

Pan-European Community of Practice  
towards standardisation for:

“Digitalisation in inspection,  
monitoring and maintenance  
of transport infrastructures”



**IM-SAFE<sup>.EU</sup>**

## Session 3



## › GET READY !

- Good afternoon and warm welcome to this online symposium!
- When joining, please mute your microphone and switch off your webcam.
- This online session is recorded.
- For questions, please use the Chat function in Zoom.



# › AGENDA

Moderator: Rizal Sebastian (TNO, NL)		Activities	Guest speakers and panellists
13:00 – 13:10	Opening	<ul style="list-style-type: none"> <li>Welcome and opening words</li> <li>Objective and agenda</li> </ul>	Machteld de Kroon (TNO, NL) Rizal Sebastian (TNO, NL)
13:10 – 13:55	Session 1: Smart Sensing and Imaging	<ul style="list-style-type: none"> <li>Session introduction</li> <li>Best practice example from INSITU, ES</li> <li>Short technical presentation by SACERTIS, IT</li> <li>Panel discussion &amp; questions from online audience</li> </ul>	Isabelle Alovisi (SACERTIS, IT) René Schumann (HOCHTIEF ViCon, DE) Sara Cuerva Navas (FERROVIAL, ES) Sverre Kjetil Rød (Norwegian Public Road Authority, NO) Diego Allaix (TNO, NL)
13:55 – 14:05	10-minute break		
14:05 – 14:50	Session 2: Artificial Intelligence	<ul style="list-style-type: none"> <li>Session introduction</li> <li>Best practice example from IBM Research, CH</li> <li>Short technical presentation by IBM Research, CH</li> <li>Panel discussion &amp; questions from online audience</li> </ul>	Ioana Giurgiu & Cristiano Malossi (IBM Research, CH) Meenagi Venkat (KNOWCE, IT) Arnwald Janssen (Rijkswaterstaat/Ministry of Infrastructure, NL)
14:50 – 15:00	10-minute break		
15:00 – 15:45	Session 3: Data interoperability	<ul style="list-style-type: none"> <li>Session introduction</li> <li>Best practice example from TNO, NL &amp; AEC3, DE</li> <li>Short technical presentation by AEC3, DE</li> <li>Panel discussion &amp; questions from online audience</li> </ul>	Matthias Weise (AEC3, DE) Raimar Scherer (TU Dresden, DE) Frank Opitz (Deutsche Bahn, DE) Michel Böhms (TNO, NL) Sanne Jansweijer (NEN, NL)
15:45 – 16:00	Conclusion	<ul style="list-style-type: none"> <li>EC policy initiatives in digitalization and transport infrastructure</li> <li>Concluding remarks</li> </ul>	Rafal Stanecki (European Commission, DG MOVE) Konstantinos Gkoumas (European Commission, JRC) Agnieszka Bigaj-van Vliet (TNO, NL)

## › **SESSION 3 : DATA INTEROPERABILITY**

### **AGENDA FOR 15:00 – 15:45**

- Session introduction (Rizal Sebastian, TNO)
  - Wide variety of data sources and types needed in inspection, monitoring and maintenance over the assets' lifecycle
  - Interoperability challenge for standardisation: open standard for linking and sharing BIM, GIS, IoT and other data
- Best practice example from TNO, NL & AEC3, DE
- Short technical presentation by AEC3, DE (Matthias Weise)
- Panel discussion & questions from online audience

## › BEST PRACTICE EXAMPLE FROM TNO & AEC3

Session 3 video 1

# › **SHORT TECHNICAL PRESENTATION**

## **MATTHIAS WEISE – AEC3, GERMANY**

## › DATA INTEROPERABILITY – CHALLENGES

OTL – Object Type Library

BIM/Digital Twin

Information Silos –  
Various Data Sources

Data Sharing &  
Data Interoperability

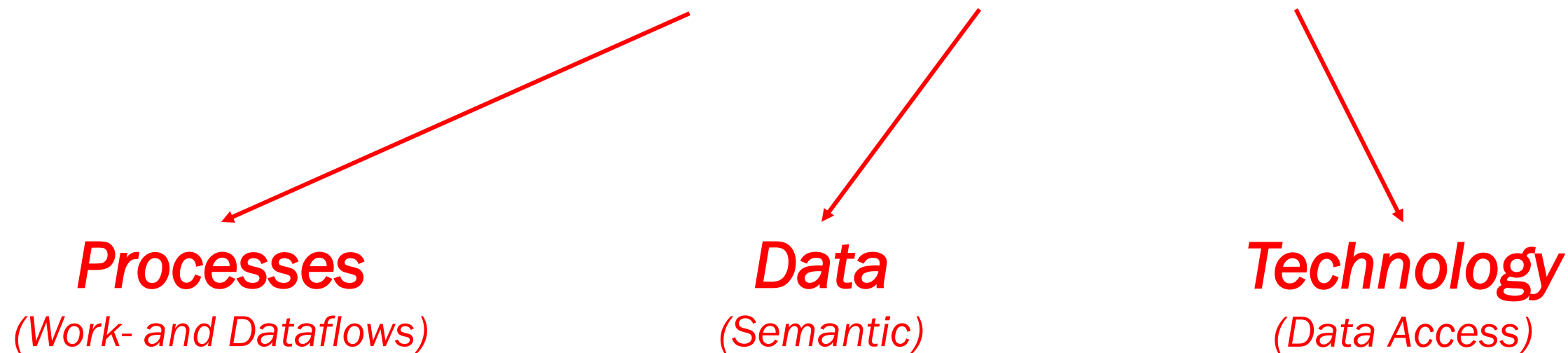
***What is missing and  
what should be standardized?***

Modelling & Linking Guide

## › APPROACH AND SIMILARITY WITH BIM

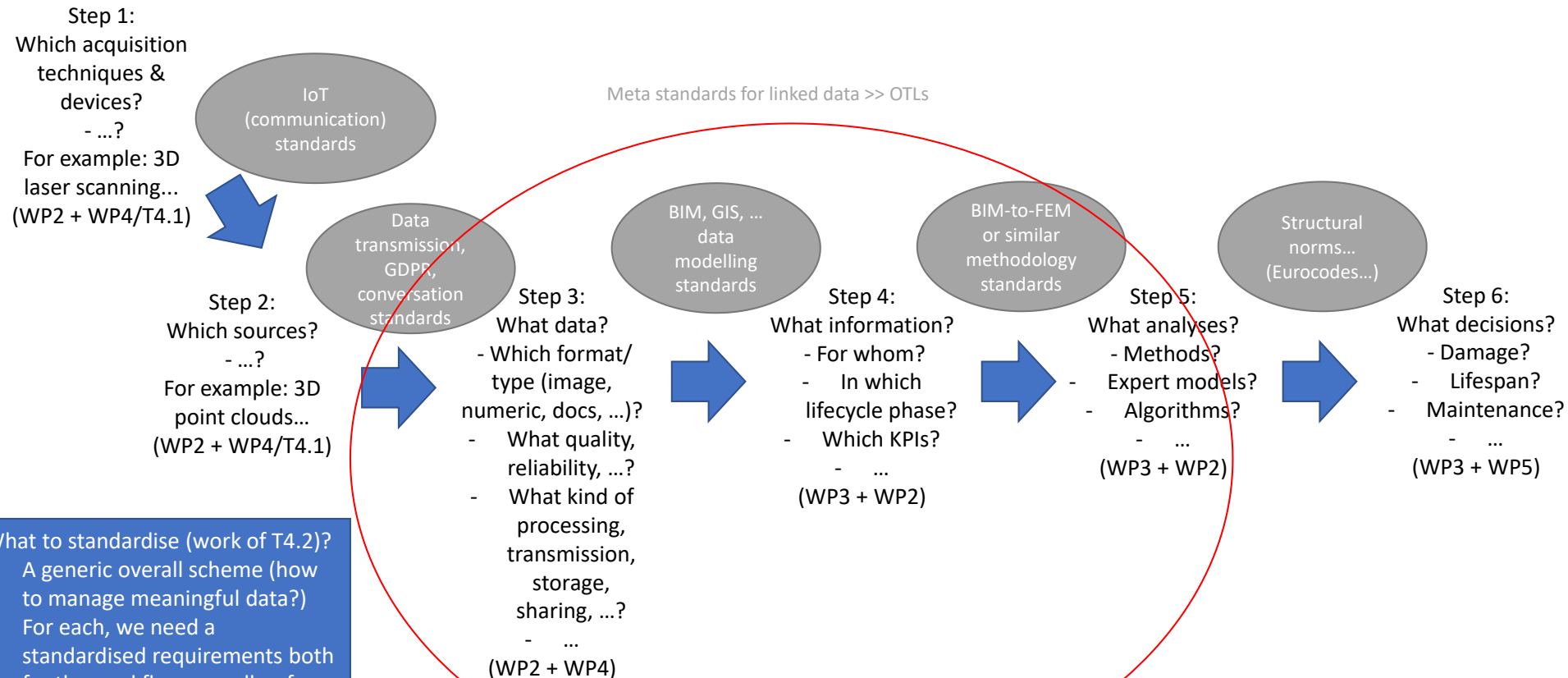
### BIM

Building Information Modelling/Model/Management





# PROCESSES

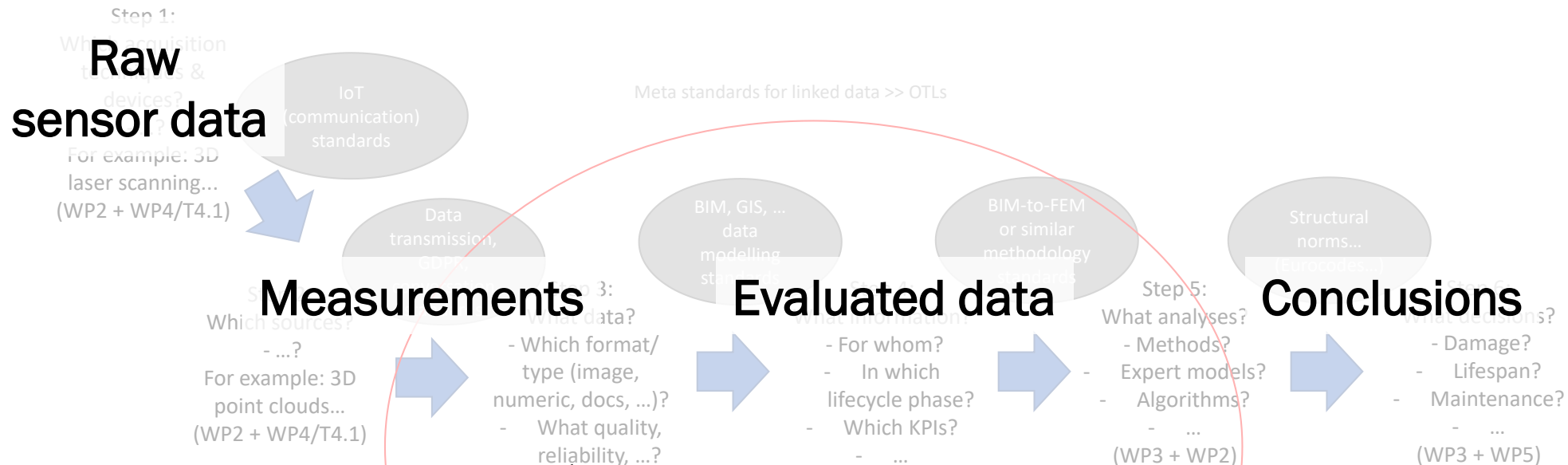


## What to standardise (work of T4.2)?

- A generic overall scheme (how to manage meaningful data?)
- For each, we need a standardised requirements both for the workflow as well as for the data
- Standardised interoperability between the different steps both regarding methods as well as data (e.g. Scan-to-FEM)
- Indicate the relevant existing standards



# PROCESSES



What to standardise (work of T4.2)?

- A generic overall scheme (how to manage meaningful data?)
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- Indicate the relevant existing standards

- › **What data is generated when, how and by whom?**
- › **What data must be stored?**
- › **What data must be published/shared?**
- › **How to capture relationships between the data?**

## DATA

### Relevant standards:

- › IFC (4.3)
- › Road-OTL by CEDR
- › CityGML, INSPIRE
- › SAREF, Brick, ..

