„Urban Digital Twin: How to fit a chameleon into a standard?"

International Forum on Urban Digital Twins, 12.09.2023
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Chair DIN Smart City Standards Forum

Content

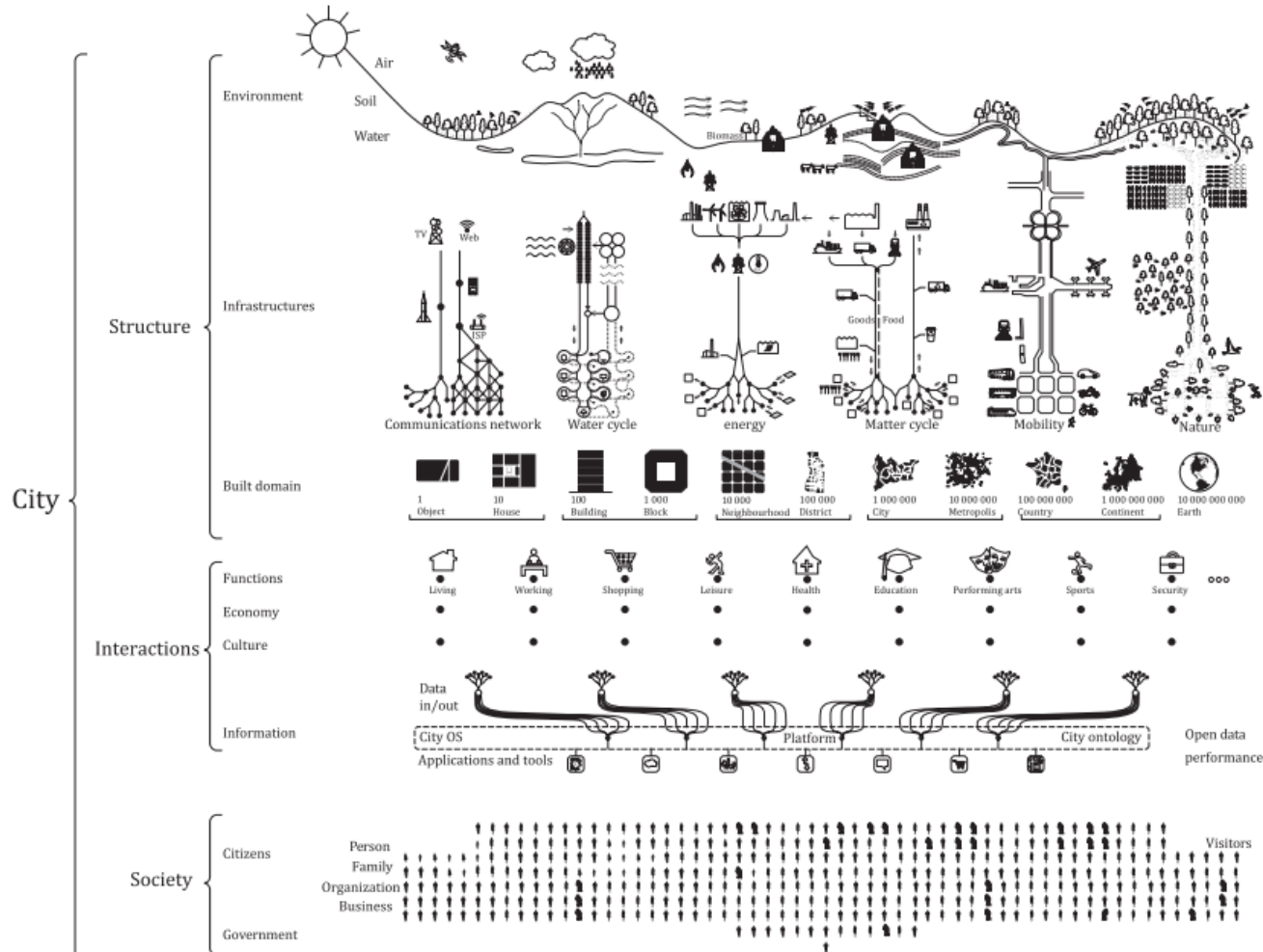City motivation for an UDT

DIN SPEC 91607
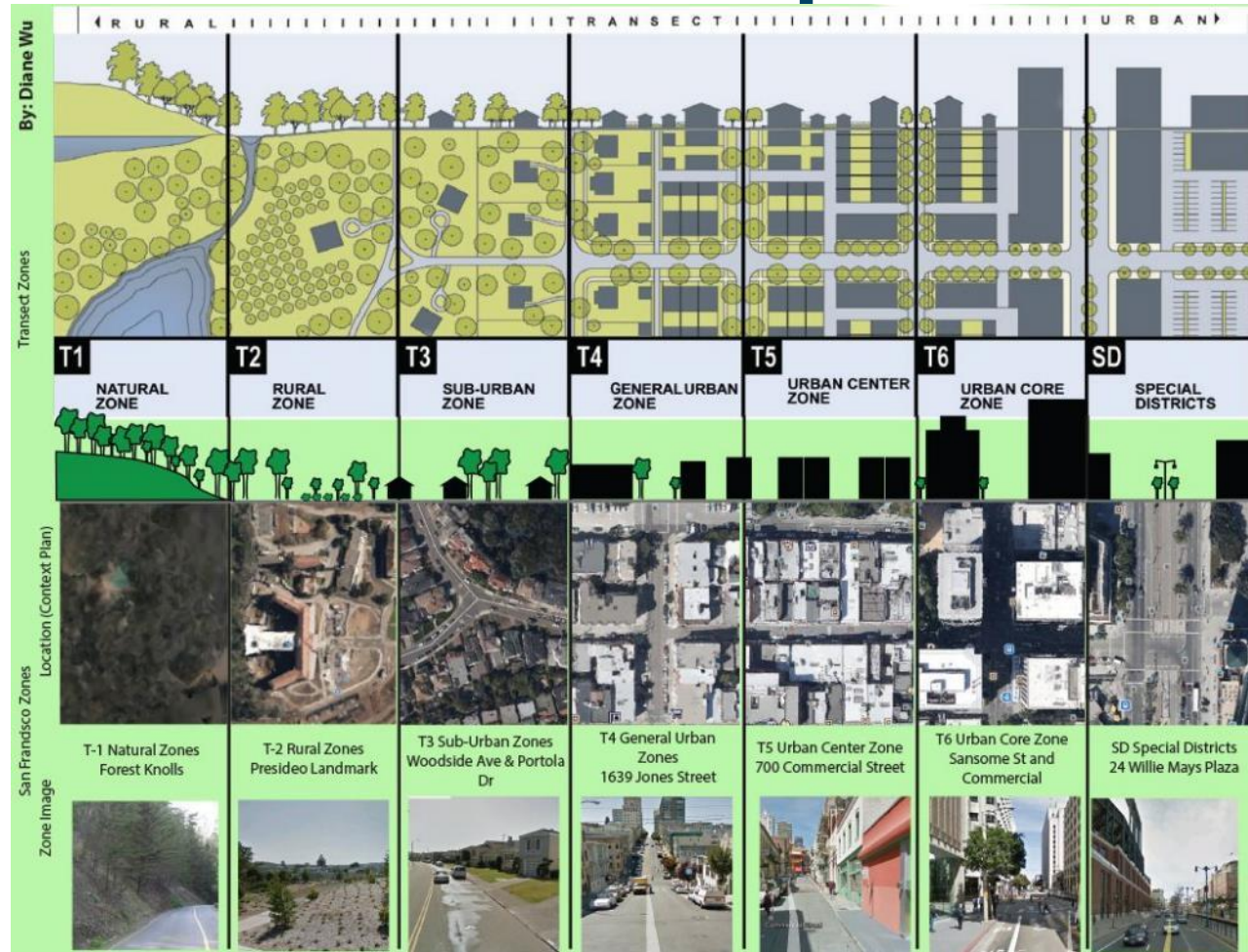
Why standards?

Standardisation landscape

Outlook

Cities are facing (g)local challenges

Source: ISO 37105:2019, Figure 1)

Each city is different
UDTs need to adapt to the local spirit

Motivation for the DIN SPEC PAS

The topic of digital twins for cities and communities is currently being addressed by many municipalities and initiatives in the German states.

There is currently no uniform view or standard for this topic.

The lack of a standardised approach

- could leave small communities with a lack of resources and know-how in information technology behind.
- complicates the transferability of solutions or (technical) interoperability.
- can result in manufacturer dependencies.
- generates unnecessary extra work in a wide variety of work areas.
- makes it difficult to position a German-European solution in the international context.

