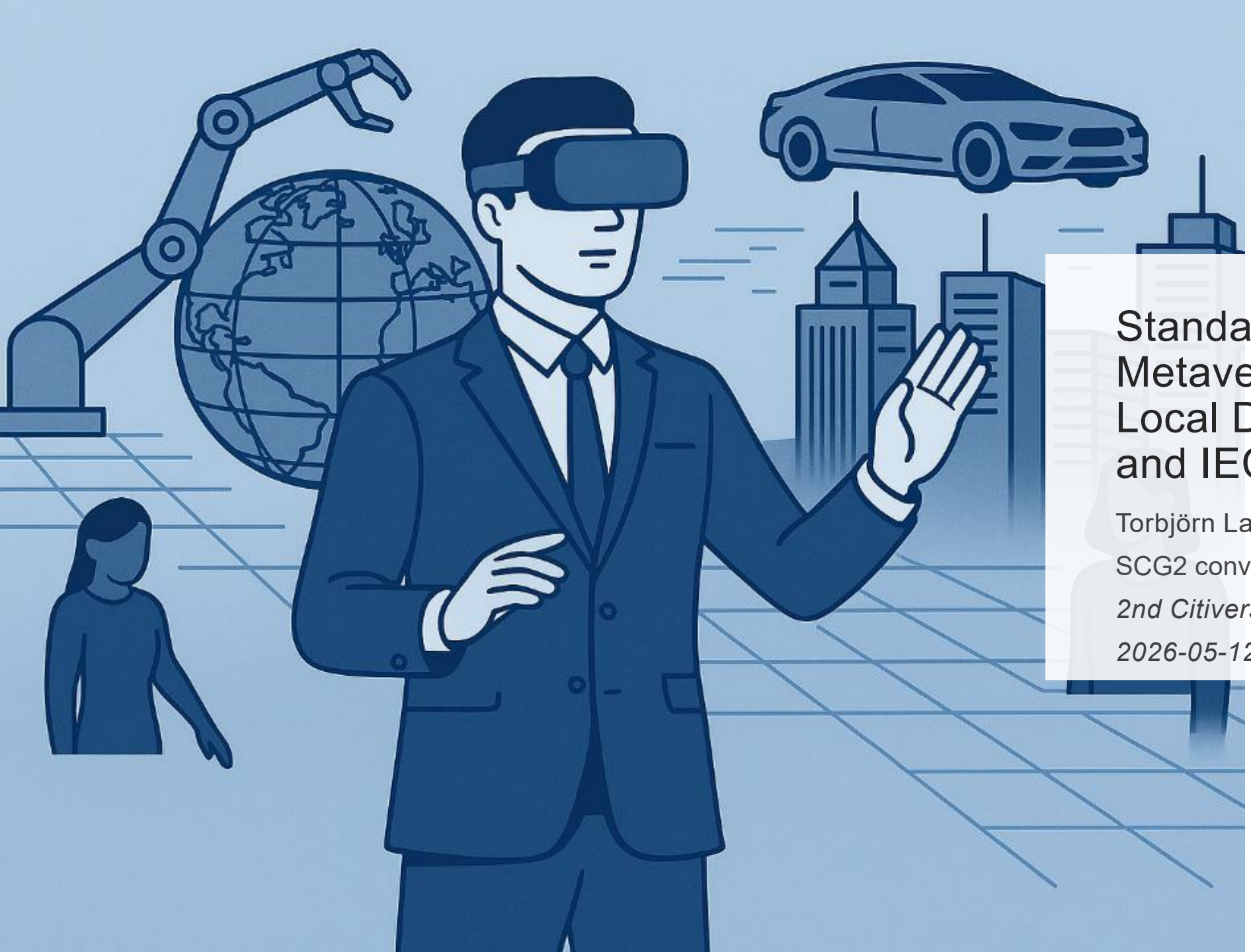


ISO JTC1 IEC
INFORMATION TECHNOLOGY STANDARDS

Standardization on Metaverse, Citiverse and Local Digital Twins in ISO and IEC

Torbjörn Lahrin,

SCG2 convenor & co convenor of JWG 16

2nd Citiverse Assembly, Geneva

2026-05-12

This presentation focus on:

ISO/IEC JTC1 SCG2 – Strategic coordination on Metaverse (including Citiverse)

JWG 16 – Joint Working Group between ISO/IEC JTC1 and IEC / SyC Smart Cities on Urban Digital Twins and City Information modelling

Short about JTC1/SCG2

- Coordinating planning and standardization work on Metaverse and CitiVerse standardization within ISO/IEC JTC 1 – Joint Technical Committee 1
- Contacts with relevant organizations within and outside ISO/IEC in these domains
- Main participants are JTC 1 Sub Committee chairs and Working Group convenors
- Also open for JTC 1 National Bodies and Sub Committee experts
- 37 registered members
- Active since May 2024

A starting point:

What sort of standards are being or needs to be developed for CitiVerse?

To be found in the Standardisation Landscape Report for CitiVerse by the European StandICT

[Standardisation Landscape for CitiVerse | StandICT.eu 2026]

Published December 2023

Produced by European standardization experts

About 350 standards, Technical Reports, Technical Specifications listed

Focus on standards for building CitiVerse and technologies needed as important building blocks for CitiVerse

Not all standards for Smart Cities. Only basic building blocks.

A SCG2 work item:

Virtual World / Metaverse categories

Serves as working material with the purpose to:

a) *Recognize the differences between various types of Virtual Worlds / Metaverse / CitiVerse*

b) *Determine what kind of standards needed for each category*

c) *Be able to discuss differences in needs and requirements.*

This is one of many ways to look upon and categorize various parts of Virtual Worlds / Metaverse / Citiverse.

3 main types of Virtual World / Metaverse Categories

The characteristics will depend on what it is supposed to reflect

Can be a fantasy or looking like something from real life

Purely fictive

Integrated with a real-life limited space

Can be integrated with a limited and well-defined real-life space, like a room, a house, a vehicle, a shop, an office, a factory or similar