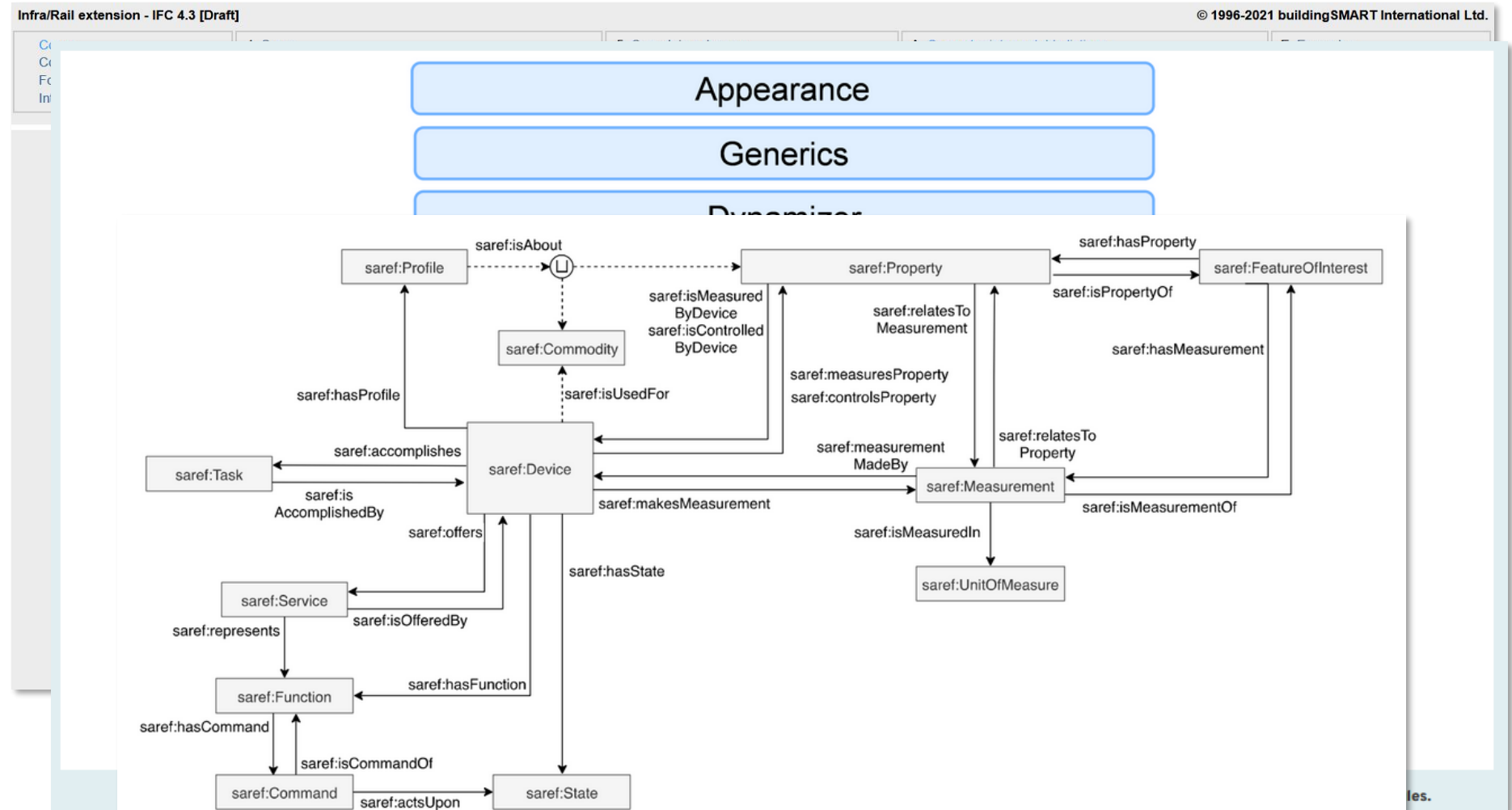


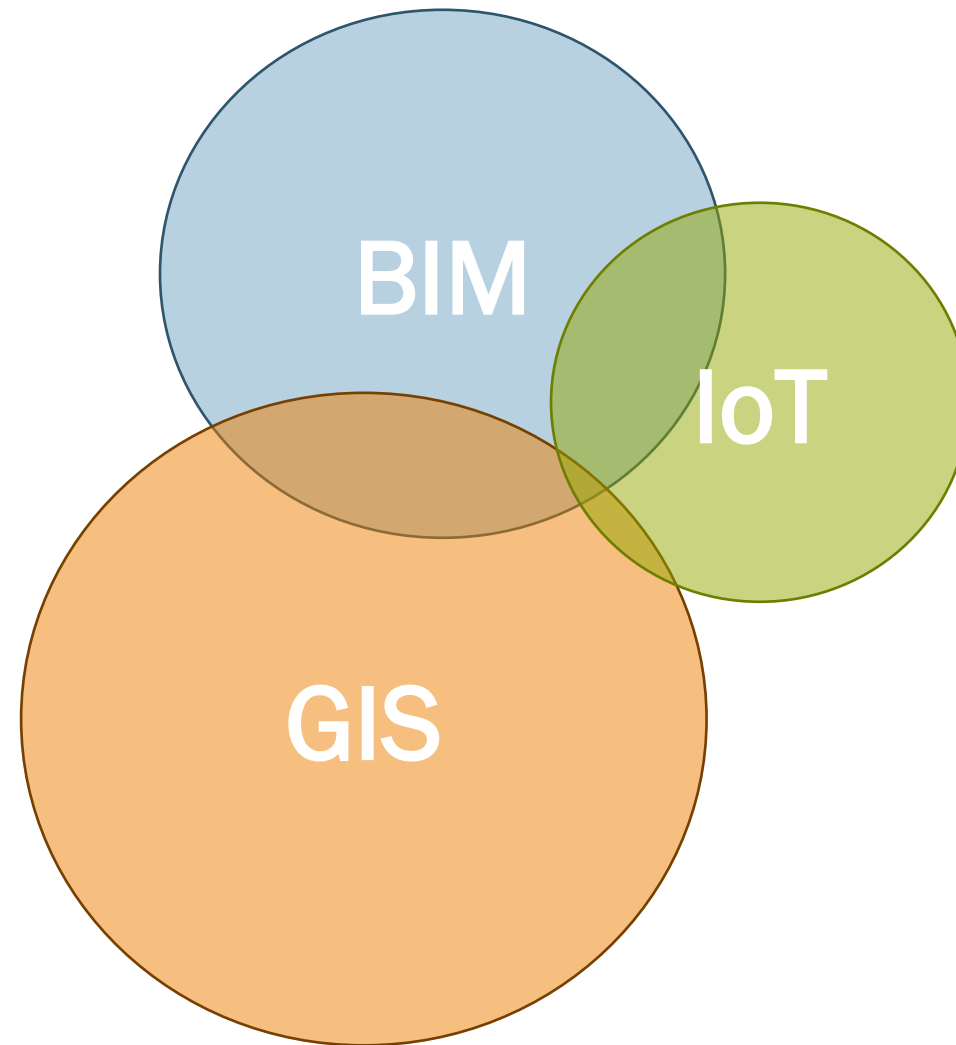
Figure 1: Overview of the SAREF ontology



## › DATA

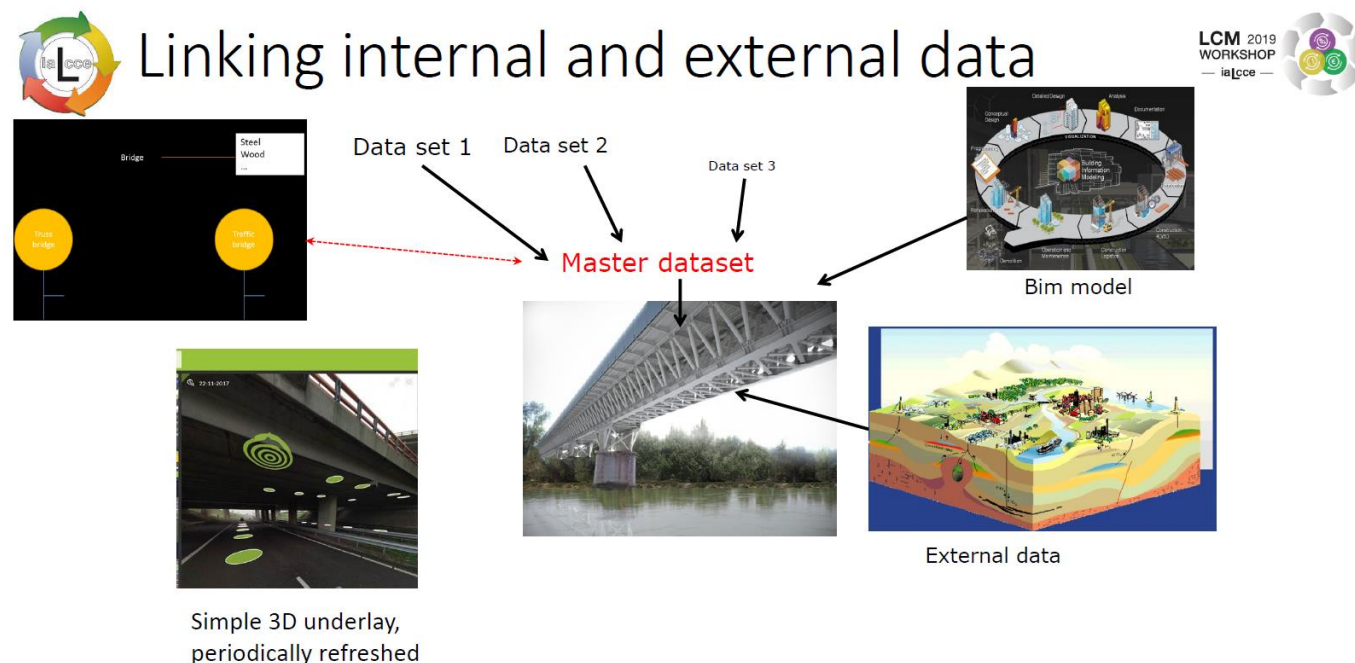
- › Relevant standards:
  - › IFC (4.3)
  - › Road-OTL by CEDR
  - › CityGML, INSPIRE
  - › SAREF, Brick, ..

- › ***What is the scope?***
- › ***Where are overlaps?***



## TECHNOLOGY

- › Emerging approaches and technologies:
  - › Linked-Data and Semantic Web Technology by W3C  
Interlink approach initiated by CEDR  
BIM-SML (Semantic Modelling and Linking) – CEN 17632
  - › Digital Twin concept
  - › MQTT, DDS – data protocols