The goal of this initiative, which is partly funded by the BMWSB project "Connected Urban Twins" (CUT), is to create a (national, i.e. German) standard for transferring the concept of digital twins to urban space, including the presentation and description of application scenarios, data access and visualisation methods, and the use of available standards.
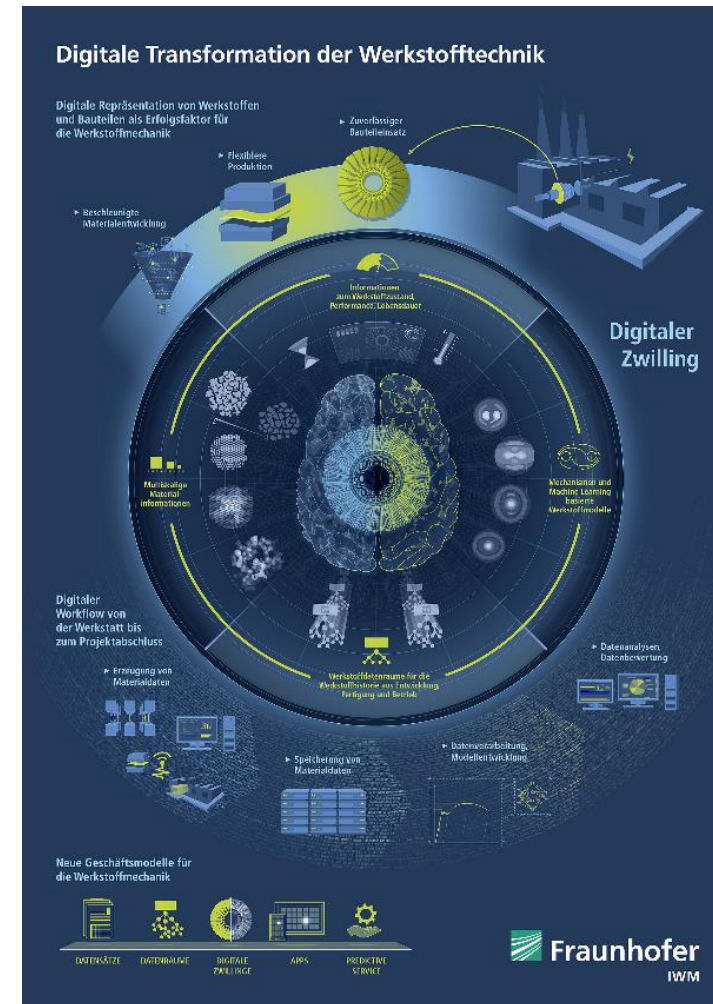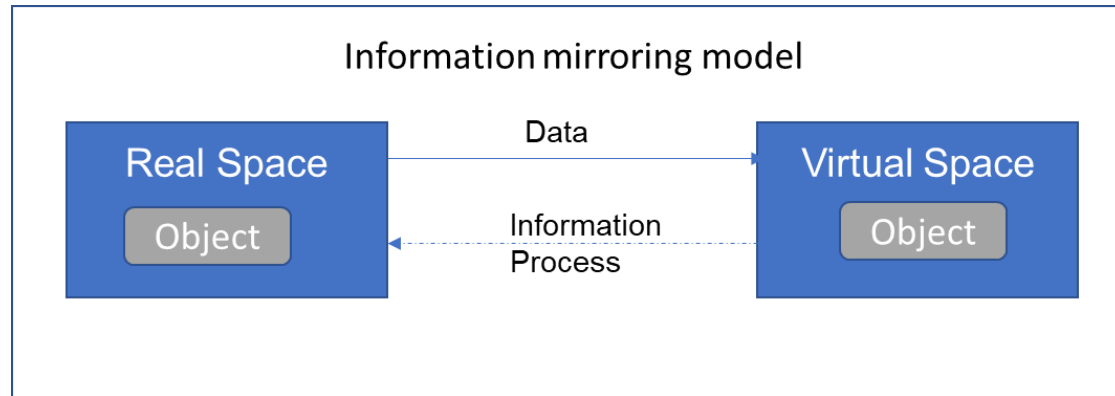
Consortium members

DIN

13 x municipalities	10 x industry	6 x science

3 x associations

From Rocket Science to a standard industry methodoloy

Building Information Modelling (BIM) as a reference

Different definitions already exist

Digital Twin (DT)—the Digital Twin is a set of virtual information constructs that fully describes a potential or actual physical manufactured product from the micro atomic level to the macro geometrical level. At its optimum, any information that could be obtained from inspecting a physical manufactured product can be obtained from its Digital Twin. Digital Twins are of two types: Digital Twin Prototype (DTP) and Digital Twin Instance (DTI). DT's are operated on in a Digital Twin Environment (DTE).
(M. Grieve - Digital Twin Institute)

The concept of a digital twin is generally accepted as a software representation of a physical system that behaves in virtual space identically as in the real world. To create a digital twin of elements in an urban neighborhood for example, a library of devices such as transformers, streetlights, energy meters, solar panels, EV chargers and bus and rail systems is necessary. Each urban "twin" is programmed to behave as its physical counterpart and incorporates associated performance characteristics such as maximum and minimum load, operating temperature characteristics, directionality in the case of automobiles, network messaging, water and electrons and other operating environment specifications.
(Industrial IoT Consortium)

Urban digital twins are a virtual representation of a city's physical assets, using data, data analytics and machine learning to help stimulation models that can be updated and changed (real-time) as their physical equivalents change. Some may consider a digital twin only describing reality (and the history of it), while it is the additional applications that bring the real intelligence and help create the common picture of reality that is the value-added of an urban digital twin
. (Living in EU – Definition)

What does 'digital twin' actually mean?
A **digital twin is a digitized copy of a smart city**, a completely virtual scale model. It was first used in the construction of buildings and other infrastructures with BIM programs, which enable all the components of a building to be monitored.
The aim of this system was to anticipate any potential faults in the material. It soon extended to other services: sewage system, energy, roads, education, etc. The digital twin is like a SimCity (the video game) with **a virtual city identical to the physical city**
(. https://tomorrow.city/a/what-is-a-digital-twin?

