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DIGITal Twins applications for safer and greener Adriatic PORTS operations

Technical report on replicability of best practices and training

(D.1.2.1)

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Document Control Sheet

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Activity	1.2 Training on best practices of Digital Twin
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WP leader esternal experts	ESRI Italia spa
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1. Executive Summary

1.1 Purpose and project's context

The purpose of this document is to provide a technical report that resumes the main findings and best practices presented during the joint trainining sessions on Digital Twins delivered in january and February 2025 to the Adriatic ports' communities.

Adriatic ports play a critical role in regional and international trade, serving as key nodes in the European maritime network. In recent years, these ports have faced mounting challenges, including pressure to enhance operational efficiency, adapt to evolving global supply chains, meet sustainability goals, and address regulatory demands.

Digitalization and automation have emerged as crucial solutions to address these challenges, offering the potential to improve port operations, reduce environmental impacts, and optimize resource utilization. Despite progress, the pace of digital transformation in the Adriatic maritime sector has been slower than desired, hindered by factors such as high costs, an aging workforce, and the complexity of adapting legacy systems.

The DIGITPORTS project, funded under the Interreg VI-A Italy-Croatia programme, aims to address these challenges by introducing innovative digital twin applications to the Adriatic port ecosystem.

1.2 Summary of the DIGITPORTS Project

The project's overarching goal is to lead the digital transformation of Adriatic ports through the development and application of digital twin technologies, thus , first and foremost, to review the processes, optimizing the public assets valorization and efficacy of port operations. These tools facilitate a vast array of operations such as dynamic scheduling of vessels calling at port, predictive maintenance of assets, real-time decision-making concerning safety of navigation ruling, and integration of administrative and operational processes into geographically based databases.

By aligning with international best practices, the DIGITPORTS initiative seeks to reduce operational costs, minimize carbon footprints, and improve resource allocation while fostering a sustainable and competitive Adriatic port ecosystem.

DIGITPORTS partnership is composed by main Core and Comprehensive European sea ports in the Adriatic area of Italy and Croatia, such as:

1. North Adriatic Sea Port Authority (ports of Venice and Chioggia) - Lead Partner
2. Port Network Authority of the Eastern Adriatic Sea (ports of Trieste and Monfalcone)
3. Port of Ravenna Authority
4. Port of Rijeka Authority
5. Port of Ploče Authority
6. Port of Zadar Authority
7. Port of Split Authority

In addition, Central Adriatic Sea Port Authority (representing the Ports of Ancona, Falconara, Pesaro, San Benedetto del Tronto, Pescara, Ortona and Vasto, hereafter ADSPMAC) si also taking part to the activities as Oberving Partner, to gain a more in-depth comprehension of the digitalization processes and the scalability of the investments that could benefit also their ports' network.

1.3 Overview and key insights of training sessions

The training has been built starting to address the gaps shown in the preliminary assessment and analysis in digitalization processes across Adriatic ports, performed in 2024. Many ports face fragmented adoption of digital tools, with limited integration of systems such as Port Community Systems, Digital Twins (DT) and IoT technologies. Cybersecurity measures and data governance frameworks remain underdeveloped, exposing ports to risks in an increasingly digital ecosystem. Furthermore, alignment with sustainability goals, including carbon footprint reduction and energy efficiency, is inconsistent across the region.

Against this background situation, it is worth noticing that the governance models of Adriatic Italian and Croatian Ports compared to the Northern range ports (such as Rotterdam) and other mentioned international hubs (Singapore and Shanghai) must be carefully taken into consideration.The formers have a landlord port structure while the latters have a public service port structure (public companies with shareholders), and the differences do impact on the range of digitalization processes that can be put in place (for more detailed analyses please refer to D. 1.1.1 Cross border benchmarking report on digitalization level of the Adriatic ports, downloadble at https://www.italy-croatia.eu/web/digitports).

2. Training sessions n. 1, 2, and 3

The first three sessions of training were delivered in Venice, on January 28, 2025, focusing on:
Session 1: SETTING THE SCENE OF DIGITAL TWIN APPLICATIONS
Session 2: FROM THEORY TO PRACTICE
Session 3: DT AS TOOL FOR EFFECTIVE STAKEHOLDERS' ENGAGEMENT

The format of the event was hybrid, with attendance in person and in streaming. All the proceedings were made available in simultaneous translations in English, Italian and Croatian languages, so to overcome any language barrier and have meaningful impact on all level of practitioners.

The training was targeted for a broader audience, not only port authorities' professionals and civil servants, so to mainstream the potentialities of DT as a core value that must be conceived in all lines of work, from technical to more legal, administrative, financial and commercial departments.
On the first, second and third training sessions, 57 (fifty-seven) people attended in person, while 57 (fifty-seven) participated remotely for a total of 114 (one hundred and fourteen) attendees.

The event was endorsed by the Venice Order of Engineers, which provide their members with training credits recognized at National level for the standards of the Engineering profession and certificates, and featured several notable speakers, including opinion leaders and representatives from

- Port of Rotterdam DT, GIS/BIM consultants,
- Port of Sines and Algarve Authority,
- ESRI inc. industry practice leads from USA, Holland and Italy
- CETENA S.p.A, a research and consultancy center in the naval and maritime field - which was established in 1962, is a Fincantieri company with its headquarters in Genoa. CETENA provides support worldwide in the maritime field in both civil and naval sectors.

The moderation of the event was led by the technical subcontractor of DIGITPORTS Lead Partner, ESRI Italia Spa and the conclusions have been summarized by the Croatian Member of the DIGITPORTS Scientific Committee, subcontracted by the Rijeka Port Authority , namely EEring.

ESRI Inc is the global market leader in geographic information system (GIS) software, location intelligence, and mapping. Since 1969, they have supported customers with geographic science and geospatial analytics (The Science of Where). ESRI team is composed by more than 6,000 employees from 73 countries and serves over 680,000 customer organizations, including 90% of Fortune 100 companies, most national governments, 30,000 cities and local governments and 12,000 universities.

Training sessions explored crucial topics for the future of port terminals and logistics in general, alongside a panel of internationally renowned experts, using both theoretical and practical examples of best practices implemented around the world, spanning from Europe (Ports of Rotterdam and Sines) to United States (Boston and others) and Australia.

2.1 Topics selection

The topics addressed several of the 2024 Cross border benchmarking activity, investigating the digitalization level of the Adriatic ports and connecting the needs on DT implementation to the various array of stakeholders that attended the training, mostly dealing with supply chain such as shipping agents, terminal operators, maritime authorities, SMEs, professionals (lawyers, engineers, Data Protection Officers, to name a few) and universities, covering following themes:

- Digital Twin Concepts and Global use Cases
- Digital Twin at the Port of Rotterdam
- Port of Sines – Digital Strategy and Digital Twin role
- Life Cycle Modelling: Examples of DT Usage in Design, Production and Operations
- Laying the foundation: Imagery technology for DT
- Drone and AI for production and operations
- DT applications for management of construction sites: environmental monitoring and interaction with surroundings
- 3D GIS and migration process from CAD – a case study
- DT as a foundation concept - Nexus Project Perspective
- Digital Twin applications for ports' accessibility, pilot's training, simulations and 3D modelling
- Enabling Stakeholder Engagement

- Internal communications: DT as Cultural Change Driver
- Conclusions

2.2 Agenda

DIGITal Twins applications for safer and greener Adriatic PORTS operations
High Level Training on Digital Twin applications in Port ecosystems
Tuesday 28/01/25 h.9:30 -18:00 - Venezia Heritage Tower, Corso Gianni Sottana, 30100 Venice-Marghera
Moderators: Mr. Leonida Bucci, Chief Development Officer, ESRI Italia,
Mr. Oliviero Vitale, DIGITPORTS Scientific Board
Simultaneous translation Italian/English/Croatian available

Timing	Topics	Speakers
09.30-09.50	Guests' registration and welcoming coffee	
09.50-10:00	Institutional greetings	Mr. Fulvio Lino DI BLASIO, President North Adriatic Sea Port Authority (ports of Venice and Chioggia)
10.00-10.15	The added value of DIGITPORTS project in the rationale of digitalization processes of NAS Port Authority	Ms. Antonella SCARDINO, Secretary General, North Adriatic Sea Port Authority
Session 1: SETTING THE SCENE OF DIGITAL TWIN APPLICATIONS		
10.15-10.40	International best practices, overview, approaches and lessons learned	Mr. Brian Keenum, Industry Practice Lead: Ports, Maritime and Rail, PS, Esri Inc.
10.40-11.05	Lessons learned from DT of the Port of Rotterdam	Mr. Jeremy Mirmelstein, Sr Solution Architect, PS, Esri Inc.
11.05-11.30	Port of Sines - Digital strategy in the context of Nexus Project The DT role	Mr. Claudio José Pinto, Director, Innovation and Information Systems, Ports of Sines and Algarve Authority
11.30-11.40	Q&A	
11.40-12.00	Coffee break	
SESSION 2: FROM THEORY TO PRACTICE (part 1)		
12.00-12.25	Life Cycle modelling: examples of DT usage in design, production and operations	Mr. Leonida Bucci, CDO, Esri Italia
12.25-13.15	Laying the foundation: Imagery technology for DT	Mr. Alberto Meroni, BD Manager, Imagery and Remote Sensing, Esri Inc.
	Drone and AI for production and operations	Mr. Alberto Meroni, BD Manager, Imagery and Remote Sensing, Esri Inc.