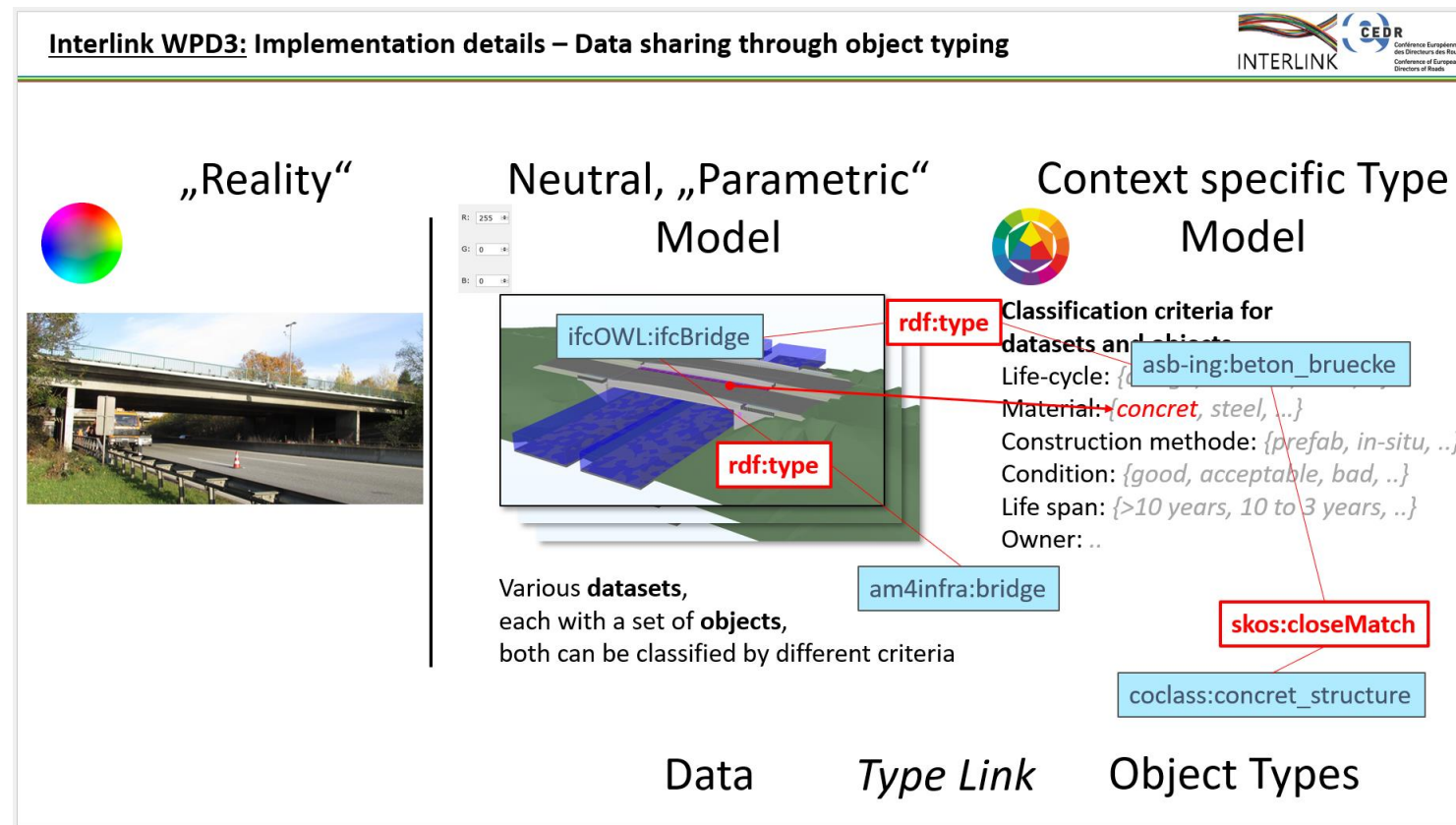


› ***What are the principles and common technology for data sharing?***

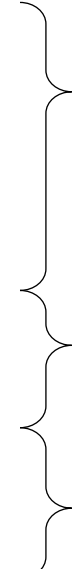
## › TECHNOLOGY

- › Emerging approaches and technologies:
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› **What are the principles and common technology for data sharing?**



## › FAIR PRINCIPLES

- › Paper published 2016 about Scientific Data Management and Stewardship (M.D. Wilkinson et al., published in Scientific Data)
  - › **F – Findable**
    - › Unique identifier for (meta) data, searchable, ..
  - › **A – Accessible**
    - › Open protocol to retrieve the data by ID, access control where necessary
  - › **I – Interoperable**
    - › Open modelling language, vocabularies following FAIR principles
  - › **R – Reusable**
    - › Well described data (license, provenance data, meet domain-relevant standards)
- 
  - Technology**  
(Management)
  - Data**  
(Semantic)
  - Process**  
(Work- and Dataflow)

further information at: <https://www.go-fair.org/fair-principles/>

## › **SESSION 3 : PANEL DISCUSSION**

- **Brief introduction of the panellists:**
  - Raimar Scherer (TU Dresden, DE)
  - Frank Opitz (Deutsche Bahn, DE)
  - Michel Böhms (TNO, NL)
  - Sanne Jansweijer (NEN, NL)
- **Sharing the views on ‘data interoperability’ (short pitches as prelude for discussions):**
  - What are the challenges of open data standardisation for transport infrastructures? (Raimar Scherer)
  - What is the data interoperability strategy of a public client and what is its expectation for standardisation? (Frank Opitz)
  - What is the landscape of open standardisation of data in the built environment? (Michel Böhms)
  - What can civil infrastructure learn from the standardisation process in the ICT domain? (Sanne Jansweijer)
- **Interactive discussion between the panellists & questions from the online audience**



## › **SESSION 3 : PANEL DISCUSSION**

**PROF. RAIMAR SCHERER – TU DRESDEN, GERMANY**

What are the challenges of open data standardisation  
for transport infrastructures?

## › **SESSION 3 : PANEL DISCUSSION**

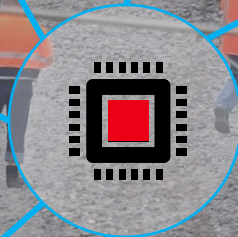
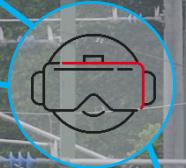
### **FRANK OPITZ - DEUTSCHE BAHN, GERMANY**

What is the data interoperability strategy of a public client  
and what is its expectation for standardisation?





# NETZE



Deutsche Bahn  
data interoperability and standardization



# Challenges of the DB group wide strategy “Starke Schiene” (Strong rail)



**climate protection**



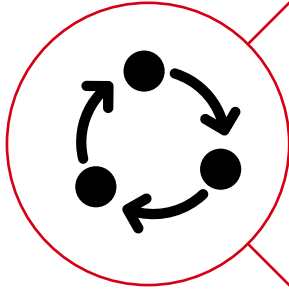
**infrastructure**



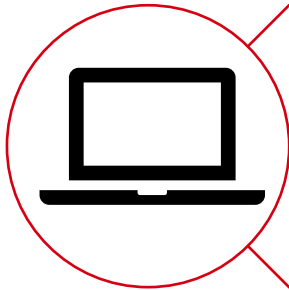
**timetable**



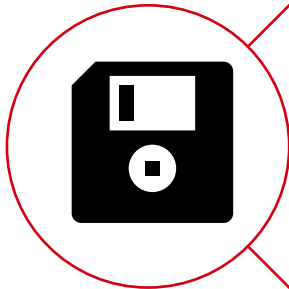
**digitalization**



Too many **breaches in the digital support of processes and workflows** – internal and with external partners



**A confusing number** of IT applications and tools – with corresponding proprietary exchange formats



**Lack of consistent data availability**, poor integration and linkability of existing data

# Key digitalization trends



## Construction Intelligence



**Digital analysis methods for data-based control of planning and construction processes**

Exemplary Technologies:

AI, Big Data Analytics



## Digital Twin



**Virtual models with real-time data for simulation and planning**

Exemplary Technologies:

Sensors, Edge Computing



## Digital technologies for construction site



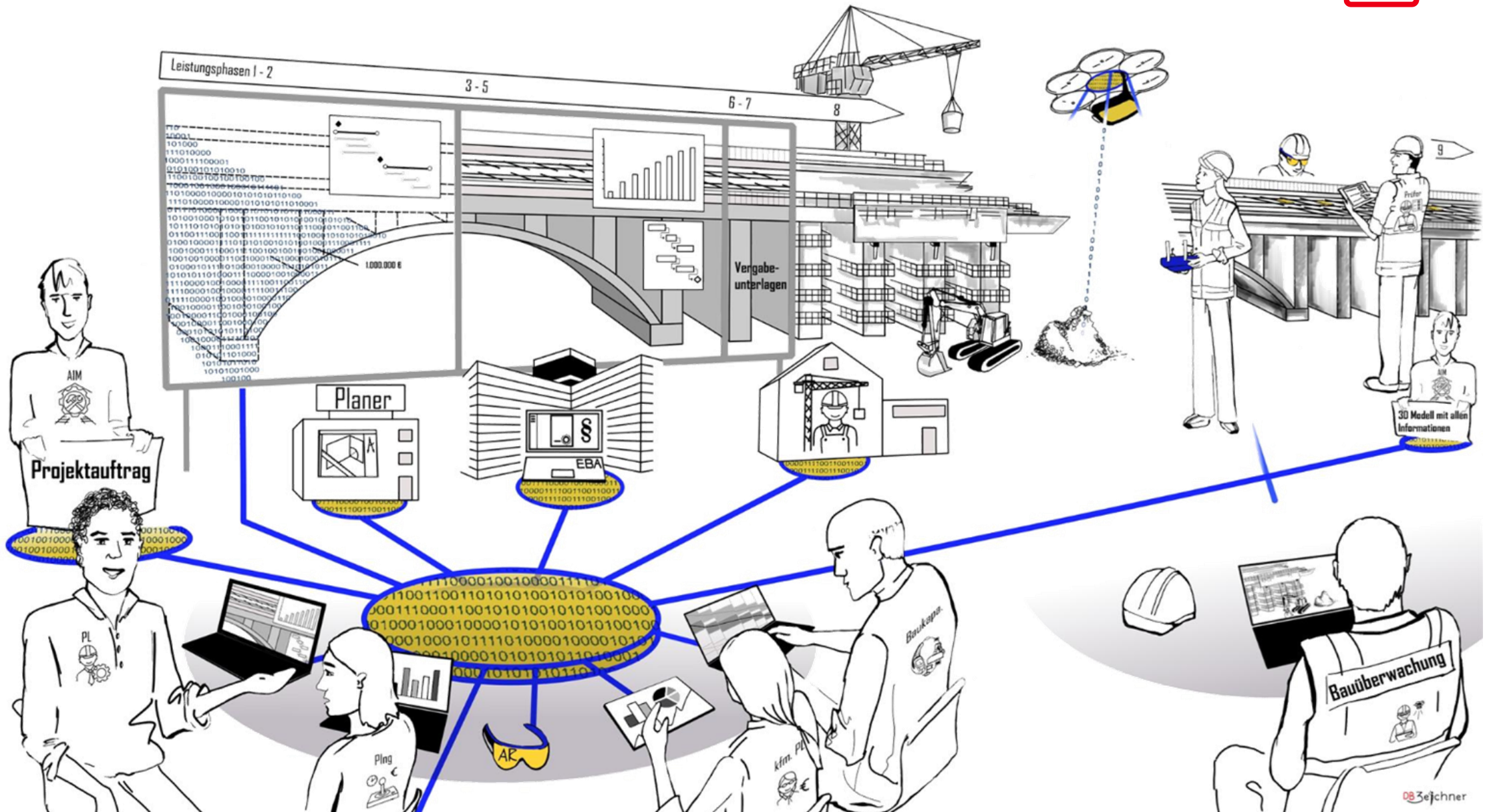
**Digital technology on the construction site to generate valuable information and for efficient construction**

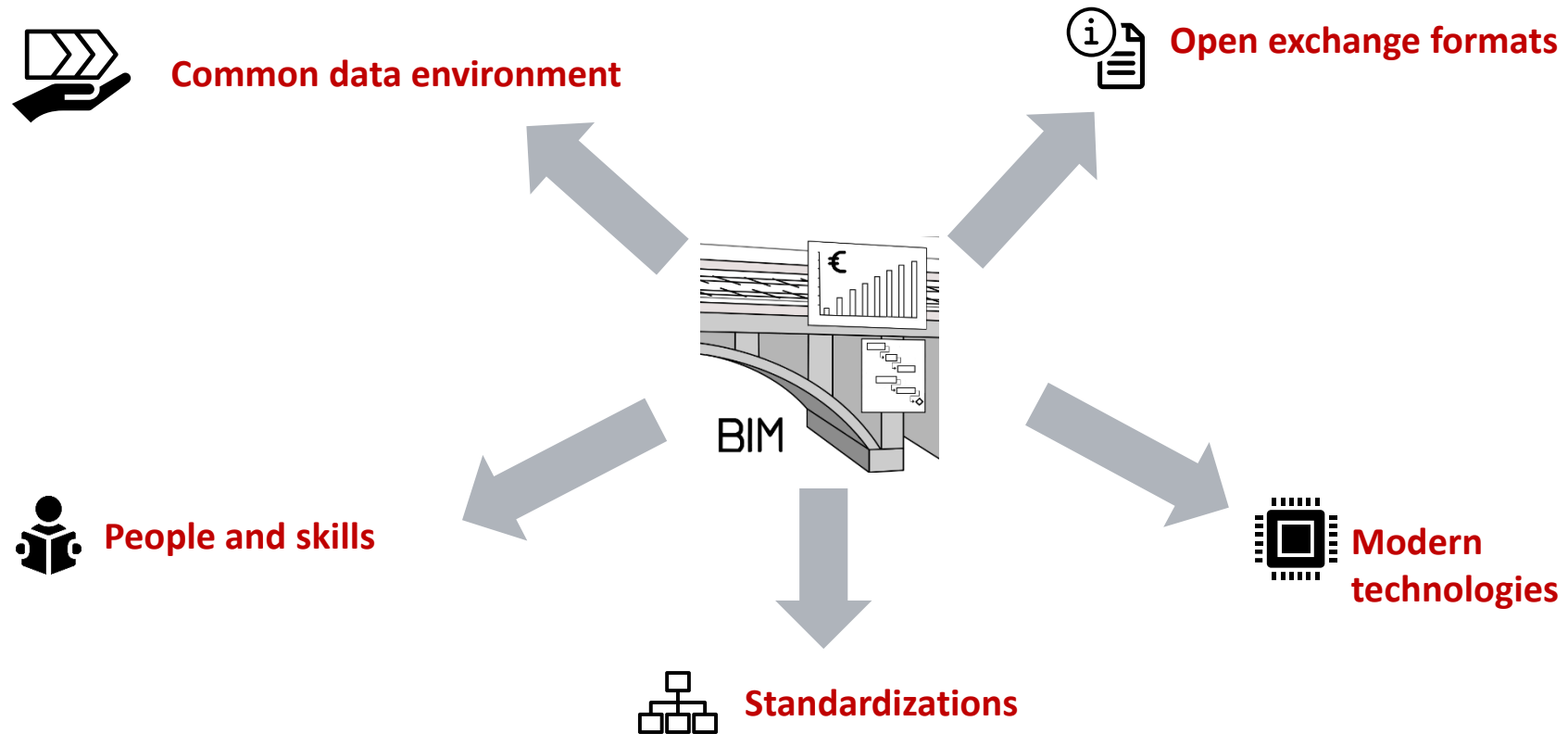
Exemplary Technologies:

Internet of Things (IoT), sensors, robotics



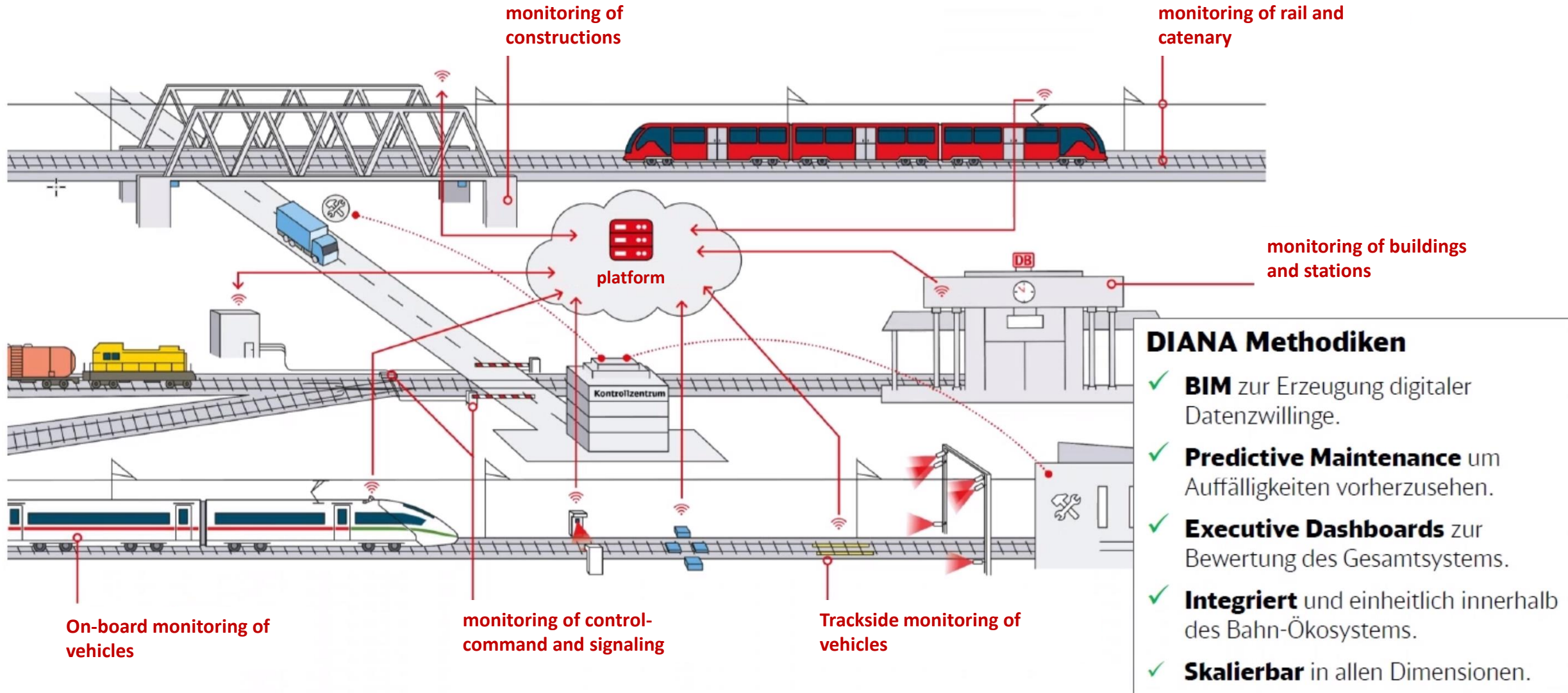
# Vision of digital infrastructure projects







# Example of use for acquiring and processing sensor data



## › **SESSION 3 : PANEL DISCUSSION**

### **MICHEL BÖHMS - TNO, THE NETHERLANDS**

What is the landscape of open standardisation of data in the built environment?



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**The Data Standardization Landscape  
in the Built Environment**

**Michel Böhms (TNO)**



Co-funded by the Horizon 2020  
Framework Programme of the European Union

## › WHY STANDARDIZE? THE BIGGER PICTURE



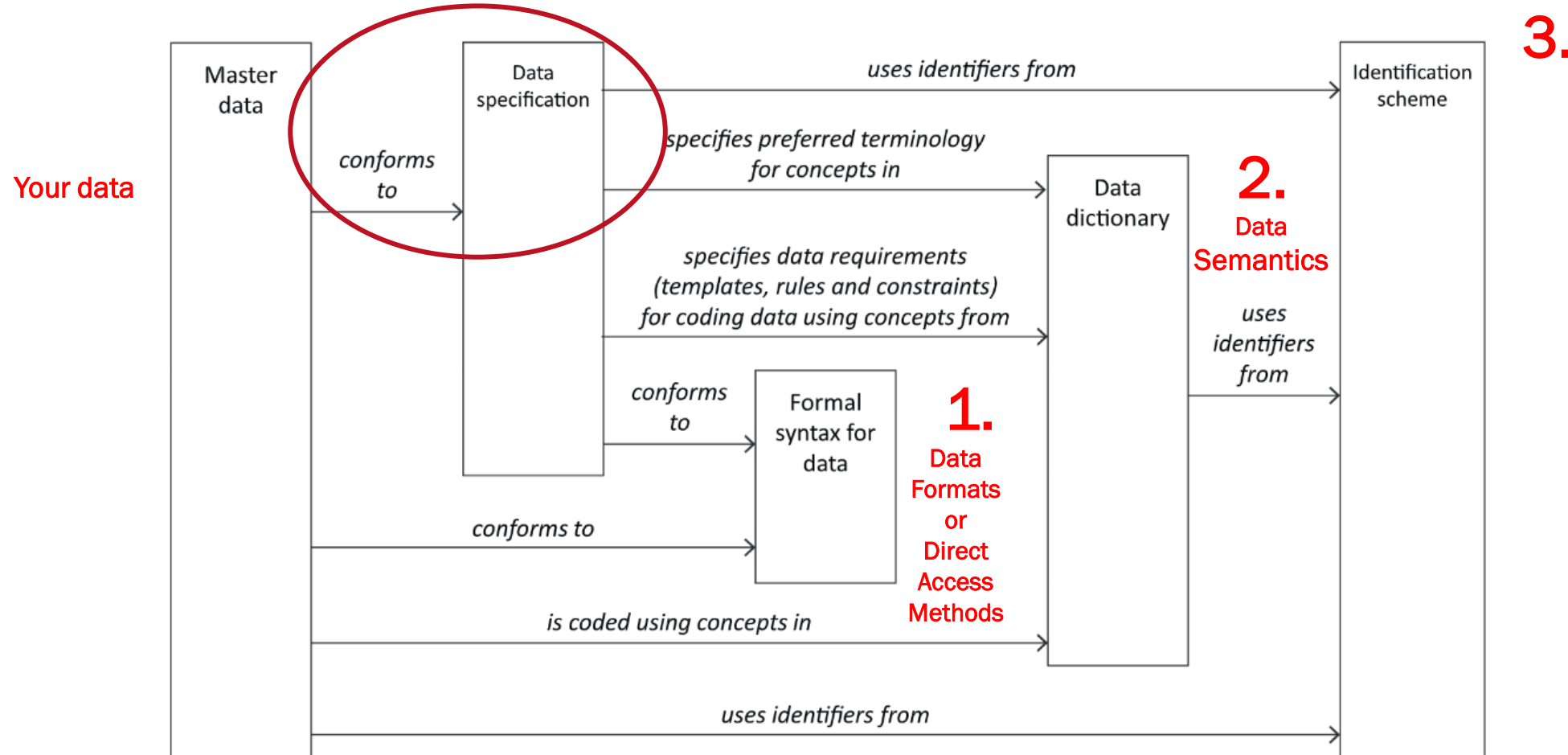
### › Data should be FAIR!

- › Findable - think Internet/WWW
- › Accessible - think identification/authentication/authorisation
- › Interoperable - **think standard data syntax (formats, direct access methods)**
- › Reusable - think standard data semantics (schemas, ontologies, OTLs)
  - but also: Right Data Quality:
    - Relevant: Fit for Purpose & Timely
    - Correct/Accurate, Consistent
    - Complete, Precise,
    - Flexible, Reproduceable
    - Traceable
    - Scalable

### › FAIR approach delivers sustainable solutions

## WHAT TO STANDARDIZE

### ISO 80000 VIEW



**Figure 1 — Data architecture for master data as specified by the ISO 8000 series**

## HOW TO STANDARDIZE?

MANY OPTIONS: IFC <> LD/SW

### 1. Data Formats / direct access methods

- › Graphical (UML)
- › ISO STEP Physical File Format (SPFF)
- › W3C XML / XQuery-XPath
- › W3C RDF-format (Turtle, RDF/XML, JSON-LD) / SPARQL
- › JSON / GraphQL

### 2. Data Semantics

- › EXPRESS schemas like IFC4.3RC2
- › UML diagrams
- › XSD schemas like InfraXML
- › SKOS/RDFS/OWL/SHACL thesauri/ontologies/OTLs acc. to CEN TC442 SML
- › JSON Schemas like bSI bSDD experiment

### 3. Identification scheme

- › Local or global
- › GUIDs like UUID, generated code
- › URI strategy in case of web-based

“BIM meets OTL”



Combination == one “Technology”