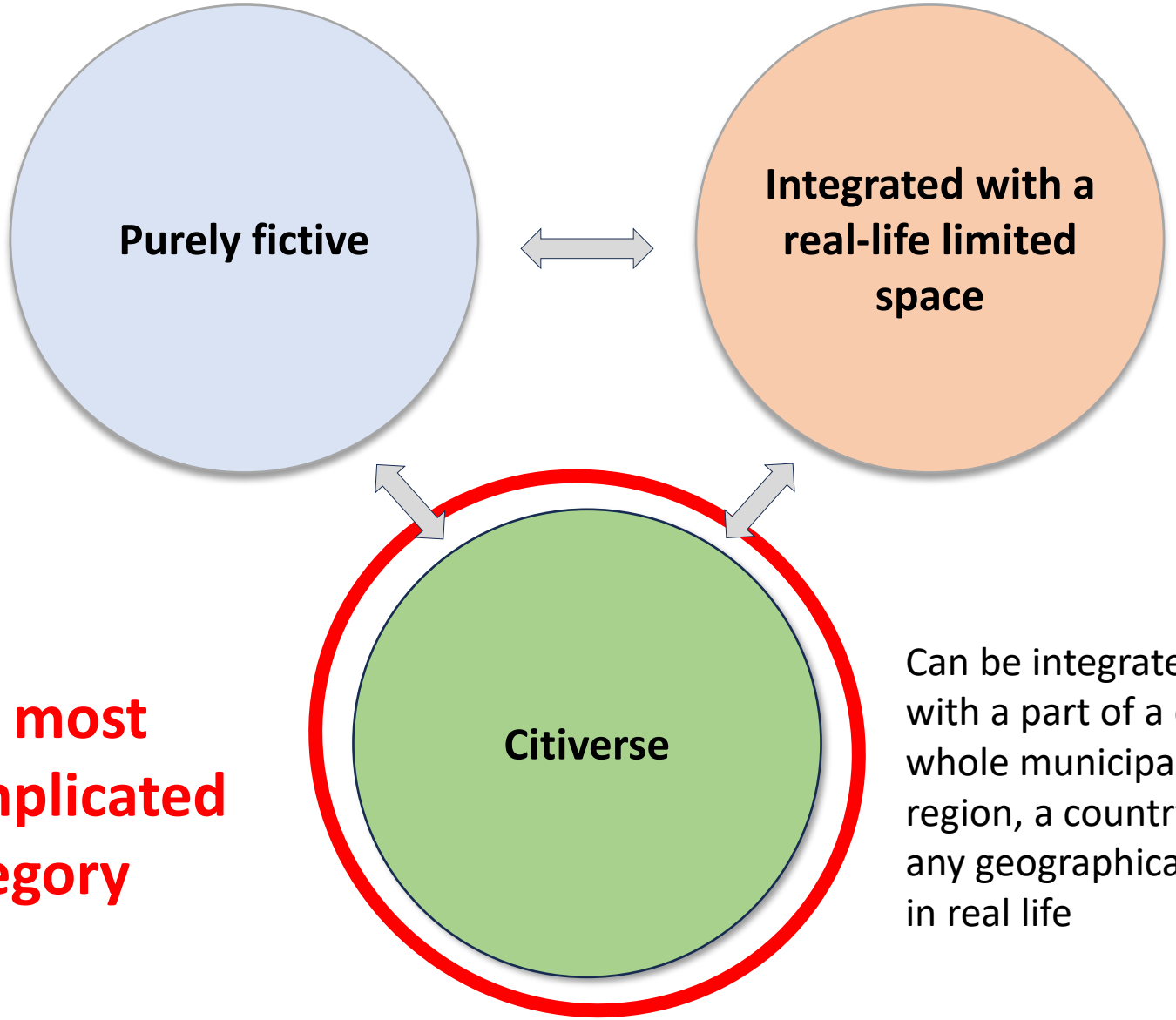
The most complicated category

Integrated with a real-life geographical area

Can be integrated with a part of a city, a whole municipality, a region, a country or any geographical area in real life

Integrated with a real-life geographical area => Citiverse

Can be a fantasy or looking like something from real life



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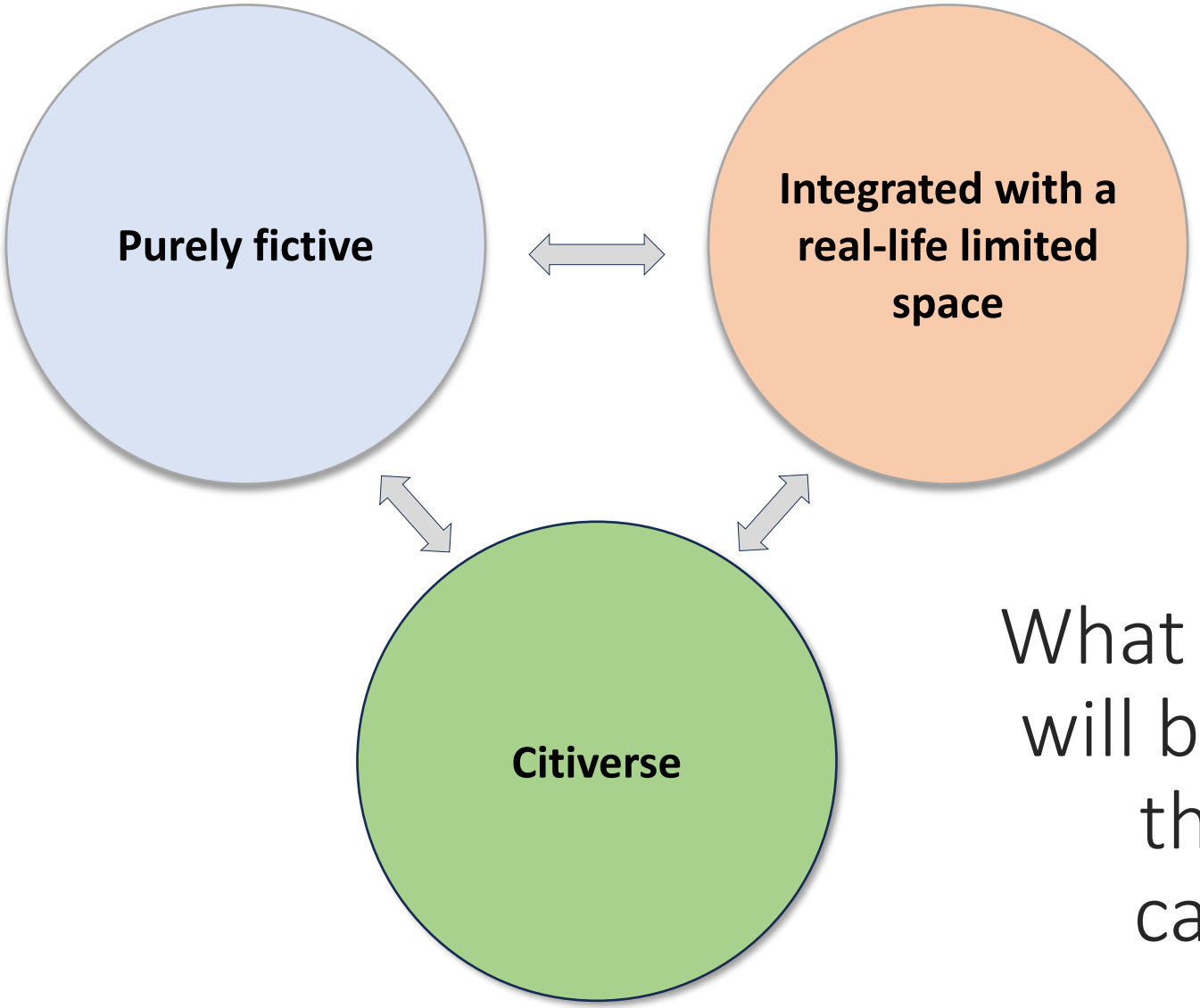
The most complicated category

