



The Standards People

# IoT Conference 2023

## H2020 MAGPIE DT Vision

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# H2020 MAGPIE: Digital Twin for the Port

sMArt Green Ports as Integrated Efficient multimodal hubs

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- Intro
- Project goals
- Functional and technical view
- Use cases: shore power, green trucking, future
- Components

# Goals

## Technical

- (i) identify requirements and existing platforms, systems, and other sources of data;
- (ii) to define a modular architecture;
- (iii) to implement interoperable digital representations of the (non-) physical assets of ports; and implement the components that form the foundation for a Digital Twin (DT) for ports .

## Non-technical

- Contribute to European Green Deal and Sustainable and Smart Mobility Strategy
- “Demonstrate technical, operational, and procedural energy supply and digital solutions in a living lab environment to stimulate green, smart and integrated multimodal transport and ensure roll-out through the European Green Port of the Future Master Plan and dissemination and exploitation activities.”

*Table 1 Overview of the adoption of technologies across MAGPIE ports and the added value of WP4 towards the application of such technologies to foster decarbonisation and green logistics operations.*

Use of technology	Port of Rotterdam	Delta Port	HAROPA PORT	Port of Sines	Added value of WP4
Digital Twins					Technological components that form a DT for the (non-)physical port assets
Interoperable information exchange between port actors					IDS-like systems architecture for the DT, ensuring secure, interoperable information exchange
Semantics for data integration					Extendable and reusable domain ontology that models the semantics of port assets
Real-time data to support decision-making					A systems architecture built that allows real-time data to be integrated according to an agreed-upon semantic model
Digital tools for decarbonisation					Tools for monitoring and simulating emissions and energy consumption levels, according to the UCs proposed by ports and MAGPIE demos
Digital tools for green logistics operations					Tools that support the operations of autonomous and electrical vehicles within port areas and the hinterland, according to the UCs proposed by ports and demos

Legend

	Established use in port operations
	In current use for port operations, with limitations on regards to the visibility and exchange of information between port actors
	In current use as either pilot contexts or small-scale implementation for specific port assets
	Not in current use, although there is either interest or plans for implementation.
	Not in current use; no plans (prior to MAGPIE)

# Functional view



*Figure 7 - The Digital Twin for ports connects port stakeholders and orchestrates digital tools to enhance decision-making. Such tools depend on heterogeneous data scattered across such stakeholders (nodes).*

# Technical view

- Data sharing infrastructure
- Message model
- Tools (consume & produce)