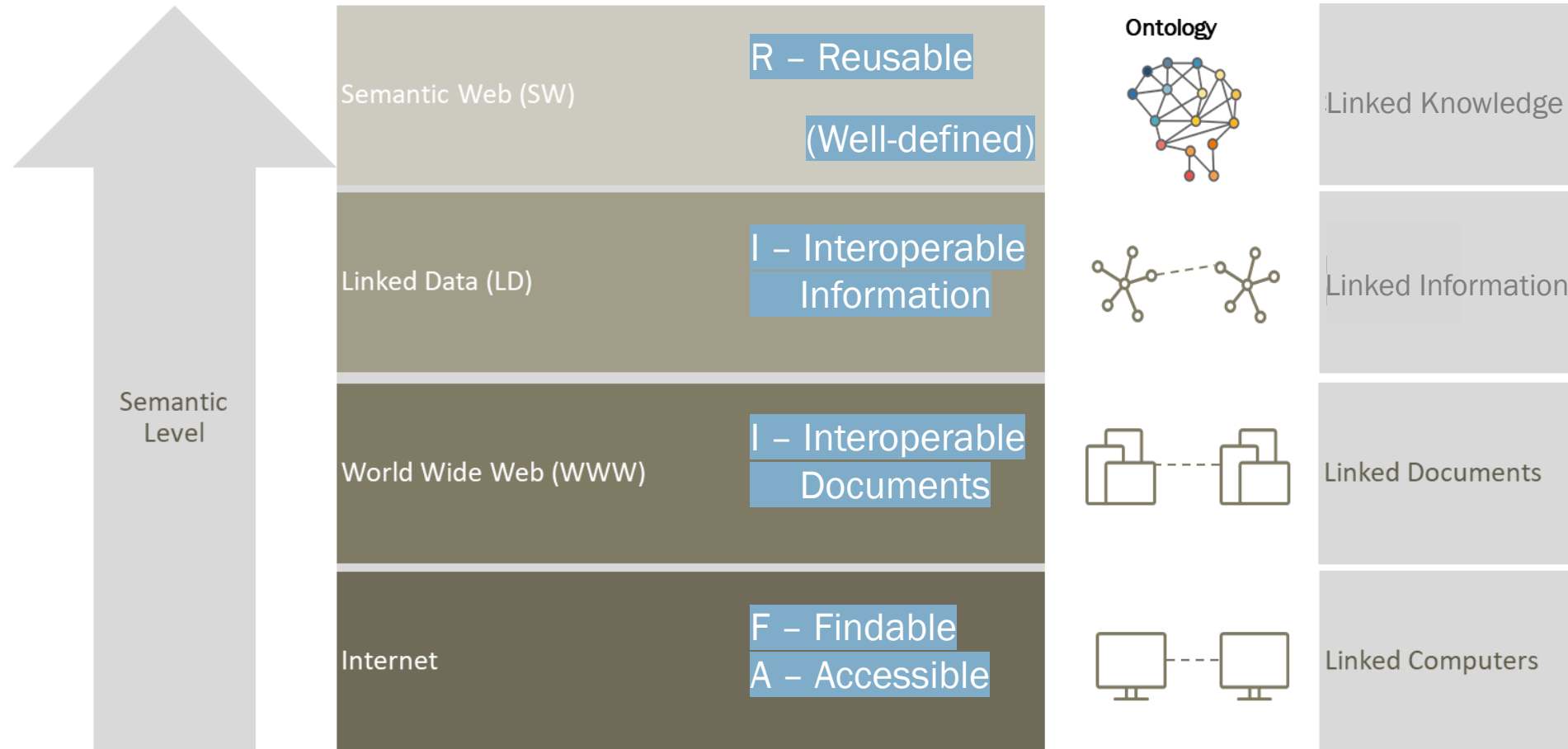
- OMG model-driven
- ISO STEP & IFC
- W3C XML
- WebDev
- W3C Linked Data/Semantic Web
- ... (too) many!



## › HOW TO STANDARDIZE?

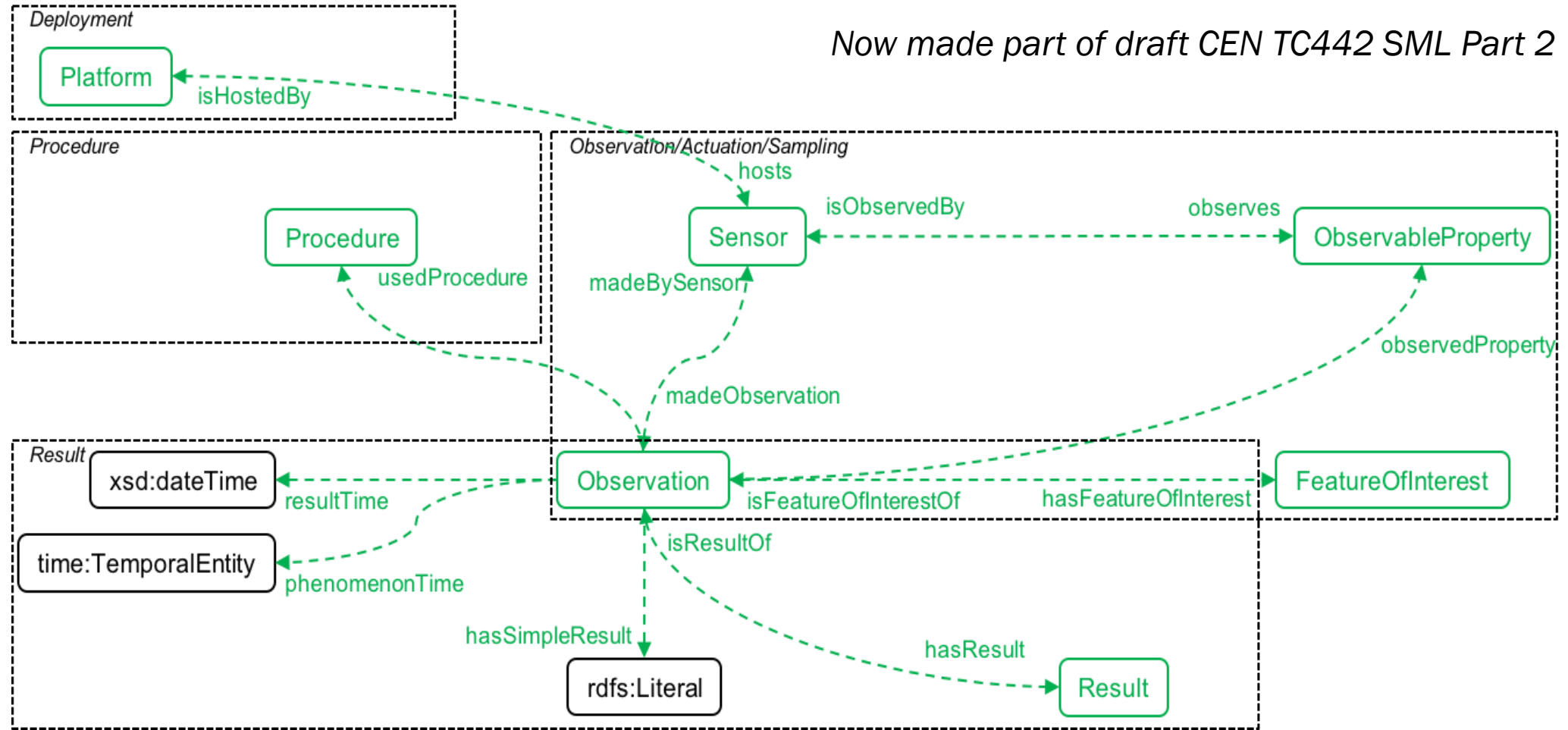
### ENABLING FAIR DATA VIA W3C LINKED DATA & SEMANTIC WEB TECHNOLOGY

#### GENERIC (BIM, GIS, SE, IOT), POWERFUL & WEB-BASED



## MEASUREMENTS ACCORDING TO W3C SSN/SOSA ONTOLOGY

Now made part of draft CEN TC442 SML Part 2







# Thank you!

[michel.bohms@tno.nl](mailto:michel.bohms@tno.nl)



## IM-SAFE<sup>.EU</sup>

MICHEL BÖHM



# Standardization of data interoperability

2022-02-24

# Sanne Jansweijer

- **Consultant ICT Standardization at NEN**
- Secretariat NEN standards committee 381184  
Data integration and interoperability
- [Sanne.Jansweijer@nen.nl](mailto:Sanne.Jansweijer@nen.nl)
- +31 15 2690499
- [LinkedIn](#)



# The world of standardization

## The Netherlands

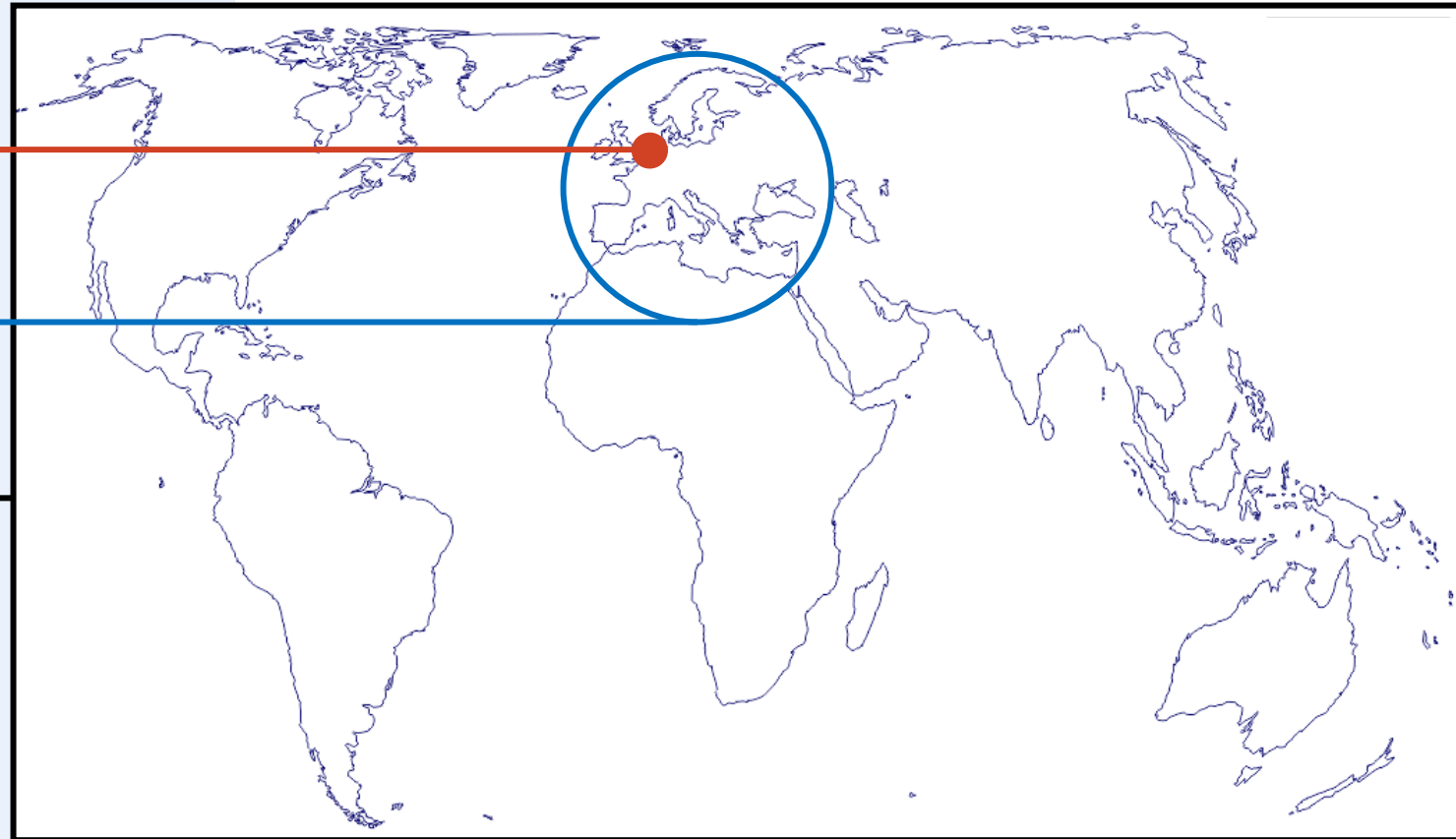
- NEN Standards committees

## Europe

- CEN and CENELEC

## World

- ISO and IEC





# About NEN

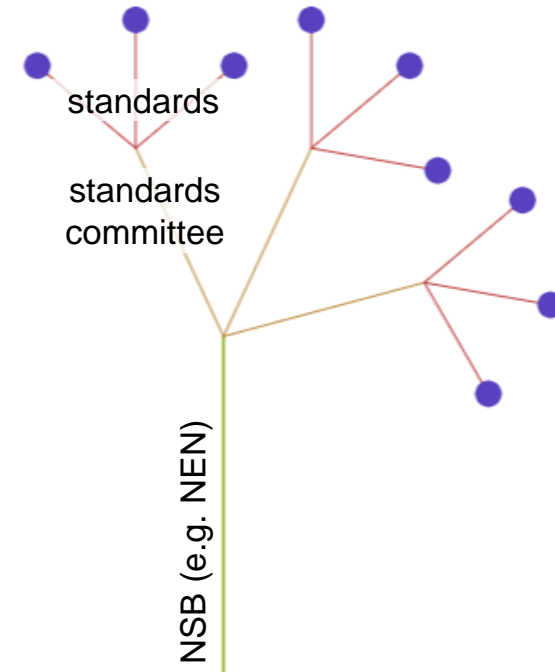
NEN facilitates the creation of voluntary agreements between parties on products, services and processes

