Interreg Italy - Croatia INTESA

EUROPEAN UNION

RAM S.p.a. Logistica · Infrastrutture · Trasporti

INTESA Project

Information Technology for Safety: synergies on National Single Windows integration for the Adriatic and Ionian Region

Dott. Roberto Mencarelli

16th December 2021

European Regional Development Fund

Politecnico di Torino

MAIN CURRENT IT TECHNOLOGIES APPLIED IN THE PORT DOMAIN

OBJECTIVES

SAFETY, OPTIMIZATION OF PORT OPERATIONS (BOTH LANDSIDE AND SEASIDE)

1. **INTERNET OF THINGS (IoT)**
   It is a network of items that includes sensors and embedded systems which are connected to the Internet and enable physical objects to gather and exchange data
2. **TRUCK APPOINTMENT SYSTEM**
   It is a digital platform that allows transport companies to book a precise time slot in which the truck can enter the terminal gate
3. **BIG DATA ANALYTICS**
   "Big Data" is the name given to the large volume of data which can be collected using different technologies; the "analytics" part consists in applying algorithm to analyze them
4. **CLOUD-COMPUTING**
   It includes the provision of computer services including servers, storage, databases, networking, softwares, analytics and intelligence over the internet ("the cloud")
5. **FAST CORRIDORS**
   They are immaterial infrastructures that allow Custom procedures to be carried out not at the container terminal but at inland logistic nodes (road and rail)

MAIN CURRENT IT TECHNOLOGIES APPLIED IN THE PORT DOMAIN

OBJECTIVES

SAFETY, OPTIMIZATION OF PORT OPERATIONS (BOTH LANDSIDE AND SEASIDE)

6 **INTERNATIONAL STANDARDS**

They are documented agreements on representation, format, definition, structuring, tagging, transmission, manipulation, use, and management of data

7 **BLOCKCHAIN**

It is a shared and immutable ledger that facilitates the process of recording transactions and monitoring assets in a business network

8 **DIGITAL TWIN**

It is the digital representation of a physical object or system

9 **DRONES**

They are robots which collect data: they can be aircrafts or aquatic drones, remotely controlled or completely autonomous

Interreg Italy - Croatia INTESA
European Regional Development Fund
EUROPEAN UNION

MAIN CURRENT IT TECHNOLOGIES IN THE PORT DOMAIN

OBJECTIVES

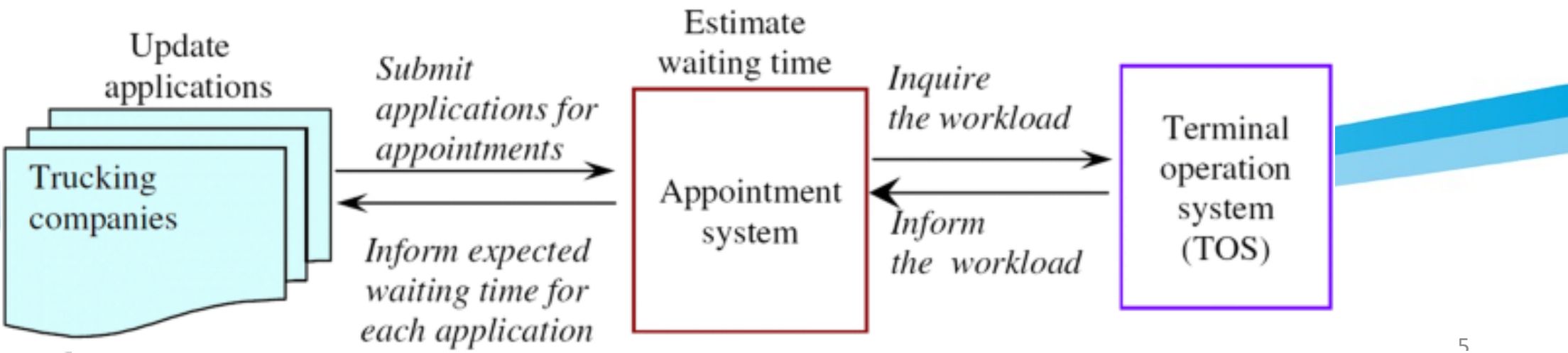
SAFETY, OPTIMIZATION OF PORT OPERATIONS (BOTH LANDSIDE AND SEASIDE)

INTERNET OF THINGS (IoT)	*It is a network of items that includes sensors and embedded systems which are connected to the Internet and enable physical objects to gather and exchange data*
TRUCK APPOINTMENT SYSTEM	*It is a digital platform that allows transport companies to book a precise time slot in which the truck can enter the terminal gate*
BIG DATA ANALYTICS	*"Big Data" is the name given to the large volume of data which can be collected using different technologies; the "analytics" part consists in applying algorithm to analyze them*
CLOUD-COMPUTING	*It includes the provision of computer services including servers, storage, databases, networking, softwares, analytics and intelligence over the internet ("the cloud")*
FAST CORRIDORS	*They are immaterial infrastructures that allow Custom procedures to be carried out not at the container terminal but at inland logistic nodes (road and rail)*
INTERNATIONAL STANDARDS	*They are documented agreements on representation, format, definition, structuring, tagging, transmission, manipulation, use, and management of data*
BLOCKCHAIN	*It is a shared and immutable ledger that facilitates the process of recording transactions and monitoring assets in a business network*
DIGITAL TWIN	*It is the digital representation of a physical object or system*
DRONES	*They are robots which collect data: they can be aircrafts or aquatic drones, remotely controlled or completely autonomous*

TRUCK APPOINTMENT SYSTEMS

What is a Truck Appointment System (TAS)?