https://www.lodplanner.com/what-is-bim/

Data hungry UDT

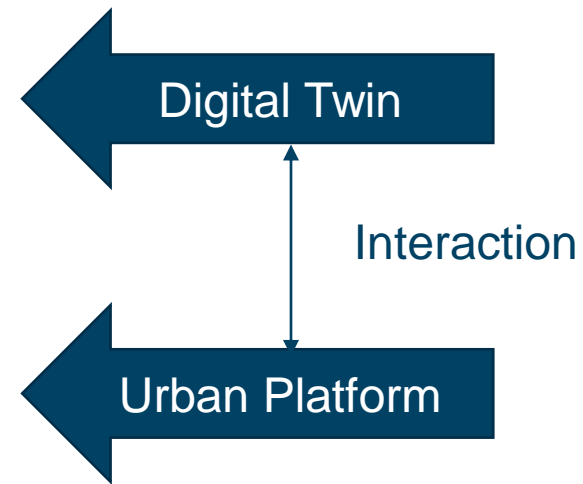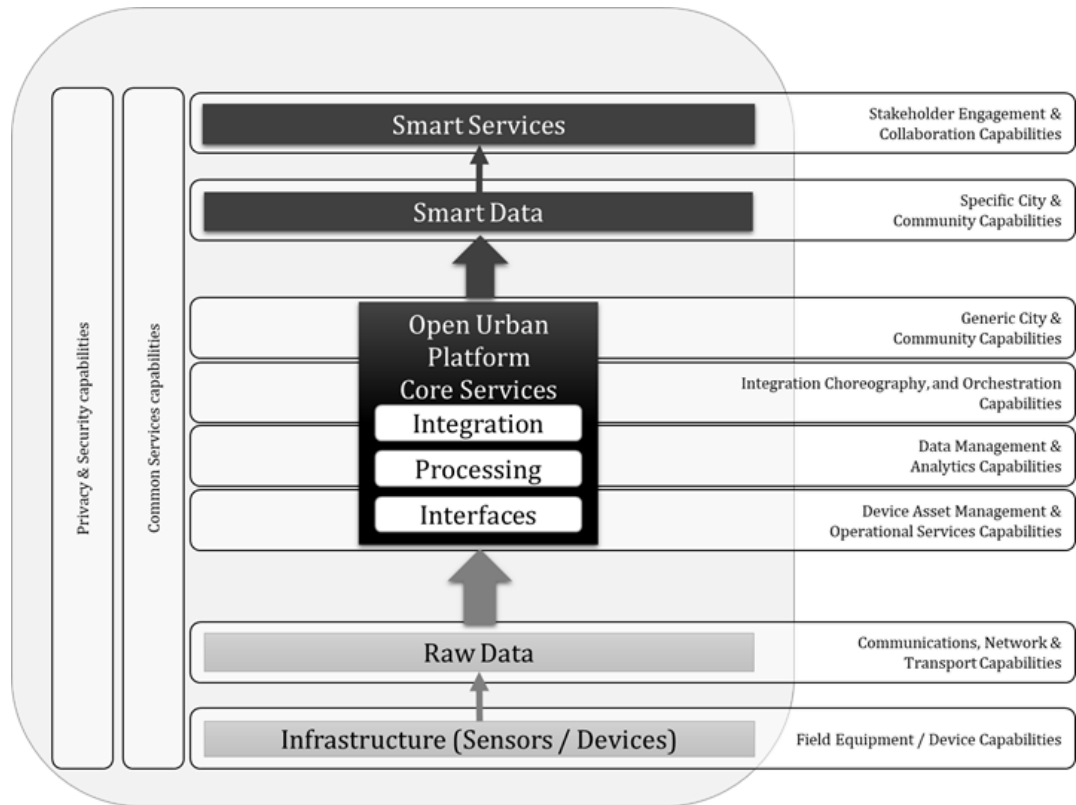Mazimwe, A.; Hammouda, I.; Gidudu, A. Implementation of FAIR Principles for Ontologies in the Disaster Domain: A Systematic Literature Review. *ISPRS Int. J. Geo-Inf.* **2021**, *10*, 324. https://doi.org/10.3390/ijgi10050324

https://www.bptrends.com/digital-transformation-turning-data-into-value/

Develop an architecture fitting to the OUP and UDT

Starting point: DIN SPEC 91357: Open Urban Platforms

Use case development

Phase 1:
Collection

Phase 2:
Alignment to fields of action and grouping

Phase 3:
Writing of use case

Around 100 User Scenarios were identified by the consortium

	Digitale Infra-struktur	Digitale Ver-waltung	Mobilität	Bauen und Wohnen	Energie	Umwelt	Bildung	Gesund-heit	Wirt-schaft	Touris-mus, Kultur und Freizeit
Technologie	Daten									
	Resilienz									
	Interoperabilität und Normen									
Entscheidungen	Partizipation									
	Steuerung									
	Integrierte Vorgehensweise									

Bild 4 — Handlungsfelder einer Kommune (vertikal) und übergreifende Querschnittsthemen (horizontal)

Reduction towards cluster of logical scenario groups

Using DIN SPECs 91387 and 91397

Emergency use case

A chameleon adapts to demands like an UDT

Not only camouflage or temperature regulation is the reason why chamelaond change their colour it also communication r moo

https://www.swr.de/wissen/1000-a en/ re-farbe-100.html

https://www.outdoorseiten.net/vb5/forum/tourenberichte/tourenberichte-ferne-l%C3%A4nder-%C3%BCbersee/80673-tz-usambaraberge-dezember-2013

Standards enable sustainability

UDT standard to support communities

Standards provide communities in addition:

1. Reliable guidelines

2. Common ground for tenders

3. Reliable detailed compendium

4. Holistic view via heterogeneous participation

5. Definition and classification of topics and key words

6. Simulations help to avoid rebound effects

7. Technology openness

8. Transferable use cases
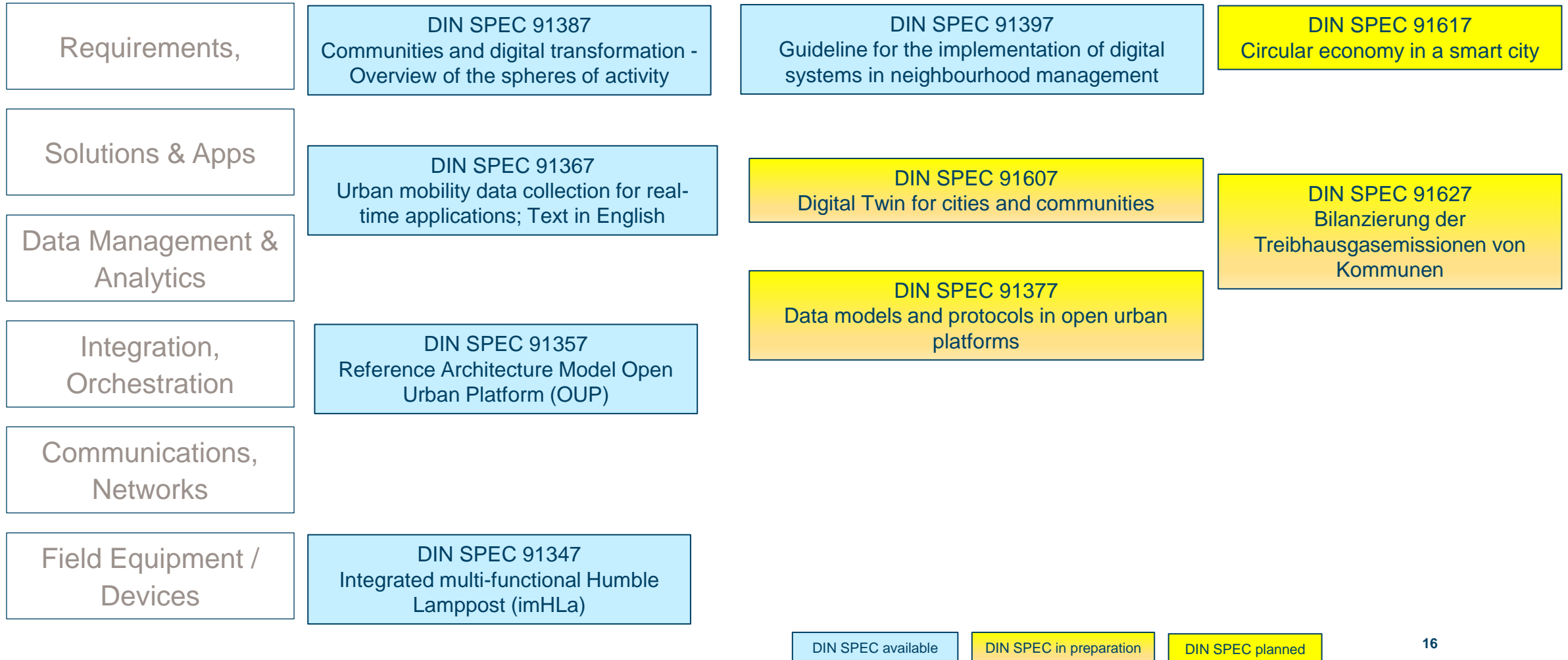
9. Transferable municipal challenges and solutions

Standards = Chameleon

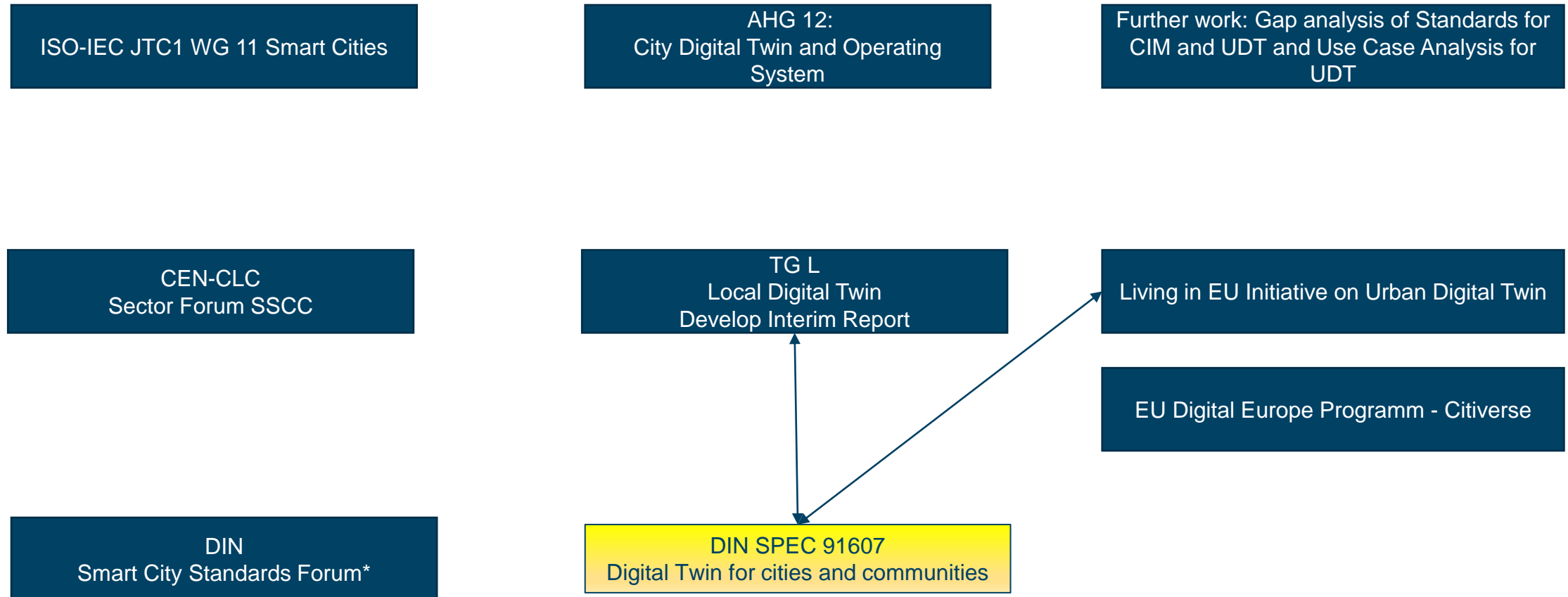https://www.geo.de/geolino/natur-und-umwelt/8357-rtkl-echsen-chamaeleons-meister-der-verwandlung © Ingo Arnd

Landscape of German Smart City Specifications

Requirements,	DIN SPEC 91387 Communities and digital transformation - Overview of the spheres of activity	DIN SPEC 91397 Guideline for the implementation of digital systems in neighbourhood management	DIN SPEC 91617 Circular economy in a smart city
Solutions & Apps	DIN SPEC 91367 Urban mobility data collection for real-time applications; Text in English	DIN SPEC 91607 Digital Twin for cities and communities	DIN SPEC 91627 Bilanzierung der Treibhausgasemissionen von Kommunen
Data Management & Analytics			
Integration, Orchestration	DIN SPEC 91357 Reference Architecture Model Open Urban Platform (OUP)	DIN SPEC 91377 Data models and protocols in open urban platforms	
Communications, Networks			
Field Equipment / Devices	DIN SPEC 91347 Integrated multi-functional Humble Lamppost (imHLa)		

DIN SPEC available   DIN SPEC in preparation   DIN SPEC planned

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UDT – CIM – Citiverse currently discussed in international standardisation

ISO-IEC JTC1 WG 11 Smart Cities	AHG 12: City Digital Twin and Operating System	Further work: Gap analysis of Standards for CIM and UDT and Use Case Analysis for UDT
CEN-CLC Sector Forum SSCC	TG L Local Digital Twin Develop Interim Report	Living in EU Initiative on Urban Digital Twin
		EU Digital Europe Programm - Citiverse
DIN Smart City Standards Forum*	DIN SPEC 91607 Digital Twin for cities and communities	