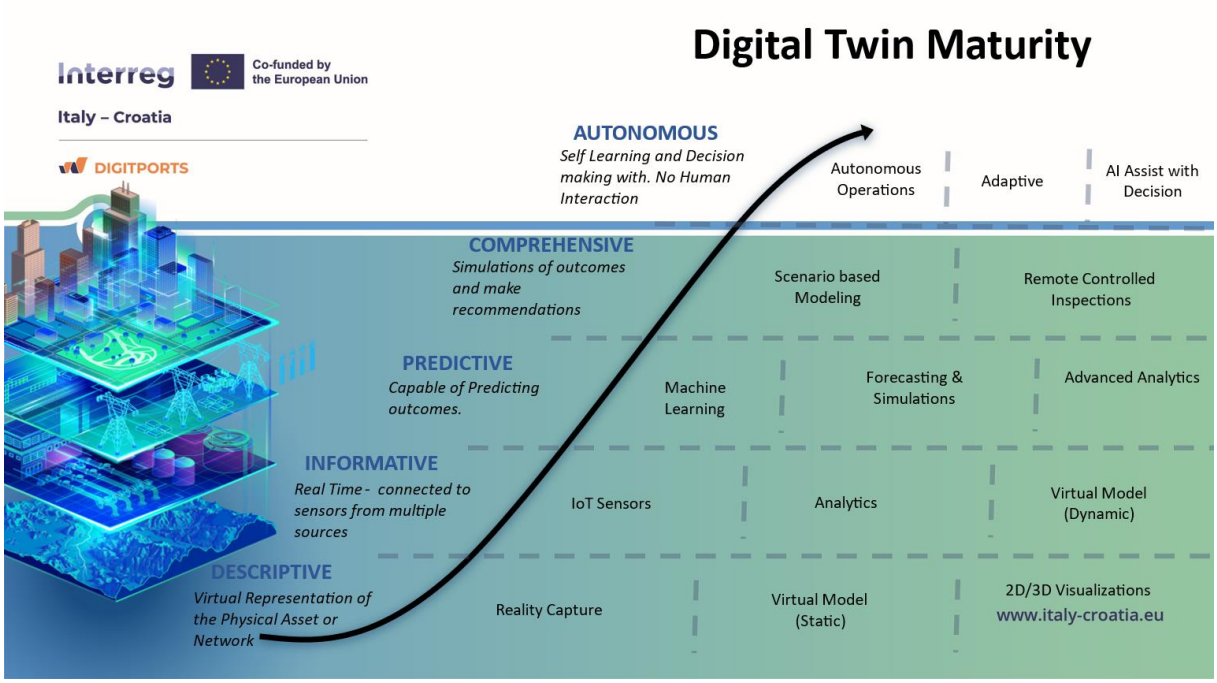
SESSION 2: FROM THEORY TO PRACTICE (part 2)		
14.30-15.10	DT applications for management of construction sites: environmental monitoring and interaction with surroundings	Mr. Matteo De Minicis, Sr. Solution Architect, Esri Italia
	A shortcut to BIM for GIS: a CAD2GIS approach case	Mr. Matteo De Minicis, Sr. Solution Architect, Esri Italia
15.10-15.30	DT as a foundation concept - Nexus Project Perspective	Ms. Monica Oliveira, Sector Lead – Transportation, Esri Portugal ; Mr. Nuno Alves, Sr Consultant, Esri Portugal
15.30-15.55	DT applications for ports' accessibility, pilot's training, simulations and 3D modelling	Ms. Maria Grazia Socievole, Jr Naval Architect and Marine Engineer, CETENA Port assesment team Mr. Daniele Milazzo, Sr Naval Architect and Marine Engineer, CETENA Port assesment team
15.55– 16:10	Q&A	
SESSION 3: DT as tool for effective stakeholders' engagement		
16.10-16.40	External relations: Communications with stakeholders and port/cities communities	Mr. Ian Koeppel, BD Manager, Transportation, Esri Inc
16.40-17.00	Internal communications: DT as cultural change driver	Mr. Leonida Bucci, CDO, Esri Italia
17.00-17.10	Q&A	
17.10-17.30	Conclusions	Mr. Dražen Vrhovski, PhD, EERing, DIGITPORTS Scientific Board (HR Member)
17.45-19.00	Networking cocktail	
13.15-13.25	Q&A	
13.30-14.30	Light lunch	

2.3 Presentations Excerpts

Session 1: SETTING THE SCENE OF DIGITAL TWIN APPLICATIONS

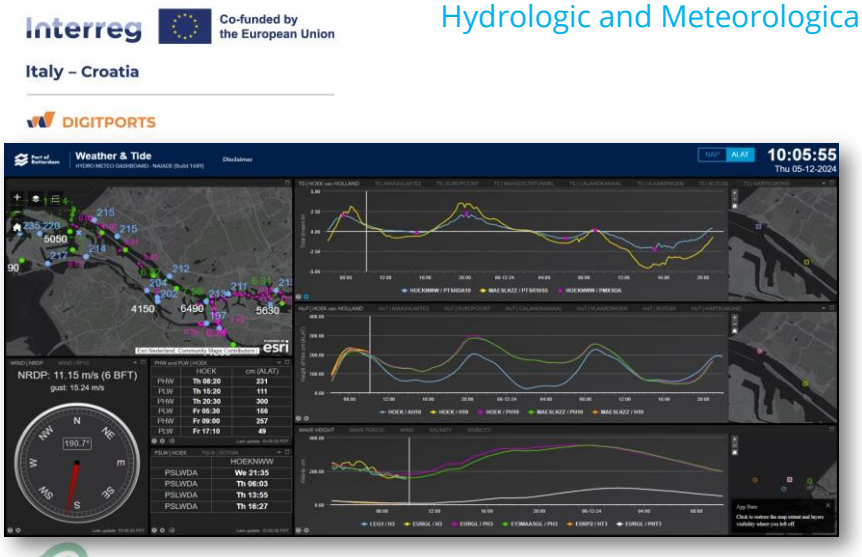
"International best practices, overview, approaches and lessons learned", Mr. Brian Keenum, Industry Practice Lead: Ports, Maritime and Rail, PS, ESRI Inc.

- Definition of DT as "a Virtual Representation of Real-World Entities and Processes, synchronized at a Specified Frequency and Fidelity", focusing on operational data, a common operating picture, workers and stakeholders throughout the port and the use of existing business systems data;
- Creating a DT is not a linear path, but it is a process and must involve all stakeholders
- DT use cases illustrated: operational overview, bathymetry, asset inspection, lease management, holistic visualization, external communication,



"Lessons learned from DT of the Port of Rotterdam", Mr. Jeremy Mirmelstein, Sr Solution Architect, PS, Esri Inc.

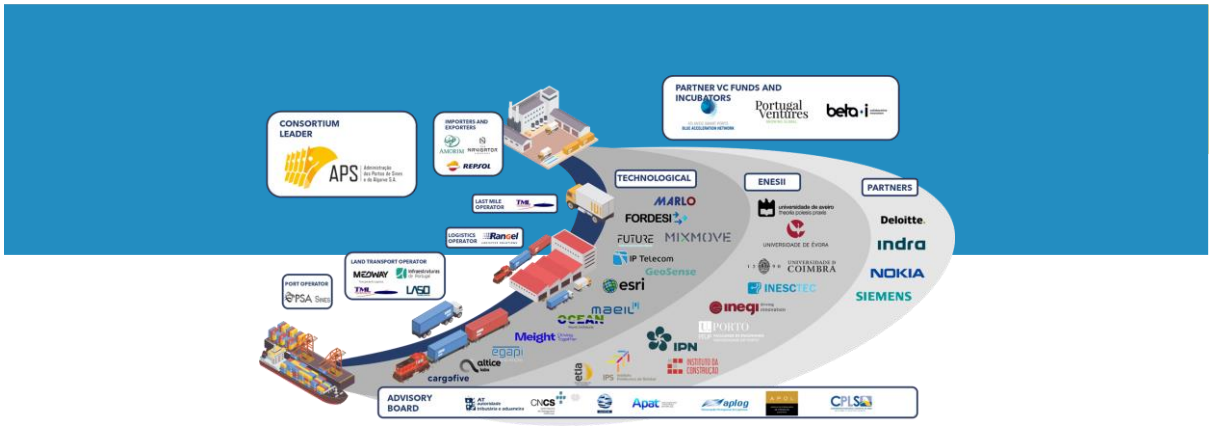
- Rationale for Digitalization: the Port of Rotterdam (PoR) has existed and expanded over centuries, but nowadays further expansion of the Maasvlakte area into the North Sea is no longer feasible, so the Port has shifted their focus away from building new harbors and toward optimizing their existing operations with DT;
- PortMaps DT system was established as the geospatial system of record, e.g. PoR GIS – Geographic Information System. PortMaps is often used as a synonym for ArcGIS – Esri's suite of Geographic Information System (GIS) software. It was first created as a system focused on the key assets of a port. Hosting the Port's infrastructure and asset data, but making it available to all departments at the PoR and integrates with multiple other software already in use at the port;
- Challenges related to people and processes: Resistance to change – "Because we've always done it that way"; Systems are owned by many separate teams across the Port; invest in a Single Point of Truth – Reduce duplication of data across systems and acceptance of changes that can take weeks/months/years;
- Lessons learned at the PoR: The Digital Twin is about digital transformation, not just a twin; Is multidimensional – 2D, 3D, and 4D; Is not only BIM data integration with GIS; Is about improving Port Operations today and in the future.