- It is a **digital platform**, managed by **terminals** or **Port Authorities**, that allows transport companies to **book in advance their arrival at the terminal** (to pick up or release a container/trailer) in a **specific time slot** of the gate opening time windows.
- The **demand of trucks** arriving on an hourly basis becomes **predictable** and **controllable**, and takes into account the optimal planning of terminal resources
- 2 main types:
  - **compulsory TAS**: trucks without a booking are not allowed to access the terminal (the system is more rigid) and a maximum truck turnaround time is usually guaranteed
  - **facultative TAS**: trucks without a booking can access the terminal but their service level is not guaranteed



Yi, S., Scholz-Reiter, B., Kim, T., & Kim, K. H. (2019). Scheduling appointments for container truck arrivals considering their effects on congestion. Flexible Services and Manufacturing Journal, 31(3), 730-762.

TRUCK APPOINTMENT SYSTEMS

MAIN BENEFITS:

- ✓ Reduction of **congestion** issues inside and outside the port area
- ✓ More efficient **planning** of **terminal resources** and increased productivity
- ✓ Reduction of **negative externalities** (CO_2 emissions, local pollution)
- ✓ Increased **service level** to truckers (reduced **truck turnaround time**)
- ✓ More efficient **logistic chain management**

POINT OF ATTENTION:

- In addition to terminals/port authorities, other relevant stakeholders must be **involved** in the TAS design and management, such as **truckers**!
- The specific features (type of TAS, penalties and no show up management, tariffs) of the TAS must be carefully chosen according to the particular terminal context.

- *Caballini, C., Gracia, M. D., Mar-Ortiz, J., & Sacone, S. (2020). A combined data mining–optimization approach to manage trucks operations in container terminals with the use of a TAS: Application to an Italian and a Mexican port. Transportation Research Part E: Logistics and Transportation Review, 142, 102054.*
- *Caballini, C., Mar-Ortiz, J., Gracia, M. D., & Sacone, S. (2018, November). Optimal truck scheduling in a container terminal by using a Truck Appointment System. In 2018 21st International Conference on Intelligent Transportation Systems (ITSC) (pp. 2525-2530). IEEE.*
- *Ambrosino D., Caballini C., Peirano L., Sacone S. (2019), "A mathematical model to face congestion issues in container terminals through a non-mandatory Truck Appointment System", International Conference on Optimization and Decision Science (ODS)-AIRO 2019, September 4-7, Genoa, Italy*
- *Caballini, Claudia, and Simona Sacone. "Simulation of novel algorithms to reduce truck congestion at container terminals." 2021 7th International Conference on Models and Technologies for Intelligent Transportation Systems (MT-ITS). IEEE, 2021.*

TRUCK APPOINTMENT SYSTEMS

Some ports using a TAS:

- **Port of Hamburg**
- **Port of Southampton**
- **Port of Felixstowe**
- **Port of Hamina-Kotka**
- **Port of Busan**
- **Port of Los Angeles**
- **Port of Long Beach**
- **Port of Hong Kong**
- **Port of Jebel Ali**

A Truck Appointment System is an important tool to reach:

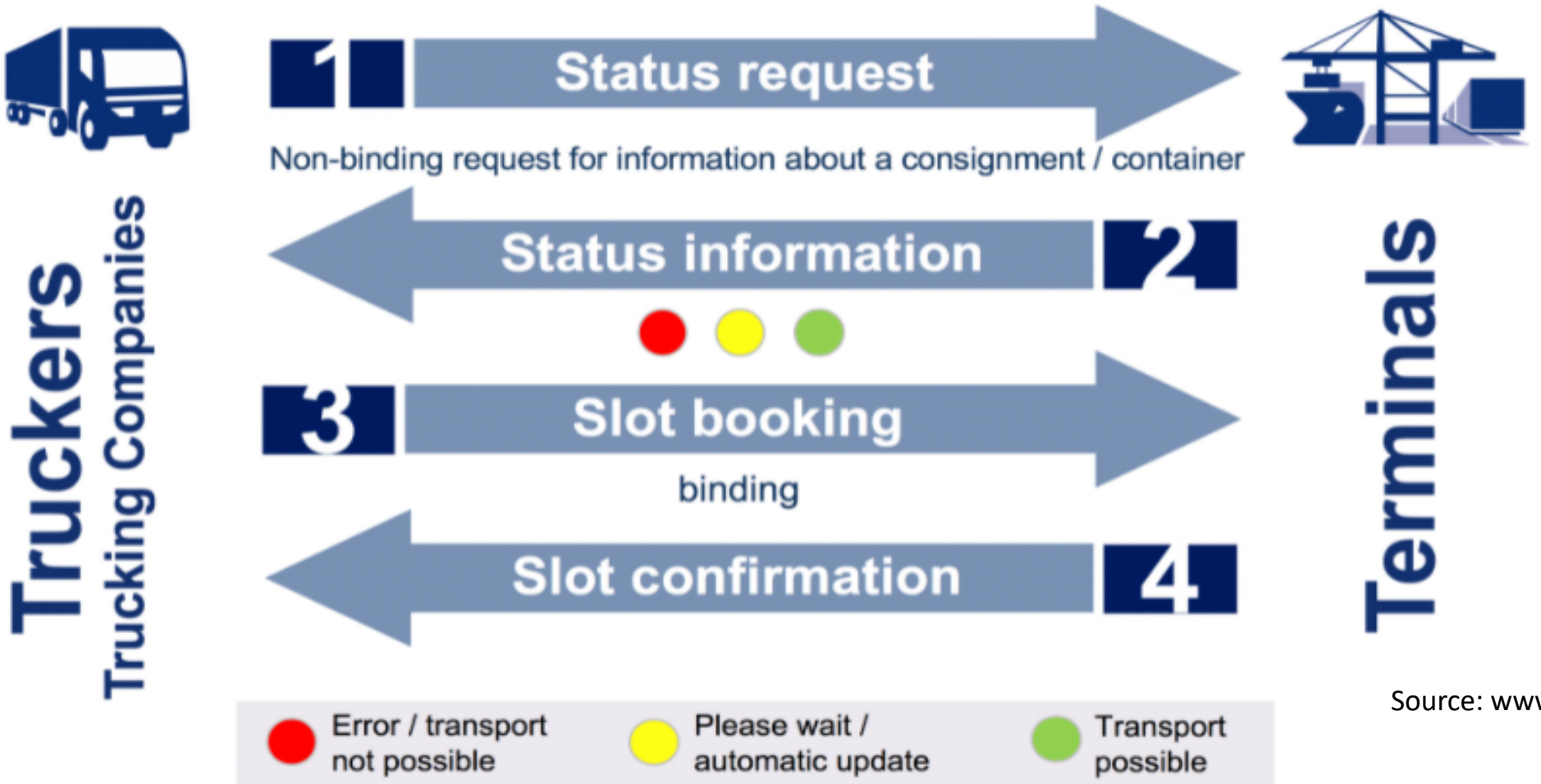
- *Greater **efficiency***
- *More **sustainable** port activities (reduced **congestion** and **environmental pollution** inside and near the terminal)*