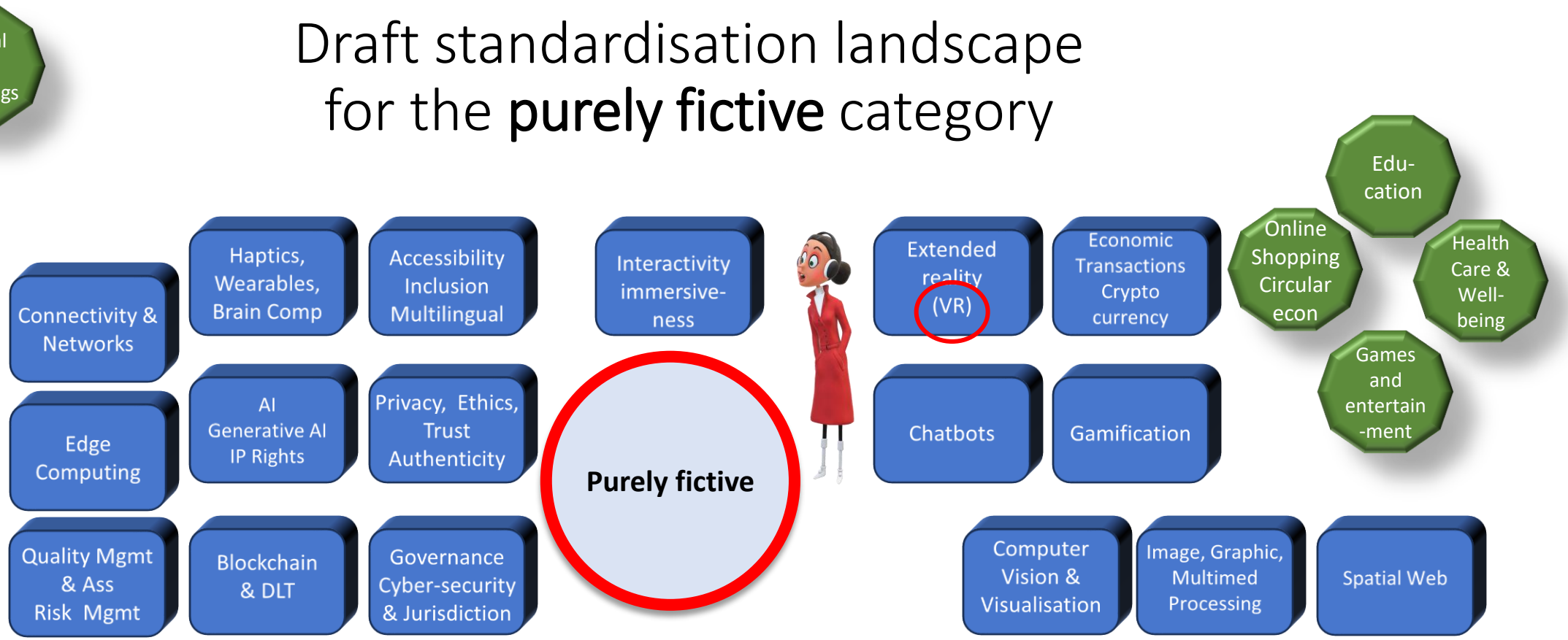
Can be integrated with a part of a city, a whole municipality, a region, a country or any geographical area in real life

What puzzle pieces?

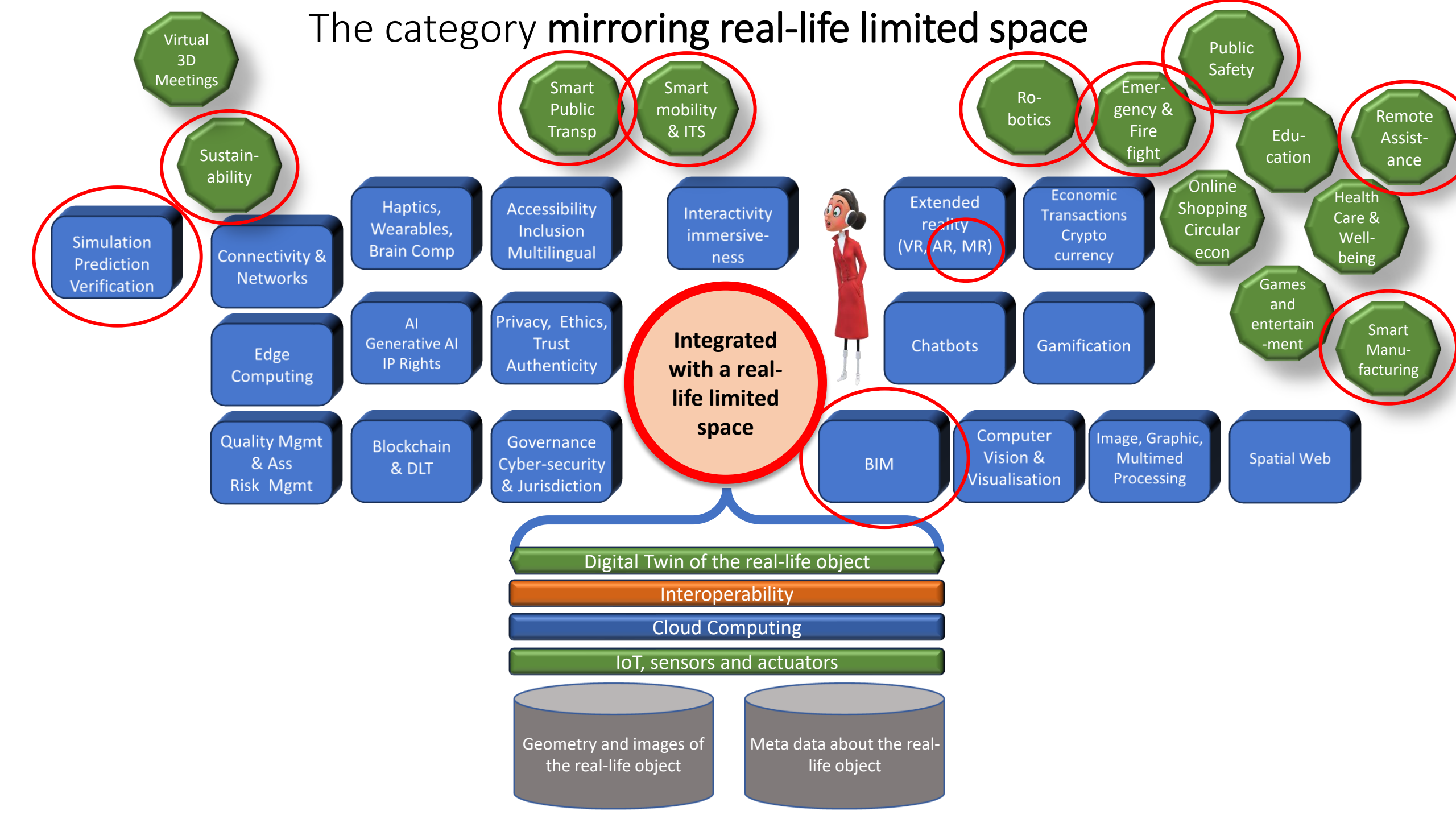


What puzzle pieces will be needed for the various categories?