nēn



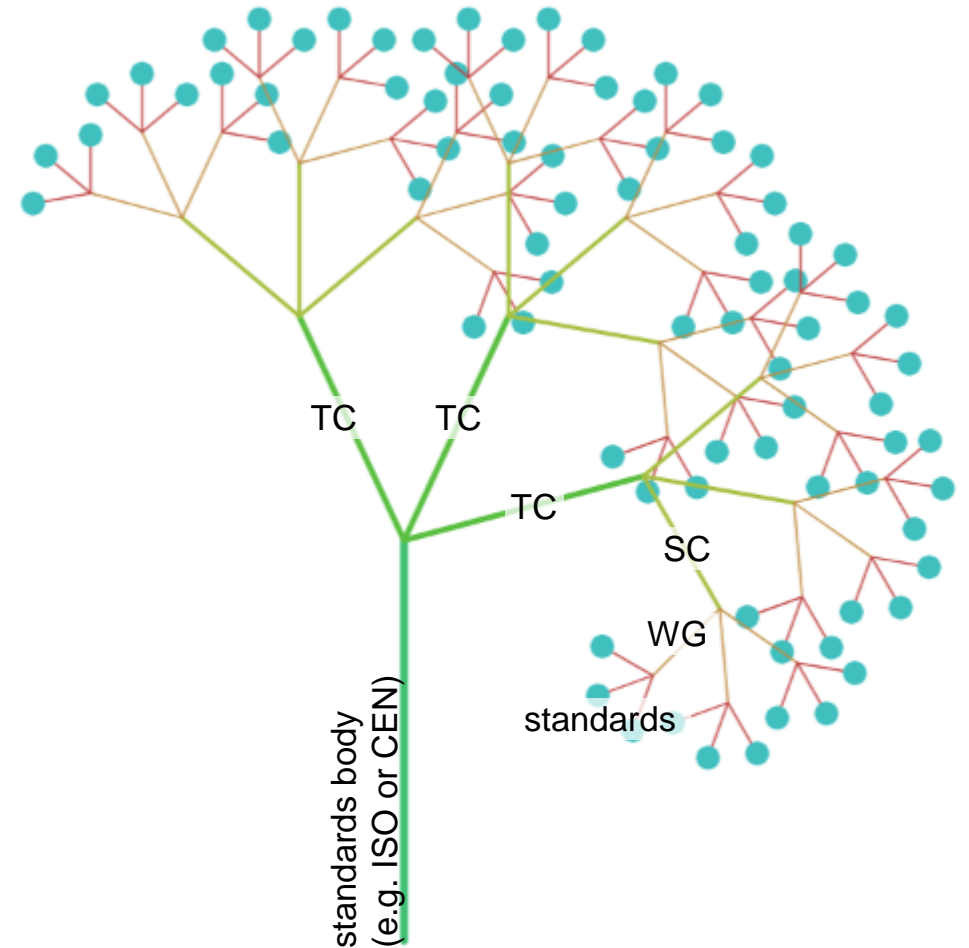
# National structure

- National standards body (NSB), e.g. NEN, BSI, DIN
- Standards committee | normcommissie
- Standards | standaarden
- Development of standards on a national level



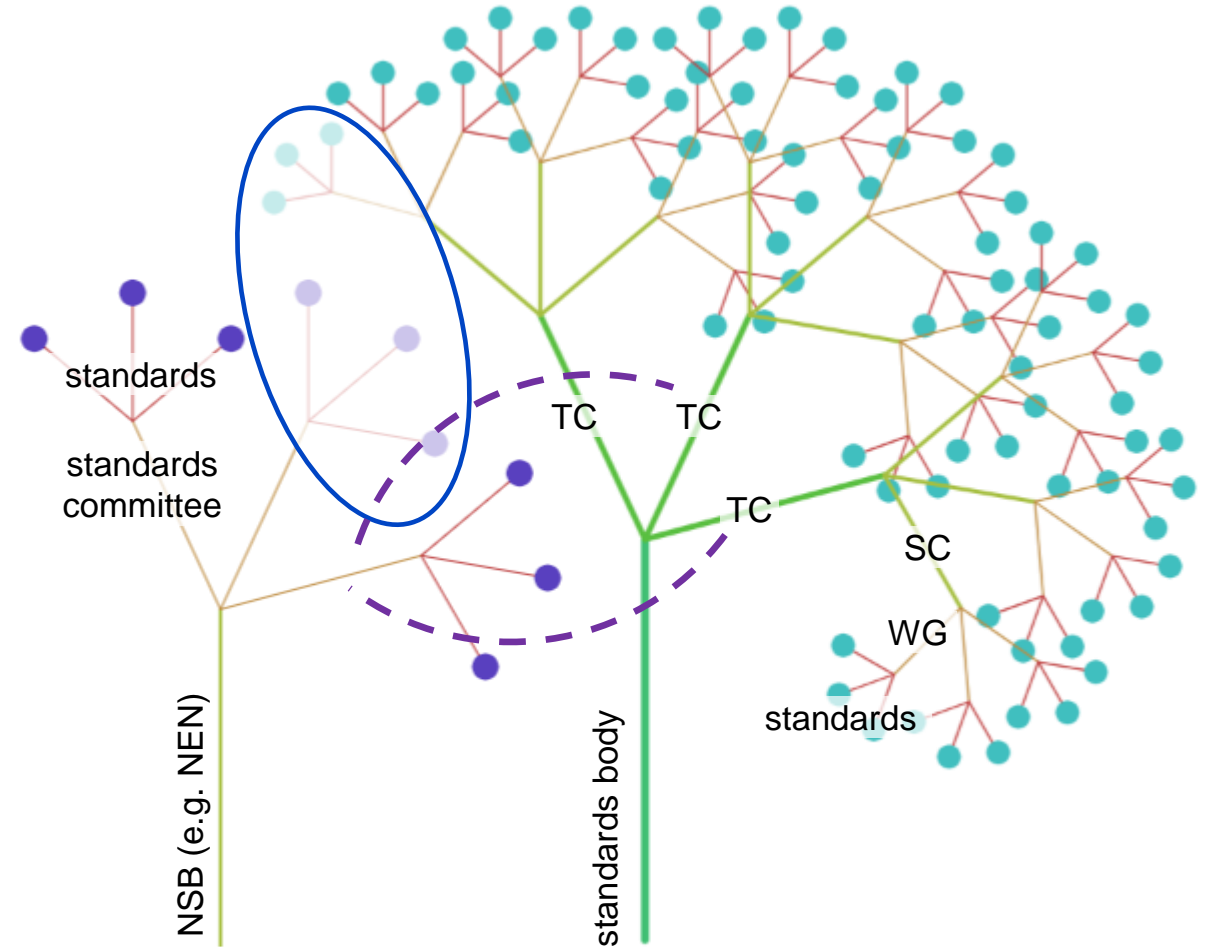
# International structure

- Standards body, e.g. ISO, IEC, CEN, CENELEC
- Technical committee (TC)
- Subcommittee (SC)
- Working group (WG)
- Standards

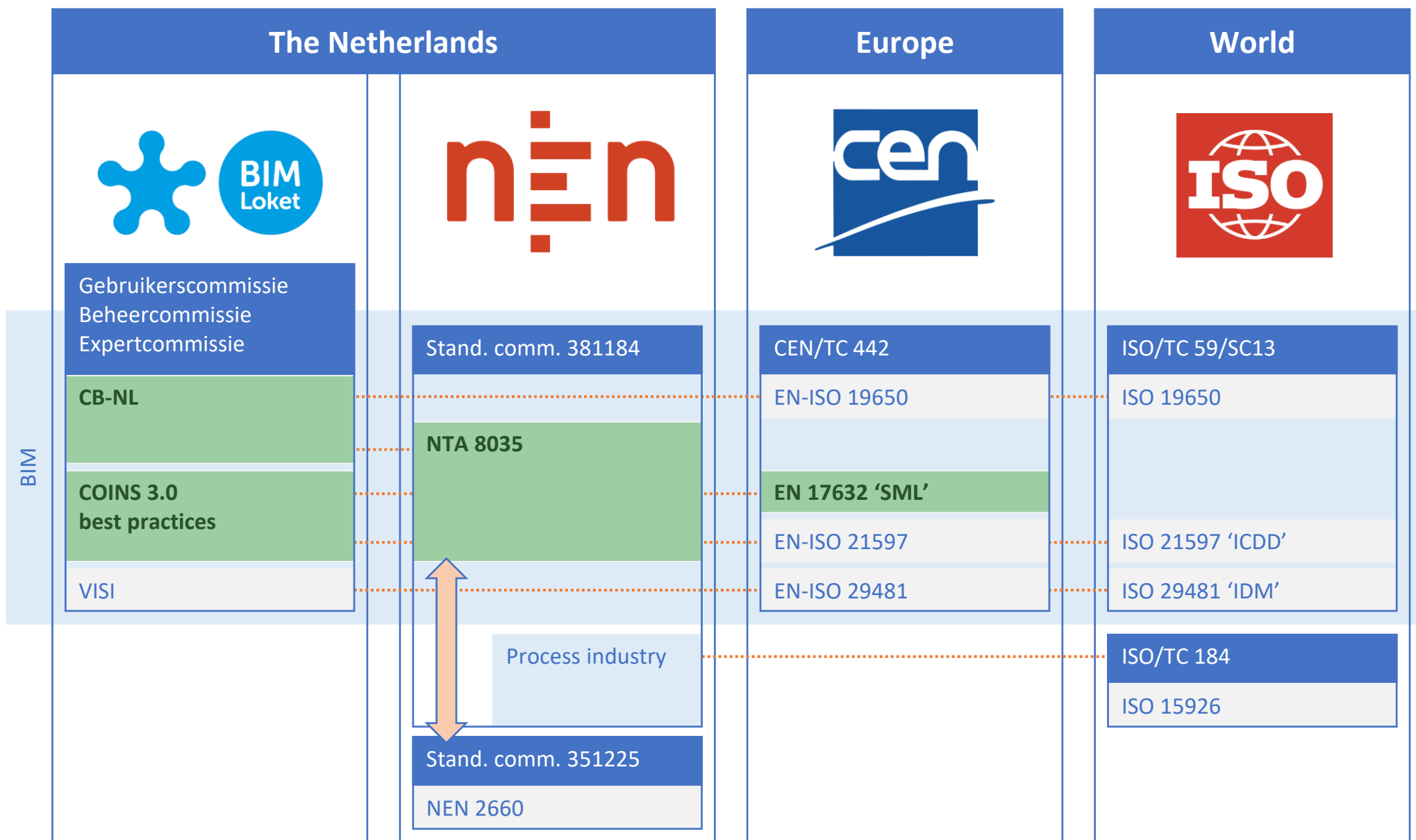


# Participation

- Each national standards committee 'follows' the standardization activities of several international technical committees.
- Members of local standards committees take part in international working groups.
- Participate through your national standards body.







