

WEBINAR

# Emerging geospatial trends 2024: opportunities for data.europa.eu in the era of digital twins

The logo for Data.europa academy is located in the bottom left corner. It features a large orange circle with a smaller white circle inside it. The text "data.europa academy" is written in white lowercase letters within the white circle. The word "data" is on the top line, "europa" is on the middle line, and "academy" is on the bottom line.

data.  
europa  
academy

13 September 2024

10.00 — 11.30 CEST

# Rules of the game



The webinar will be recorded and available on the [data.europa academy](https://data.europa.academy)



For questions, please use [Sli.do](https://sli.do).



Please reserve 3 min after the webinar to help us improve by filling in our feedback form.



# Introduction



**Inmaculada Farfan  
Velasco**  
Project Manager,  
Data.europa.eu,  
Publications Office of  
the EU



**Antje Kügeler**  
*con terra*  
Consultant  
Spatial Data Infrastructures



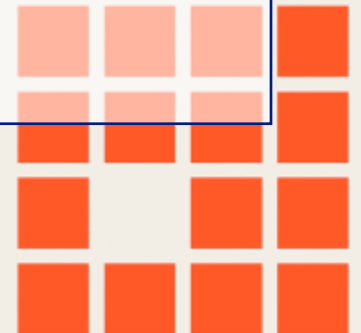
**Dr. Thore Fehner**  
*con terra*  
Team Lead Open Data and  
Copernicus



**Dr. Holger Fritze**  
*con terra*  
Consultant  
Spatial Data Infrastructures



**Dr. Simon Jirka**  
*52°North*  
Managing Director



# Agenda

10.00 – 10.05	Welcome and introduction
10.05 – 10.15	<b>Warm-up:</b> What current trends regarding geospatial topics come to mind?
10.15 – 10.50	Geospatial Digital Twins
10.50 – 11:05	<b>Q&amp;A</b>
11:05 – 11:20	<b>Brainstorming</b> of opportunities for <a href="https://data.europa.eu">data.europa.eu</a>
11.20 – 11.25	Summary and next steps
11.25 – 11.30	Closing



# What's a trend?

A trend is a “*general development or change in a situation or in the way that people are behaving*”

(quoted from Cambridge Dictionary

<https://dictionary.cambridge.org/dictionary/english/trend>)



Trends named by participants in webinar on September 8, 2023

**slido**

Please download and install the Slido app on all computers you use



**What current trends regarding geospatial topics come to mind?**

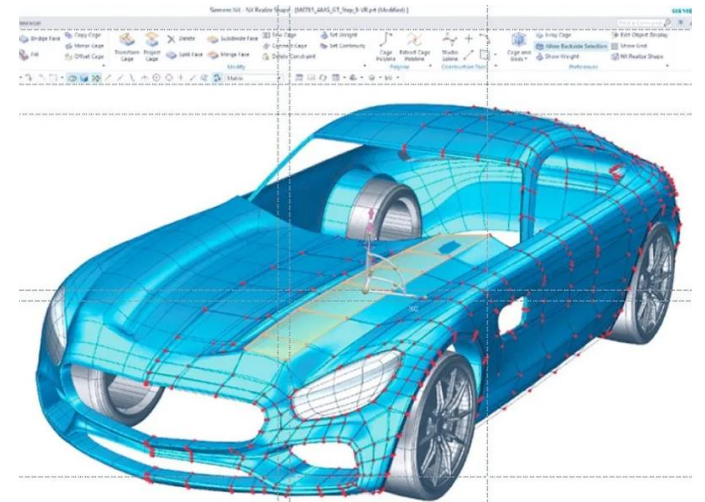
① Start presenting to display the poll results on this slide.

# Geospatial Digital Twins

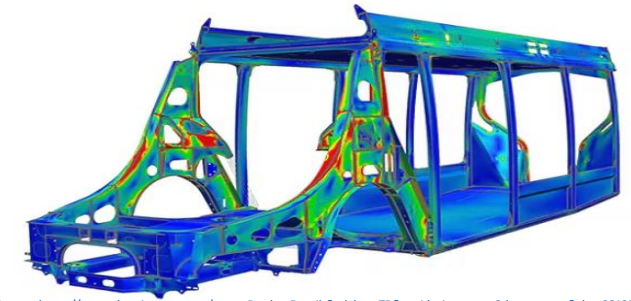
- Introduction and framing the context
- Examples and data sources
- Technologies and open standards