# CIM Concept in international standardisation
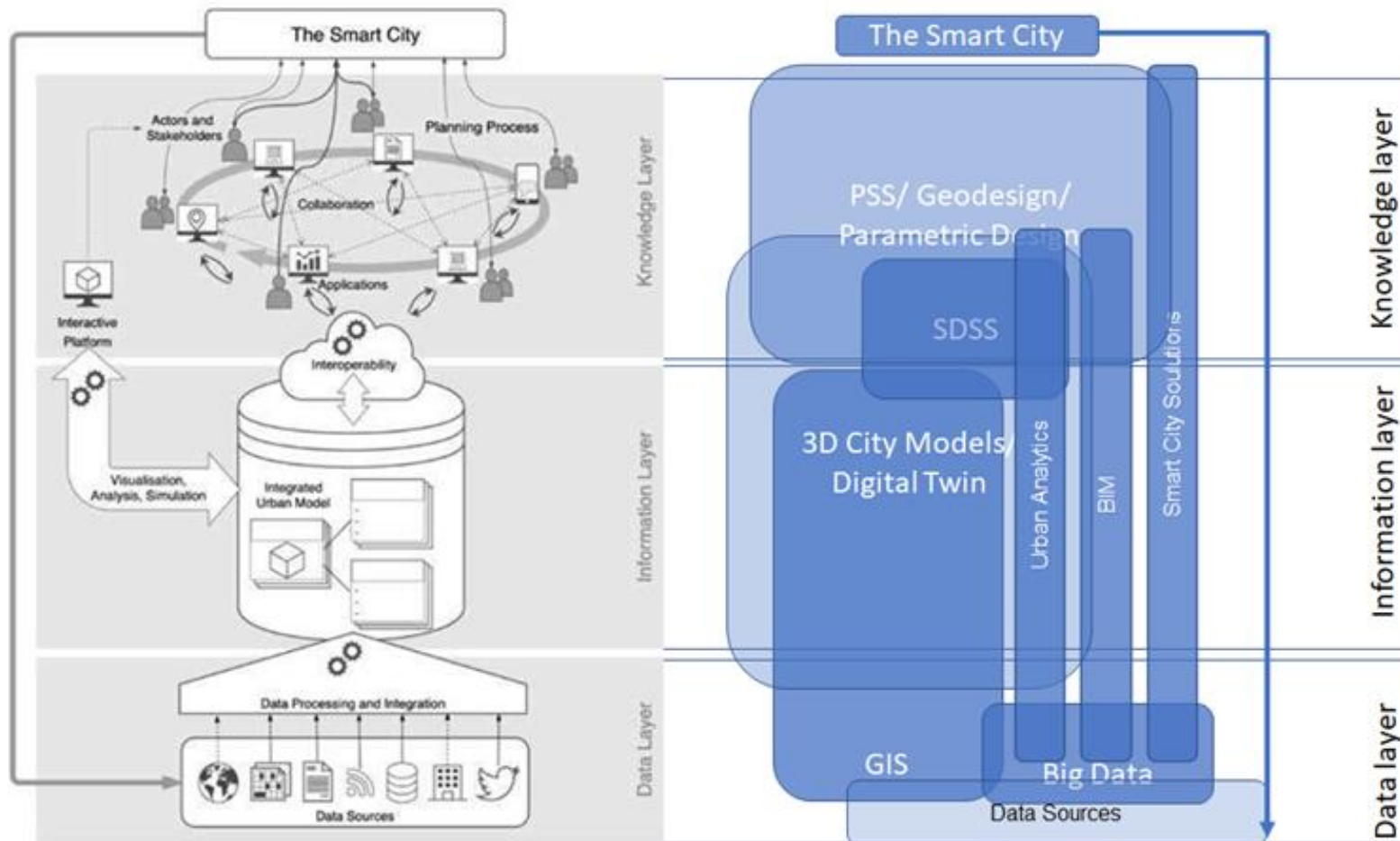
Conceptual Framework for City Information Modelling

CIM definition*
practice of using interactive digital technologies
in the process of urban planning and city management by all actors and stakeholders, to collaboratively deliver the vision of a smart city: a sustainable, inclusive, healthy, prosperous, and participative city

* IEC Technology Report – City Information Modelling and Urban digital Twins

From BIM to CIM to Citiverse
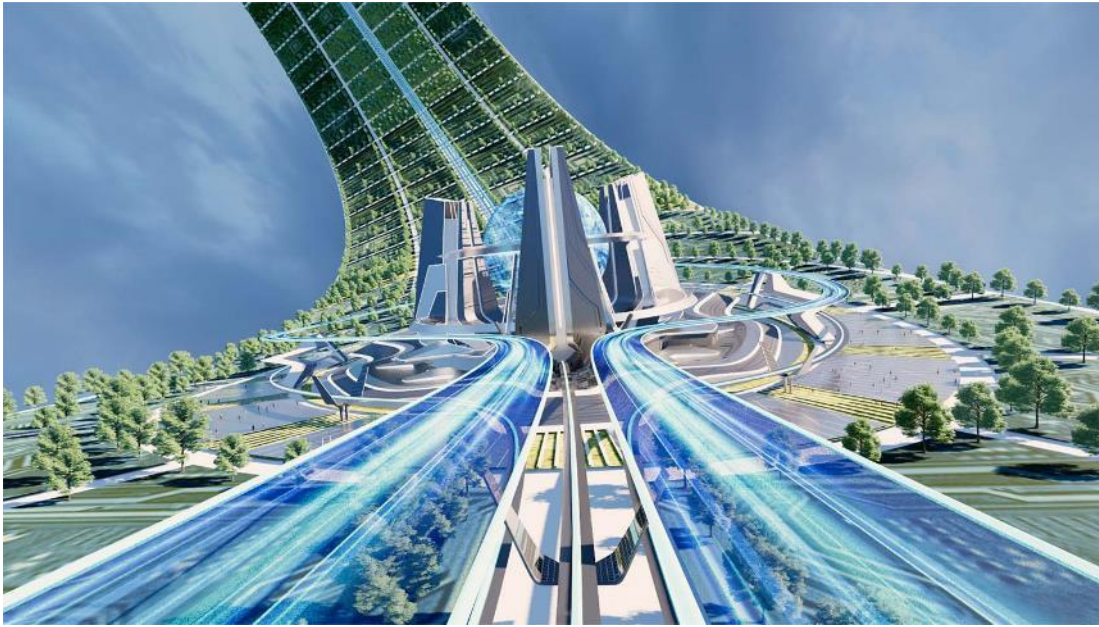
https://gamefi.org/hub/metacity?_sm_nck=1

Proposed definition: A CitiVerse is a series of interconnected and distributed hybrid and virtual worlds representing, and synchronized with, their physical counterparts. It offers new (administrative, economic, social, policy-making, and cultural) virtual goods/services/capabilities to city and community actors such as citizens, represented as digital avatars.