Benefitting from existing standards

# Relevant technical committees (TCs)

## Digital data interoperability

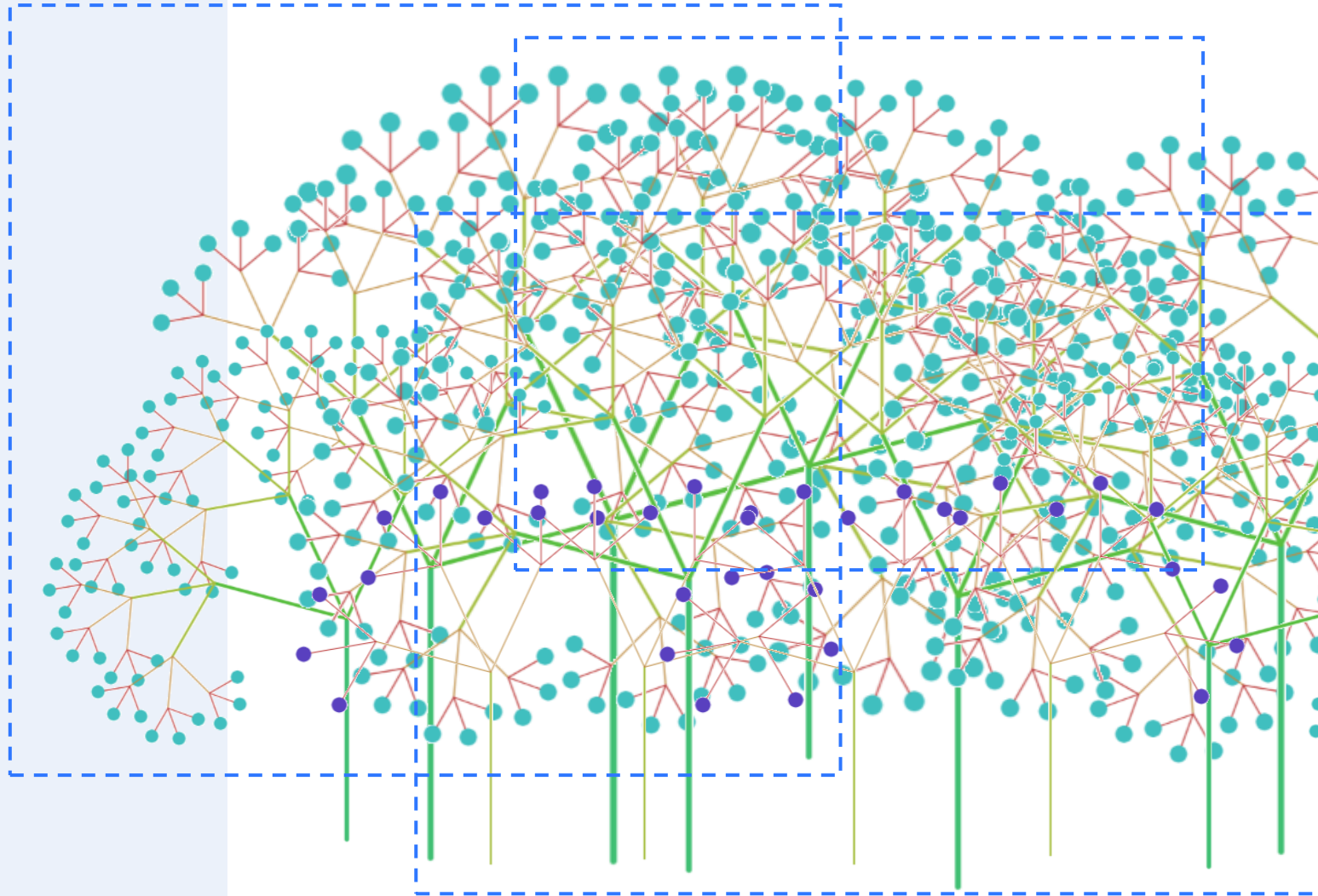
- CEN/TC 442 - Building Information Modelling
- ISO/TC 184 - Automation systems and integration
  - SC 4 Industrial data
  - SC 5 Interoperability, integration, and architectures for enterprise systems and automation applications
- ISO/TC 59/SC 13 - Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM)
- ISO/TC 10 Technical product documentation
- ISO/TC 46 Information and documentation

- ISO/IEC JTC 1/SC 32 Data management and interchange
- ISO/IEC JTC 1/SC 41 IoT and Digital Twin
- ISO/IEC JTC 1/SC 42 Artificial Intelligence

Benefitting from existing standards

# Searching standards

- There is no meta site covering *all* existing standards; each site only covers a collection of standards.
- StandICT – meta site for identifying ICT working groups as well as standards by topic.
- ISO search international standards
- IEC search international electrotechnical standards
- CEN CENELEC search European standards
- Search and purchase through the website of your local standards body, e.g. NEN



Benefitting from existing standards

# Browsing standards

- Browse standards via relevant technical committees
  - StandICT working group search engine
  - ISO TCs
  - CEN TCs
  - IEC TCs (electrotechnical standards)
  - CENELEC TCs (electrotechnical standards)

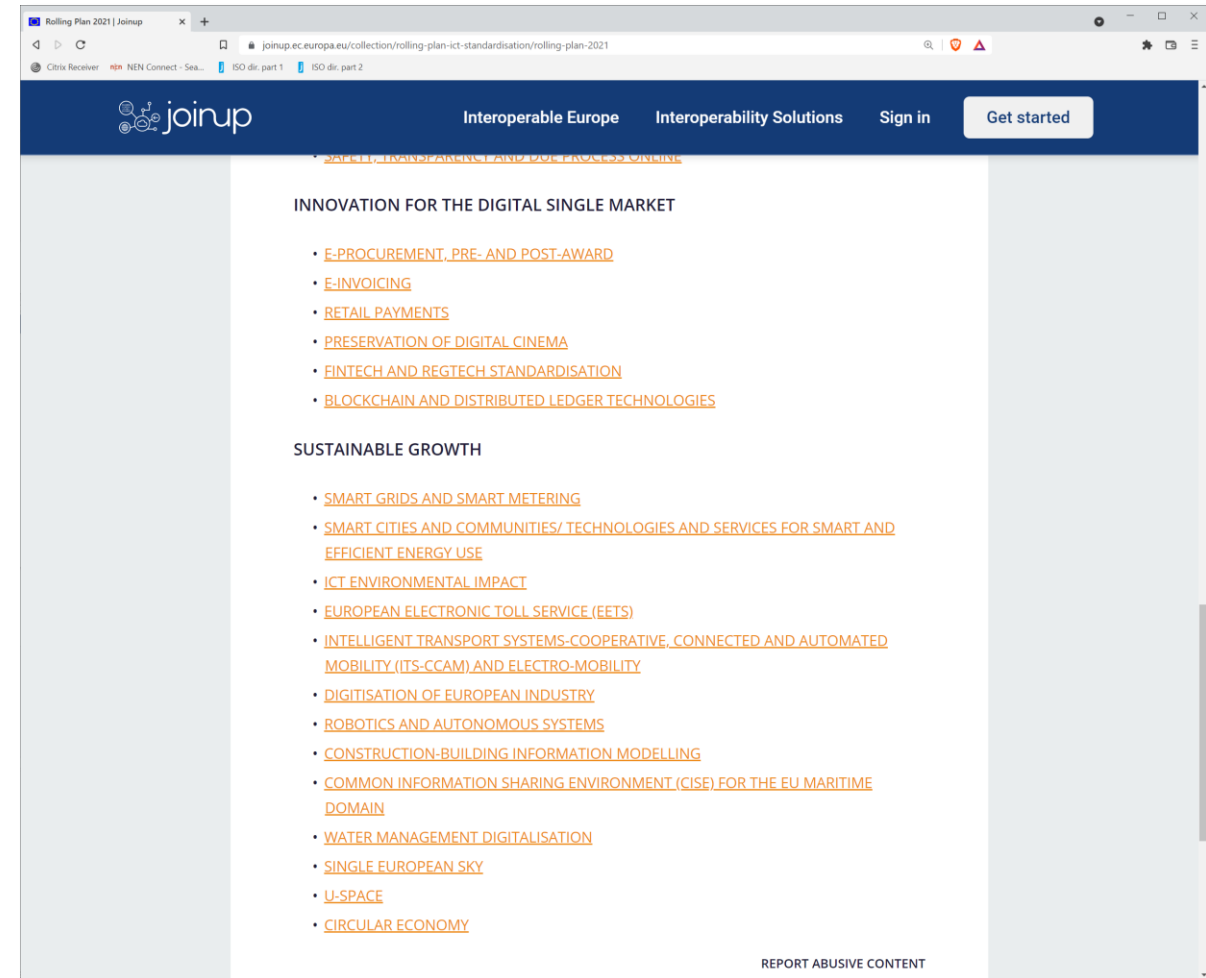
The screenshot shows the ISO Technical Committees website. The main heading is "LIST OF TECHNICAL COMMITTEES". To the right, there is a filter option: "FILTER BY TECHNICAL SECTOR: BUILDING AND CONSTRUCTION (24)". A dropdown menu is open, showing a list of sectors: ALL SECTORS, FOOD AND AGRICULTURE, CHEMICALS, BUILDING AND CONSTRUCTION (highlighted), BUSINESS MANAGEMENT AND INNOVATION, ENERGY, SUSTAINABILITY AND ENVIRONMENT, HEALTH, MEDICINE AND LABORATORY EQUIPMENT, HORIZONTAL SUBJECTS, INFORMATION TECHNOLOGY, GRAPHICS AND PHOTOGRAPHY, MECHANICAL ENGINEERING, NON-METALLIC MATERIALS, ORES AND METALS, FREIGHT, PACKAGING AND DISTRIBUTION, SECURITY, SAFETY AND RISK, SERVICES, SPECIAL TECHNOLOGIES, and TRANSPORT. Below the list, there are counts for "working area" and "Working area".

REFERENCE	TITLE
ISO/TC 21	Equipment for fire protection and fire fighting
ISO/TC 59	Buildings and civil engineering works
ISO/TC 71	Concrete, reinforced concrete and pre-stressed concrete
ISO/TC 74	Cement and lime [STANDBY]
ISO/TC 77	Products in fibre reinforced cement [STANDBY]
ISO/TC 89	Wood-based panels
ISO/TC 92	Fire safety
ISO/TC 96	Cranes
ISO/TC 98	Bases for design of structures
ISO/TC 136	Furniture
ISO/TC 160	Glass in building
ISO/TC 162	Doors, windows and curtain walling
ISO/TC 163	Thermal performance and energy use in the built environment
ISO/TC 165	Timber structures
ISO/TC 167	Steel and aluminium structures
ISO/TC 178	Lifts, escalators and moving walks

Benefitting from existing standards

# Explore existing reports

- IM-SAFE report on *Actual and future context of transport infrastructure monitoring and maintenance* contains mentions of standards relevant to the project.
- Rolling plan for ICT standardization provides a unique bridge between EU policies and standardisation activities in the field of information and communication technologies (ICT).





# More information

- Participate through your national standards body.
- For participation in NEN Standardization committees, please contact Sanne Jansweijer.



The screenshot shows the NEN website page for 'Informatie-integratie en interoperabiliteit'. The header includes the NEN logo and navigation links: Norm kopen, Norm ontwikkelen, Trainingen, Evenementen, Certificatie & keurmerken, Over, Inloggen, and a language selector set to NL. The main banner features the title 'Informatie-integratie en interoperabiliteit' and a call to action: 'Graag meer informatie ontvangen over deze normcommissie?'. Below this, a button says 'Ja, ik wil meer informatie'. The page also includes a section titled 'Schrijf mee aan nieuwe standaarden over datauitwisseling.' with a paragraph explaining the importance of data exchange in the digital world. At the bottom, there is a contact section for Sanne Jansweijer, a consultant, with her phone number (015 2 690 200) and email (kid@nen.nl).

**Normcommissie**  
**Informatie-integratie en interoperabiliteit**

**Graag meer informatie ontvangen over deze normcommissie?**

Laat uw gegevens achter, dan nemen wij zo snel mogelijk contact op!

[Ja, ik wil meer informatie](#)

Liever direct contact?

**Sanne Jansweijer** | Consultant  
015 2 690 200  
kid@nen.nl



Standard for  
progress

## › **SESSION 3 : DISCUSSION WITH ONLINE AUDIENCE**

- Received questions from the online audience:
  - Why should I participate in standardization? What's in it for me?
  - How can we create a quicker change process for codes and standards that are written based on "old" technology?
  - Which standard is available for storage and access of measurement data?
- More questions: ...

Please ask questions to our panellists via Chat in Zoom

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# › **CLOSING SESSION**

## **AGENDA FOR 15:45 – 16:00**

- **Brief introduction of the panellists:**
  - Rafal Stanecki (European Commission, DG MOVE)
  - Konstantinos Gkoumas (European Commission, JRC)
  - Agnieszka Bigaj-van Vliet (TNO, NL)
- **Strategic reflections:**
  - EC policy initiatives in digitalization and for resilient, safe and performing of transport infrastructure. (Rafal Stanecki)
  - Reflection on the discussed topics and the importance of digitalisation and data standardisation. (Konstantinos Gkoumas)
  - Concluding remarks from the Project Coordinator of IM-SAFE Coordination & Support Action. (Agnieszka Bigaj-van Vliet)
- **Closing words and thanks to all guest speakers, panellists and participants.** (Rizal Sebastian)



## › **CLOSING SESSION : PANEL DISCUSSION**

**RAFAL STANECKI - EUROPEAN COMMISSION, DG MOVE)**



# Digitalisation of transport infrastructure

IM-SAFE Project – Symposium

*Rafal Stanecki*

*R&I DG MOVE*

# European Strategy for Data



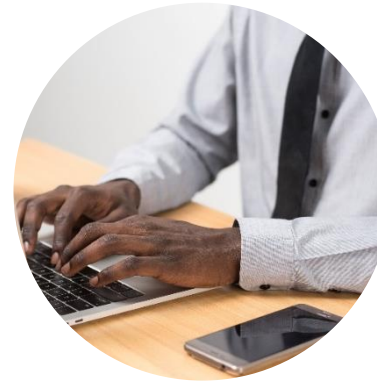
## A governance framework for data

including a legislative framework for the governance of European data spaces and other cross- sectoral measures for data access and use



## Enablers

Investing in a High Impact Project on European data spaces and federated cloud infrastructures



## Competences

Empowering individuals, investing in digital skills & data literacy and in dedicated capacity building for SMEs.



