

GISSC 2025

Global ICT Standards Conference 2025

(세션3) 시티버스 ICT 융합 표준프레임워크

지속가능한 도시를 위한 혁신, 시티버스 개념 및 표준화 동향

김근영 연구원
ETRI

ICT Standards and Intellectual Property:
AI for All

Index

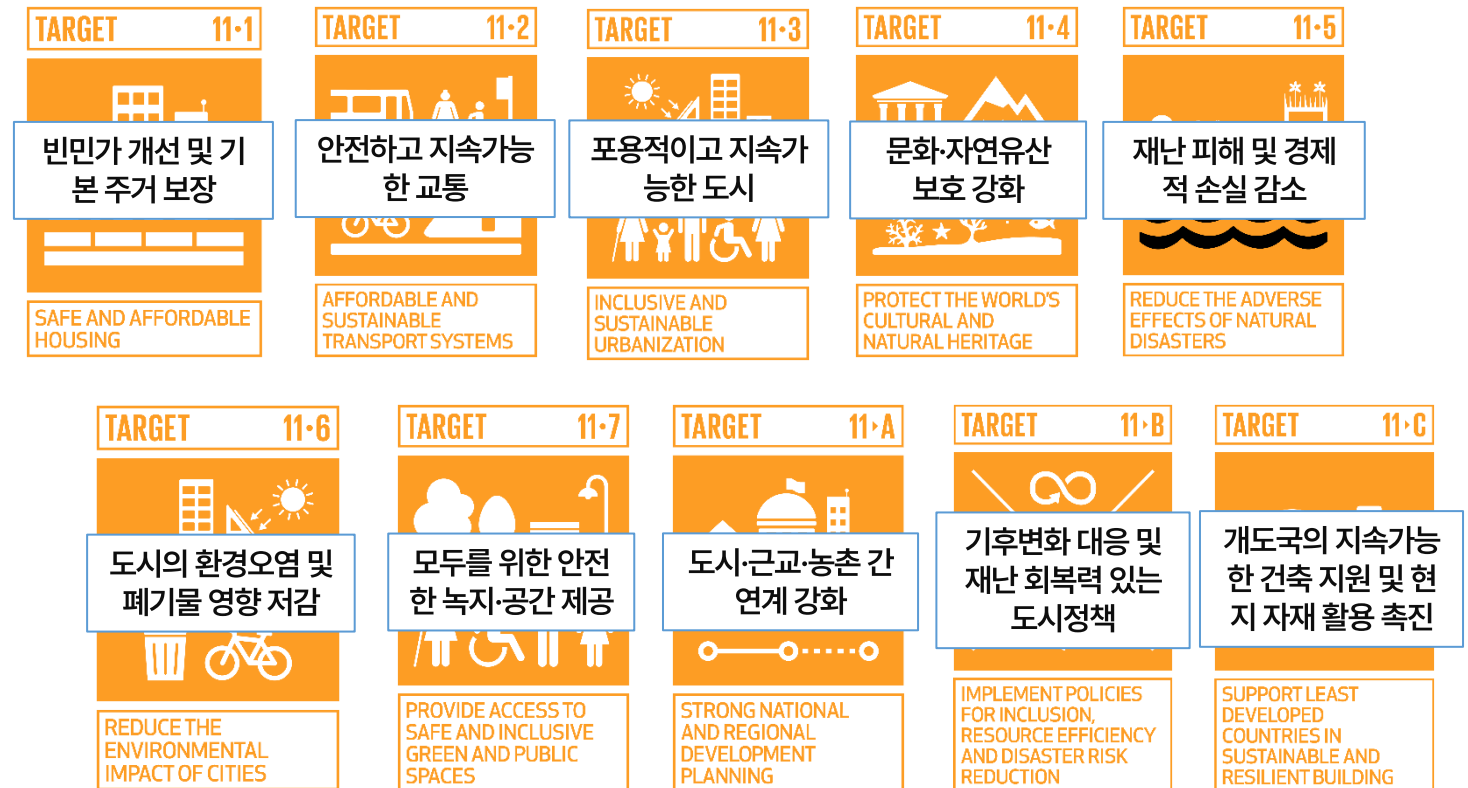
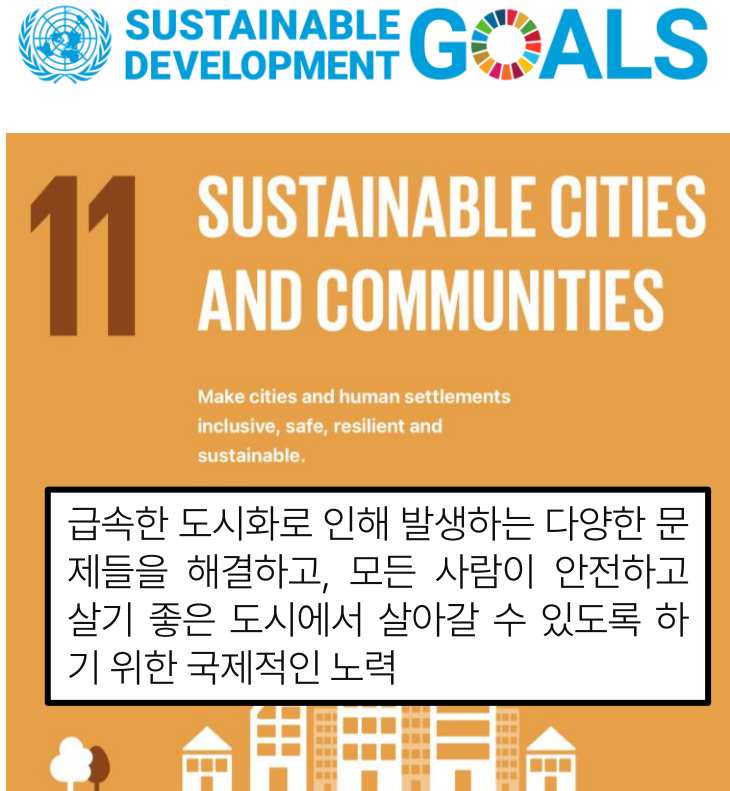
01 지속가능한 도시(sustainable cities and communities) 개요

02 Citivesre 개념

03 Citivesre 표준화 동향

01. 지속가능한 도시(sustainable cities and communities)

UN SDG 달성 목표



02. 지속가능한 도시의 발전

| ICT 기술을 활용한 도시의 지속가능성 확보 노력

ICT 융합

정보통신 간 또는 정보통신과 다른 산업 간에
기술 또는 서비스의 결합 또는 복합을 통하여
새로운 사회적·시장적 가치를 창출하는
활동 및 현상

정보통신 진흥 및 융합활성화 등에 관한 특별법(2014.2.14. 시행)

스마트도시

도시의 경쟁력과 삶의 질의 향상을 위하여
건설·정보통신기술 등을 융·복합하여 건설된
도시기반시설을 바탕으로 다양한 도시서비스를
제공하는 지속 가능한 도시

스마트도시 조성 및 산업진흥 등에 관한 법률(2017.2)

스마트시티는
도시를 구성하는 여러 도메인에
ICT 기술을 적용하는
ICT 융합과 인류문명의 총합체

도시의 지속가능성 및 위기대응
능력 확보를 위해서,
다양한 ICT 기술 적용을 통한
진화는 필수 요소!