Draft standardisation landscape for the **purely fictive** category



The category **mirroring real-life limited space**



Metaverse category based on a geographical area

Smart Energy
Virtual 3D Meetings
Virtual Culture & Tourism
Sustain-ability
Smart Cities
Urban Plan-ning
Smart Public Transp
Smart mobility & ITS
Smart Traffic
Auto-nomous Vehicle
Ro-botics
Emer-gency & Fire fight
Public Safety
Demo-cracy & civil dialog
Edu-cation
Remote Assist-ance
Online Shopping Circular econ
Health Care & Well-being
Games and entertain-ment
Smart Manu-facturing

Simulation Prediction Verification
Connectivity & Networks
Haptics, Wearables, Brain Comp
Accessibility Inclusion Multilingual
Interactivity immersive-ness
Extended reality (VR, AR, MR)
Economic Transactions Crypto currency

Big Data
Edge Computing
AI Generative AI IP Rights
Privacy, Ethics, Trust Authenticity
Chatbots
Gamification

Geospatial Technologies
Quality Mgmt & Ass Risk Mgmt
Blockchain & DLT
Governance Cyber-security & Jurisdiction
CIM & BIM
Computer Vision & Visualisation
Image, Graphic, Multimed Processing
Spatial Web

Citiverse

Local Digital Twin
Local Digital Twin
Local Digital Twin
Local Digital Twin
Local Digital Twin
Local Digital Twin

Interoperability / MIM / Dataspaces

Cloud Computing

Internet of Things

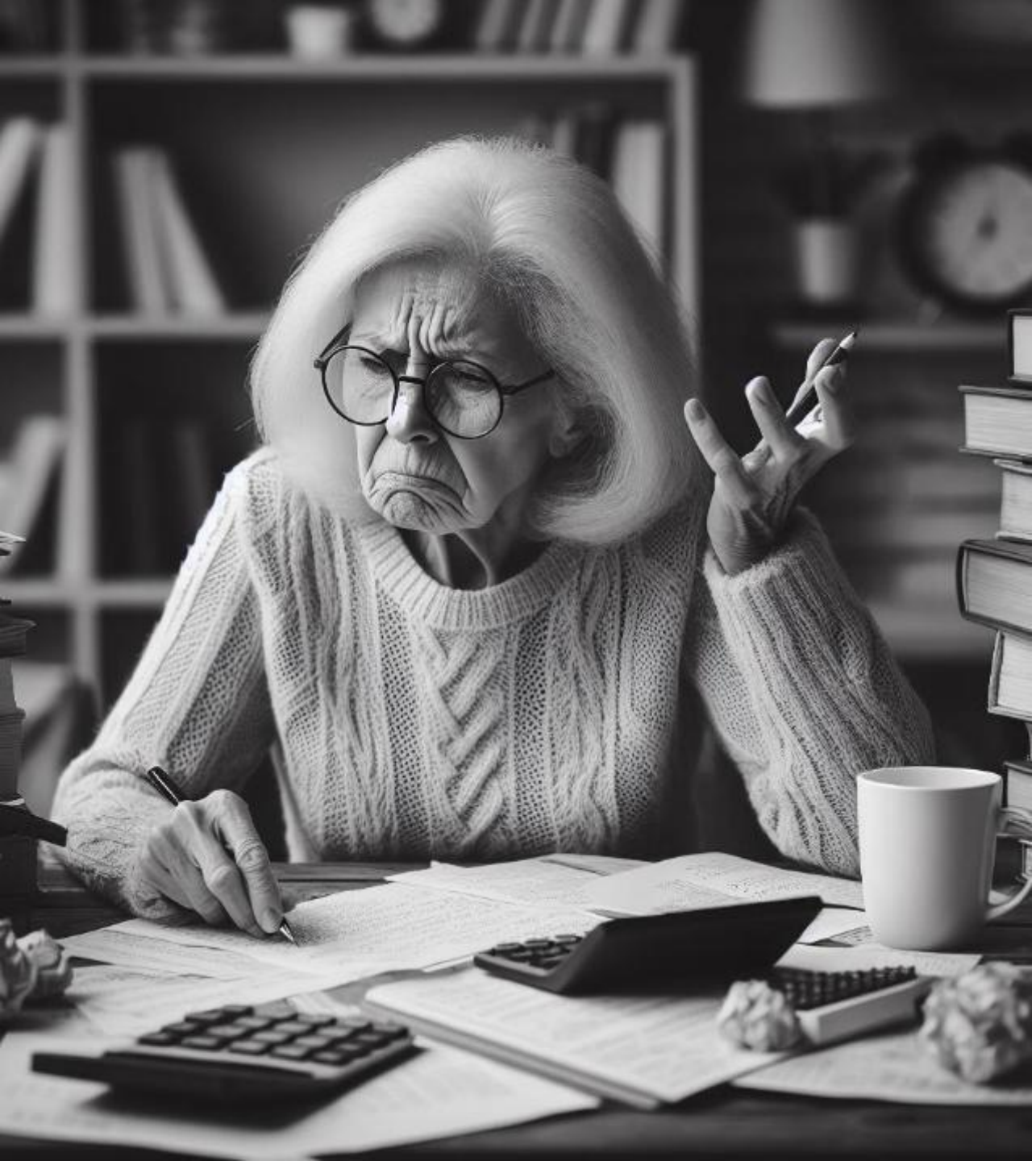
Geo-spatial Data
Sensor data & Actuators
Cameras & Photos
Environ-mental Data
Roads & Transport
Energy Consump-tion Data
Urban Infra-structure Data
Demo-graphic & Social Data
Govern-ment Records
Emer-gency Services Data
Citizen Feedback Data
Historical Data
Accessi-bility Data
Cultural and Heritage Data
Economic Data

Needs for Metaverse / Citiverse standards in JTC1, ISO & IEC

IEC SyC Smart Energy
Smart Energy
TC 205
Virtual 3D Meetings
TC228
SC29
Virtual Culture & Tourism
TC46
Sustain-ability
TC268
SC24
SC39
SC41
JTC4
Smart Cities
TC268
WG11
SC24
JTC4
Urban Plan-ning
TC204
WG11
JTC4
Smart Public Transp
WG11
Smart mobility & ITS
TC204
Smart Traffic
WG11
Auto-nomous Vehicle
TC204
Ro-botics
TC299
TC159
TC184
Emer-gency & Fire fight
TC292
TC92
Public Safety
TC292
Demo-cracy & civil dialog
Edu-cation
SC26
SC29
SC36
Remote Assist-ance
TC173
Online Shopping Circular econ
TC323
Health Care & Well-being
TC215
Games and entertain-ment
Smart Manu-facturing
TC184
Simulation Prediction Verification
Connectivity & Networks
SC6
SC25
SC27
Haptics, Wearables, Brain Comp
SC37
SC43
TC133
Accessibility Inclusion Multilingual
TC260
SC35
TC314
Interactivity immersive-ness
TC159
SC24
Extended reality (VR, AR, MR)
TC100
SC24
SC36
Economic Transactions Crypto currency
TC68
Big Data
SC42
Edge Computing
SC38
SC41
AI Generative AI IP Rights
SC42
Privacy, Ethics, Trustworthiness Authenticity
SC27
SC37
SC38
SC44
WG13
Metaverse (including CitiVerse)
SC35
SC24
SC29
SC41
Chatbots
SC35
Gamification
Geospatial Technologies
TC211
Quality Mgmt & Ass Risk Mgmt
TC176
TC262
Blockchain & DLT
TC307
Governance Cyber-security & Jurisdiction
SC40
SC27
CIM & BIM
JWG16
TC59
Computer Vision & Visualisation
SC24
Image, Graphic, Multimed Processing
SC29
SC24
Spatial Web
SC29