## Rollout of common European data spaces

in crucial economic sectors and domains of public interest, looking at data governance and practical arrangements.

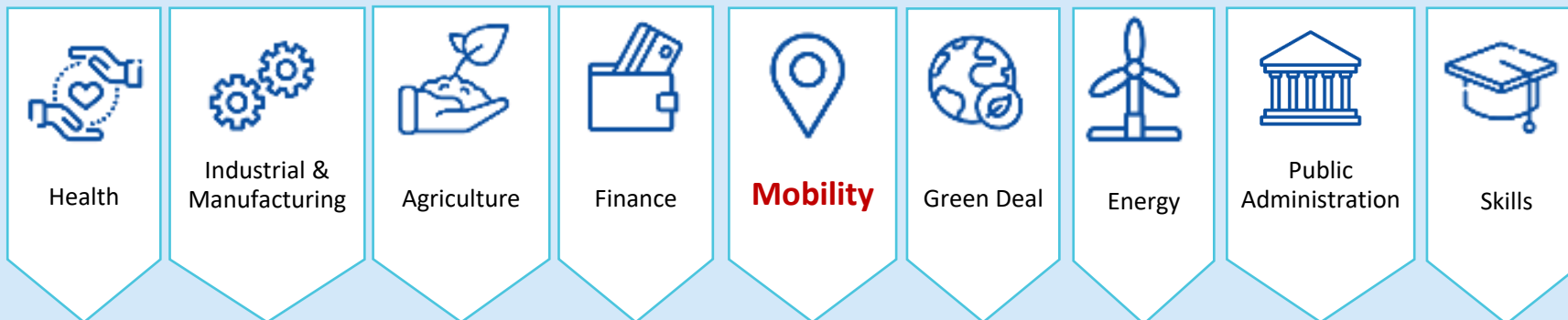
# Common European data spaces

Rich pool of data  
(varying degree of  
accessibility)

Free flow of data  
across sectors and  
countries

Full respect of GDPR

Horizontal  
framework for data  
governance and data  
access



- Technical tools for data pooling and sharing
- Standards & interoperability (technical, semantic)
- Sectoral Data Governance (contracts, licenses, access rights, usage rights)
- IT capacity, including cloud storage, processing and services

# Sustainable and Smart Mobility Strategy (2020)

- *Sustainability*: Green Deal calls for 90% reduction in GHG emissions from transport by 2050.
- *Digitalisation*: opportunity to make mobility smarter, more efficient and greener.
- *Resilience*: transport sector heavily affected by the COVID-19 pandemic. Need to support the recovery.





# Mobility Strategy – milestones (selection)

**By 2030**

- **Paperless freight** transport
- **Automated mobility** deployed at a large scale
- Integrated electronic **ticketing**
- Operational **multimodal Trans-European Transport Network** equipped for sustainable and smart transport with high speed connectivity (**core** network)

**By 2050**

- Operational **multimodal Trans-European Transport Network** equipped for sustainable and smart transport with high speed connectivity (**comprehensive** network)
- **Death toll** for all modes of transport in the EU close to **zero**

# “Smart” in the Strategy



## Achieving seamless, safe and efficient connectivity

- offering a seamless multimodal experience
- supporting sustainable choices by taking advantage of digitalization & automation
- shaping the mobility of the future
- ensuring the right framework and enablers are in place

# Main objectives of the TEN-T revision

## General objectives

To make transport **greener** in view of reaching the climate neutrality targets by 2050

To facilitate **seamless and efficient** transport in order to better connect people and businesses all over Europe

To increase the **resilience** of the TEN-T network to climate change and other natural or man-made disasters

To improve the efficiency of the **governance tools** of the TEN-T Regulation

## Specific objectives

To provide the infrastructural basis for a **modal shift** to sustainable transport modes

To improve the **coherence and integration between the different layers** of the network including its **maritime links**

To adapt and **digitalise** the infrastructure of all modes to **limit congestion and improve safety and security** and to **better address needs of passengers and freight** (services, safety)

To reinforce the **role of the urban nodes** as to enable seamless passenger flows between the TEN-T and local networks

To improve the **preparedness and resilience** of infrastructure, including its maintenance

To increase **coherence and efficiency** between EU and national policies as well as between the different tools (CNC vs. RFC)

# Provisions for smart and resilient transport in TEN-T rev.

## Article 42: ICT systems for transport

- other dimensions of data sharing covered, including optimisation of supply chains, Internet of Things (IoT) devices, etc

## Article 44: new technologies and innovation

- new element of cyber-security

## Article 45: safe and secure infrastructure

- firm requirement to ensure that transport infrastructure provides for safe and secure passenger and freight movements

## Article 48: resilience of infrastructure

- objective: to maintain the infrastructure in a way that it provides the same level of service and safety during its lifetime

## Article 48: maintenance and project life cycle

# Thank you



## › **CLOSING SESSION : PANEL DISCUSSION**

**KONSTANTINOS GKOUMAS - EUROPEAN COMMISSION, JRC**



# JRC supporting the digitalisation of transport infrastructure

The 4th Pan European CoP Forum – IM-SAFE Symposium

*Konstantinos Gkoumas*

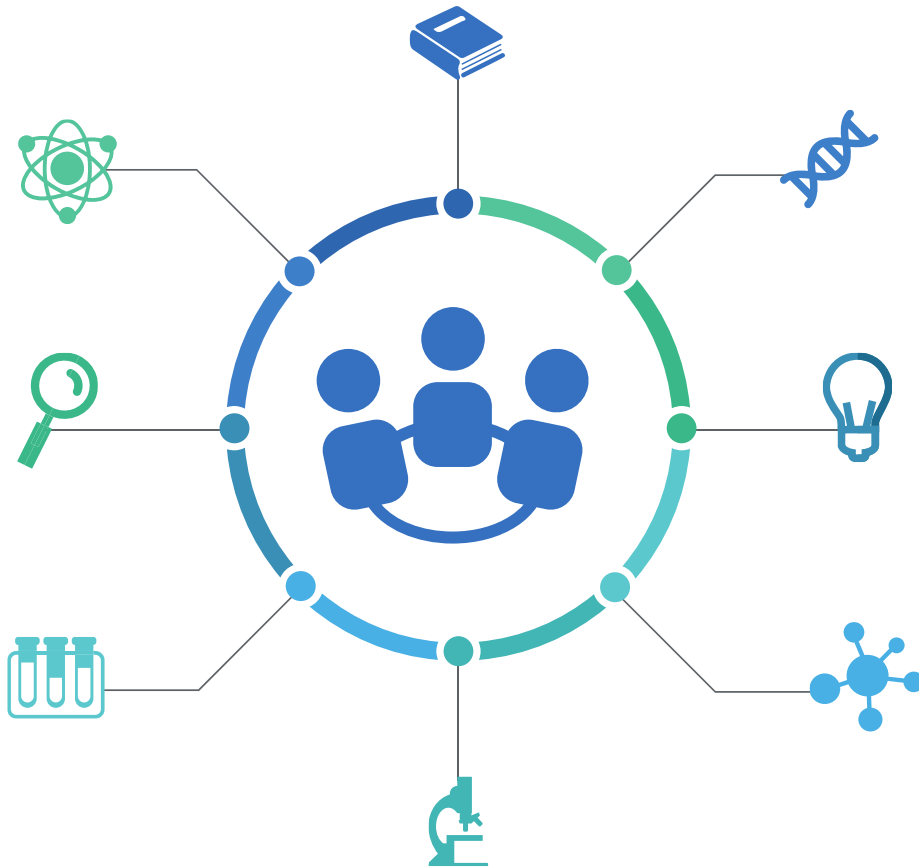
*European Commission, Joint Research Centre*

# JRC mission



As the **in-house science and knowledge service of the Commission** our mission is to support EU policies with **independent evidence** throughout the whole policy cycle, from anticipation and development, through implementation and monitoring.

# The need for evidence to inform policy



- Technical knowledge and scientific evidence can be produced at the ELSA lab.
- Knowledge management to monitor technological progress and assess enablers and bottlenecks.
- Broad experience in standardisation processes.
- JRC stands at the forefront of the European policy-making support towards the incorporation of data-driven SHM.

# JRC supporting innovation & compliance

## The European Laboratory for Structural Assessment (ELSA)



## Standardisation & the Eurocodes



JRC TECHNICAL REPORTS

### Standardisation needs for the design of underground structures

Authors:  
A. Athanasopoulou, A. Bezuijen,  
W. Bogusz, D. Boumas, M. Brandtner,  
A. Breunese, U. Burbaum, S. Dinova,  
R. Frank, H. Ganz, U. Grunicke,  
H. Jung, A. Lewandowska, G. Nuijten,  
A. Pecker, S. Psoomas, K. Roessler,  
A. Schott, M.L. Sousa, H. Stille,  
D. Subrin

Editors:  
A. Athanasopoulou, W. Bogusz,  
D. Boumas, S. Dinova, R. Frank,  
M.L. Sousa, A. Pinto

2019



## Knowledge management



JRC SCIENCE FOR POLICY REPORT

### Research and innovation in bridge maintenance, inspection and monitoring

*A European perspective  
based on the Transport  
Research and Innovation  
Monitoring and  
Information System  
(TRIMIS)*

Gloumas, K., Marques Dos Santos, F.L.,  
van Balen, M., Tsakalidis, A., Ortega  
Hortelano, A., Grosso, M., Haq, G.,  
Pekár, F.  
2019





# Recent research on bridge monitoring and maintenance from H2020 projects

Technology	Sub-technologies	Project(s)
<b>Air drones for inspection</b>	Artificial Intelligence (AI), UAVs, GNSS Computer vision, Laser Scan, Ultrasonic sensors	AERIAL-CORE, AEROARMS, AEROBI, Bridgescan
<b>Guided Wave-based monitoring of fibre reinforced polymer (FRP) composites in bridges</b>		BriFace
<b>Bridge concrete scanner using ultrasounds</b>		COBRI
<b>Autonomous ground robotic vehicle for road maintenance and upgrade</b>	AI, 3D Scanner, UAVs	HERON
<b>Real-time acoustic monitoring sensor</b>	AI, Internet of Things (IoT)	RTExd
<b>Monitoring and decision support tools</b>	Big Data, BIM, GIS	SAFE-10-T, SAFEWAY, PANOPTIS
<b>Mobile dielectric-elastomer strain sensor</b>	Photovoltaic panel	SENSKIN
<b>Smart Skin Sensor System for remote SHM</b>		SmartPatch
<b>360-degree field camera connected to a Robotic Station for monitoring structural integrity</b>	Pattern recognition, Digital Imaging Correlation (DIC)	VG360

Source: TRIMIS

# Expectations and challenges for the digitalisation of transport infrastructure

- New and emerging digital technologies can revolutionize the way structures and transport infrastructures are designed, build and maintained. Examples: digital twins, UAVs, IoT, AI, machine learning, vision based monitoring, indirect monitoring etc.
- For new technologies, interdisciplinary teams needed to break the silos. Linkage/ transition between disciplines is necessary.
- Standardisation, data interoperability and security are paramount.
- Digitalization provides different levers to enable the sustainability transition.
- Technologies should be supported by policy and implementation actions at several levels.

# Keep in touch



EU Science Hub: [ec.europa.eu/jrc](https://ec.europa.eu/jrc)



@EU\_ScienceHub



EU Science Hub – Joint Research Centre



EU Science, Research and Innovation



Eu Science Hub



[konstantinos.gkoumas@ec.europa.eu](mailto:konstantinos.gkoumas@ec.europa.eu)

# Thank you



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## › **CLOSING SESSION : PANEL DISCUSSION**

**AGNIESZKA BIGAJ-VAN VLIET - TNO, THE NETHERLANDS**

Concluding remarks from the Project Coordinator of IM-SAFE



# › **MANY THANKS !**

## RIZAL SEBASTIAN (TNO, NL)

- All participants
- Presenters and panellists
- European Commission officers (Rafal, Konstantinos)
- TNO colleagues (Machteld, Agnieszka, Diego, Michel)
- Elna Minderman from CROW – the symposium organizer



## Pan-European Community of Practice towards standardisation for:

“Digitalisation in inspection,  
monitoring and maintenance  
of transport infrastructures”



# IM-SAFE<sup>.EU</sup>

## Thank you for your participation!

For further questions:

[info@im-safe-project.eu](mailto:info@im-safe-project.eu)