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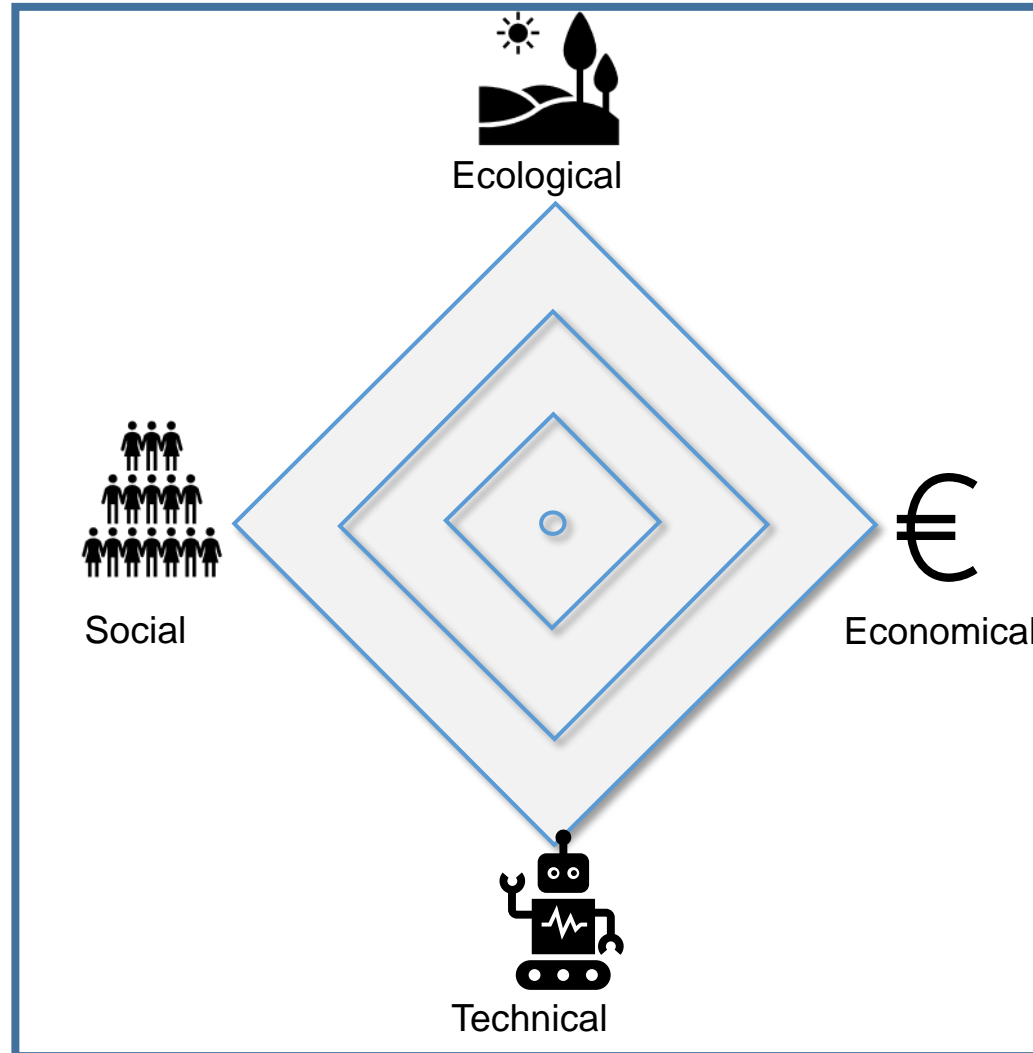Robert-Bürkle-Straße 1

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Value — inspired by people

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Standards enable sustainability

Ecological

Social

Economical

Technical

Resource thriftiness

No manufacturer dependency

Investment protection

Interoperability

More topics

Data & Facts	Inhalt

Project duration: 20 months
Period: March 2022 – December 2023

Publication planned: January 2024

Initiator
- CUT project (Munich, Hamburg, Leipzig): msg systems ag
- Kick-off meeting: 22 March 2022

Contact:
- DIN: Stefan Kelnberger
- msg systems ag: Joachim Schonowski

DIN business plan:
- https://www.din.de/en/wdc-beuth:din21:347212214

Inhalt:
- The planned DIN SPEC 91607 focuses on the "Urban Digital Twin" (UDT), taking into account the overarching municipal ecosystem.
- This includes a definition for the UDT and important technical terms as well as their classification.
- The UDT shall be considered through different, overarching usage scenarios and from different perspectives, e.g. from a technical, user or decision-maker point of view.
- A maturity model for the UDT shall be developed, taking into account various parameters, in order to serve as a guide for other cities and municipalities in the development of their own UDTs. Technologically, this is to be transferred into a kind of modular construction kit.
- The planned standard (DIN SPEC 91607) thus describes an overarching architecture for the digital twin for cities and municipalities and should also be usable internationally. For this reason, an English-language translation is planned.

Scope	This document describes the requirements for the Urban Digital Twin and is intended for use in German and European municipalities. It is aimed at researchers, IT experts, professional and technical operators of a digital twin of municipal data platforms, as well as actors in specialised fields of action.
Adjustment	International standardisation: IEC, ISO, CEN/CENELEC, (inter-) national activities