# What's a Digital Twin?

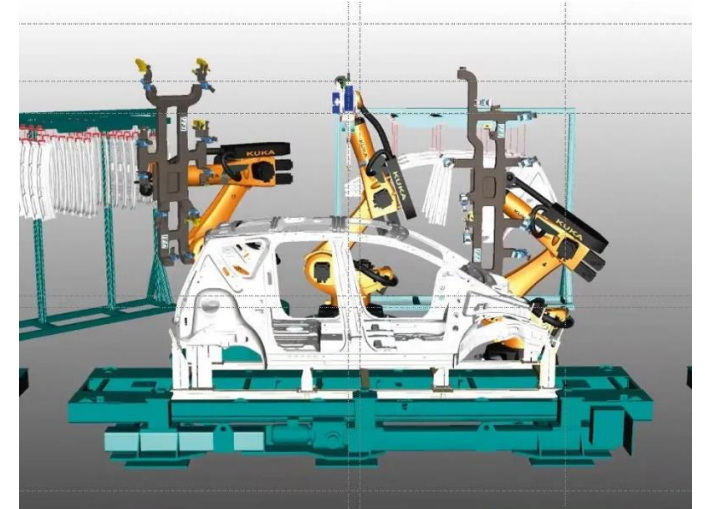
- virtual representation of a real object or system
- covers its entire life cycle
- updated from real-time data
- uses simulation, machine learning and reasoning
- to support decision-making



Source: <https://www.siemens.com/at/de/branchen/automobilherstellung/digital-twin-produkt.html>



Source: [https://www.dex.siemens.com/ccrz/ProductDetails?cclcl=tr\\_TR&seoid=simcenter-3d-structures&sku=SC13500](https://www.dex.siemens.com/ccrz/ProductDetails?cclcl=tr_TR&seoid=simcenter-3d-structures&sku=SC13500)



Source: <https://www.siemens.com/de/de/branchen/automobilherstellung/digital-twin-produktion.html>



SDI

3D

## Data and Interfaces

Data streams

open standards

sensory data

Real time data

GeoAI-Methods

Simulations

## Analyses, Scenarios and Forecasting

What if?