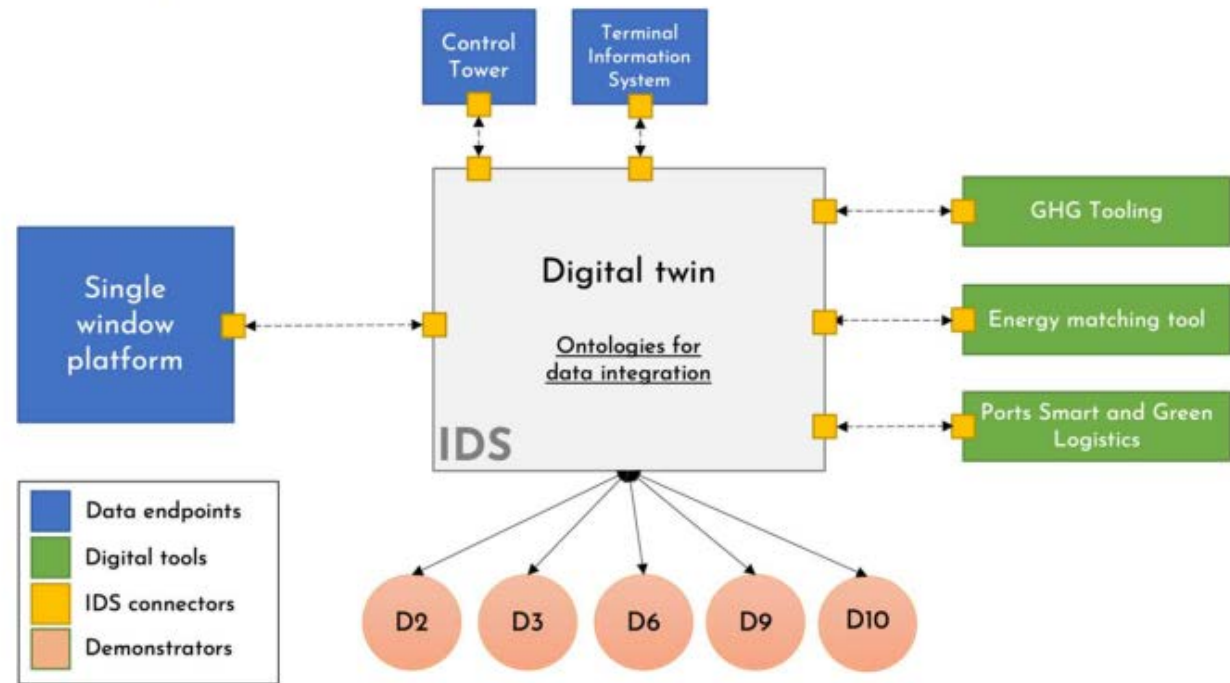


Figure 8 - The conceptual system architecture for the Digital Twin will follow the International Data Space Reference Architecture (IDS-RAM). The information layer will encompass a domain ontology developed within the scope of MAGPIE. IDS connectors will allow the interoperable, secure exchange of data between internal and external stakeholders.

Table 3 - Demonstrators to be supported by the Digital Twin

DEMONSTRATORS TO BE SUPPORTED BY THE DIGITAL TWIN		
Task	Name	Lead Partner
3.8	2 - Smart Energy Systems	EUR
3.9	3 - Shore power Peak Shaving	TNO
5.3	6 - Autonomous e-barge and transshipment	POR
6.2	9 - Green Connected Trucking	TNO
6.3	10 - Spreading Road traffic	POR

# Technical view

- Data sharing infrastructure
  - IDS
- Message model
  - RDF Ontology
- Tools (consume & produce)