IoT

+

데이터 허브

+

디지털트윈

+

메타버스

+

AI

CitiVerse

03. 스마트 시티의 발전 현황(기업)

| 스마트 시티는 기존 "IoT", "데이터 허브" 등의 기술 활용을 넘어 "**디지털 트윈**", "**메타버스**" 등의 기술 접목으로 진화 중



OCEANIX BUSAN

- UN-HABITAT와 협력하여 세계 최초 지속가능한 해상 도시 구축 예정(~2028)
- 해상 도시 운영에 필요한 에너지 생산 및 자원 재활용을 위한 **최신 ICT 기술** 적용

NEOM PROJECT

- 친환경적이며, 시민 참여형 스마트시티 구축 예정(~2030)
- 지속가능성 확보 및 시민의 상호작용을 위해 **디지털트윈**, **메타버스** 등의 ICT 기술 적용 고려



Dassault Systems

도시의 모든 구조물과 대응되는 **디지털트윈**을 구현하고, 모든 데이터를 수치화하여 분석 및 시뮬레이션 제공



[Virtual Singapore]

NVIDIA, META 등

메타버스를 이용, 초실감 가상세계를 구축하고, 도시 내 다양한 산업에 대한 대규모 협업 서비스 등 제공



[NVIDIA Omniverse]

"Digital Twin", "Metaverse" 등의 주요 기술 적용으로 CitiVerse 개념이 등장

04. 스마트 시티의 발전 현황(주요국)

스마트시티 분야의 환경 변화

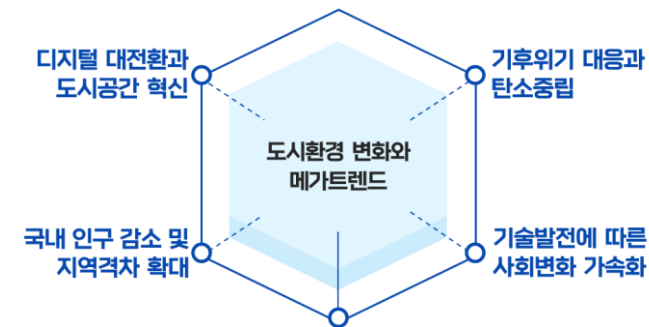
주요국의 스마트시티 정책

 EU	 일본	 싱가포르
사회적 도전과제에 대응하기 위해 Horizon Europe 프로그램 ('21~'27, 약 130조 원) 도입	인구감소 상황에서 필수·도시서비스 지속적 공급을 위한 '슈퍼시티' 구상 발표('20)	'스마트네이션'(디지털경제·디지털정부· 디지털사회) 건설을 국가비전으로 제시('14)
• 총 100개 도시를 기후중립적 스마트도시로 전환하도록 지원	• 규제장벽을 철폐하고, 도시데이터의 활용성 제고	• 데이터 공유를 위해 데이터 표준을 제정하고, 공공서비스를 제공하는 국가 플랫폼 운용

- EU집행위원회는 「웹4.0 및 가상세계 전략」을 통해 European CitiVerse 구축을 추진 중이며, Digital Europe Program을 통해 CitiVerse를 위한 기술 개발을 진행 중
- 두바이는 ITU-T와 협력하여 CitiVerse 관련 대규모 신규 프로젝트 추진 논의 중

제4차 스마트도시 종합계획('24~'28)

도시환경 변화와 메가트렌드를 반영하여 플랫폼 도시 구현, 기후위기 대응 강화, 디지털트윈 기반 도시 구축 등을 추진



01 지속가능한
공간모델 확산

02 AI·데이터 중심
도시기반 구축

03 민간 친화적
산업생태계 조성

04 K-스마트도시
해외진출 활성화

05. 시티버스의 등장

I EU 및 ITU-FG

European Union

...can be composed of a series of **interconnected distributed virtual worlds** representing their physical counterparts and synchronized...

Digital Europe Programme (2023.4)



... be said to be a **combination of Local Digital Twins and Metaverse....**

EU Observatory for ICT Standardization (2023.12)

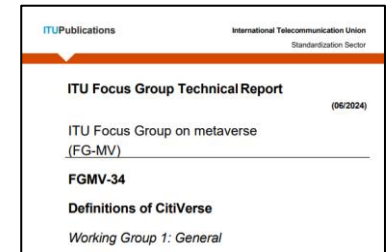
- ※ Local Digital twins (LDT)
 - = Urban Digital Twins (UDT)
 - = City Information Modeling (CIM)
 - = City Digital Twins

ITU FG-MV (concluded on June 2024)

3.2.1 CitiVerse (option one): **metaverse for city**

NOTE: CitiVerse seeks to prioritize a human-centred approach and promote sustainable development.

3.2.1 CitiVerse (option two): **metaverse for cities prioritizing a human-centred approach and promoting sustainable development.**



ITU Focus Group on metaverse FGMV-34 (2024.6)



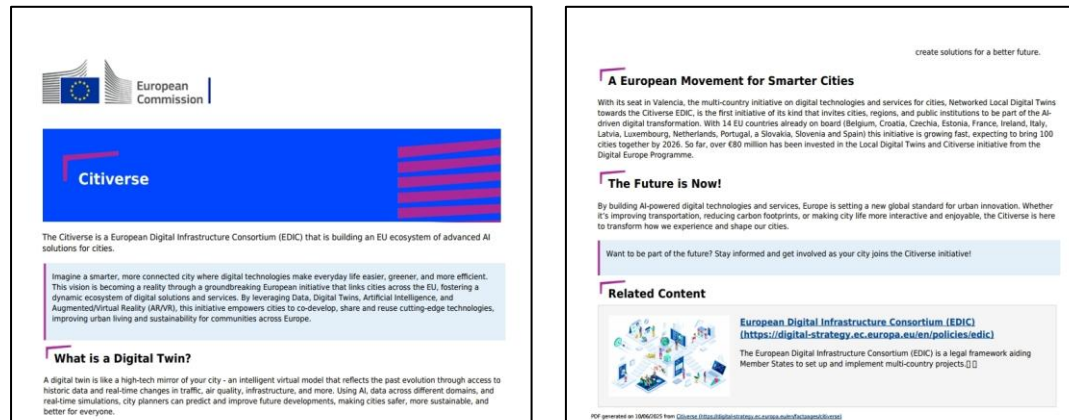
ITU Focus Group on metaverse FGMV-35 (2024.6)

...as the **cross-sectoral adoption of the metaverse within cities**, involving the interaction of digital and physical world objects with a given city's envisioned digital ecosystem.