Models

Realistic

Interaction in 3D

## Visualization and interaction

# Geospatial Digital Twin

Make spatial issues more tangible

feedback

## share and collaborate

Immersion

Natural voice input

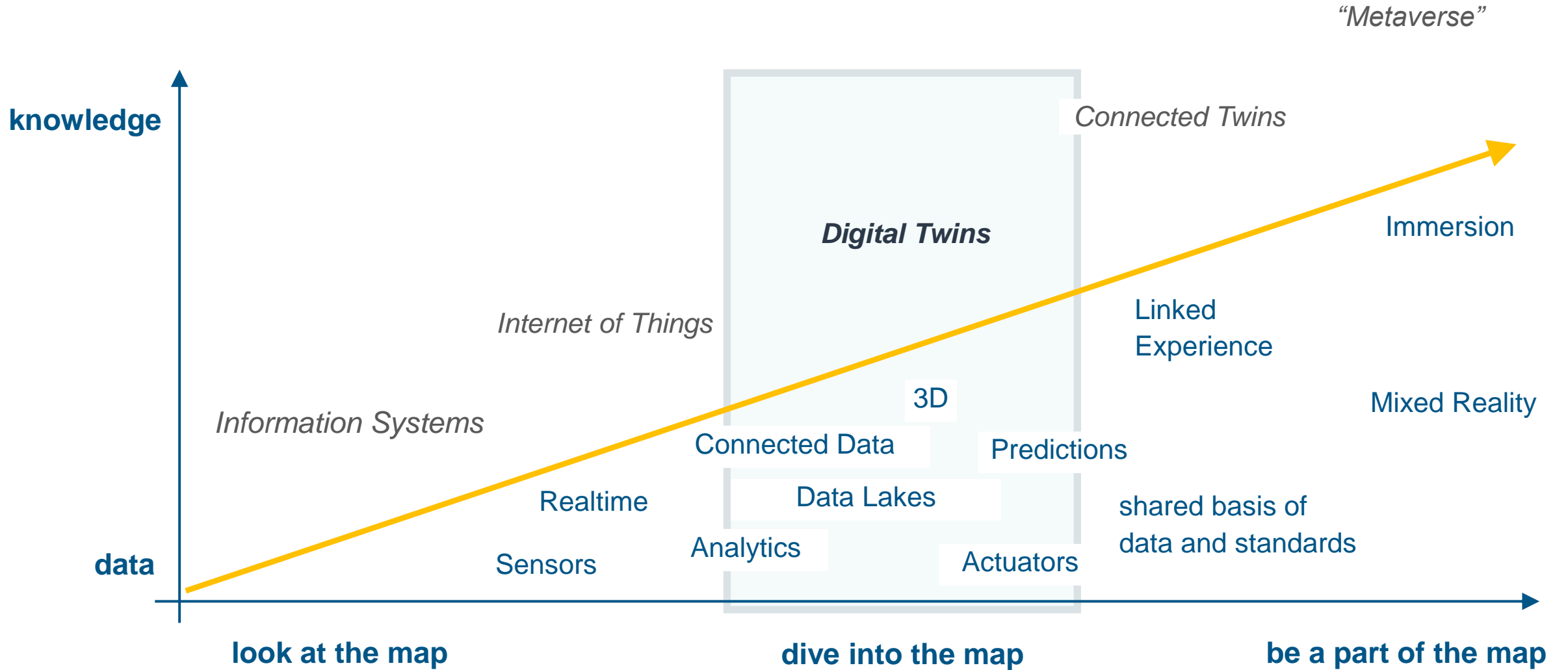
Seamless collaboration

Planning decisions

## Decide and execute

Direct control

# Framing the context



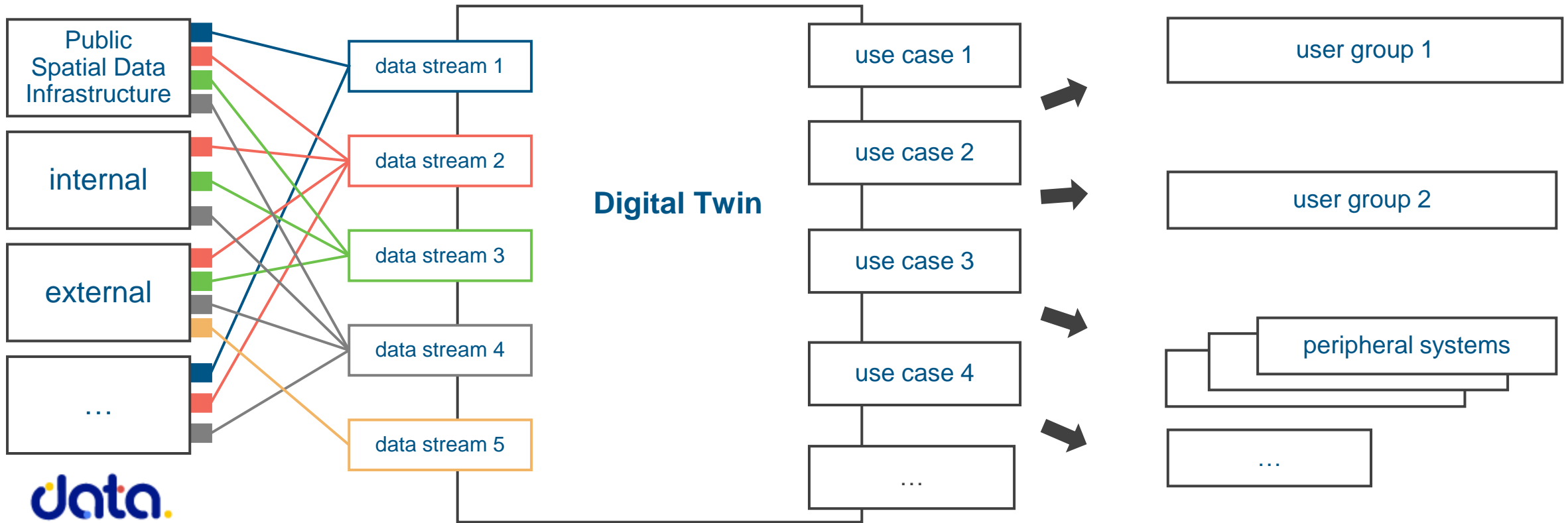
# Information model for digital twins

Standardized interfaces  
source systems

Automated  
data streams

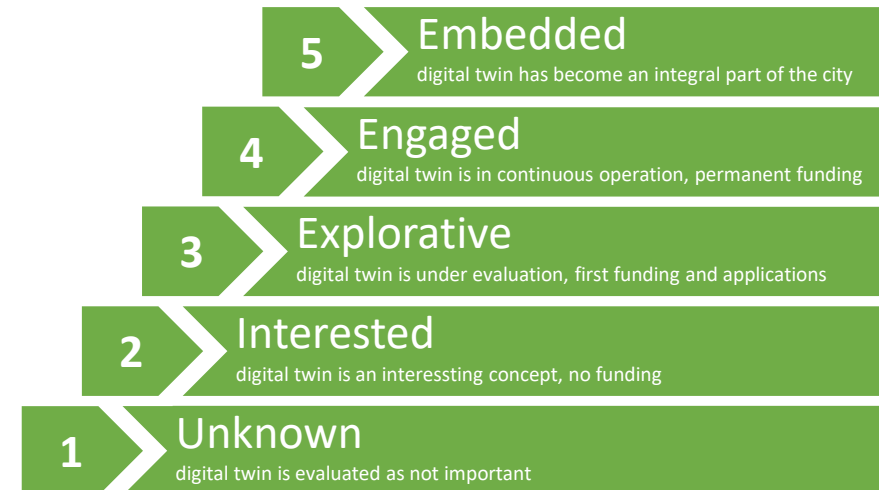
Use-case driven  
transformation

User-centered  
provisioning



# Maturity model

- Maturity model by Fraunhofer Institute for Experimental Software Engineering (IESE)