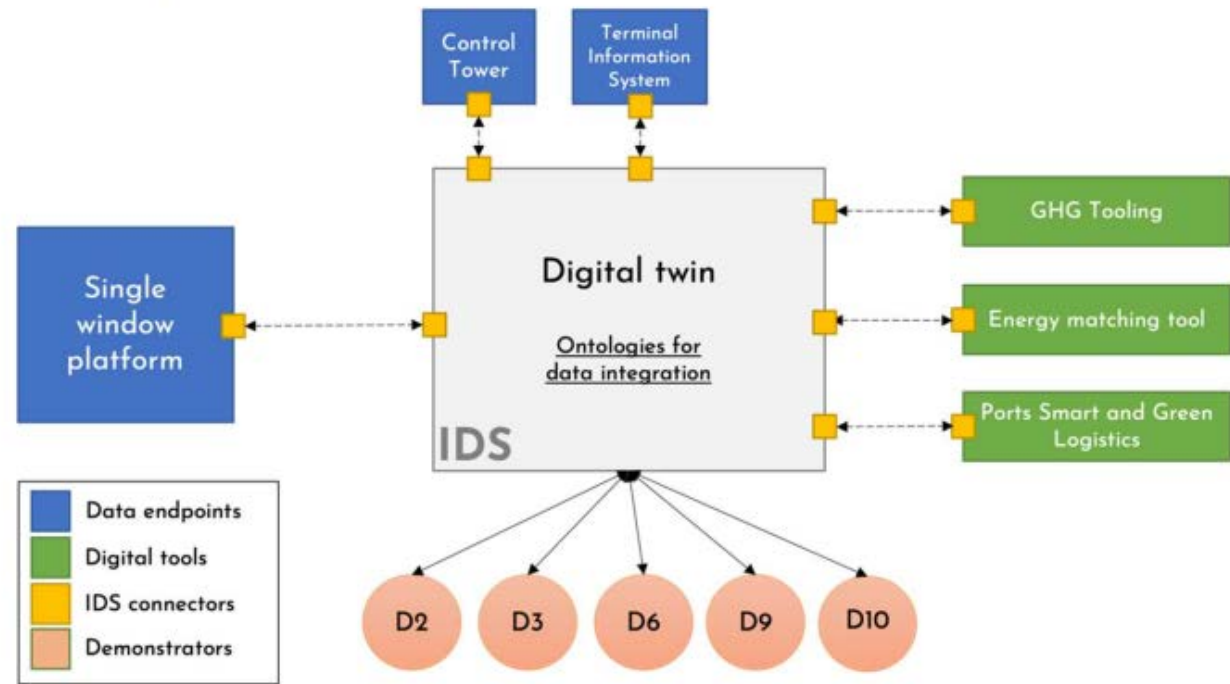


Figure 8 - The conceptual system architecture for the Digital Twin will follow the International Data Space Reference Architecture (IDS-RAM). The information layer will encompass a domain ontology developed within the scope of MAGPIE. IDS connectors will allow the interoperable, secure exchange of data across port entities and external stakeholders.

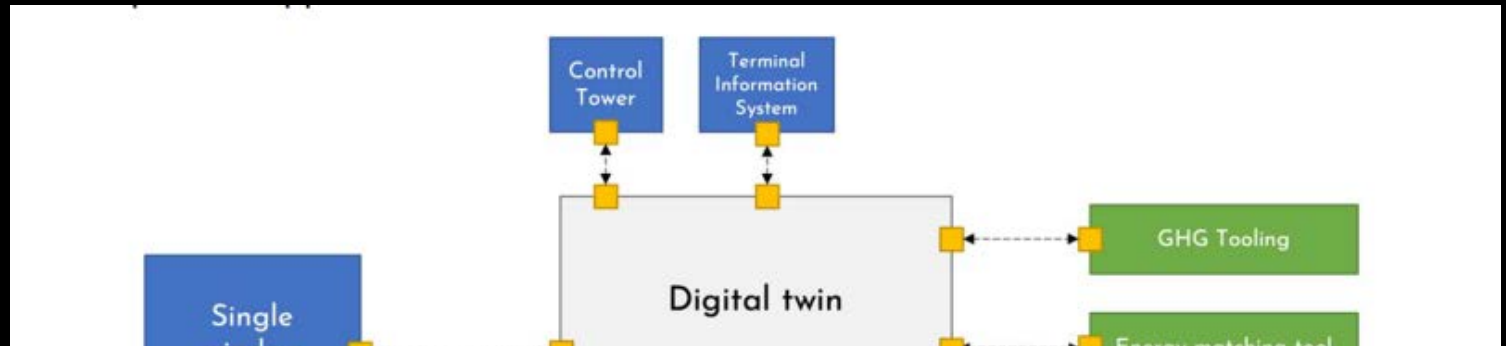
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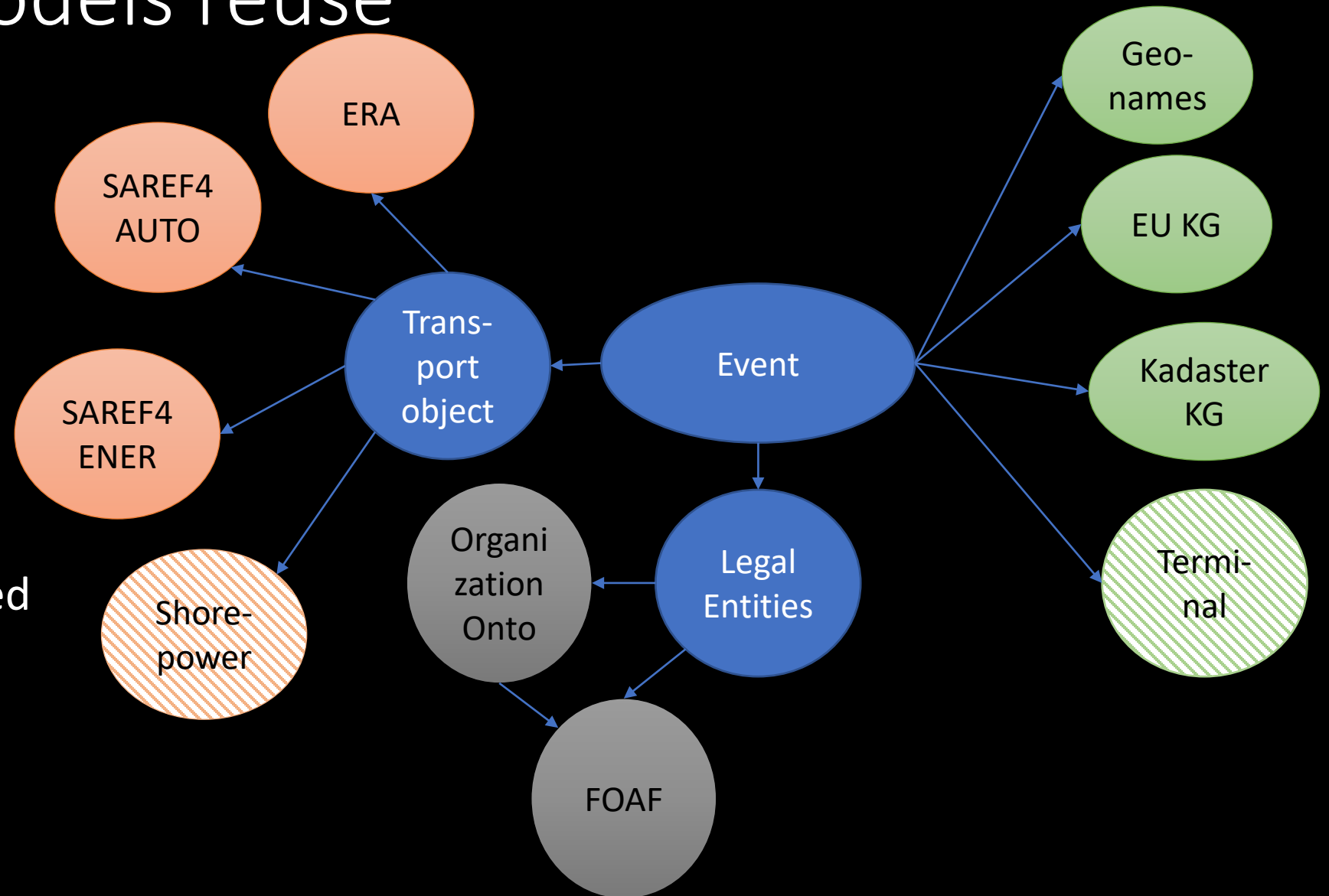