- To support the real-time decision making- measurements of the hydrologic and meteorologic conditions of the port are made available to the Harbour Master and even the public
- dashboards provide a real-time sense of conditions, for current and future planning in an attempt to ensure that data is available to those that need it

"Port of Sines - Digital strategy in the context of Nexus Project: The DT role", Mr. Claudio José Pinto, Director, Innovation and Information Systems, Ports of Sines and Algarve Authority

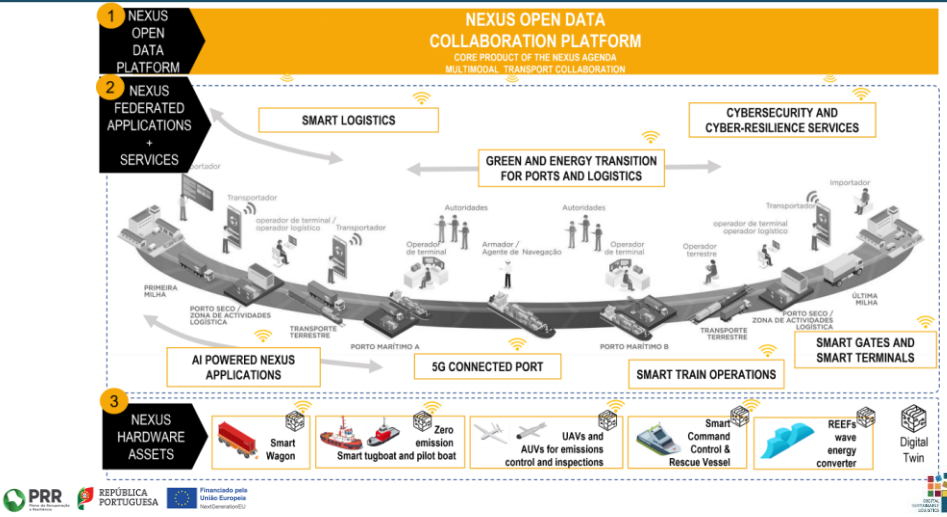
- Digital Strategy of the Port of Sines: NEXUS Agenda is about changing the focus to a better understanding of business' dynamics and the supply chains as well as the impact of the port on the performance of the logistics chains; assume the role of traffic promoter; enable the company to act beforehand; transition from infrastructure manager to network manager thus contributing to the resolution of bottlenecks in the hinterland; coordinating different interests and comply with the stakeholders' expectations; to define initiatives positively impacting stakeholders' activity; cooperate to influence the improvement of the port's connections to transport networks and other relevant decisions for the territory; from facilitator to catalyst offering connectivity (physical and digital) and centrality, enhancing the competitiveness of the companies located inside the port's area of influence; actively contribute to the development of the ZILS/ZAL; to strengthen and broaden the hinterland while diversifying port users; to play a key role in projects oriented towards the decarbonizing of the economy and energy transition



NEXUS Agenda (consortium of 35 partners)

An Open Innovation Ecosystem for Digital and Green Transition in Transport and Logistics

NEXUS Products and Services



Impacts and Goals

SECTORIAL IMPACTS

- **997** NEW JOBS (until 2030)
  - **248** during project execution
  - **623** direct permanent jobs (until 2030) associated to technology exploitation
  - **126** indirect permanent jobs
- **28** new products and services with an average TAM* above **300 million euros / year**
- **More than 5% increase in the Gross Added Value of the Ports, Transports and Logistic Sector, by 2027**

*TAM = Total Addressable Market

REDUCED CO2 EMISSIONS

- **55%** reduction in the Logistics operations associated to the port of Sines (**854,6 ton CO2/year**)
- Directly supports **434.644 ton CO2 savings over a 10 years,** by promoting modal transfer to train operations in multimodal corridors
- **25% GHG target reduction** in the multimodal networks demonstrating NEXUS Technologies
- **Drag along effect** to the Ports, Transports and Logistics Sector

EXPORTS

- NEXUS high technology exports to reach **55.9 million euros / year** by 2030

INCREMENT PORTUGUESE LOGISTICS PERFORMANCE

- Strong contribution to allow Portugal to rank in the **top 20** of countries in the World Bank's **Logistics Performance Index**, with a score above **3,75**

INCREMENT R&D SPENDING

- Important contribution to reach the target of **11% average annual growth in R&D spending** in the Mobility, Space and Logistics sector, until 2025

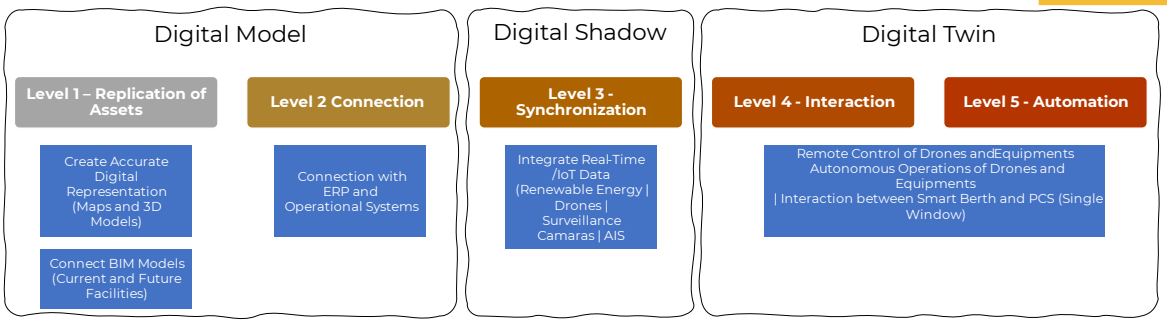
LEVERAGING LOCAL LARGE-SCALE PUBLIC AND PRIVATE INVESTMENTS

- **Direct contribution and synergies** with local public and private investments, worth more than **4.900 million Euros:**
  - Sines Hyperscaler Data Center
  - Public and Private Investments in the Atlantic Multimodal Corridor and Expansion of Sines Container Terminal
  - Repsol Investment in the Sines Industrial Corridor