06. 시티버스의 개념 확립

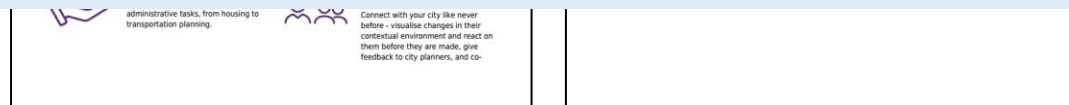
| EDIC 및 ITU-T SG20

Citiverse in a European Digital Infrastructure Consortium(EDIC)



Introducing the Citiverse: Your City in the Virtual World

The Citiverse is a next-level digital space where **citizens, communities, and city officials** can interact in a whole new way by applying AR/VR to **participatory decision making**.



ITU-T SG20 (Y.citiverse-reqts ongoing)

3.2.1 citiverse: an **integrated environment** that **enables urban experience innovation**, ensures **human-centric urban operation**, and

supports intelligent and efficient urban management through virtual worlds that represent s, and is synchronized with a smart sustainable city

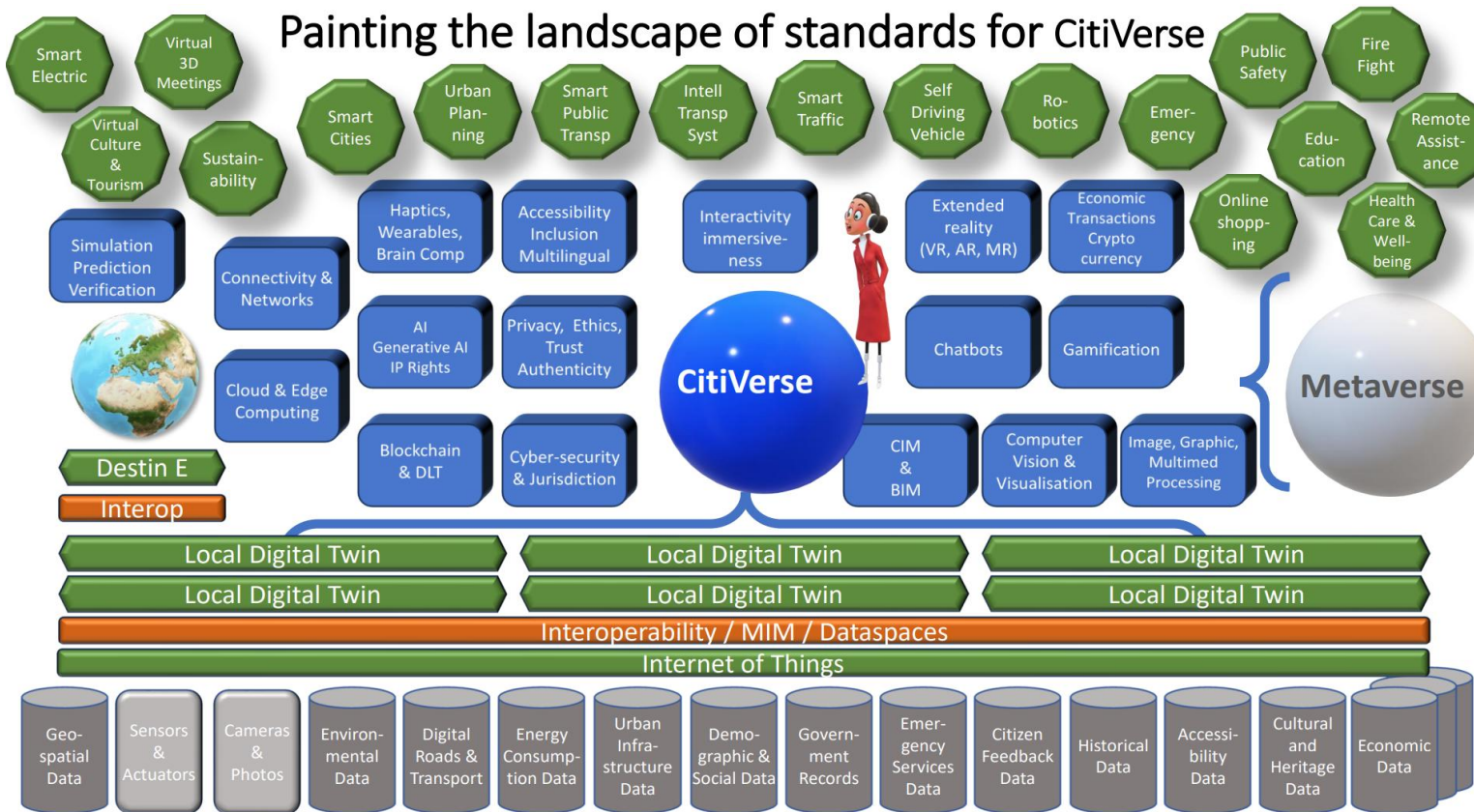


ITU SG20 Y.citiverse-reqts (2025.9)

Cities + Metaverse = Citiverse

07. 시티버스의 개념 확립

| Citiverse를 위한 주요 기술 및 응용



Citiverse ≠ Metaverse

IoT -> Digital Twin으로 구현되는
도시 인프라의 활용 측면이 강조

AI, Blockchain, Cyber-security 등 다
양한 기술들이 융합

08. 시티버스 글로벌 이니셔티브

| Global Initiative on Virtual World and AI – Discovering Citiverse

- ITU, UNICC(유엔국제컴퓨팅센터), Digital Dubai를 중심으로 2024년에 글로벌 협의체 출범
- UN virtual worlds day, citiverse challenge 등을 통해 시티버스에 대한 글로벌 인식 및 관련 개발 확산



UN Virtual Worlds Day

Delivering on the Pact for the Future with AI-Powered Virtual Worlds

11-12 June 2025
Turin, Italy

itu.int/un-virtual-worlds-day/

Co-organized by: United Nations, ITU, ITC, Food and Agriculture Organization of the United Nations, UNICC, UNRISD, UN Tourism, UN Women, UNICEF, UNECE, UNU, THE WORLD BANK, ECA, UN-Habitat.

In partnership with: Ministero delle Imprese e del Made in Italy.

Hosted by: ITC.

Supported by: ETRI, ASTON, SANDBOX, Mimbus, NEXT G, URA.