Different approaches and rules can be set:

- *TAS compulsory or optional*
- *Penalties for no show up*
- *Multiple bookings*

A best practice: Port of Hamburg

The Port of Hamburg introduced the Truck Appointment System in 2017 to **avoid bottlenecks** and **improve efficiency**.



Source: www.dakosy.de

A best practice: Port of Hamburg

How does it work?

APPOINTMENT TIME PHASE

Source: www.dakosy.de

Rules:

- Never arrive at the terminal without a slot booking or if your arrival time differs greatly from your booked slot (see Priority 3).
- Always endeavor to arrive at the terminal within the booked time window (see Priority 1). A truck can only be processed within the extended leeway period (see Priority 2) if the situation at the terminal allows it.
- Cancel or rebook your slot as soon as you realize you won't be able to make it for your booked time window. In any case before the start of the time window! This is the only way to enable the terminals to plan realistically and offer available capacities to everyone as best they can.

Interreg Italy - Croatia INTESA
European Regional Development Fund
EUROPEAN UNION

A best practice: Port of Hamburg

Benefits:

Seaport

- Optimizes planning for truck routes
- More efficient use of existing infrastructure through avoidance of peak time overloads
- Increased attraction for the location

Terminals

- Avoids peak-time overloads
- More efficient disposition
- Faster dispatching
- Flexible allocation of resources
- Avoidance of wait times and traffic jams at the terminal entrance
- Standardized and uniform processes
- Support (24x7)

Truckers/Forwarders

- Dispatch within the slot time (+/- 30 min.)
- Better planning and disposition possibilities
- High transparency due to the terminal capacity utilization display
- Simple integration of the slot booking procedure into your own in-house IT system
- More than 20 external software solutions available, e.g. UNIKAT GE Truck
- Support (24x7)

Interreg Italy - Croatia INTESA
European Regional Development Fund
EUROPEAN UNION

MAIN CURRENT IT TECHNOLOGIES IN THE PORT DOMAIN

OBJECTIVES

SAFETY, OPTIMIZATION OF PORT OPERATIONS (BOTH LANDSIDE AND SEASIDE)