TRAINING GAPS

- **1 Specialised Academia** for ports and multimodal networks

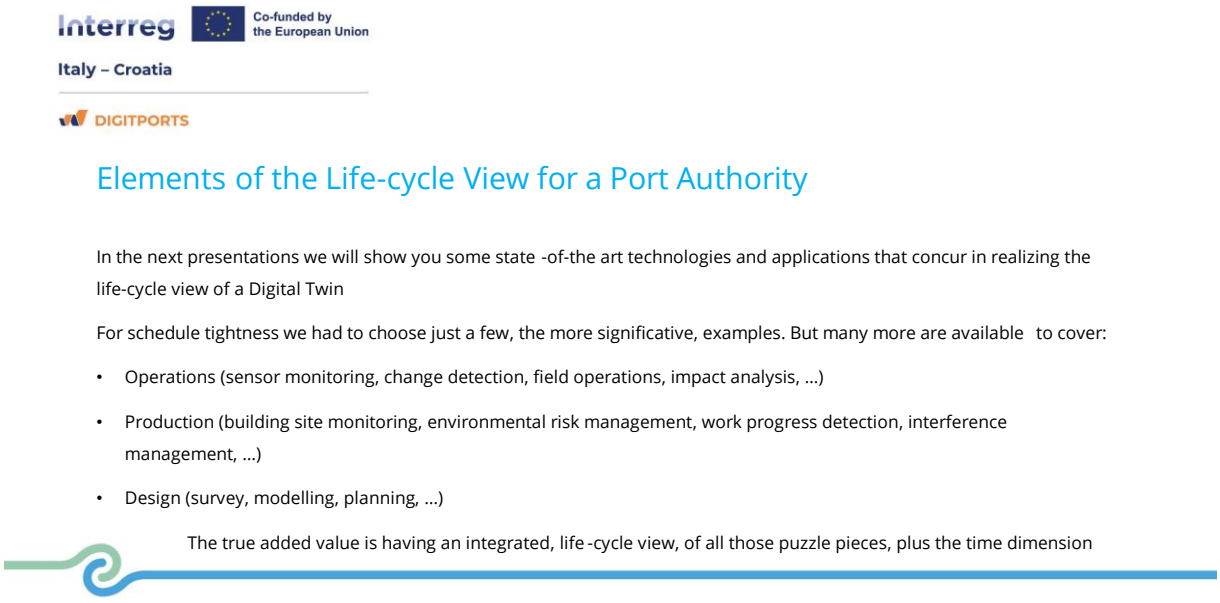
NEXUS Digital Twin RoadMap

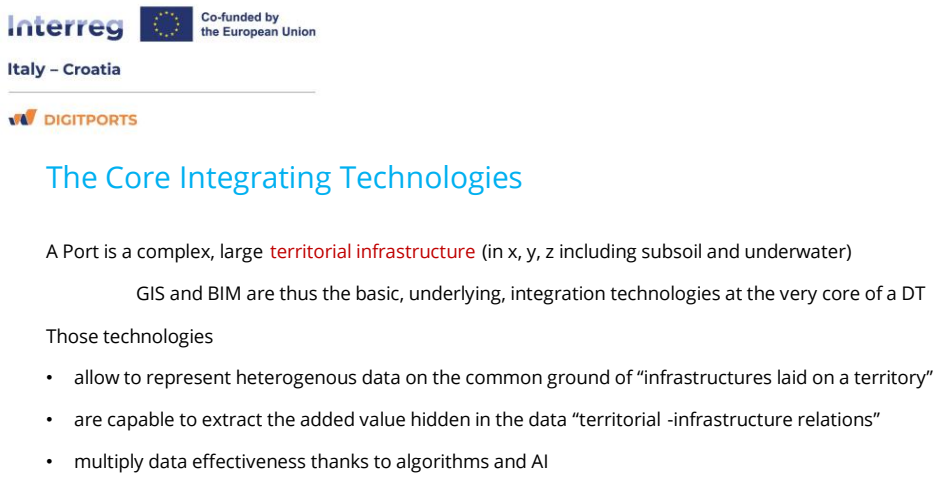


Session 2: FROM THEORY TO PRACTICE

"Life Cycle modelling: examples of DT usage in design, production and operations", Mr. Leonida Bucci, CDO, Esri Italia

- Digital Twin is not a software and is about the way you arrange (a part of) your digital assets to be compliant with the principles of full life cycle and is usually the result of a process that takes your existing legacy data and applications, transform and integrates them to satisfy the Digital Twin principles
- DT to be effective, open to multiple stakeholders, durable in time MUST be based on open data formats





"Laying the foundation: Imagery technology for DT", Mr. Alberto Meroni, BD Manager, Imagery and Remote Sensing, Esri Inc.

- Key role of Imagery in the Digital Twin as it enables the digital representation of a Physical Asset, such as a train station, an airport, a port or even a large City;
- This process of transforming 2D images into a 3D product that represents the physical reality is what we at Esri call Reality Mapping, creating accurate digital representations of the physical world using images, lidar technologies or both;
- To develop these products, you can use sensors mounted on different platforms, such as drones, airplanes or satellites: the results in terms of quality will be different, but we have a considerable flexibility measuring the GSD (Ground Sample Distance) more simply the size of the elementary unit captured by the sensor, or the pixel size greatly influences the result;
- Imagery for Digital Twin is a cost-effective method for building foundational data layers; the process is highly automated, and the results can be used in a wide range of engineering and GIS applications.

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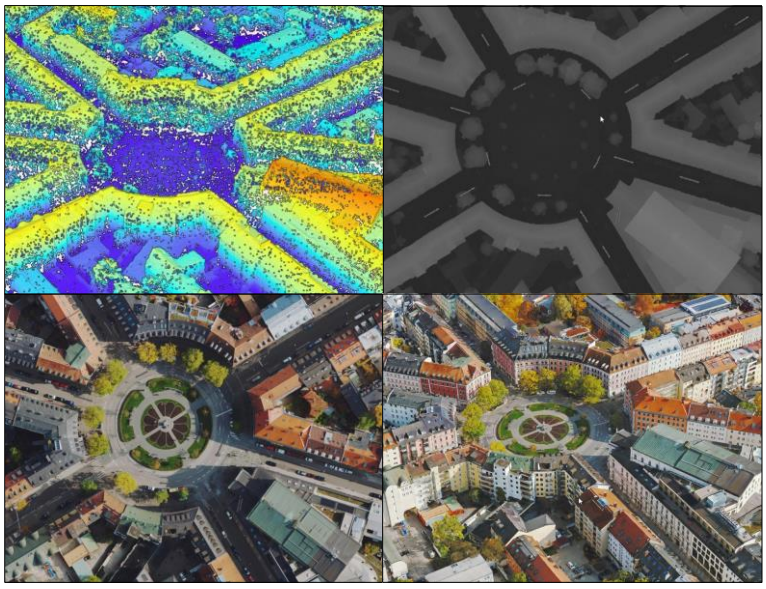
The fundamental products for digital representation

- Point Cloud
- DSM
- True-Ortho
- 3D mesh models



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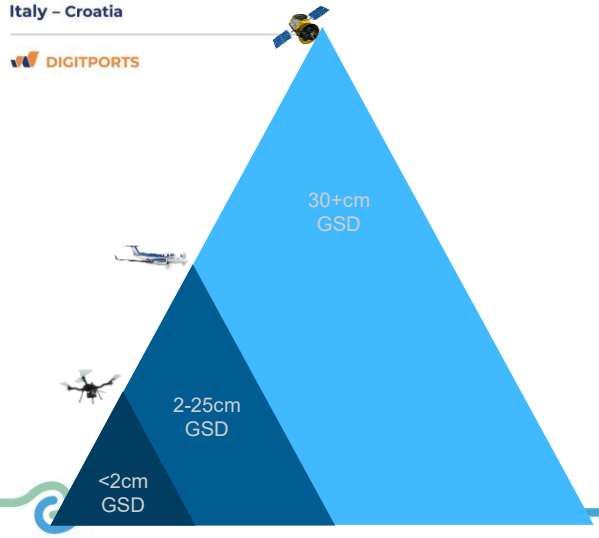


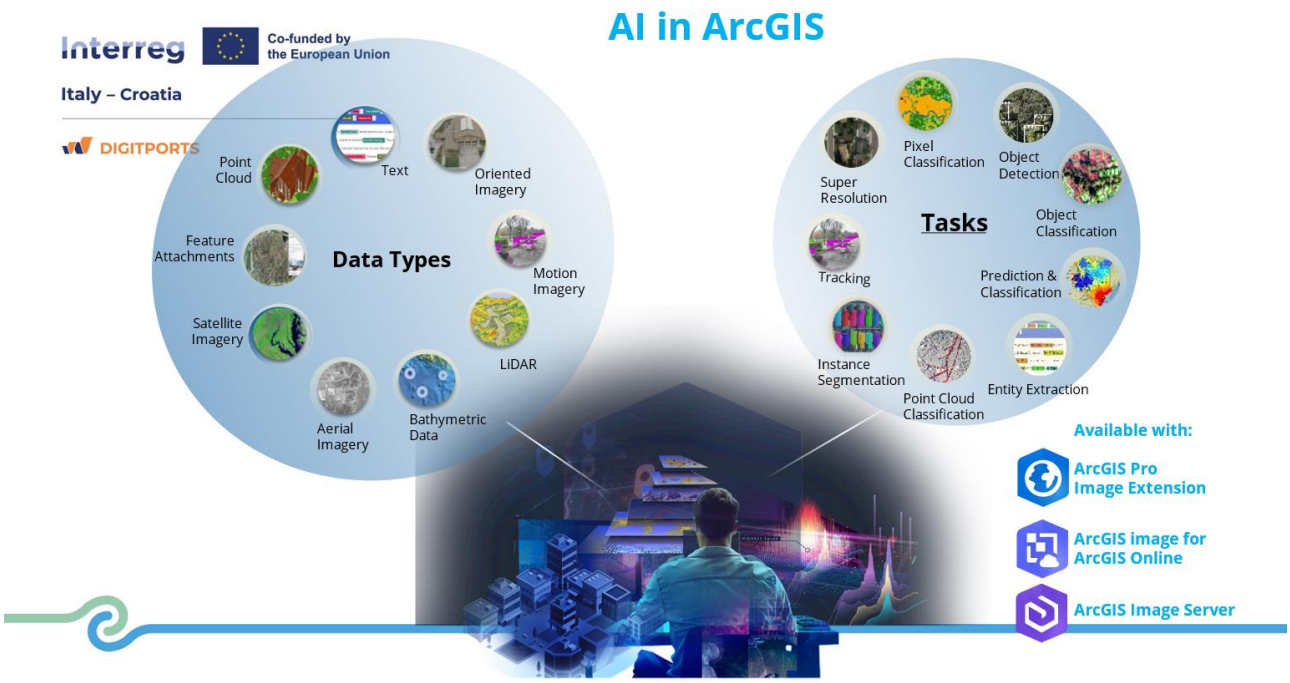
Data courtesy Airbus, Pleiades Neo, GSD 30 cm

Data courtesy City of Milano, CGR SPA & Esri Italy, GSD 5 cm

Data courtesy HNIT Baltic. GSD 1 cm

"Drone and AI for production and operations", Mr. Alberto Meroni, BD Manager, Imagery and Remote Sensing, Esri Inc.

- Drone Imagery pros and cons: Capability to capture very detailed imagery; fully flexible time frame; may encounter limitations over large areas; suitable for highly automated workflows;
- Satellite Imagery (Electro-optical sensor) pros and cons: capability to capture detailed images; temporal acquisitions with limitations; flexibility in extending the coverage area; operations may be subject to weather condition; suitable for highly automated workflows;
- Satellite SAR/Radar (SAR sensor): capability to capture detailed images; temporal acquisitions with limitations; flexibility in extending the coverage area; day/night operations without weather constraints; partly suitable for automated workflows
- AI and Imaging can support port operations in: Identify and count objects of interest; monitor an area systematically (Change Detection); identify possible infringements in the maritime and land port area



"DT applications for management of construction sites: environmental monitoring and interaction with surroundings", Mr. Matteo De Minicis, Sr. Solution Architect, Esri Italia

- Location Intelligence and Digital Twin lead to Safe, Efficient and Sustainable Projects;
- GIS Technology is an invaluable resource for large construction projects;
- Integration with other digital tool like Drones, BIM integration, IoT optimize time and efforts.