Global Initiative on Virtual Worlds and AI

Discovering the Citiverse

itu.int/metaverse/virtual-worlds



1st UN Citiverse Challenge

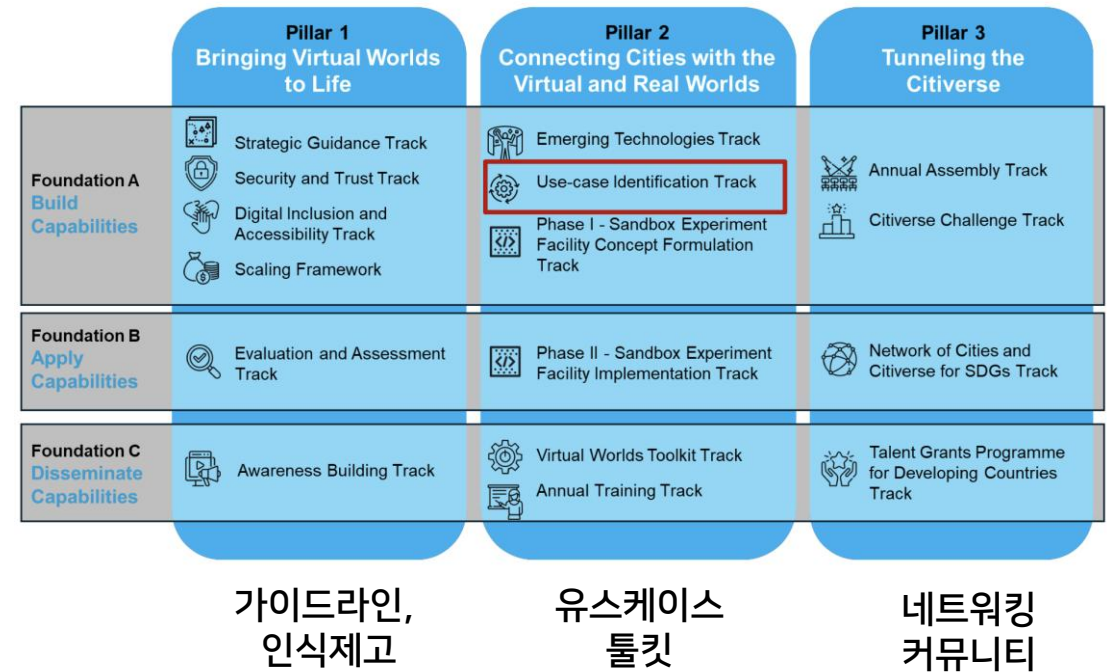
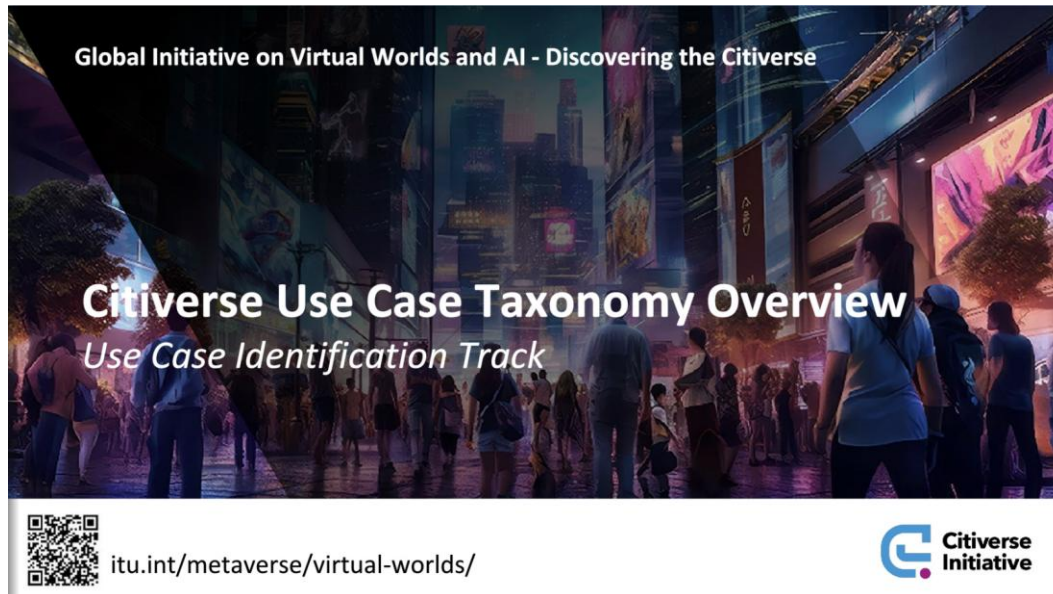
Citiverse: Designing digital public infrastructure of future cities

Co-organized by: DIGITAL DUBAI, IoT Convergence & Open Sharing System, W&G, University of Central Lancashire, UAB, UNECE, UN Tourism, Food and Agriculture Organization of the United Nations, THE WORLD BANK, UNICEF, UNICC, ITU.

09. 시티버스 글로벌 이니셔티브

| Global Initiative on Virtual World and AI – Discovering Citiverse

- 2025년 제 2차 UN virtual worlds day에서 시티버스에 대한 5개 분류 50여종의 유스케이스 분석집 발간



<https://www.itu.int/net/epub/TSB/2025-Citiverse-Use-Case-Taxonomy-Overview-Use-Case-Identification-Track/index.html#p=1>

10. 시티버스 글로벌 이니셔티브

| 5대 Thematic Areas

Thematic Area	High Level Description
Urban Planning, Placemaking, and Infrastructure	This thematic area is focused on leveraging virtual worlds to transform the way we create and live in cities. 도시의 물리적 공간을 디지털로 재현하고, 시민 중심의 설계·인프라 의사결정 지원 placemaking and liveable spaces and urban infrastructure engineering.
City Administration, Services, and Public Participation	This thematic area is focused on leveraging virtual worlds to transform city governance and public service delivery. 공공서비스 가상화 및 시민이 정책 형성과 행정 운영에 직접 참여할 수 있는 구조 마련 public service delivery, sustainable city operations and citizen participation and co-creation.
Economic Development, Education and Tourism	This thematic area is focused on leveraging virtual worlds to provide immersive and vocational training. 몰입형 학습과 디지털 경제·관광 생태계를 통해 도시의 지속가능한 성장 기반 확장
Transport and Mobility	This thematic area is focused on leveraging virtual worlds to transform the way people and goods move. 실시간 시뮬레이션 및 가상 교통환경을 통해 이동 흐름 최적화, 친환경 교통체계 구현 transportation and micromobility.
Public Safety, Health and Disaster Resilience	This thematic area is focused on leveraging virtual worlds to strengthen public safety, health and disaster management and climatic resilience. 재난 대응·보건 관리·안전 훈련을 가상환경에서 실험·강화하여 도시 대응력 실현

11. 시티버스 글로벌 이니셔티브 – Horizon mapping

| Citiverse Usecase Overview and Horizon mapping

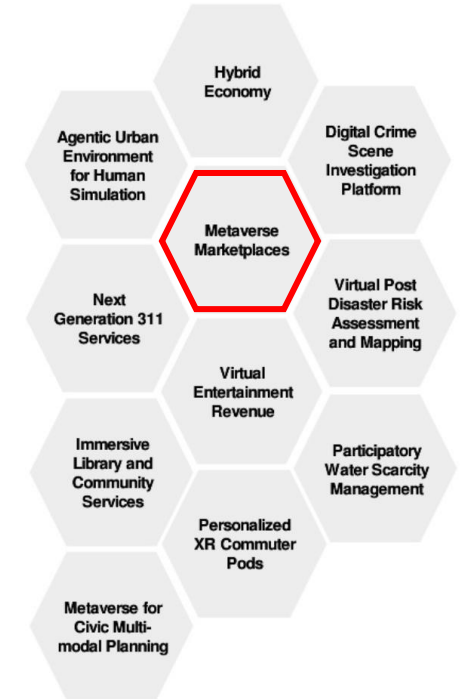
Horizon 1: Current Deployment



Horizon 2: Piloting



Horizon 3: Discovery



이미 실세계에 배포되고 있는 성숙한 솔루션

파일럿 또는 초기 적용 단계의 신흥 유스케이스

잠재력이 있으나 아직 탐색 단계

12. 시티버스 글로벌 이니셔티브 – Usecase 1 (Horizon 1)