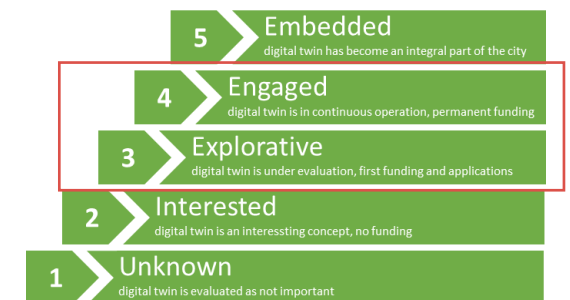


Source: Fraunhofer IESE (2021): „Der Digitale Zwilling für smarte Städte – zwischen Erwartungen und Herausforderungen“

# Digital Twin Disaster Management



- Facilitate digitalization in disaster management
- Component of a digital situation picture for North-Rhine Westfalia, Germany
- Lightweight 3D application, especially for specialist and IT administrations without GIS expertise



# Digital Twin Disaster Management

### Karteninhalte

**Szenarienauswahl**

Hintergrundkarten  
Luftbild

Themenkarten

- 3D Darstellungen
- Auswertung IG NRW
- Kat. Schutz
- Adressen, Verwaltungsgrenzen
- Anlagen besondere Gefahren
- Einrichtungen (Medizin, Soziales...)
- Bevölkerung
- Boden / Geologie
- Brand- und Katastrophenschutz
- Gewässer
- Klima / Wetter
- Schutzgebiete

### Szenarienauswahl

- Überflutungen
- Wetterlage - Winter
- Wetterlage - Hitze
- Wetterlage - Sturm
- Erdmassenbewegung
- MANV
- Betreuung, Unterbringung
- Epidemie
- Tierseuche
- Stromausfall
- Explosionsgefahren
- Bahnunfall
- Absturz Himmelskörper, Luftfahrzeuge
- Unfall kerntechn. Anlagen
- Alle Szenarien zurücksetzen

### IG NRW Digitaler Zwilling Gefahrenabwehr

Suche nach ...

Analyse | Karten

Es gelten keine Zugriffsbeschränkungen

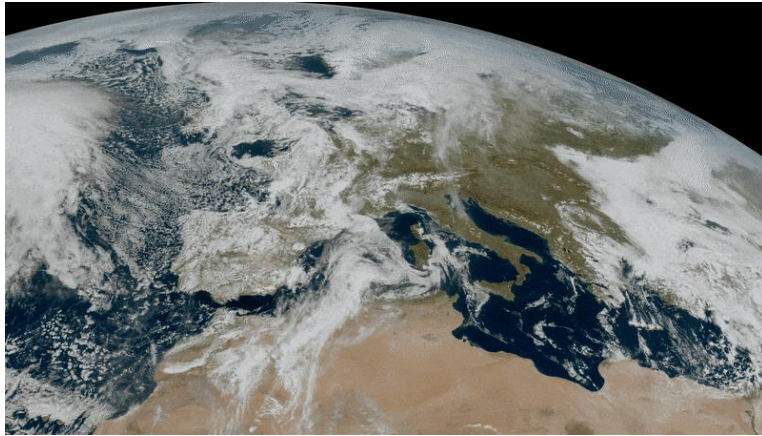
Legende Karteninhalte

Powered by Esri

354.787 : 5.648.297 ETRS89 / UTM Zone 32N

# Spotlight Destination Earth

Images: [Destination Earth \(destination-earth.eu\)](https://destination-earth.eu) Website



- Flagship initiative of European Commission
- Goal: develop high-accurate model of the Earth (digital twin)
- DestinE shall be used to
  - model, monitor and simulate
  - natural phenomena, hazards and
  - related human activities.
- DestinE is implemented by
  - ECMWF
  - ESA and
  - EUMETSAT
- Visit <https://destination-earth.eu/> for more information

# Example DestinE Use Cases

Images: [Destination Earth \(destination-earth.eu\) Website](https://destination-earth.eu)



Energy

## Destination Renewable Energy (DRE)

Developing the Hybrid Renewable Energy Forecasting System (HYREF) demonstrator to support simulation and projection services that are part of the DRE digital ecosystem.

Procured by: ESA

[Read more >](#)



Flooding

## Disaster Risk Mitigation & Climate Adaptation

Providing higher-resolution meteorological forecasts that can help address the challenges caused by compound flooding.

Procured by: ECMWF

[Read more >](#)



Energy

## Improved Energy System Modelling

Providing tools and guidance to support the European Transmission and Distribution System Operators in improving the energy system modelling.

Procured by: ECMWF

[Read more >](#)



Extreme Weather

## Simulating the Future of Extreme Events

Developing a catalogue of simulated extreme events with information from the high-resolution Climate DT data stream.