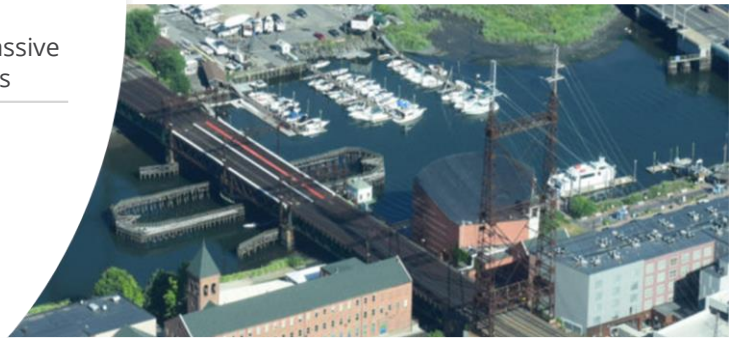
This is because …

… Location Matters

AEC Projects are SPATIAL

AEC professionals integrate massive amounts of data and data types

Location Integrates AEC Data



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GIS and BIM integration

Any structure can be viewed in a real-world context for deeper analysis throughout the project life cycle.

Together, GIS and BIM support **scenario planning** such as

- Environmental constrains for site selection
- line-of-sight analysis for surroundings development
- **material flow** for circular design

GIS and BIM support also **construction and maintenance phase**

- Sensors locations and **real-time monitoring**
- O&M work orders
- …

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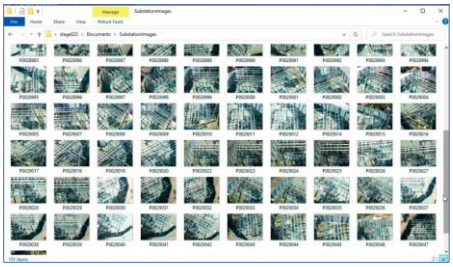
Efficiency & Safety

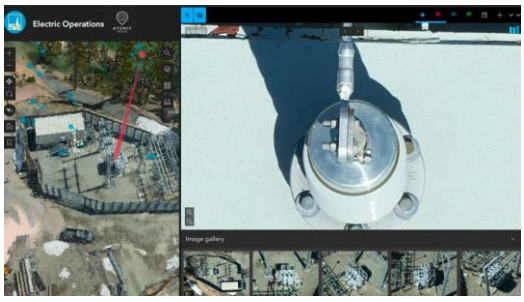
Electrical substations operations

Drone inspections can improve efficiency and safety in maintenance operations.

A DT based on location intelligence **truly improves** efficiency.

25% time saved to issue a work order





"A shortcut to BIM for GIS: a CAD2GIS approach case", Mr. Matteo De Minicis, Sr. Solution Architect, Esri Italia

- 3D buildings are significant assets in a 3D GIS, not only for representation purposes;
- They can later be used as a basis for powering a BIM project;
- Case study on the digitalization of railway stations;
- A key element to consider is data interoperability;
- It is therefore essential to adopt open data formats;
- A well-designed and structured workflow is crucial for the success of the transition.

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Case study - Digitalization of railway Stations Project

Centralize and normalize the **floor plans** (CAD) of the stations.

Standardizing the data model – **IMDF (Indoor Mapping Data Format)** of the Open Geospatial Consortium OGC

Create a geodatabase functional to the management of indoor spaces and indoor navigation.

Census and geolocate the relevant **units and equipment** for maintenance, regulatory and commercial activities.

Automate the drafting of **Station Usage Plans** (PuDS)

Start an **integration between management systems** on a floor plan basis.

Open Geospatial Consortium

195 main Italian railway stations involved along Italian railway network

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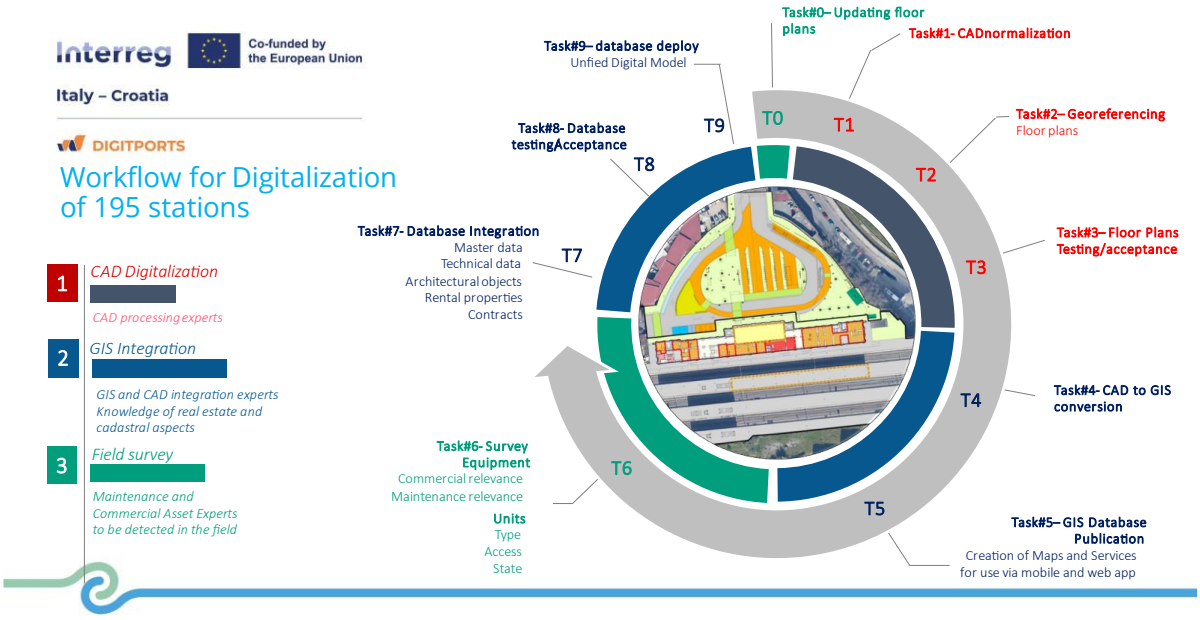
Indoor Mapping Data Format – Interoperability

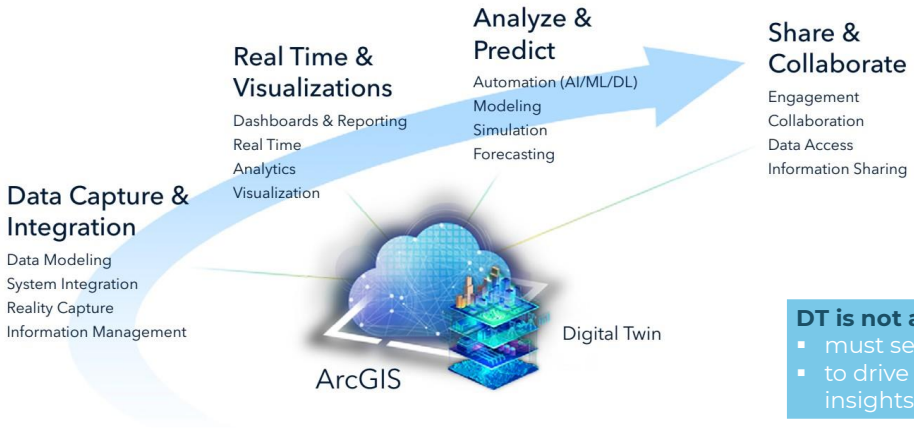
IMDF Data Model (OGC standard)	Archibus (workplace mng.)	AutoCAD (floor plans)	GIS	SAP (PM & RE)	Cadastral
Geographic Data					
Site (Venue)	Site	Poligono	Site	Località	Particelle Cat. Terreni
Location data					
Fabbricato (Building + footprint)	Building	Perimetro + Nome File	Facility	Fabbricati + altre SeTE	Particelle Cat. Fabbricati
Piano (Floor)	Floor	File per Piani	Level		
Locale (Unit)	Room	Perimetro + etichetta	Unit		Vani (planimetria)
Assets (equipments)					
Equipment (Fixture)	Equipment		POI	Impianti o SeTE	
Management perimeters					
Sezioni (Section)	Room	Perimetro + etichetta	Section	Ogg. Architettonici	Subalterno Cat. Fabb
Geofence	Room	Perimetro + etichetta	Zone	Oggetti Locativi	



"DT as a foundation concept – Nexus Project Perspective", Ms. Monica Oliveira, Sector Lead – Transportation, Esri Portugal; Mr. Nuno Alves, Sr Consultant, Esri Portugal

- Geographic information is crucial in maritime activities;
- GIS can be the glue that allows several stakeholders, visualize, analyze, monitor, planning, take decisions and engage with their customers and communities;
- A DT should be a living system, gathering information from several types and fonts of data and information, most of them are geographically related;
- DT is not an end in itself. It needs a purpose to serve and drive meaningful insights and decisions;
- Nexus Location Intelligence Platform.