Predictive Transit Scheduling

Description

Digital twins can be used to support AI-powered predictive transit scheduling by simulating and visualizing real-time passenger demand, traffic conditions, and operational scenarios across city-wide transport networks. City stakeholders such as fleet operators and transport planners can use these platforms to dynamically adjust transport schedules, optimize vehicle dispatching, and reduce service gaps based on live and forecasted data. IoT sensors across vehicles, stations, and road networks can feed real-time information into digital replicas of the transit system to enable continuous performance monitoring. AI could be leveraged to anticipate surges in demand, recommend fleet adjustments, and optimize resource allocation.

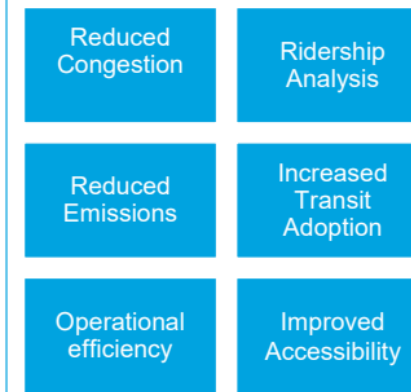
Example

Madrid has embraced the power of AI and digital twins to modernize its public transport system, focusing on bus scheduling. The Empresa Municipal de Transportes optimizes bus deployment based on passenger demand, traffic conditions, and environmental data. This approach minimizes delays, improves fleet efficiency, and enhances the rider experience, especially during peak hours or disruptions. AI helps to predict ridership surges and adjust frequencies, contributing to operational cost savings and sustainability goals.

Key Technologies



Impacts



Horizon
1

SDG Alignment



Target 9.4



Target 11.2, 11.3, 11.6

Risk Level

Public safety	Low	Medium	High
Stakeholder acceptance	Low	Medium	High
Data privacy and security	Low	Medium	High
Financial/operational	Low	Medium	High

itu.int/metaverse/virtual-worlds/

13. 시티버스 글로벌 이니셔티브 – Usecase 2 (Horizon 2)

XR Mobility Planning

Description

Urban planners can use immersive XR environments to simulate proposed changes in transit routes, station placement, and pedestrian impact before construction begins. Urban planners, transport authorities, and community engagement teams can use these platforms to visualize design impacts, assess accessibility improvements, and integrate public feedback into infrastructure projects. These tools allow residents to virtually walk through redesigned transport infrastructure and give feedback before construction begins. These tools also enable public participation and equity-focused design.

Example

The City of Boston and the Massachusetts Bay Transportation Authority are using immersive VR tools to improve public engagement and equity outcomes in the design of new transit infrastructure. By combining GIS, urban simulation, and VR headsets, stakeholders and residents can experience proposed changes to bus stops, subway stations, and pedestrian interfaces in three dimensions. This fosters a deeper understanding of the urban environment and helps ensure that infrastructure meets the needs of all users, particularly underrepresented communities.

Key Technologies



Impacts



SDG Alignment



Target 16.7



Target 11.2, 11.3

Risk Level

Public safety	Low	Medium	High
Stakeholder acceptance	Low	Medium	High
Data privacy and security	Low	Medium	High
Financial/operational	Low	Medium	High

itu.int/metaverse/virtual-worlds/

14. 시티버스 글로벌 이니셔티브 – Usecase 3 (Horizon 3)

Metaverse for Civic Multi-modal Mobility Planning

Description

A metaverse environment can allow stakeholders – from city planners to residents – to interact with different 3D models of mobility systems, going beyond simulating proposed changes to individual infrastructure assets, to enabling citizens to explore the impacts on multi-modal connections. This can be used to simulate routes for active travel such as cycling and micro-mobility to test safety and experience. In a metaverse environment, citizens can also interact and vote on policy proposals. AI and GAI can be leveraged to generate different design options and support multi-lingual and personalised interaction interfaces for users to navigate the virtual environment.

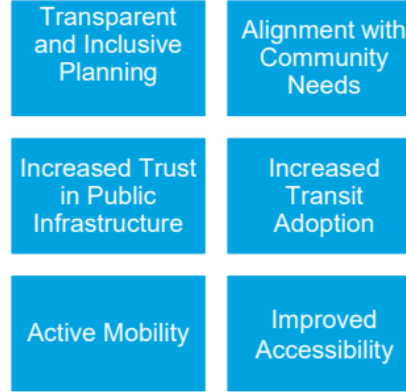
Example

Kaunas Municipality is discussing a participatory planning pilot using Unreal-powered 3D models and VR environments to visualize tram alignments. Citizens can walk through proposed tram stations virtually, explore multimodal connections, and vote on key choices – a Baltic-first approach to deep civic engagement in transport infrastructure planning.

Key Technologies



Impacts



SDG Alignment



Target 16.7



Target 11.2, 11.3, 11.6

Risk Level

Public safety	Low	Medium	High
Stakeholder acceptance	Low	Medium	High
Data privacy and security	Low	Medium	High
Financial/operational	Low	Medium	High

itu.int/metaverse/virtual-worlds/

15. 시티버스 국내 동향

| 시티버스표준화 포럼

- `25. 7.22 시티버스표준화포럼 설립
 - 국내외 표준화 활동
 - 표준 보급 및 확산 기여
 - 융합서비스 발굴 및 공유



시티버스표준화 포럼의 목표

산학연관 협력을 통해 시티버스 관련 국내·외 표준화 활동과
표준 기반의 시장 및 산업활성화와 글로벌 선도 기반 마련



16. 시티버스(citiverse) 표준화 동향 - ITU

ITU-T에서 시티버스 관련 국제표준 개발의 필요성을 인식하고 이를 반영

ITU-T WTSA Resolution 98 – Enhancing the standardization of Internet of Things, digital twins, and smart sustainable cities and communities for global development

...

resolves to instruct Study Group 20

1 to develop ITU-T Recommendations aimed at implementing focused on IoT, digital twins, and SSC&C, addressing a broad range of areas, including, but not limited to, ~~on issues related to new and emerging technologies~~ telecommunications/ICTs such as the metaverse for SSC&C, as well as digital services and solutions for and vertical industries;

...

8 to explore and study the concepts and frameworks of citiverse to enhance urban planning, sustainability, and citizen engagement.