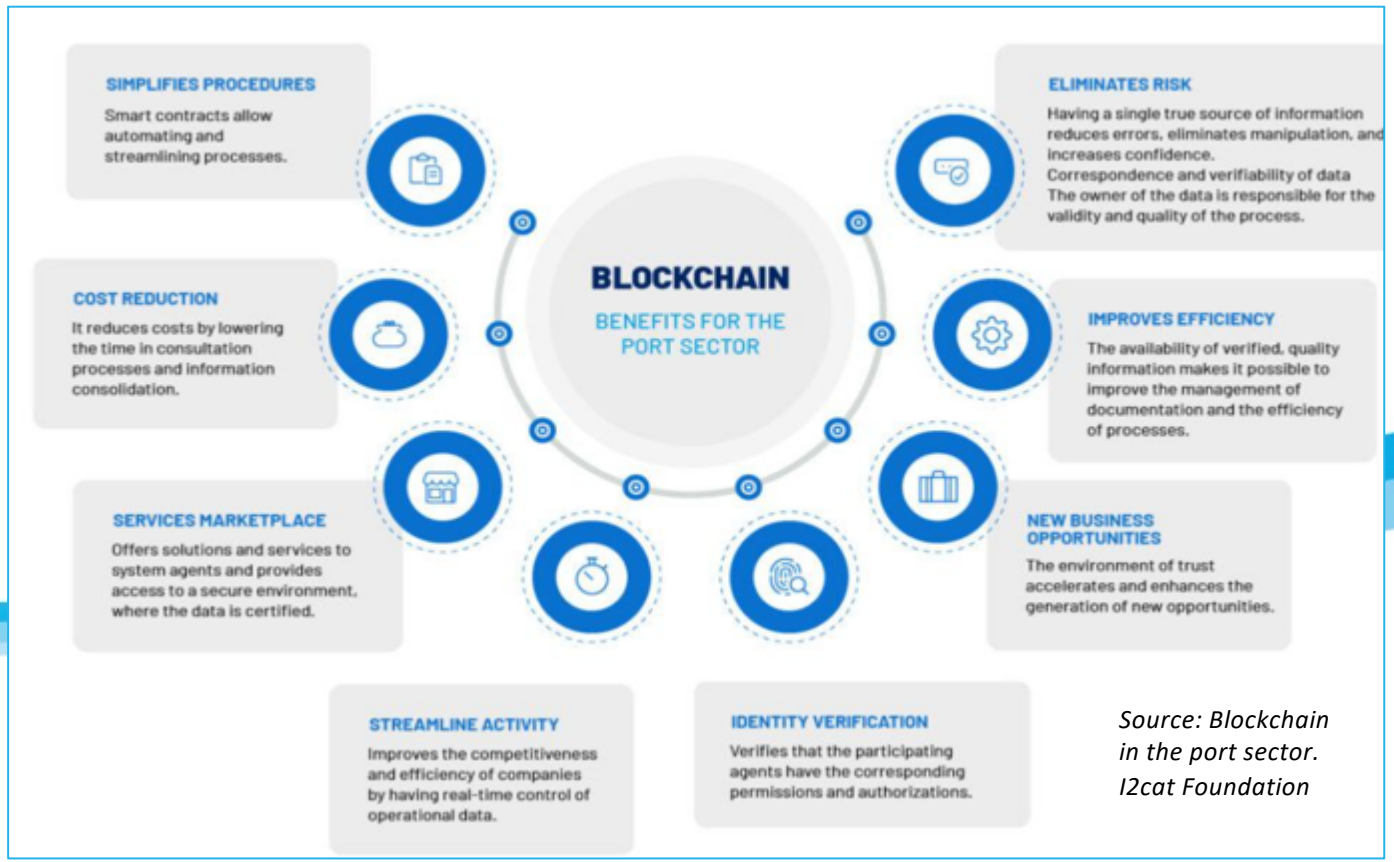
INTERNET OF THINGS (IoT)	*It is a network of items that includes sensors and embedded systems which are connected to the Internet and enable physical objects to gather and exchange data*
TRUCK APPOINTMENT SYSTEM	*It is a digital platform that allows transport companies to book a precise time slot in which the truck can enter the terminal gate*
BIG DATA ANALYTICS	*"Big Data" is the name given to the large volume of data which can be collected using different technologies; the "analytics" part consists in applying algorithm to analyze them*
CLOUD-COMPUTING	*It includes the provision of computer services including servers, storage, databases, networking, softwares, analytics and intelligence over the internet ("the cloud")*
FAST CORRIDORS	*They are immaterial infrastructures that allow Custom procedures to be carried out not at the container terminal but at inland logistic nodes (road and rail)*
INTERNATIONAL STANDARDS	*They are documented agreements on representation, format, definition, structuring, tagging, transmission, manipulation, use, and management of data*
BLOCKCHAIN	*It is a shared and immutable ledger that facilitates the process of recording transactions and monitoring assets in a business network*
DIGITAL TWIN	*It is the digital representation of a physical object or system*
DRONES	*They are robots which collect data: they can be aircrafts or aquatic drones, remotely controlled or completely autonomous*

BLOCKCHAIN

What is Blockchain?

- A blockchain is a **shared and immutable ledger** that facilitates the process of **recording transactions** and **monitoring assets** in a business network.
- When a transaction occurs, it is recorded as a "**block**" of data and each block is linked to the previous one. After this process the two transactions are blocked together in an irreversible chain: the blockchain.

This technology is becoming increasingly useful in creating digital platforms ***for sharing information in the port industry more efficiently*** *and with a* ***higher security level.***



Source: Blockchain in the port sector. I2cat Foundation

Interreg Italy - Croatia INTERREG European Regional Development Fund

EUROPEAN UNION

BLOCKCHAIN

Some ports using Blockchain:

Port of Antwerp	*Blockchain based document workflow*
Port of Rotterdam	*Container logistics Blockchain pilot*
Port of Busan	*Blockchain platform implementation*
Port of Marseille	*PCS implementation using Blockchain*
Port of Abu Dhabi	*The first Abu Dhabi entity to develop and launch its own blockchain technology*
Port of Barcelona	*PCS implementation using Blockchain*