Procured by: ECMWF

[Read more >](#)



# Open Data is a really important Data Source (but not the only one)

- Sourcing data for digital twins is time consuming
- Open Data catalogues helped significantly. Federal / local geodata as well, as they contain a lot of additional information.
- Kindergardens, schools and hospitals seem like mundane information
- Highly requested as digital data services (API) by disaster response officials
- Easy to integrate as data / API are available as open data
  - well structured, accurate and up-to-date
  - available as an API

# data.europa.eu to find data

Kindergarden (Daycare)

**European data**  
data.europa.eu - The official portal for European data

Home > Datasets > Children's Day Facilities in NRW (INSPIRE)

**Dataset** Children's Day Facilities in NRW (INSPIRE)  
Updated: 19.09.2022

Default Quality Similar datasets

Created: 22.02.2018  
Updated: 19.09.2022  
Language: German  
Contact Point: Organization Name: Rando Begim

Distributions (1)

Link to the data	Format	Updated	Actions
8472210-4295-4165-5a0d-f02e48789e4-1	download	download	Download Limited data Update

Keywords (11)  
Categories (1)  
Dataset extent

Hospitals

**European data**  
data.europa.eu - Le portail officiel des données européennes

Home > Jeux de données > Hôpitaux en Rhénanie-du-Nord-Westphalie (INSPIRE)

**Jeu de données** Hôpitaux en Rhénanie-du-Nord-Westphalie (INSPIRE)  
Mis à jour: 13 August 2024

GovData Éditeur: Geoportail

Jeu de données Qualité Jeux de données similaires

Créé: 25 November 2020  
Mis à jour: 13 August 2024  
Langues: German  
Éditeur: Titre: Geoportail

Distributions (3)

Link to the data	Format	Updated	Actions
INSPIRE-WM1 NW Krankenhäuser	download	14 August 2024	Télécharger Données liées Validez
Krankenhäuser in NRW (INSPIRE)	download	14 August 2024	Télécharger Données liées Validez
OGC-API Features Krankenhäuser in NRW (INSPIRE)	download	14 August 2024	Télécharger Données liées Validez

Téléchargez tout

Keywords (8)  
Catégories (4)  
Étendue du jeu de données

Schools

**European data**  
data.europa.eu - Le portail officiel des données européennes

Home > Jeux de données > Inspire Emplacements scolaires NRW

**Jeu de données** Inspire Emplacements scolaires NRW  
Mis à jour: 13 August 2024

GovData Éditeur: Geoportail

Jeu de données Qualité Jeux de données similaires

Créé: 01 August 2008  
Mis à jour: 13 August 2024  
Langues: German  
Éditeur: Titre: Geoportail

Distributions (3)

Link to the data	Format	Updated	Actions
INSPIRE Schulkatortorte NRW	download	14 August 2024	Télécharger Données liées Validez
OGC-API Features Schulkatortorte in NRW (INSPIRE)	download	14 August 2024	Télécharger Données liées Validez
WMS Schulkatortorte in NRW (INSPIRE)	download	14 August 2024	Télécharger Données liées Validez

Téléchargez tout

Keywords (23)  
Catégories (3)  
Étendue du jeu de données

# Data Quality

- Schools, Daycare (Kindergarden) and Hospital are available
    - as OGC API Features
    - as CSV Download
    - as OGC WMS
  - All services are updated regularly
  - Good Documentation
- Ready to be used / enhanced with additional data in a digital twin

# Vulnerable Assets & Spatial Search: Flooding, Bomb Disposal,...

**Schutzgüter bestimmen**

Kreis Rechteck Polygon

Ziehen Sie einen Kreis in der Karte auf, um Objekte auszuwählen.

Schutzgüter berücksichtigen (6 von 6)

Vorhandene Ergebnisse ersetzen.

**Ergebnisse**

Einwohner 1 Kindergärten 31 Ergebnisse

Auf Auswahl zoomen  Elemente entfernen  CSV herunterladen

<input type="checkbox"/>	ID	Name	Gefördert	Kinder unter 3	Kinder über 3
<input type="checkbox"/>	2366	Caterpillar Kindertagesstätte	ja	8,000	8,000
<input type="checkbox"/>	2367	Räuberhöhle e.V.	ja	2,000	20,000
<input type="checkbox"/>	2368	Kindertagesstätte Orgelpfeifen e.V.	ja	8,000	9,000

# Combining Digital Twins

## Flooding in Northern Germany (December '23)



# Technologies and Standards

- Data access and integration
- Need for interoperability
- Reducing integration efforts and facilitating data re-use
- Standards for geospatial information: Open Geospatial Consortium (OGC)
- Specific challenges for Digital Twins
  - 3D data
  - Real-time data

# 3D Geospatial Data and Services

- 3D Data is an important foundation for the creation of many Digital Twins
- There are different standards available to support the interoperable provision of 3D data
  - OGC 3D Tiles
  - OGC I3S - Indexed 3D Scene Layers
  - OGC API 3D GeoVolumes
  - OGC CityGML (3D City Models)
  - OGC 3D Portrayal Service