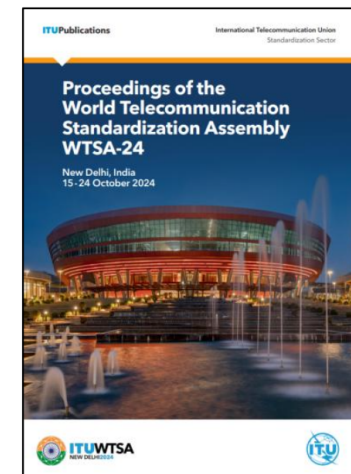
...

ITU-T SG20

Internet of Things and smart cities and communities



Internet of Things, digital twins and smart sustainable cities and communities



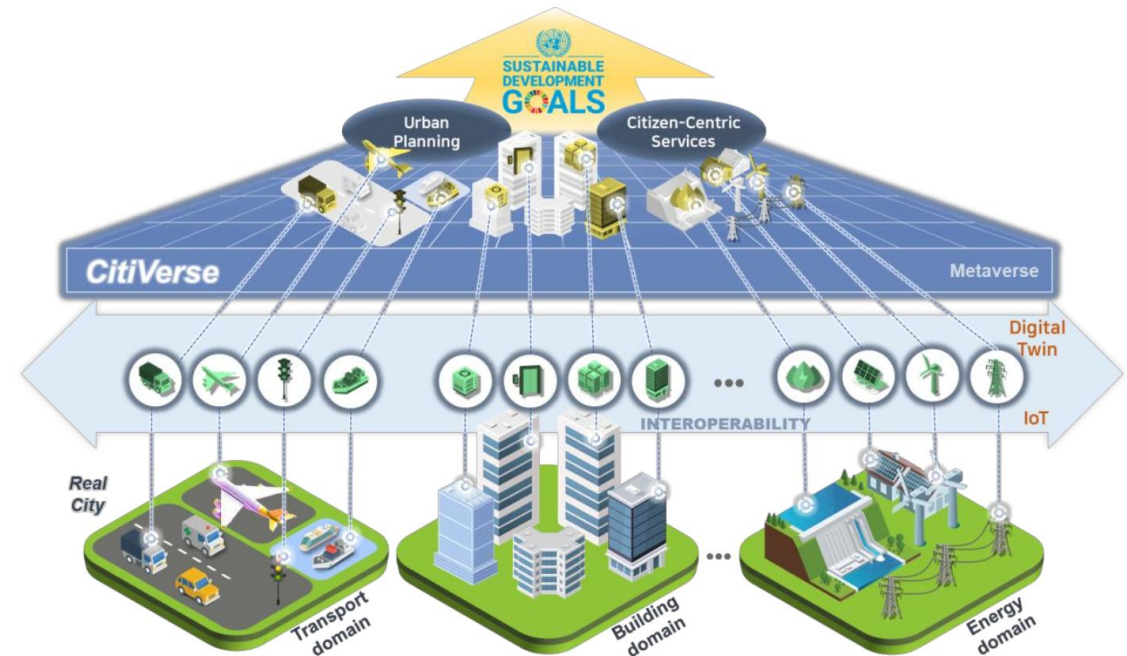
17. 시티버스(citiverse) 표준화 동향 - ITU

ITU-T Y.citiverse-reqts (on-going)

25.1 : NP 채택 (ETRI)

 INTERNATIONAL TELECOMMUNICATION UNION TELECOMMUNICATION STANDARDIZATION SECTOR STUDY PERIOD 2022-2024		STUDY GROUP 20 Original: English Geneva, 15-24 January 2025
Question(s): 1/20		
CONTRIBUTION		
Source:	Korea (Rep. of)	
Title:	Proposed new work item on Y.citiverse-reqts – “Requirements of citiverse platform for smart sustainable cities and communities”	
Contact:	Geunyoung Kim ETRI Korea (Rep.of)	Tel: +82-42-860-5380 E-mail: kimgy@etri.re.kr
Contact:	Kyoungjae Sun ETRI Korea (Rep.of)	Tel: +82-42-860-5749 E-mail: kjsun@etri.re.kr
Contact:	Seongyun Kim Korea Electronics Technology Institute Korea (Rep.of)	Tel: +82-31-789-7581 E-mail: seongyun.kim@keti.re.kr

Abstract: This contribution proposes to initiate a new work item on “Requirements of citiverse platform for smart sustainable cities and communities” based on the gap analysis. This document also contains A.1 justification form and proposed baseline text.



- 디지털트윈 기반의 진화된 스마트시티 플랫폼
- 현실 도시에 대한 가상화를 통해 가상 도시 구현
- 물리 도시와의 상호연결 및 동기화
- 도시민의 참여와 공동체 소통(citizen-centric)을 활성화

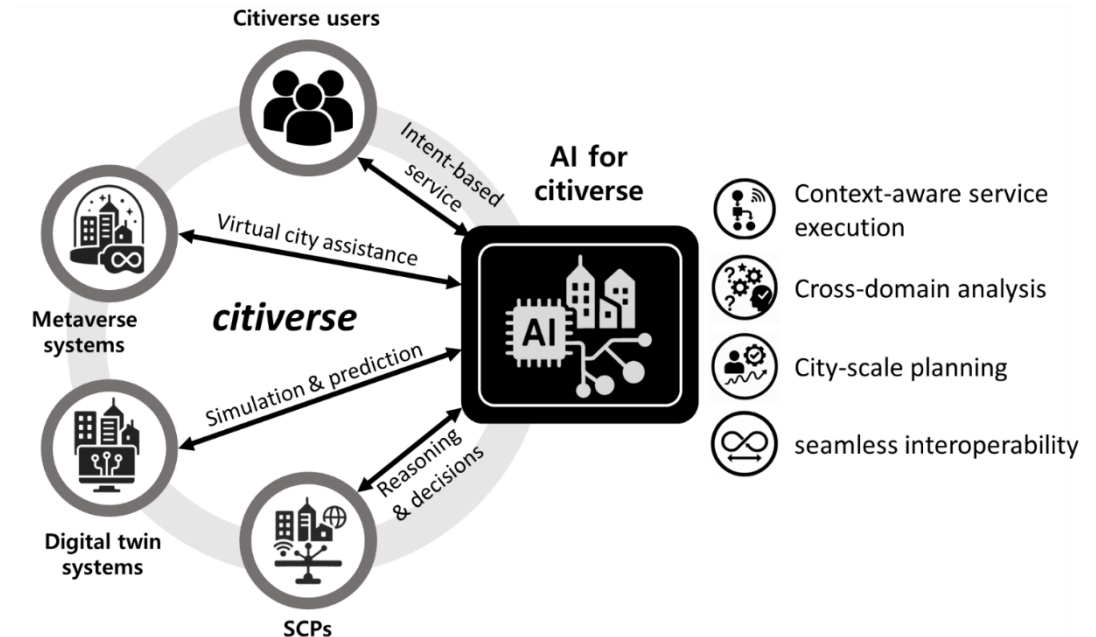
18. 시티버스(citiverse) 표준화 동향 - ITU

ITU-T Y.citiverse-ai-reqts (on-going)

25.9 : NP 채택 (KETI)

 INTERNATIONAL TELECOMMUNICATION UNION TELECOMMUNICATION STANDARDIZATION SECTOR STUDY PERIOD 2025-2028		STUDY GROUP 20 Original: English Geneva, 15-25 Sep 2025
Question(s): 1/20		
CONTRIBUTION		
Source:	Korea (Rep. of)	
Title:	Proposed new work item on Y.citiverse-ai-reqts - "Requirements for AI-enhanced smart sustainable cities and communities through citiverse"	
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Abstract: This contribution proposes to initiate a new work item on the "Requirements for AI-enhanced smart sustainable cities and communities through citiverse". This document also contains A.1 justification form and proposed baseline text.