Local Digital Twin
Local Digital Twin
Local Digital Twin
JWG16
Local Digital Twin
Local Digital Twin
Local Digital Twin
SC41
Interoperability / MIM / Dataspaces
WG11
SC6
SC24
SC29
SC31
SC32
SC38
Cloud Computing
SC38
Internet of Things
SC41

Geo-spatial Data
TC211
Sensor data & Actuators
SC41
Cameras & Photos
Environ-mental Data
Roads & Transport
Energy Consump-tion Data
Urban Infra-structure Data
Demo-graphic & Social Data
Govern-ment Records
Emer-gency Services Data
Citizen Feedback Data
Historical Data
TC154
Accessi-bility Data
TC171
SC7
Cultural and Heritage Data
WG11
Economic Data
SC31
SC38



Citiverse will mostly be based on Local Digital Twins

There are several challenges with Local Digital Twins

These will influence Citiverse standardization

A need to address Local Digital Twins

Smart Energy
Virtual 3D Meetings
Virtual Culture & Tourism
Sustain-ability
Smart Cities
Urban Plan-ning
Smart Public Transp
Smart mobility & ITS
Smart Traffic
Auto-nomous Vehicle
Ro-botics
Emer-gency & Fire fight
Public Safety
Demo-cracy & civil dialog
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Online Shopping Circular econ
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Games and entertain-ment
Smart Manu-facturing

Simulation Prediction Verification
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Geospatial Technologies
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Computer Vision & Visualisation
Image, Graphic, Multimed Processing
Spatial Web

Citiverse

Local Digital Twin
Local Digital Twin
Local Digital Twin
Local Digital Twin
Local Digital Twin
Local Digital Twin

Interoperability / MIM / Dataspaces

Cloud Computing

Internet of Things

Geo-spatial Data
Sensor data & Actuators
Cameras & Photos
Environ-mental Data
Roads & Transport
Energy Consump-tion Data
Urban Infra-structure Data
Demo-graphic & Social Data
Govern-ment Records
Emer-gency Services Data
Citizen Feedback Data
Historical Data
Accessi-bility Data
Cultural and Heritage Data
Economic Data

Local Digital Twins – a standardization challenge

Smart Electric
Virtual 3D Meetings
Virtual Culture & Tourism
Sustain-ability
Smart Cities
Urban Plan-ning
Smart Public Transp
Intell Transp Syst
Smart Traffic
Self Driving Vehicle
Ro-botics
Emer-gency
Public Safety
Fire Fight
Edu-cation
Remote Assist-ance
Online shopp-ing
Health Care & Well-being
Games and entertain-ment
Smart Manu-facturing

Simulation Prediction Verification
Connectivity & Networks
Big Data
Cloud & Edge Computing
Geospatial Technologies

Haptics, Wearables, Brain Comp
Accessibility Inclusion Multilingual
AI Generative AI IP Rights
Privacy, Ethics, Trust Authenticity
Blockchain & DLT
Cyber-security & Jurisdiction

Interactivity immersive-ness
Extended reality (VR, AR, MR)
Economic Transactions Crypto currency
Chatbots
Gamification

Metaverse category mirroring a real-life geographical area

CIM & BIM
Computer Vision & Visualisation
Image, Graphic, Multimed Processing
Spatial Web

Local Digital Twin
Local Digital Twin
Local Digital Twin
Local Digital Twin
Local Digital Twin
Local Digital Twin
Interoperability / MIM / Dataspaces
Cloud Computing
Internet of Things

Geo-spatial Data
IoT Platform
Sensor Data
Camera feed
Cameras
Environ-mental Data
Roads & Transport
Energy Consump-tion Data
Urban Infra-structure Data
Demo-graphic & Social Data
Govern-ment Records
Emer-gency Services Data
Citizen Feedback Data
Historical Data
Accessi-bility Data
Cultural and Heritage Data
Economic Data

Lots of non-compatible techniques and standards

Smart Electric
Virtual 3D Meetings
Virtual Culture & Tourism
Sustain-ability
Smart Cities
Urban Plan-ning
Smart Public Transp
Intell Transp Syst
Smart Traffic
Self Driving Vehicle
Ro-botics
Emer-gency
Public Safety
Fire Fight
Edu-cation
Remote Assist-ance
Online shopp-ing
Health Care & Well-being
Games and entertain-ment
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Chatbots
Gamification
Geospatial Technologies
Blockchain & DLT
Cyber-security & Jurisdiction
CIM & BIM
Computer Vision & Visualisation
Image, Graphic, Multimed Processing
Spatial Web

Metaverse sub space mirroring a real-life geographical area

Local Digital Twin
Local Digital Twin
Local Digital Twin
Local Digital Twin
Local Digital Twin
Local Digital Twin
Interoperability / MIM / Dataspaces
Cloud Computing
Internet of Things

Geo-spatial Data
IoT Platform
Sensor Data
Camera feed
Cameras
Environ-mental Data
Roads & Transport
Energy Consump-tion Data
Urban Infra-structure Data
Demo-graphic & Social Data
Govern-ment Records
Emer-gency Services Data
Citizen Feedback Data
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Economic Data

JWG 16 City Information Modelling and Urban Digital Twins

Cooperation between **ISO/IEC JTC1** and **IEC/SyC Smart Cities**

To be transferred from SyC Smart Cities to ISO/IEC JTC4

GAP analysis (IEC TS 63526)

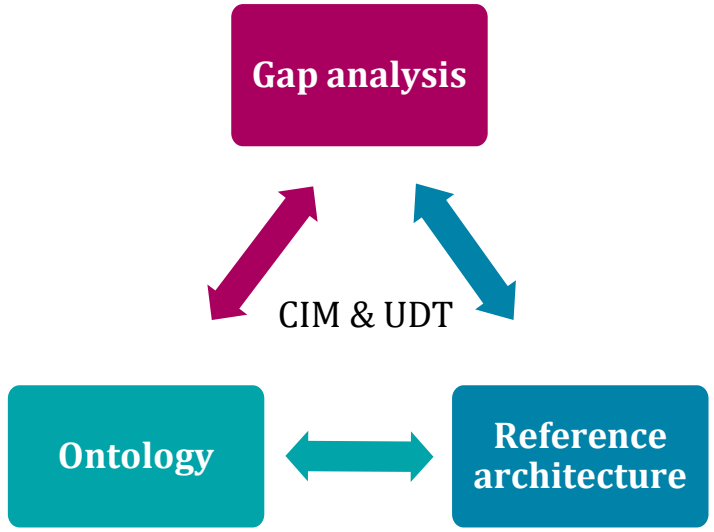
Project leader: Chunlan Guo, SyC Smart Cities