# OGC Standards for 3D Data

- There are two OGC Community Standards
- Encoding of 3D Meshes, 3D (Building Models), Point Clouds
- OGC 3D Tiles
  - <https://www.ogc.org/standard/3DTiles/>
  - Submitted by AGI (Analytical Graphics, Inc.) → Cesium
  - Just supports WGS84 as world-wide coordinate reference system
- OGC I3S - Indexed 3D Scene Layers
  - <https://www.ogc.org/standard/i3s/>
  - Submitted by Esri → ArcGIS
  - Flexible support of coordinate reference systems



# OGC API 3D GeoVolumes

- Emerging standard
- Belongs to the new OGC API Family of standards
- Enable interoperable discovery of and access to 3D geospatial content
- Approach: abstract from currently co-existing solutions for providing access to 3D geospatial content
- Comprises resource model and corresponding API

# Real-time Data

- Two use cases:
  - Streaming-based data delivery
    - Minimize latency of data delivery
    - Data is delivered as soon as it is available
    - Technologies and standards: MQTT, AMQP
  - Access to archived time-series data
    - Efficient query options and data discovery
    - Technologies and standards: OGC API Connected Systems, OGC SensorThings API

# Internet of Things (IoT)


- Interconnected devices: e.g., sensors
- Collection of data
- Sharing data via the internet
- Important source of information
- Examples
  - Smart homes
  - Wearable devices
  - Connected cars
  - ...



# MQTT

- MQTT: Message Queuing Telemetry Transport
- Publish/subscribe protocol
- Efficient data delivery to subscribers
- Based on topic structure
- Different quality of service levels
- Popular in the Internet of Things Community

**Dataset** Showcase Traffic Light Forecast Hamburg (historical)

 GovData Publisher: Landesbetrieb Straßen, Brücken und Gewässer Updated: 10 May 2022

**Dataset** Quality Similar datasets

Dataset feed Linked data Cite Embed

—Dataset obsolete—  
—Currently, the data for the node 2150 will not be updated—


The dataset includes LSA process data for four nodes in Hamburg and contains current signal expressions in real time. In addition, data on detectors such as bicycles, pedestrians, vehicle requirements and bus messages are transmitted. Notes on latency: 4 minutes List of nodes: — 413: At The junction railway/Bundesstraße — 279: Edmund-Siemers-Allee/Grindelallee — 271: Theodor-Heuß-Platz/Edmund-Siemers-Allee — 2150: Edmund-Siemers-Allee/CCH

For more information about the real-time service:

The OGC SensorThings API compliant real-time data service contains data streams and positions of lane relationships at intersections with light signalling systems for cyclists, pedestrians and motor vehicles in the city of Hamburg. When provided to the light signal system, the following data streams are delivered as JSON objects: Primary signals, secondary signals, auxiliary signals, acoustic signals, automotive signal requirements, cyclist signal requirements, pedestrian signal requirements, acoustic signal requirement, public transport pre-registration, public transport notification, public transport alarm, signal jam and wave second. In the OGC SensorThings API, the information on the lane relationships is stored in the entity Thing. For the data streams listed above, which are available at a specific thing, an entry is created in the entity Datastreams that references the corresponding thing.

All times...

Show More

 The title and description of this dataset are machine translated. Show More

## Distributions (16)

Link to the data	Format	Updated	Actions
Description STA MQTT-Broker Show more	MQTT	10 May 2022	Download Linked data Validate
Description SensorThings API (STA) Show more	STA	10 May 2022	Download Linked data Validate
Metadata description from the metaver	HTML	10 May 2022	Download Linked data Validate

# OGC SensorThings API

- Provision of all kinds of sensor data
- Interface based on REST and JSON
- Comprehensive filtering functionality for data access
- Can be combined with MQTT Broker
- Focused on Internet of Things applications
- Includes data model specification



<https://www.ogc.org/standard/sensorthings/>

**Dataset** Traffic Lights Data Hamburg

GDI-DE Publisher: Landesbetrieb Straßen, Brücken und Gewässer Updated:

**Dataset** **Quality** **Similar datasets**

Dataset feed **Linked data** **Cite** **Embed**

**Languages:** German

**Publisher:** Name: Landesbetrieb Straßen, Brücken und Gewässer  
E-Mail: <mailto:info@LSBG.Hamburg.de>

**Contact Points:** Organization Name: Landesbetrieb Straßen, Brücken und Gewässer  
E-Mail: <mailto:info@LSBG.Hamburg.de>  
Address: Sachsenkamp 1-3, Hamburg, D-20097, DEU

**Catalogue Record:** Added to data.europa.eu: 30 July 2022  
Updated on data.europa.eu: 15 June 2024

**Spatial:** Coordinates: `[[ [ 8.420551, 53.964153 ], [ 10.326304, 53.964153 ], [ 10.326304, 53.394985 ], [ 8.420551, 53.394985 ], [ 8.420551, 53.964153 ] ]]`