Digital Twin:: Life Cycle



DT is not an end in itself
- must serve a purpose
- to drive meaningful insights and decisions

Value Proposition

- **Decision support and validation system**
  - **Real-time awareness** of the situation and movements in port
  - **Berth plans and maneuvers creation** with advanced simulation capabilities
  - Anticipate changes and **adapt to new scenarios** (alerts for operational adjustments)
  - Permanent evaluation of secutiry thresholds

- **Collaborative environment**
  - Integration of data from **different sources and processes** (Port calls, business rules, operational and natural constraints
  - **Automate data collection**
  - Stakeholders and systems **information sharing** at the time when its needed

Value Proposition

- **Optimization**
  - **Optimize** the usage of berths and **operational resources**
  - Use of **historical data** to automate decisions and give suggestions
  - **Measure and analyze** the efficiency of the process

"DT applications for ports' accessibility, pilot's training, simulations and 3D modelling", Ms. Maria Grazia Socievole, Jr Naval Architect and Marine Engineer, CETENA Port assessment team Mr. Daniele Milazzo, Sr Naval Architect and Marine Engineer, CETENA Port assessment team

- 3D modelling provides realistic and immersive scenarios, optimising the efficiency and quality of the Digital Twin and its applications
- GIS softwares enable the creation of realistic 3D models by integrating geospatial data and real-world coordinates.
- Port assessment is the set of analysis and simulation techniques aimed at analysing the operational context of the port ecosystem.
- DT enable the simulation, monitoring, and optimization of port operations in real-time, with human-in-the-loop integration to enhance efficiency, safety and sustainability.

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CETENA DT EVOLUTION

Technological advancements have enabled a transition over the past 40 years from electromechanical solutions to fully digital ones.

In recent years, the qualitative performance improvement has been exponential.

Looking ahead, we anticipate a further surge driven by the adoption of emerging technologies.

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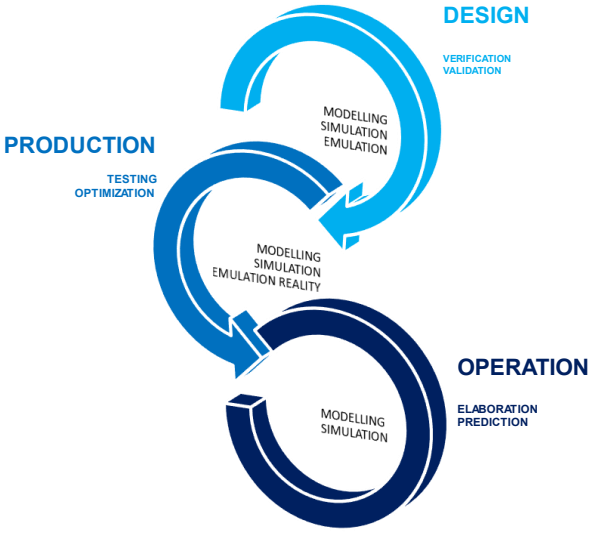
DIGITAL TWIN

Digital Twin (DT)is a virtual replica of a physical system, integrated with real-time data, enabling simulations, predictive analysis, and process optimization for improved decision-making.



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IN CONCLUSION

Digital Twins allow real-time simulation based on the human in the loop paradigm.

This requires enabling tools such as GIS software, which generate artifacts using high-precision data.

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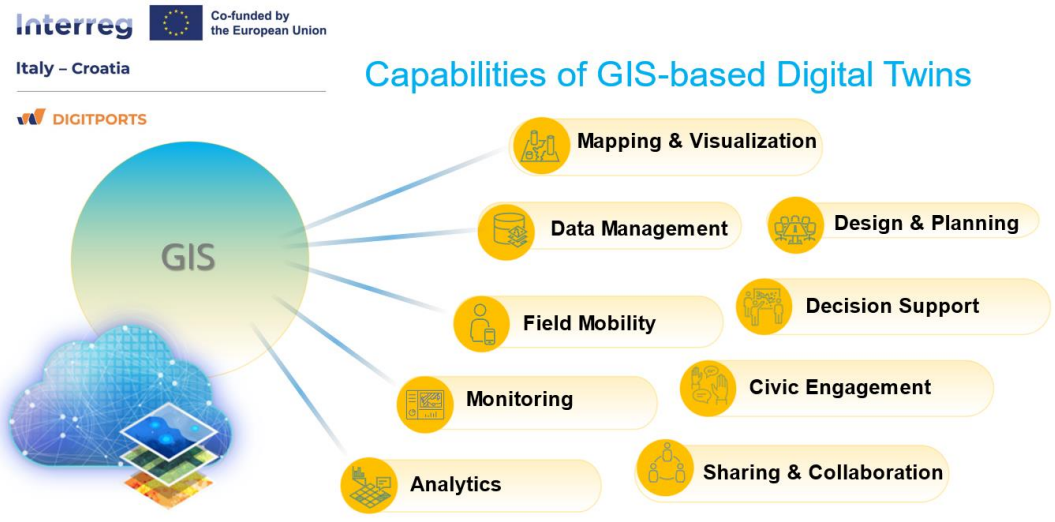
Session 3: DT AS TOOL FOR EFFECTIVE STAKEHOLDERS ENGAGEMENT

"External relations: Communications with stakeholders and port/cities communities", Mr. Ian Koeppel, BD Manager, Transportation, Esri Inc

- When working with stakeholders, mutual trust among the various party is very important
- New, easily understandable and specific communication tools must be used
- GIS-based DT can be used for
    - Create interactive infographics, surveys and dashboards
    - Analyze sentiment on initiatives and changes
    - Facilitate two-way engagement with community
- Interconnecting People, Organizations and Stakeholders with GIS HUBS
- Telling stories with Maps allows to share Maps and Reports and helps with public engagement, internal communication, education



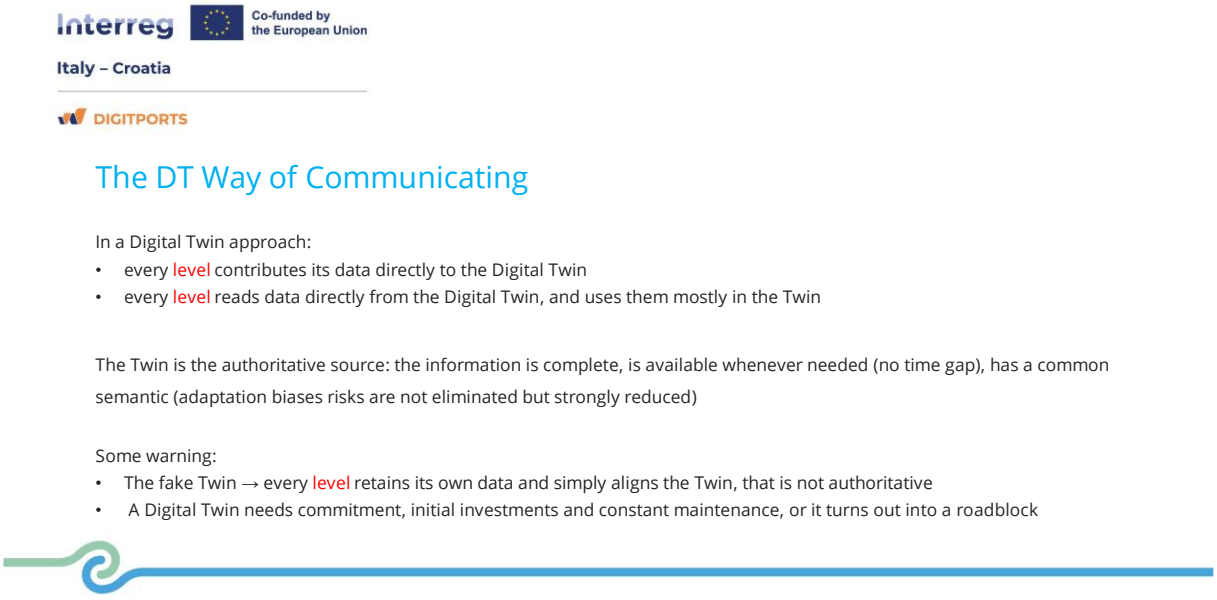
Bring Stakeholders Together

Selected Use Cases

- Port of London - Interactive Master Planning Maps
- Port of Rotterdam - PortMaps Portal
- Ports of North Sea - IMMERSE project
- Port of Boulogne sur Mer - GIS-BIM Integration video

"Internal communications: DT as cultural change driver", Mr. Leonida Bucci, CDO, Esri Italia

- The world is moving fast, trades are constantly growing, competition is high, time and prices are the main KPIs
- Competition is embracing the digital revolution to become faster and more convenient, and a Port Authority must also adapt to the new pace.
- In this ever-changing digital world, effective communication is vital at all levels, especially in the field of Digital Twins.
- A classic type of communication shows its limitations.
- More modern communication can be achieved with DT.
- The main barrier in DT adoption is the human factor, which requires sharing, transparency, trust and accountability