Reference Architecture

Project leader: Torbjörn Lahrin, JTC1

Ontology

Suggested leader: Furong Wang, SyC Smart Cities



Short about JWG 16

Joint working group between JTC1 and SyC Smart Cities on Urban Digital Twins and City Information modelling

28 active experts

Incoming liaison from:

- OGC – Open Geospatial Consortium
- ITU-T Study Group 20

Co convenors:

- SyC Smart Cities - Chunlan GUO
- JTC1 - Torbjörn Lahrin

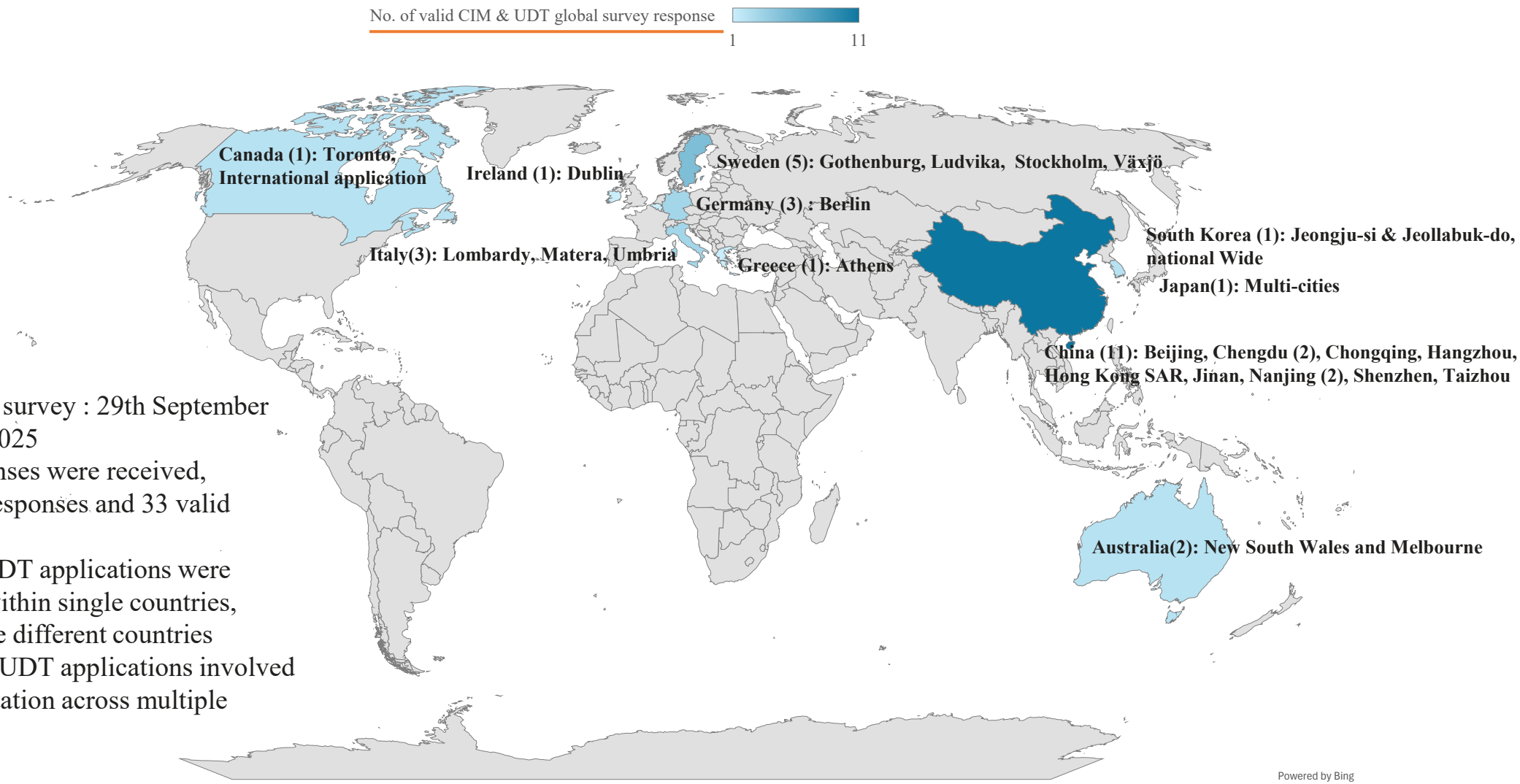
https://www.iec.ch/dyn/www/f?p=103:14:404930262863078::::FSP_ORG_ID,FSP_LANG_ID:49078,25

City Information Modelling and Urban Digital Twins global survey

Questionnaire (13 sections, 36 questions)

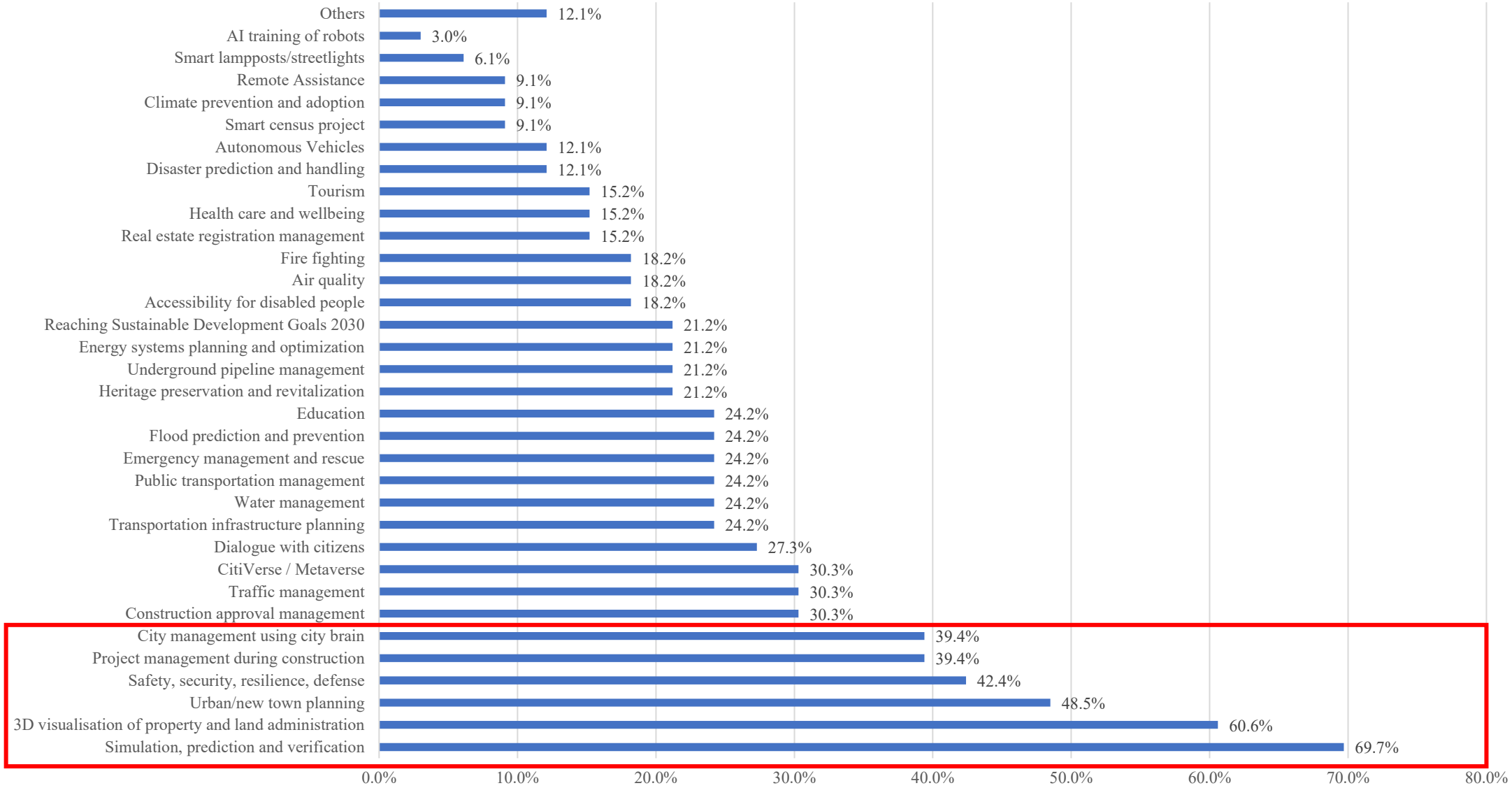
1. Screening: Individuals with experience in or involvement with projects related to City Information Modelling (CIM), Urban Digital Twins, or similar initiatives
2. The primary role of participants
3. The geographical location and scope of the application
4. The sector of the application
5. The primary organizer/owner
6. Data used
7. Technology/tool used
8. Interoperability
9. IoT utilization
10. AI capabilities
11. Metaverse and CitiVerse
12. Utilisation of standards
13. Participant information