- AI를 통해 도시 전반의 분석 계획 의사결정 자동화 수행
- 상황 인식, 데이터 흐름 분석, 인프라 계획 최적화, 이기종 시스템 간 데이터 호환등을 위한 AI 역할을 소개

19. 시티버스(citiverse) 표준화 동향 – ISO/IEC

| JTC 1 TTR on CitiVerse



JTC 1 Technology Trend Report 2024

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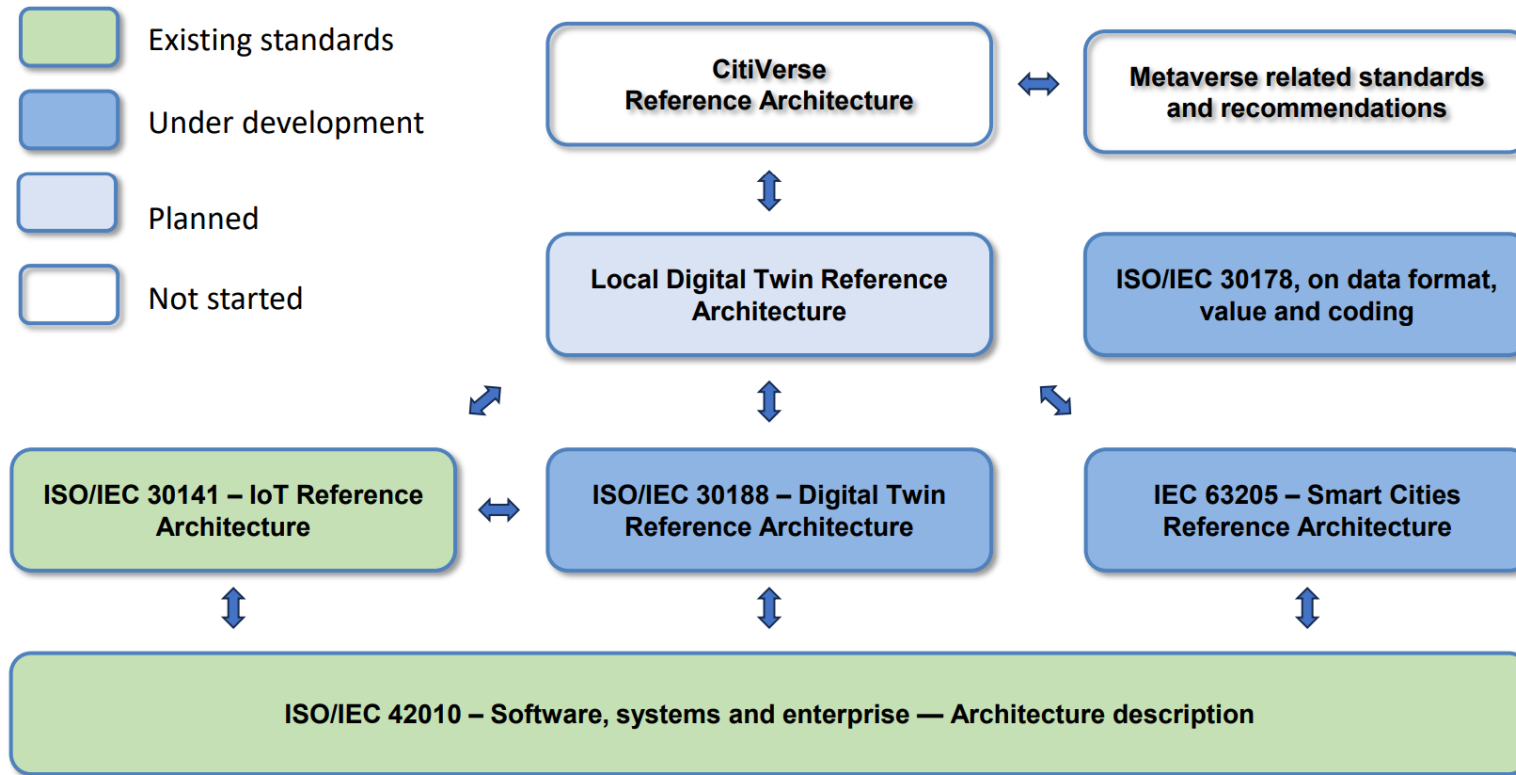
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- 시티버스에 대한 개념 설명
 - 새로운 정의가 아닌, 기존의 정의들을 참조
- 주요 특성 및 기술 분류
 - 각 기술요소에 대한 표준화 기구 활동 분석
- 유스케이스
 - 총 7종의 유스케이스를 정의하고, 각 유스케이스를 위한 관련 표준 매핑
- 도전 과제 분석 및 권고
 - CitiVerse를 위한 표준 개발 관점에서의 갭분석 및 과제 설정