Interreg Italy - Croatia INTESA European Regional Development Fund

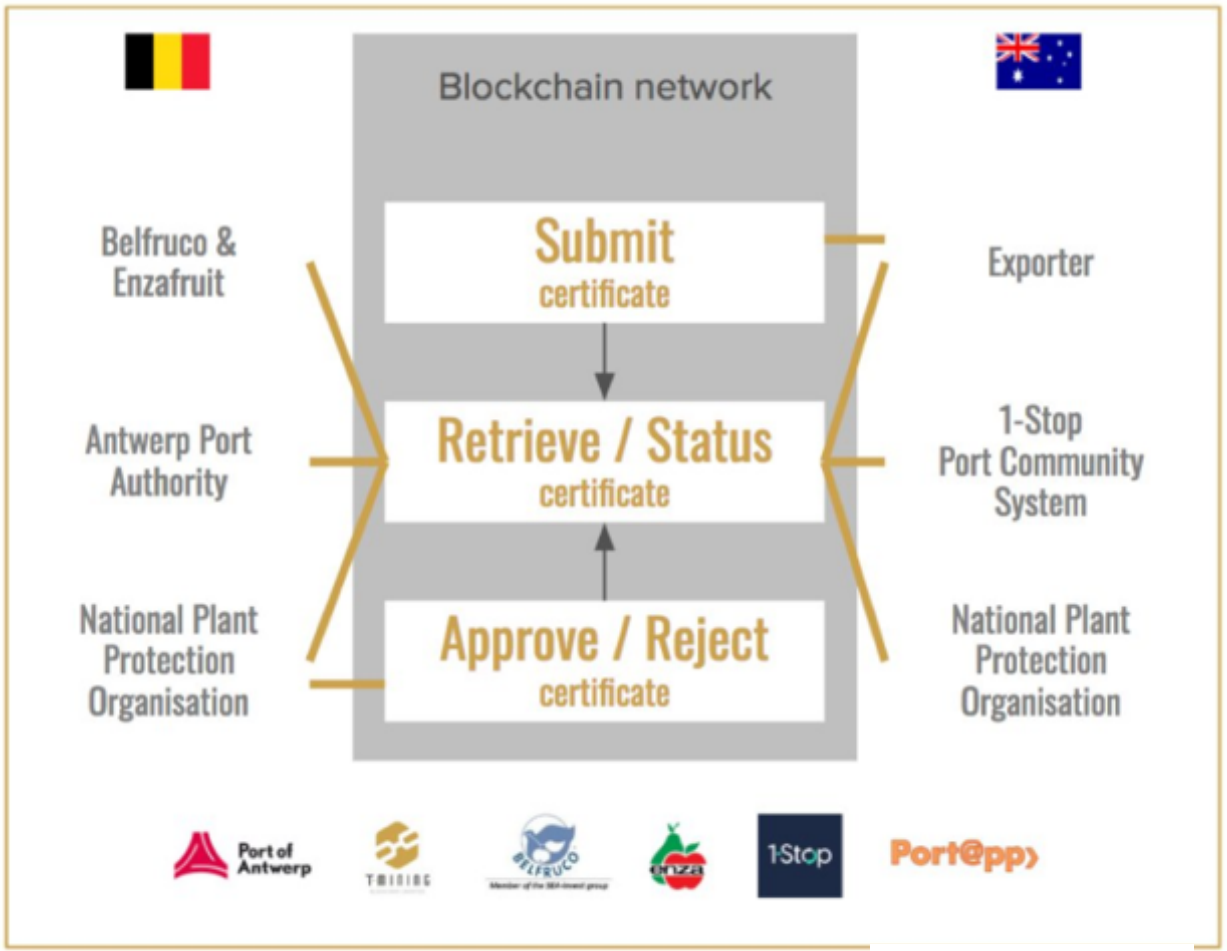
EUROPEAN UNION

BLOCKCHAIN

Blockchain and safety

- The Blockchain technology is mainly used to increase security; however, it can also be implemented to **increase safety** along the logistic chain.

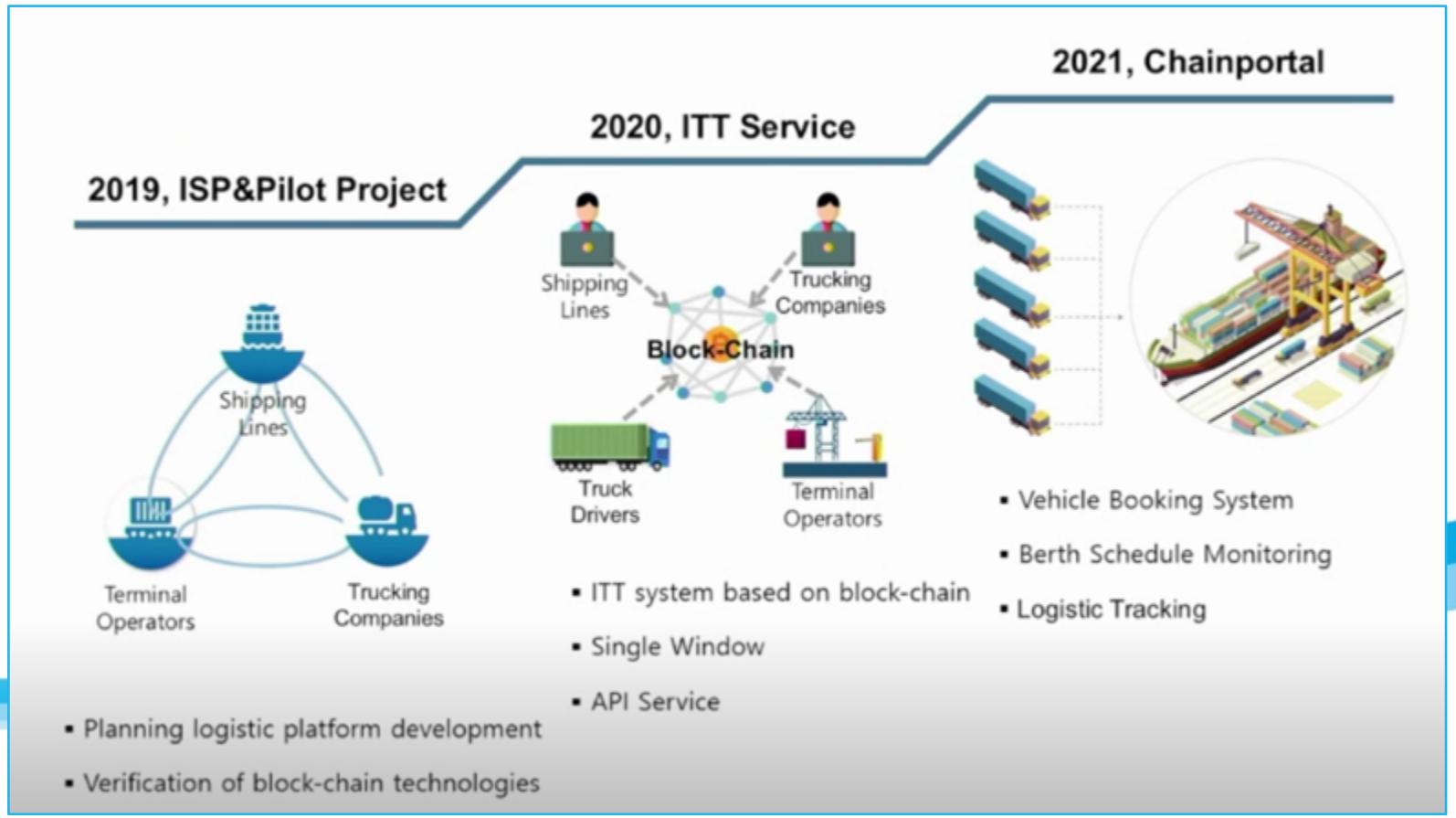
- In 2018 the Port of Antwerp started a pilot project partnering with the start-up T-Mining: all documents were transferred using Blockchain.
- A specific solution was developed for **phytosanitary certificates**, together with Belfruco, Enzafruit, PortApp, 1-Stop and T&G Global, **to guarantee the safety of fruit and vegetables.**
- In particular, the pilot required that fruit imported from New Zealand and destined to the European market were provided with digital phytosanitary certificates that were transferred via blockchain technology.