City Information Modelling and Urban Digital Twins global survey: September 2024 to March 2025

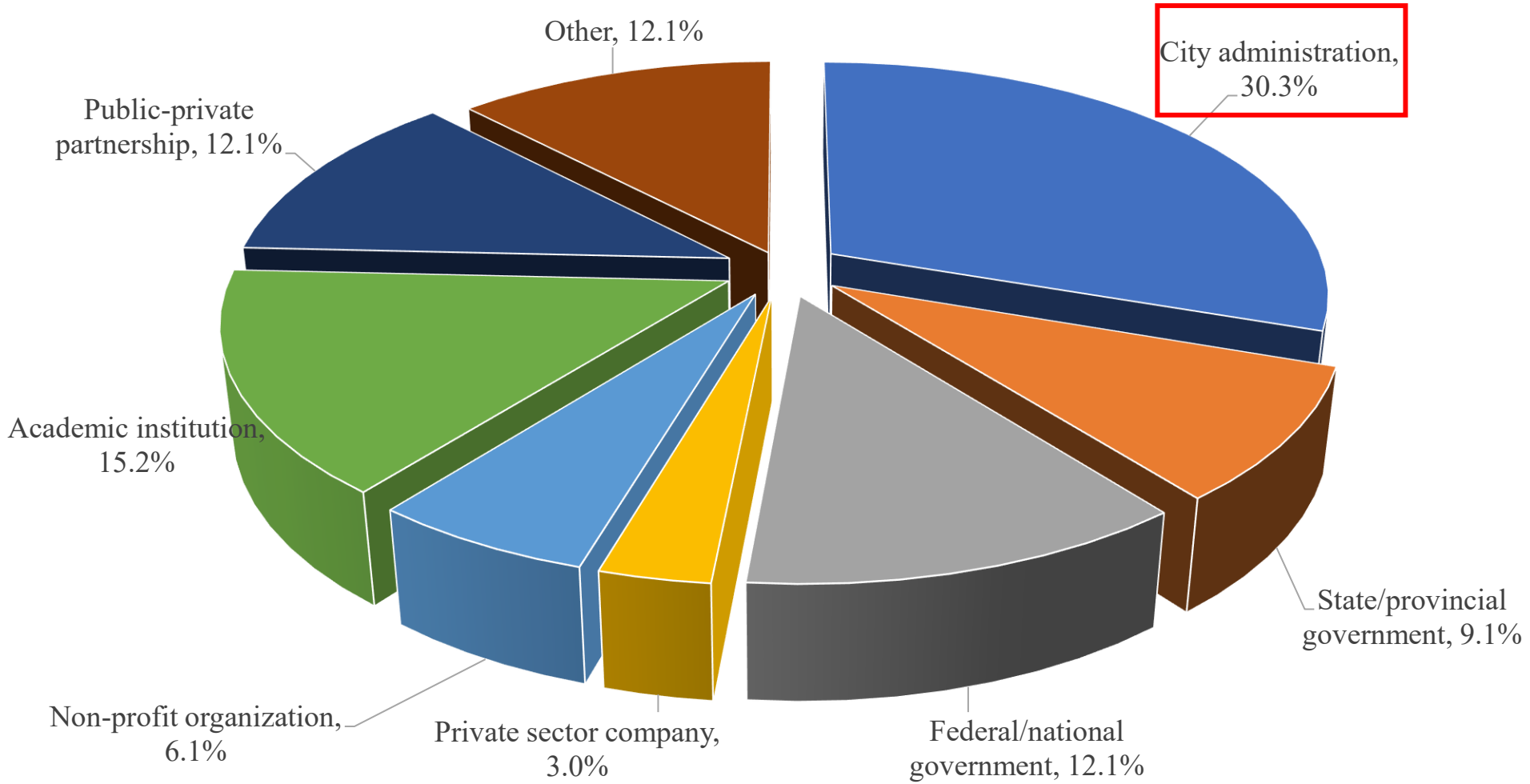


- CIM & UDT global survey : 29th September 2024 to 31st March 2025
- 42 completed responses were received, including 9 invalid responses and 33 valid responses
  - 28 CIM/UDT applications were reported within single countries, across nine different countries
  - Five CIM/UDT applications involved implementation across multiple countries