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# Ontology models reuse

- Reuseability
- Extensibility
- Modularisation
- How to facilitate:
  - Competency questions
  - Application-based development



# Discussion & conclusion

- MAGPIE works to demonstrate DT functionality:
  - Data definition using RDF ontologies
  - Data sharing via data space principles
  - Tools working as consumers and providers of data
- Ontology extension
  - Competency questions
  - Use-case based

# References

- MAGPIE, D4.1: <https://www.magpie-ports.eu/wp-content/uploads/2023/01/Deliverable-D4.1-Digital-platforms-and-services.pdf>
- MAGPIE, D4.2: <https://www.magpie-ports.eu/wp-content/uploads/2023/05/Deliverable-D4.2-Definition-of-Modular-Architecture-for-Port-Digital-Twin.pdf>

# Ontology references

- [SAREF: the Smart Applications REference ontology \(etsi.org\)](#)
- <https://saref.etsi.org/saref4ener/v1.1.2/>
- [SAREF extension for automotive \(etsi.org\)](#)
- <https://data-interop.era.europa.eu/era-vocabulary>
- [IATA - ONE Record](#)
- <https://kadaster.wvr.io/kadaster-knowledge-graph>
- [GeoNames](#)
- [The EU Knowledge Graph - EU Knowledge Graph \(linkedopendata.eu\)](#)
- [FOAF Vocabulary Specification \(xmlns.com\)](#)
- [The Organization Ontology \(w3.org\)](#)