Source: safety4sea.com

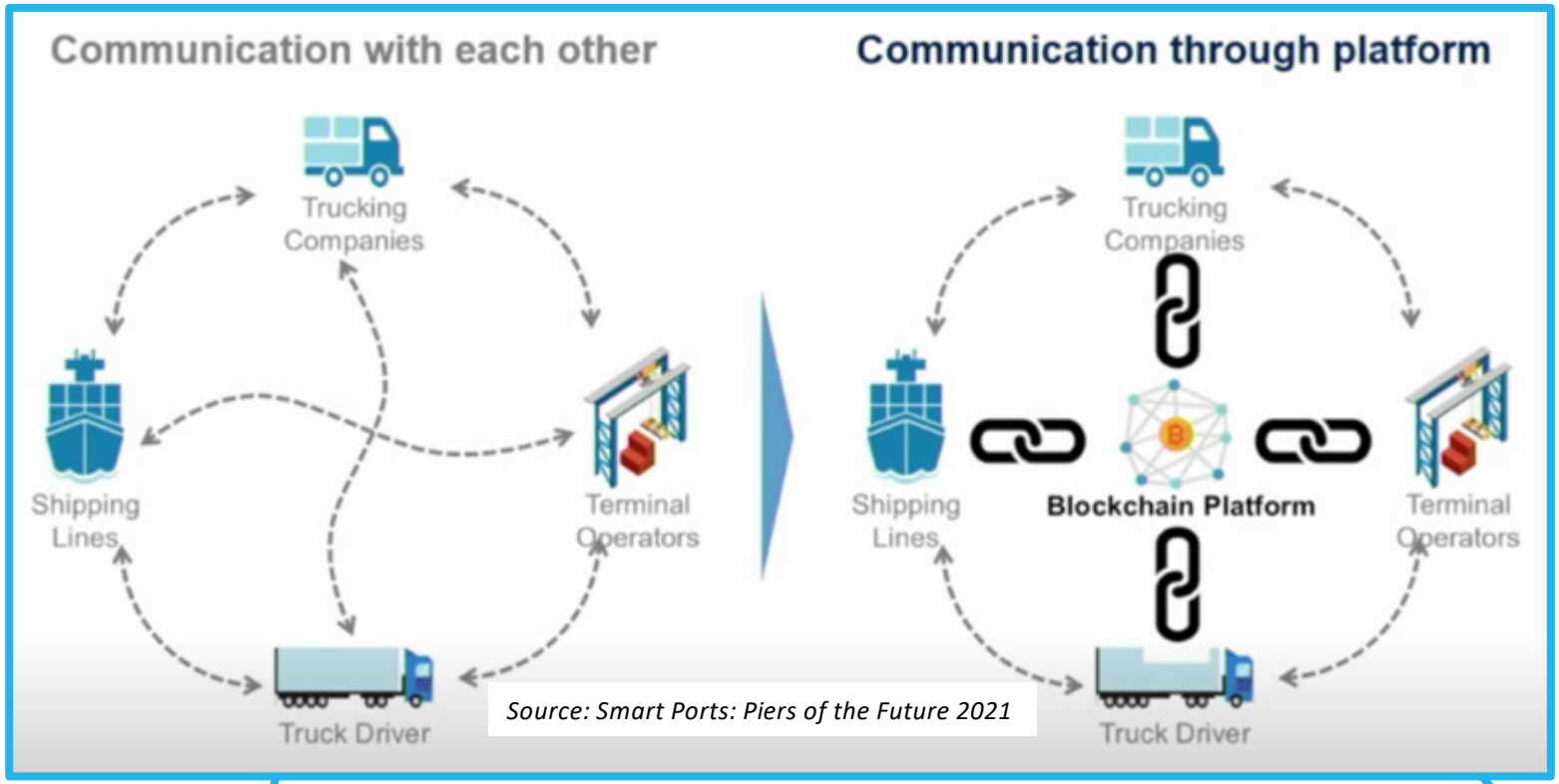
A best practice: Port of Busan

- To enhance efficiency in sharing information between the port stakeholders, a Blockchain platform has been implemented in the Port of Busan.
- For the success of the project it was important to **involve all the stakeholders** to cooperate in order to develop the platform using a step-by-step approach.