**Show More** ▾

**i** The title and description of this dataset are machine translated. **Show More** ▾

**Distributions (13)**

Link to the data	Format	Updated	Actions
<a href="#">STA Gesamtserviceabfrage: Traffic Light Forecast Hamburg mit den letzten 3 Beobachtungswerten der verfügbaren Datastreams (JSON)</a> <b>Show more</b> ▾	UNKNOWN	UNKNOWN	<a href="#">Download</a> ▾ <a href="#">Linked data</a> ▾ <a href="#">Validate</a>
<a href="#">STA Layerabfrage: Akustiksignalanforderung je Fahrspurbeziehung - letzte 10 Beobachtungswerte (JSON)</a> <b>Show more</b> ▾	UNKNOWN	UNKNOWN	<a href="#">Download</a> ▾ <a href="#">Linked data</a> ▾ <a href="#">Validate</a>

# OGC API Connected Systems

- OGC API Family of standards
- Functionality
  - Provision of sensor data
  - Provision of relevant sensor metadata
- Supports many data formats and protocols (O&M, SensorML, GeoJSON, MQTT, Websocket)
- Currently in development



<https://ogcapi.ogc.org/connectedsystems/>

# Conclusion on Technologies and Standards

- There are suitable standards available to support the provision of data needed to build Digital Twins
- Need to promote the use of these standards in order facilitate data reuse
- Investigate how to provide metadata for new types of data sources (e.g. describing the data streams offered by a MQTT Broker)

# Q&A



**Inmaculada Farfan  
Velasco**  
Project Manager,  
Data.europa.eu,  
Publications Office of  
the EU



**Antje Kügeler**  
*con terra*  
Consultant  
Spatial Data Infrastructures



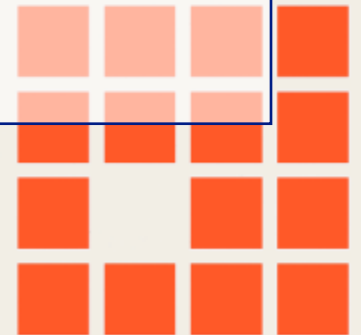
**Dr. Thore Fehner**  
*con terra*  
Team Lead Open Data and  
Copernicus



**Dr. Holger Fritze**  
*con terra*  
Consultant  
Spatial Data Infrastructures



**Dr. Simon Jirka**  
*52°North*  
Managing Director





slido

Please download and install the Slido app on all computers you use



## Audience Q&A

① Start presenting to display the audience questions on this slide.

**slido**

Please download and install the Slido app on all computers you use



**What opportunities for data.europa.eu might arise from this trend? How can data.europa.eu benefit from and support Digital Twins?**

① Start presenting to display the poll results on this slide.

# Next steps

- Short report to be published
- Findings will provide input to further development of data.europa.eu

*Thank you!*

## Geospatial Trends 2023

Opportunities for data.europa.eu from emerging trends in the geospatial community

*October 2023*

Stay up-to-date on our  
**2024 activities!**

The logo for Data.europa academy is located in the bottom left corner. It features a large orange circle with a smaller white circle inside it. The text "data.europa academy" is written in white lowercase letters within the white circle. The word "data" is on the top line, "europa" is on the middle line, and "academy" is on the bottom line. The dots in "data" and "europa" are stylized with small orange and white circles.