20. 시티버스(citiverse) 표준화 동향 – ISO/IEC

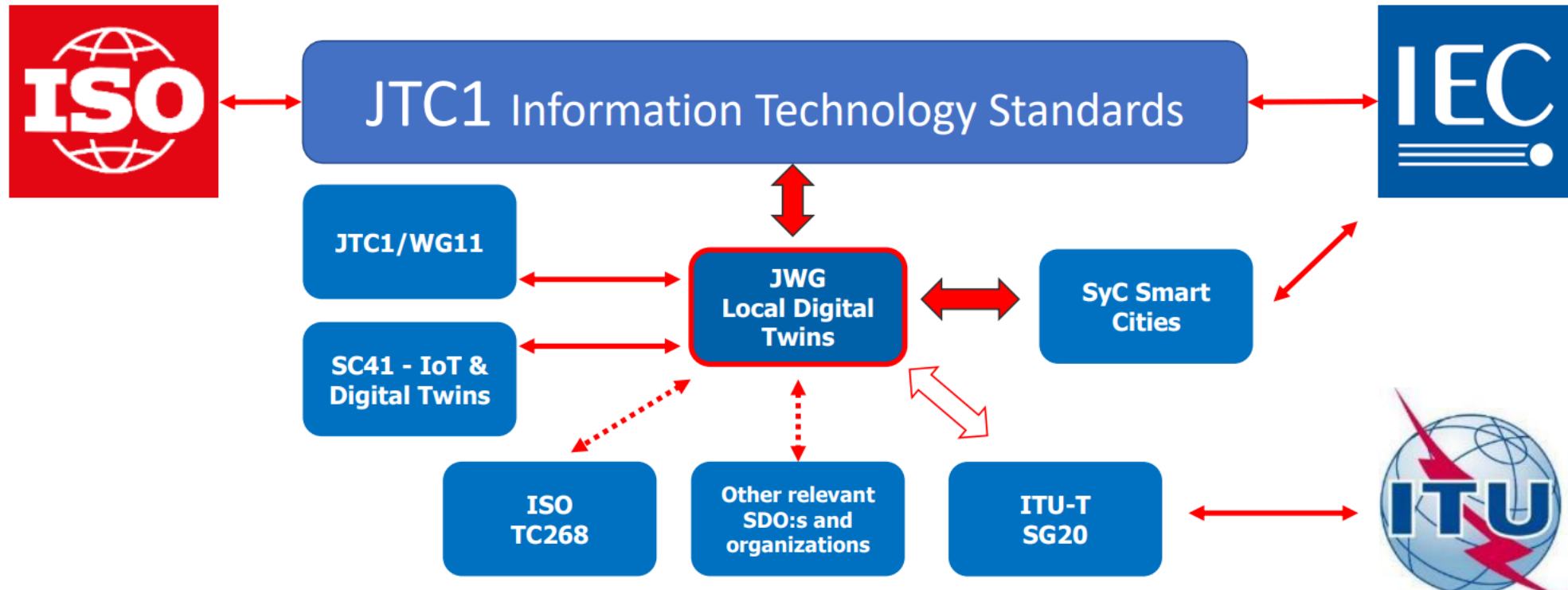
JTC 1 Standardization Roadmap on CitiVerse



21. 시티버스(citiverse) 표준화 동향 – ISO/IEC

| JTC 1 Standardization Roadmap on CitiVerse

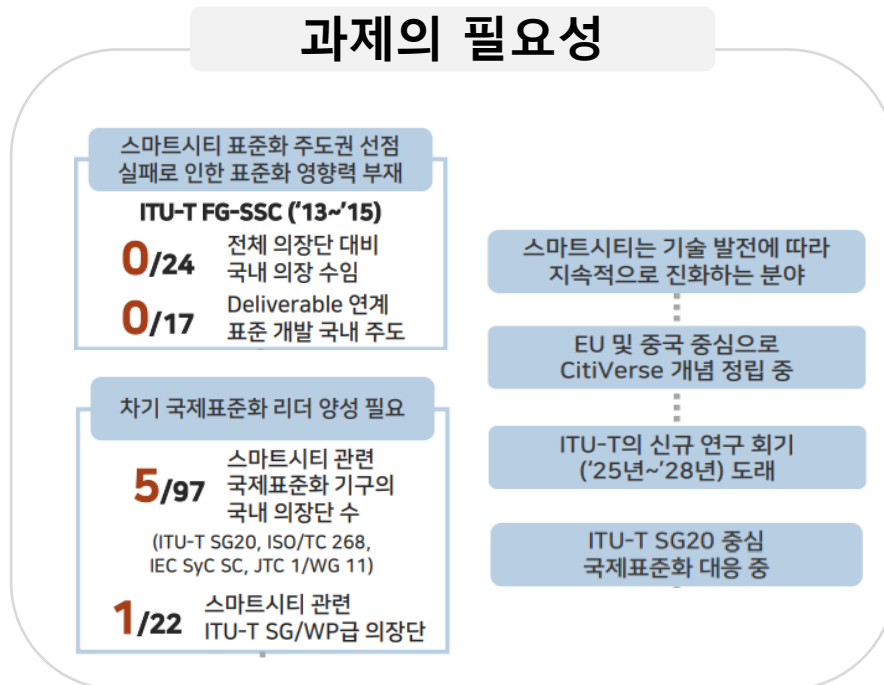
JWG regarding Urban Digital Twins and City Information Modelling



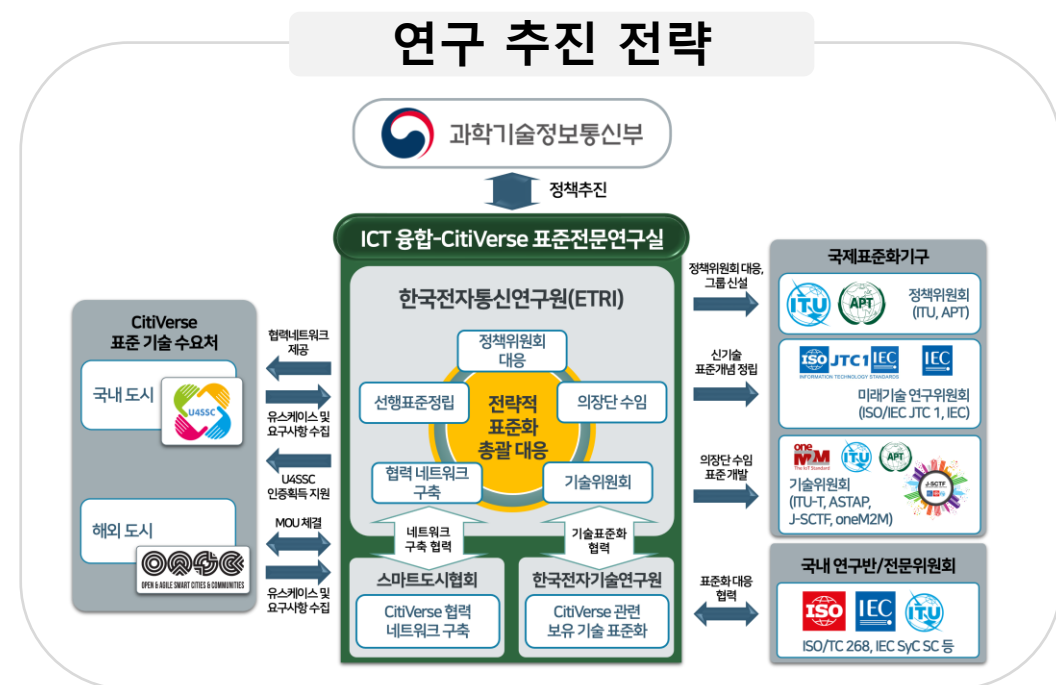
22. 결론

- CitiVerse 관련 국제 표준화 이니셔티브 주도의 적기!
 - 국제사회는 시티버스를 중심으로 한 다양한 정책 및 표준화 논의중, **CitiVerse 관련 주도권 확보가 중요**
 - 시티버스 표준전문연구실을 통한 국내외 포럼 활동, 표준화 진행 중

과제의 필요성



연구 추진 전략



GLISC 2025

Global ICT Standards Conference 2025

- 감사합니다 -

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AI for All