Source: Smart Ports: Piers of the Future 2021

A best practice: Port of Busan

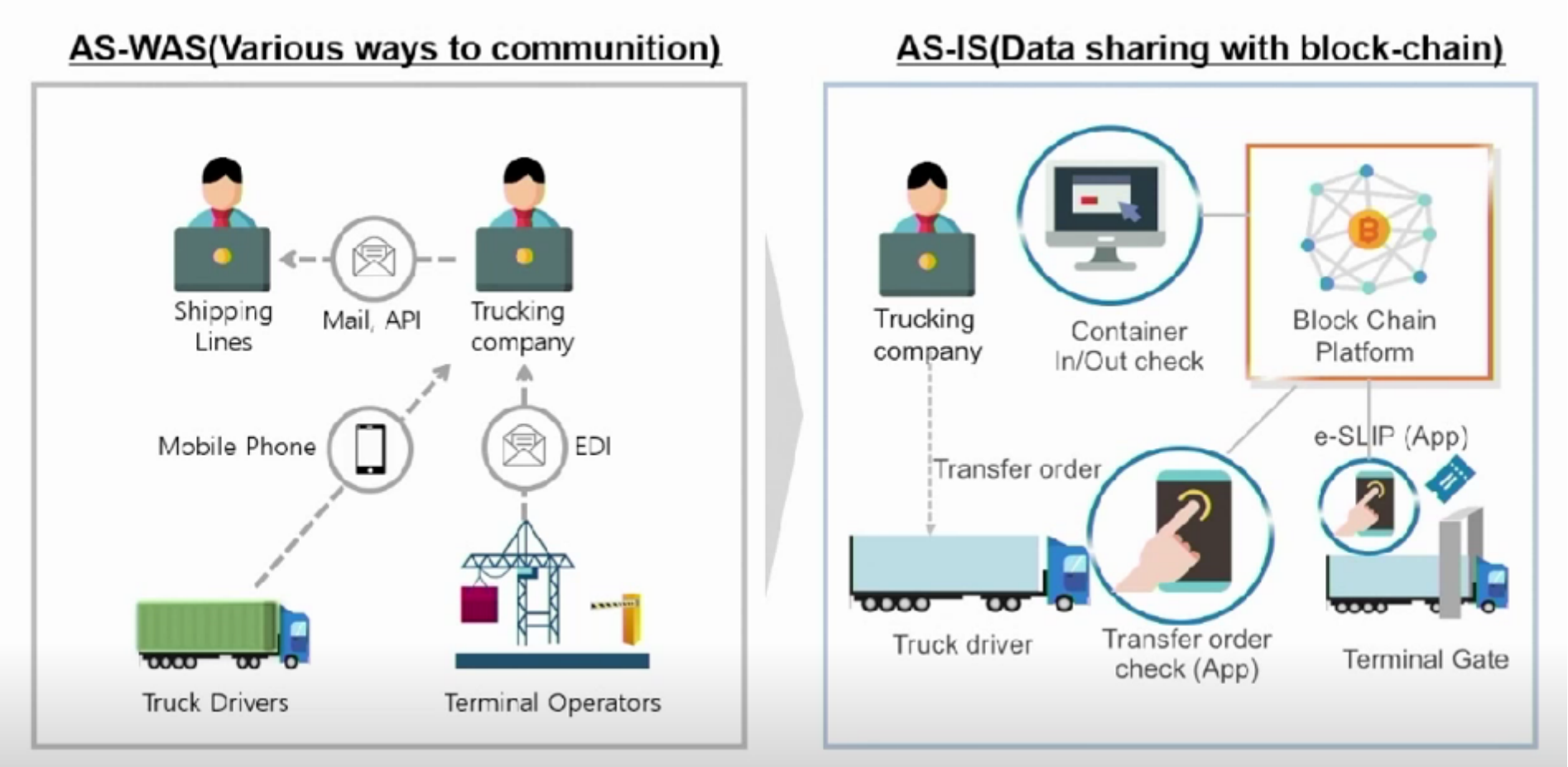


Source: Smart Ports: Piers of the Future 2021

A great amount of stakeholders (9 terminal operators, about 300 trucking companies, about 50 shipping lines…) communicate with each other in several ways (IT systems, emails, phone…) and that makes information sharing slow and inefficient due to data duplications and errors.

- The Blockchain technology enables ***real-time data sharing***.
- This platform guarantees a single source of information ***reducing errors*** and *eliminating data manipulations*.
- The availability of verified real-time data allows faster and more efficient operations, increasing also ***safety***.

A best practice: Port of Busan



Source: Smart Ports: Piers of the Future 2021

The vehicle booking system implemented in the port of Busan uses the Blockchain technology to improve data management.
Trucking companies and terminal operators can *share data more efficiently* through each blockchain node *saving time* and *decreasing* operational *costs*.