The sectors of CIM, UDT, and similar initiative applications



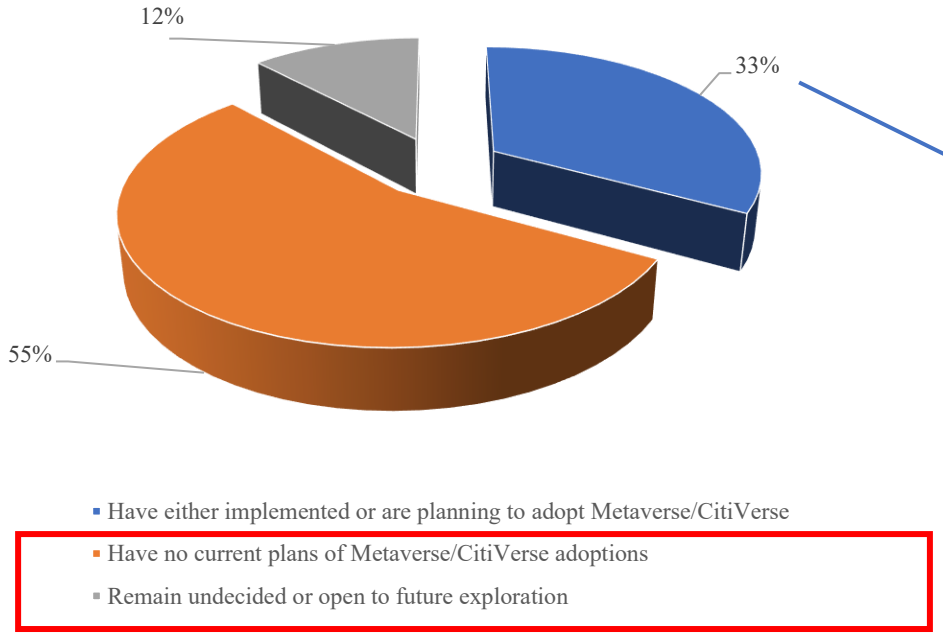
The primary organizer/owner of CIM, UDT, and similar initiative projects



Note: The other specified organizers include standardization bodies, consortiums (such as the EU PANTHEON Consortium), telecommunications operators (can be in public-private partnerships), and urban planning authorities (can be in public-private partnerships).

Metaverse and CitiVerse adoptions in CIM, UDT and similar initiative projects

Have you implemented or are you planning to implement any CitiVerse or Metaverse technology and functionality within or in conjunction with your CIM/UDT solution?



Key Metaverse/CitiVerse adoptions

(1) Immersive visualisation and digital collaboration

- Several organizations are leveraging Metaverse environments for real-time, multi-user collaboration (e.g., Unreal Engine-based XR platforms).
- Some focus on high-fidelity 3D rendering for historical preservation, creating interactive virtual heritage sites to enhance public engagement.
- Virtual operations and maintenance enable remote experts to collaborate in a shared Metaverse space with integrated voice, data visualisation, and AI-powered Q&A.

(2) Extended Reality (XR) integration

- VR/AR applications are being used in urban planning, disaster prevention, and tourism, enhancing situational awareness and decision-making.
- Some respondents employ mixed reality (MR) in leadership dashboards to improve data presentation and stakeholder interaction.

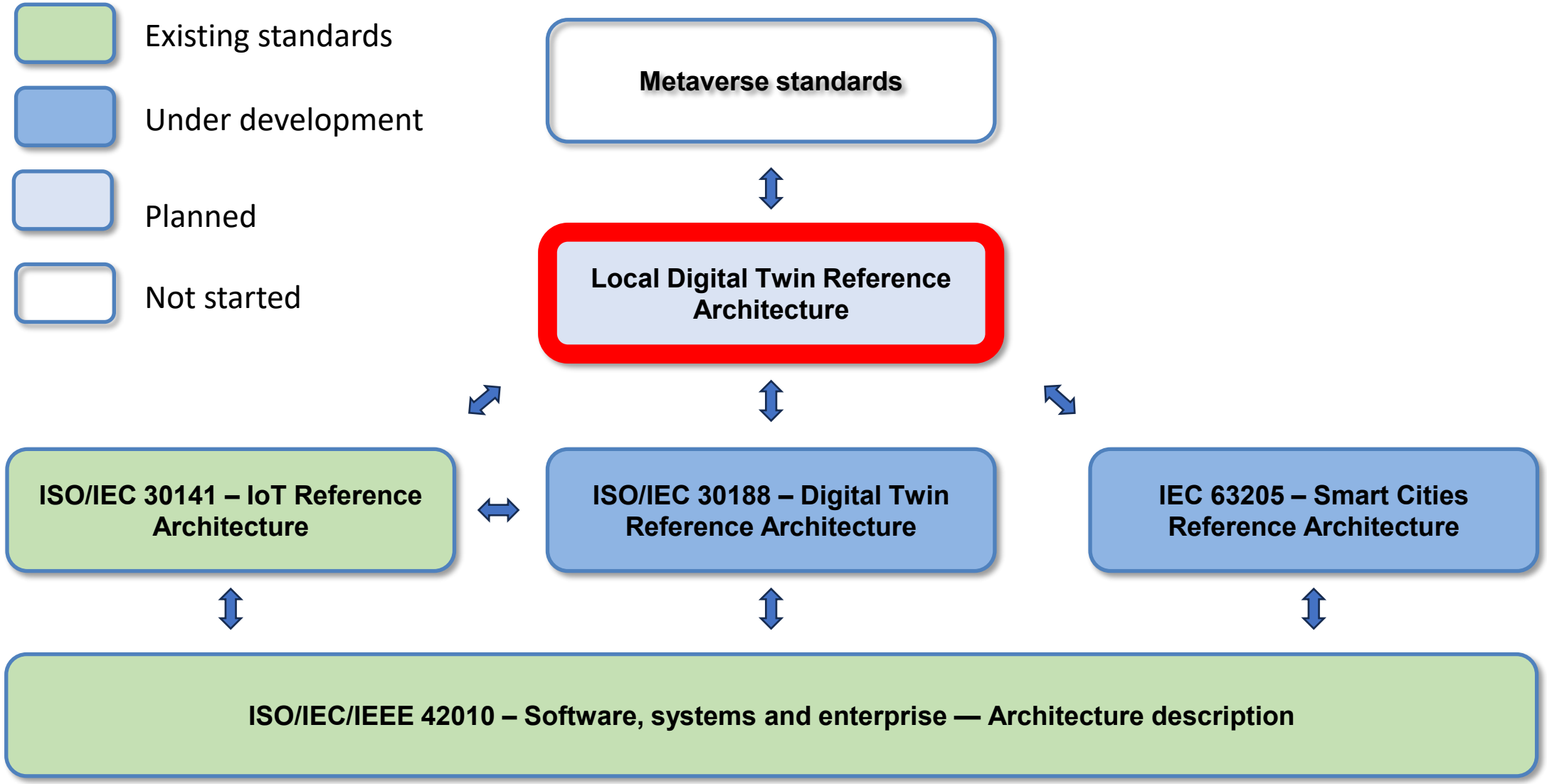
(3) Digital humans & policy simulation

- One respondent is exploring digital human avatars to analyse and explain urban policies within CIM platforms, suggesting a future where AI-driven virtual agents assist in governance.

(4) Omniverse & real-time data streaming

- NVIDIA Omniverse and Unreal Engine are being used in Citiverse projects to enable real-time 3D streaming and accessibility-enhanced urban simulations.

The ISO/IEC Local Digital Twin Reference Architecture is based on other ISO/IEC Reference Architectures



Welcome to join the work or establish cooperation

Join as:

- Liaison or NB expert in JWG 16 and SCG2
- Invited expert / stakeholder
- Expert in upcoming Joint Working Groups
- Expert or NB in JTC1 and/or JTC4

Keep contact / discuss collaboration:

- tobbe@of-us.se

Use existing liaison and experts:

- ITU-T JCA-MV is represented in SCG2
- ITU-T SG20 is liaison in JWG 16
- OGC is liaison in JWG 16

Thank you!

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