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Conclusions

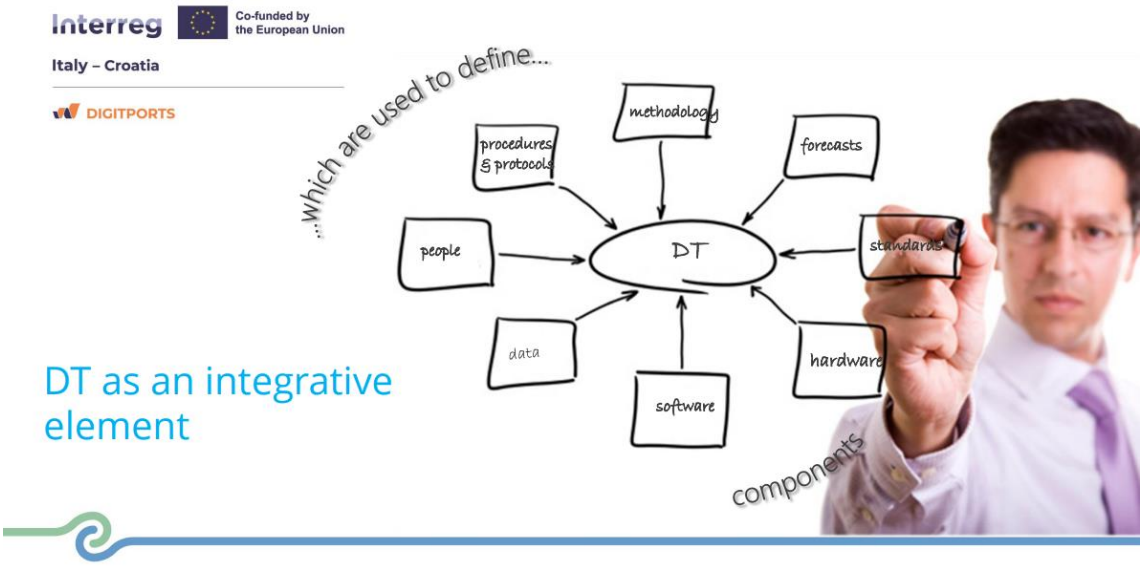
Using the Digital Twin as the vital component for internal communication should not be seen as an option, but rather as a structural feature.

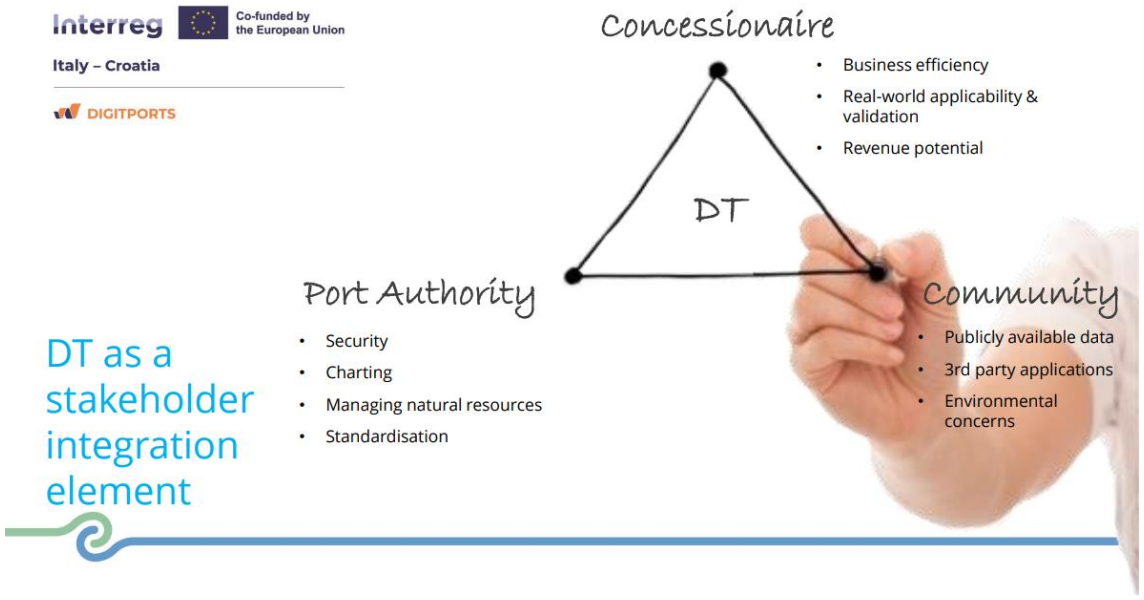
Using the Digital Twin all the different stakeholders inside the Port collaborate in a fast, accurate and risk managed way

Modern competition cannot be faced with siloed approaches any more

"Conclusions", Mr. Dražen Vrhovski, PhD, EERing, DIGITPORTS Scientific Board (HR Member)

- Conclusions

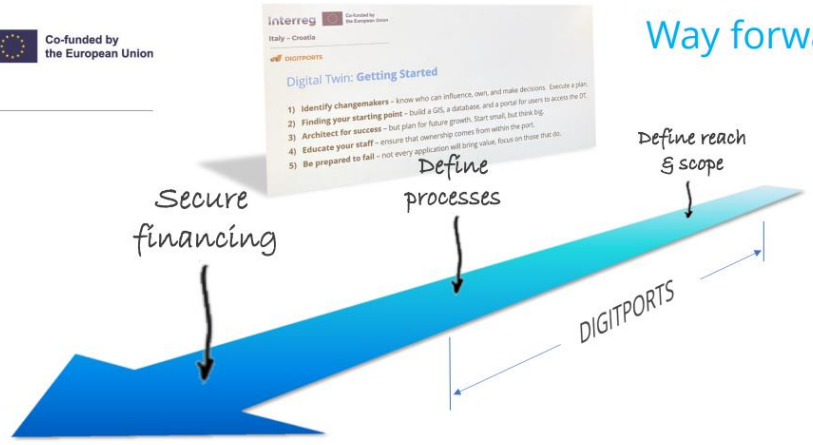




Typical challenges

- DT system **ownership**
  - Business process management responsibility
  - Revenue potenial → data ownership, IPR...
  - Output integrity
- **People**
  - Staffing
  - Outsourcing
- Financing
  - Implementation and maintenance
  - Budgeting
- Wider area **applicability**
  - Standardisation (processes, components and outputs)
  - **Scalability** and unification
  - Implementation and operationalisation framework/strategy

Way forward



3. Follow up training session n. 4

The follow up training session were delivered Online, on February 17, 2025.

3.1 Topics selection

Topics covered in the follow-up training session are the following:

- Drafting functional and technical specifications for the pilot actions;
- Risk management in the procurement and execution phases of the pilots;
- BIM/GIS integration for environmental monitoring in constructions sites.

3.2 Agenda

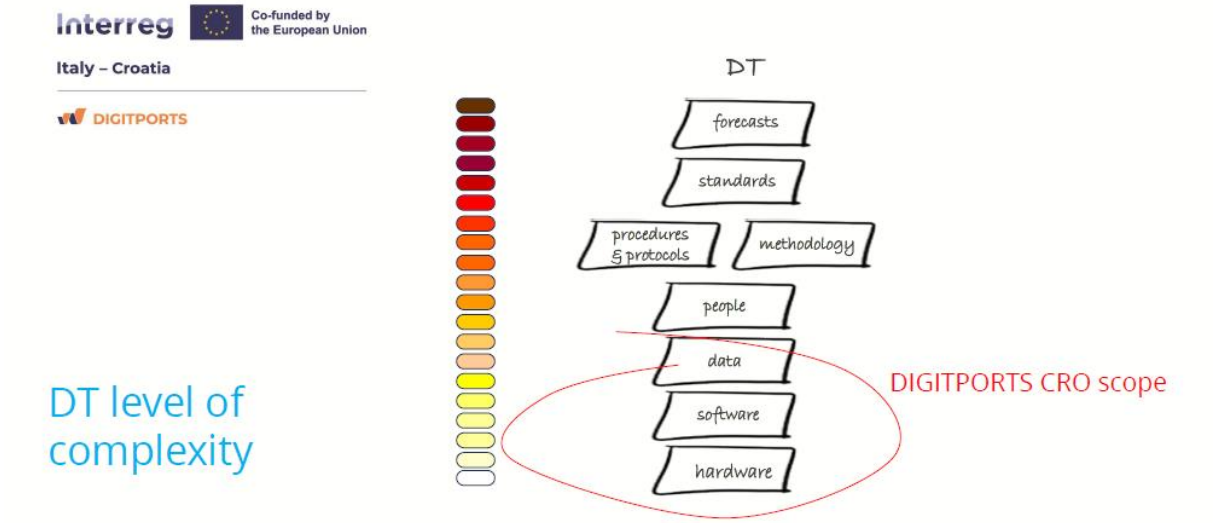
DIGITal Twins applications for safer and greener Adriatic PORTS operations
High level training follow up session 4
Online session - 17/02/2025 – h. 11-13