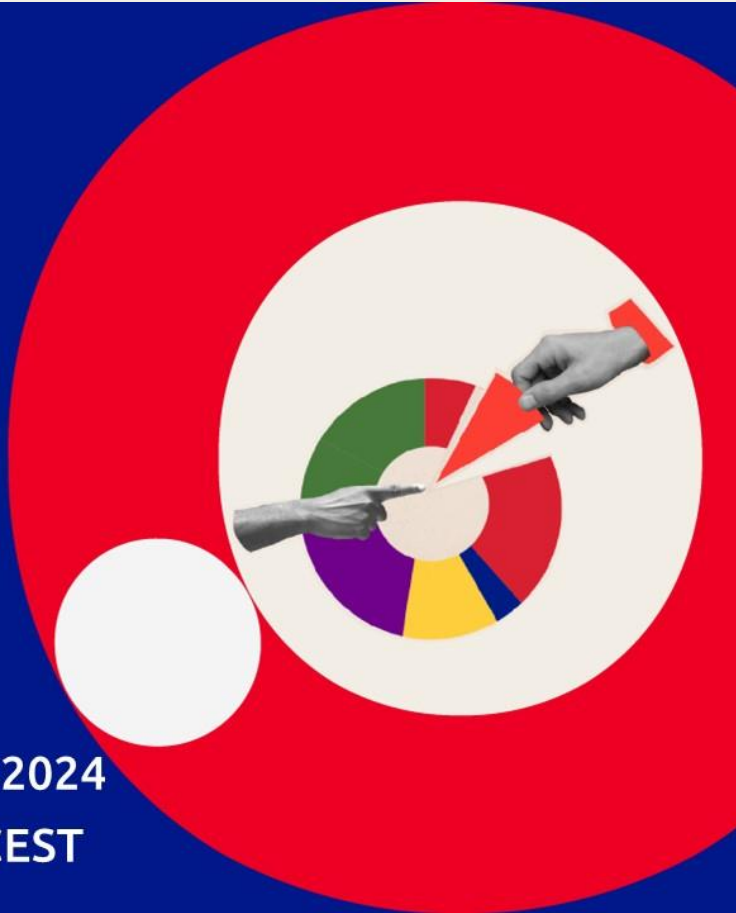
data.  
europa  
academy

WEBINAR

# Beyond Europe: global perspectives on open data excellence

**data.**  
**europa**  
academy

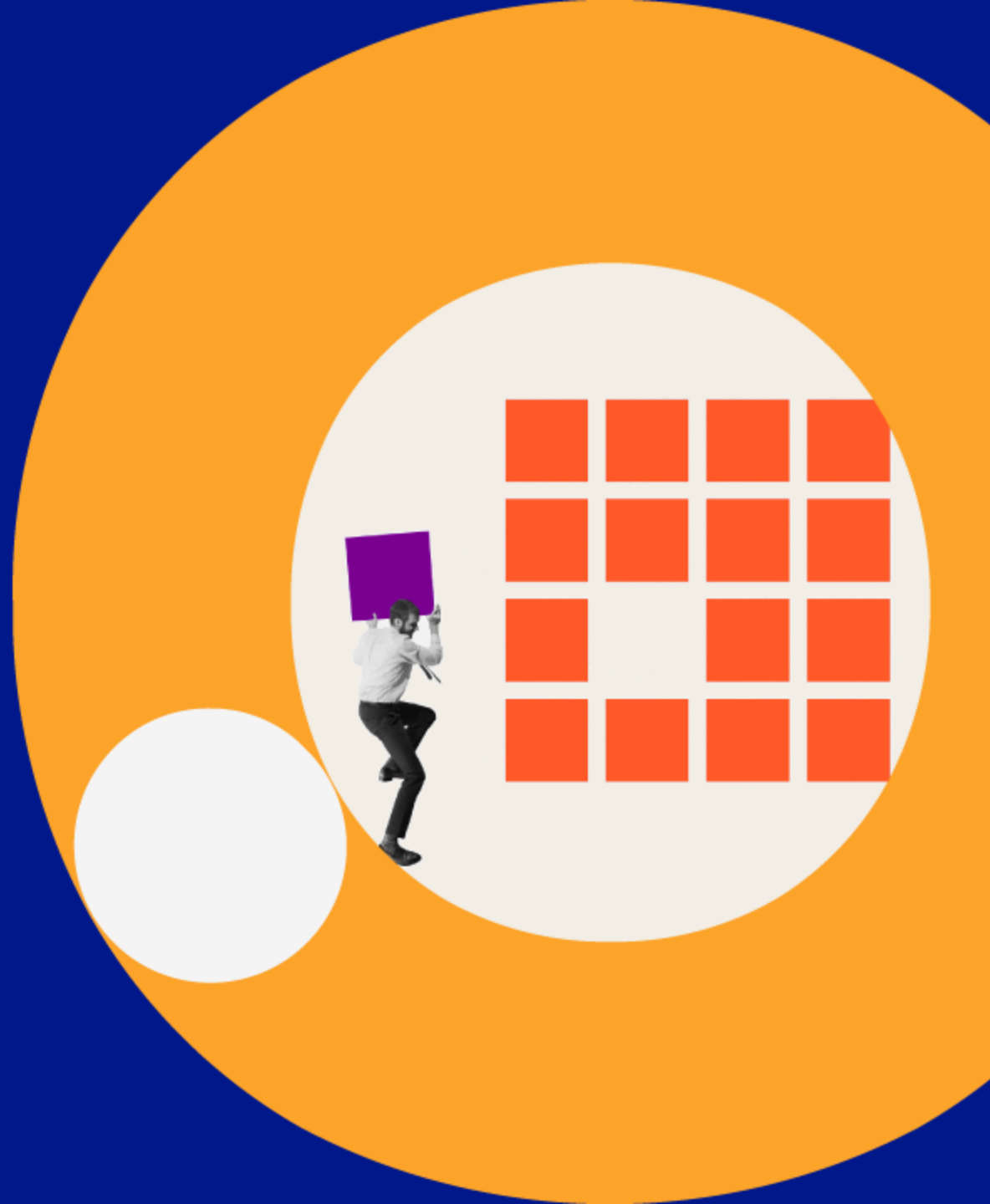
20 September 2024  
14.00 – 15.00 CEST



**data.**  
**europa**  
academy



Your opinion is  
important to us



# Thank you