Session 4		
Timing	**Topics**	**Speakers**
11:00 – 11:15	Welcoming and wrap up of first 3 sessions of training held on 28/01	Mr. Sebastiano Ferrara, Director Innovation and Digitalization, North Adriatic Sea Port Authority, DIGITPORTS LP
11:15– 11:35	Drafting functional and technical specifications for the pilot actions	Mr. Dražen Vrhovski, PhD, EERing, DIGITPORTS Scientific Board (HR Member)
11:35 – 12:00	Risk management in the procurement and execution phases of the pilots	Mr. Sasa Aksentijevic PhD, EERing, DIGITPORTS Scientific Board (HR Member)
12:00 – 12:15	Q&A	
12:15 - 12:40	BIM/GIS integration for environmental monitoring in constructions sites	Mr. Michele Ieradi, CTO Esri Italia Spa
12:40 – 13:00	Q&A and conclusions	

3.3 Presentations Excerpts

"Drafting functional and technical specifications for the pilot actions", Mr. Dražen Vrhovski, PhD, EERing, DIGITPORTS Scientific Board (HR Member)

- Best practices replicability report
- Summary from the High Level Training
- Challenges and mitigations



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DIGITPORTS CRO reach

Concessionaire
- Business efficiency
- Real-world applicability & validation
- Revenue potential

DT

Port Authority
- **Security**
- **Charting**
- **Managing (natural) resources**
- Standardisation

Community
- Publicly available data
- 3rd party applications
- Environmental concerns

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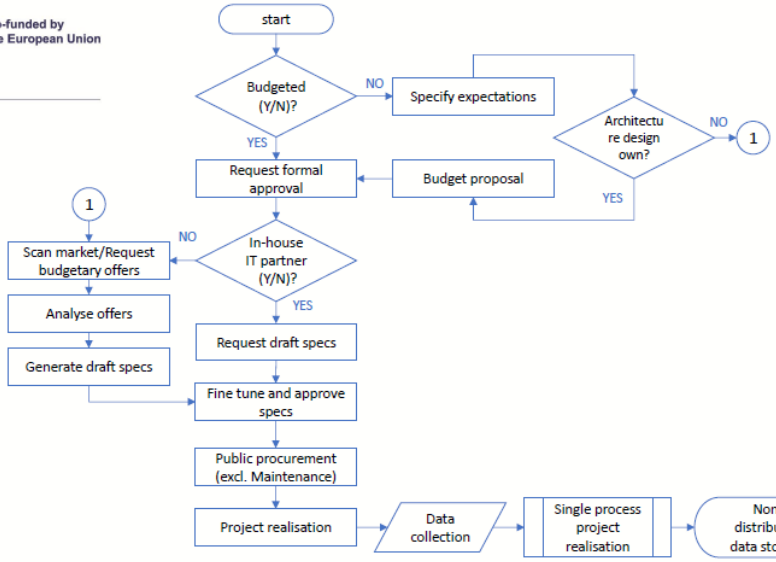
Typical roadmap



"Risk management in the procurement and execution phases of the pilots", Mr. Sasa Aksentijevic PhD, EERing, DIGITPORTS Scientific Board (HR Member)

- Introduction to Risk Management in Digital Twin Projects
- Key risk in Digital Twin implementation
- Risk mitigation strategies
- Specific risks for DIGITPORTS Pilot Projects
- Generale risks in Digital Twin Projects

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Specific Risks for Split and Ploče Pilot Projects

Challenges in Port Digitalization

- **Split - AI-powered Energy Management:** Risk: Accuracy of AI-driven energy demand forecasting and real-time monitoring.
- **Split - RFID Cargo Tracking:** Risk: System reliability and stakeholder adoption of real-time tracking solutions.
- **Ploče - SmartPortPloče 5G Network:** Risk: Connectivity issues and security vulnerabilities in private 5G infrastructure.
- **Ploče - Port Community System:** Risk: Integration challenges with existing transport management systems.

Photo by Anton Sharov on Unsplash

Both Split and Ploče ports face unique digitalization risks. Split's AI-powered energy management requires accurate demand forecasting to avoid inefficiencies. The adoption of RFID-based cargo tracking also depends on seamless stakeholder integration. Ploče, meanwhile, is implementing a private 5G network under SmartPortPloče, which presents potential connectivity and security risks. Additionally, integrating a new Port Community System with existing transport management frameworks is a key challenge. Addressing these risks ensures the successful implementation of digital twin applications in these ports.

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Wrap-Up & Key Takeaways

Risk Management in Digital Twin Implementation

Proactive Risk Management
Early identification and mitigation of risks ensure smoother implementation.

Stakeholder Engagement
Collaboration among port authorities, policymakers, and operators is key.

Sustainability & Innovation
Balancing technological advancement with environmental and financial sustainability.

As we conclude, it's essential to recognize that successful digital twin implementation in Adriatic ports hinges on effective risk management. Proactively identifying and mitigating risks can prevent disruptions and ensure smooth deployment. Strong stakeholder engagement, involving policymakers, port authorities, and private operators, is crucial to align strategies and foster collaboration. Lastly, balancing innovation with sustainability—both financial and environmental—is key to long-term success. By addressing these aspects, Adriatic ports can lead the way in maritime digitalization.

"BIM/GIS integration for environmental monitoring in constructions sites", Mr. Michele Ieradi, CTO Esri Italia Spa

- Together, GIS and BIM support scenario planning
  - Environmental constraints for site selection
  - Line-of-sight analysis for surroundings development
- GIS and BIM support also construction and maintenance phase
  - IoT sensor location and real-time monitoring

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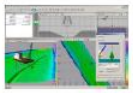
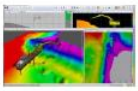
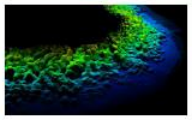
DREDGE GUIDANCE

REAL-TIME MONITORING OF DREDGING ACTIVITIES THROUGH GRAPHICAL AND NUMERICAL INFORMATION



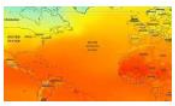


MONITORING OF THE EVOLUTION OF THE SEABED



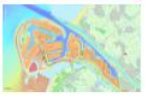
ENVIRONMENTAL DATA ACQUISITION

OTHER DATA



GIS PLATFORM ON CONFIGURABLE DASHBOARDS

HISTORY FOR DATA ANALYSIS VIEWABLE IN 4D – "ONE CLICK" REPORTING"



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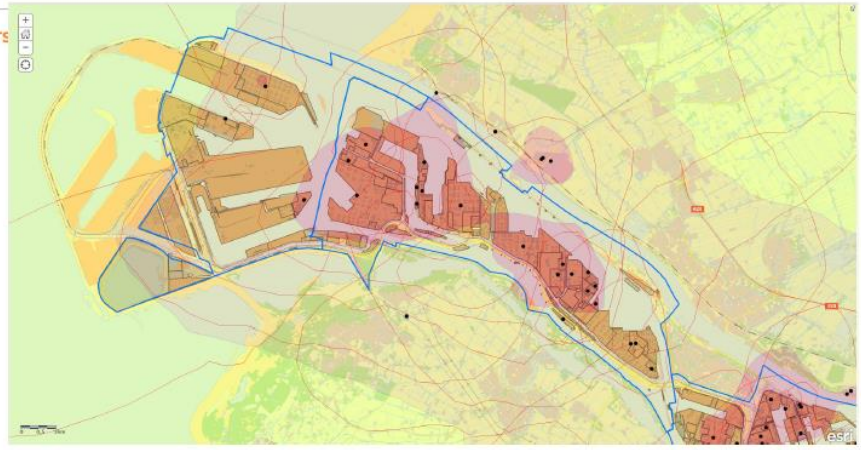
Environmental data



4. Attachments

For the full downloadable package of the presentations delivered during the Training Sessions, please visit the DIGITPORTS project's official website: https://www.italy-croatia.eu/web/digitports

5. Glossary

Acronym	Description
2D	**2 D**imensional (it refers to objects or representations that have only two dimensions: X, Y
3D	**3 D**imensional (it refers to objects or representations that have three dimensions: X, Y and Z (height/depth)
4D	**4**th **D**imension (in context Engineering and CAD, integrates time-base information in 3D models)
5G	**5**th **G**eneration (of mobile network technology)
AEC	**A**rchitecture **E**ngineering **C**onstruction
AI	**A**rtificial **I**ntelligence
BIM	**B**uilding **I**nformation **M**odeling
CAD	**C**omputer **A**ided **D**esign
CRM	**C**ustomer **R**elationship **M**anagement
DB	**D**ata**B**ase
DL	**D**eep **L**earning
DSM	**D**igital **S**urface **M**odel
DTM	**D**igital **T**errain **M**odel
DT	**D**igital **T**win
ENC	**E**lectronic **N**avigational **C**harts
ERP	**E**nterprise **R**esource **P**lanning
ESRI	**E**nvironmental **S**ystems **R**esearch **I**nstitute
GIS	**G**eographic **I**nformation **S**ystem
GSD	**G**round **S**ampling **D**istance
IMDF	**I**ndoor **M**apping **D**ata **F**ormat
IoT	**I**nternet **o**f **T**hings
IPR	**I**ntellectual **P**roperty **R**ights
IT	**I**nformation **T**echnology

ML	**M**achine **L**earning
O&M	**O**peration **And M**aintenance
PM	**P**roject **M**anager
POC	**P**roof **O**f **C**oncept
RDBMS	**R**elational **D**ata**B**ase **M**anagement **S**ystem
SAR	**S**ynthetic **A**perture **R**adar
TEU	**T**wenty-foot **E**quivalent **U**nit
UI	**U**ser **I**nterface