BLOCKCHAIN

A best practice: Port of Barcelona

- ***PORTIC**, the PCS of the port of Barcelona, announced in May 2021 its integration with **TradeLens, the blockchain-enabled digital logistics platform*** developed by A.P. Moller-Maersk and IBM. *The Blockchain technology enables exchange of information in real time* contributing to more transparent and secure operations.
- ***PORTIC** is **the first and only PCS in Spain to be integrated with the TradeLens platform**, consolidating the strategy of the Port of Barcelona and its Port Community to continue advancing as a smart port*.

www.tradelens.com

MAIN CURRENT IT TECHNOLOGIES IN THE PORT DOMAIN

OBJECTIVES

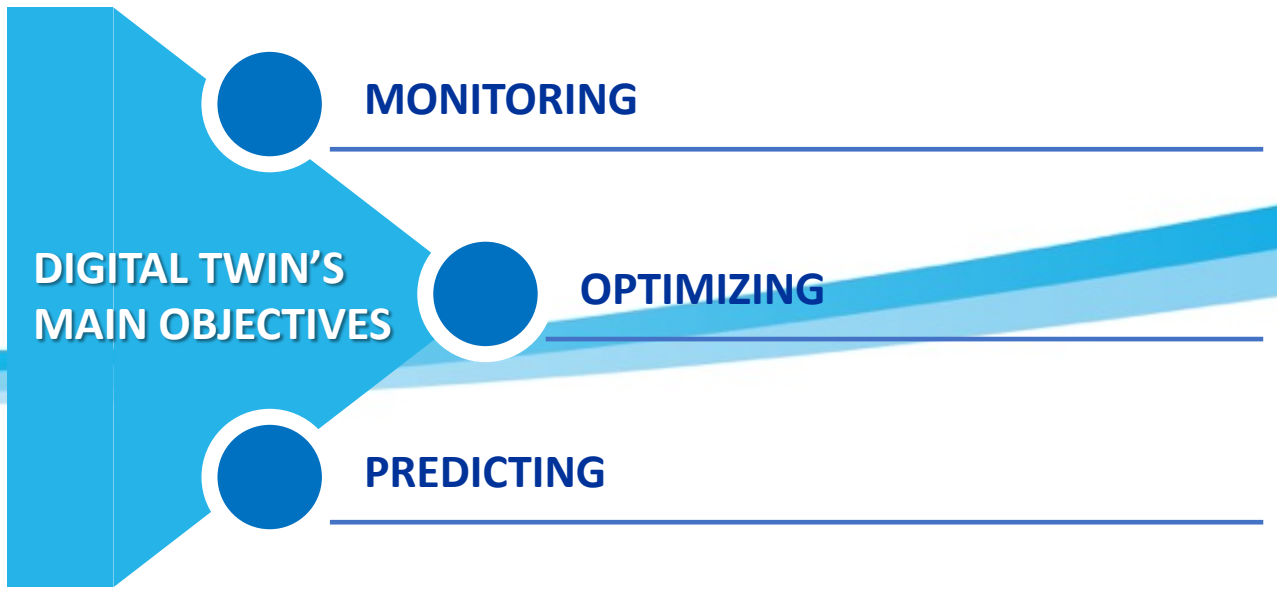
SAFETY, OPTIMIZATION OF PORT OPERATIONS (BOTH LANDSIDE AND SEASIDE)

INTERNET OF THINGS (IoT)	*It is a network of items that includes sensors and embedded systems which are connected to the Internet and enable physical objects to gather and exchange data*
TRUCK APPOINTMENT SYSTEM	*It is a digital platform that allows transport companies to book a precise time slot in which the truck can enter the terminal gate*
BIG DATA ANALYTICS	*"Big Data" is the name given to the large volume of data which can be collected using different technologies; the "analytics" part consists in applying algorithm to analyze them*
CLOUD-COMPUTING	*It includes the provision of computer services including servers, storage, databases, networking, softwares, analytics and intelligence over the internet ("the cloud")*
FAST CORRIDORS	*They are immaterial infrastructures that allow Custom procedures to be carried out not at the container terminal but at inland logistic nodes (road and rail)*
INTERNATIONAL STANDARDS	*They are documented agreements on representation, format, definition, structuring, tagging, transmission, manipulation, use, and management of data*
BLOCKCHAIN	*It is a shared and immutable ledger that facilitates the process of recording transactions and monitoring assets in a business network*
DIGITAL TWIN	*It is the digital representation of a physical object or system*
DRONES	*They are robots which collect data: they can be aircrafts or aquatic drones, remotely controlled or completely autonomous*

DIGITAL TWIN

What is a Digital Twin?

- ***A Digital Twin is the digital representation of a physical object or system*** made possible by **IoT technologies** which allow to collect different kind of data. This technology has great potential since it is flexible and can serve different purposes.
- Sensors can measure the **location** of an object in the port area and can also collect **data on weather conditions** such as wind, **temperatures** or the **mooring/unmooring** of a ship.
- **Real-time monitoring** is probably the primary functionality this technology makes available.
- A digital Twin allows **simulations** to be run both to **improve efficiency** and to **predict events** to **optimize port management and safety**.



DIGITAL TWIN

Few of the ports which use Digital Twin:

- **Port of Antwerp**
- **Port of Rotterdam**
- **Port of Montreal**
- **Port of Singapore**
- **Port of Hamburg**
- **Port of Livorno**
- **Port of Oulu**

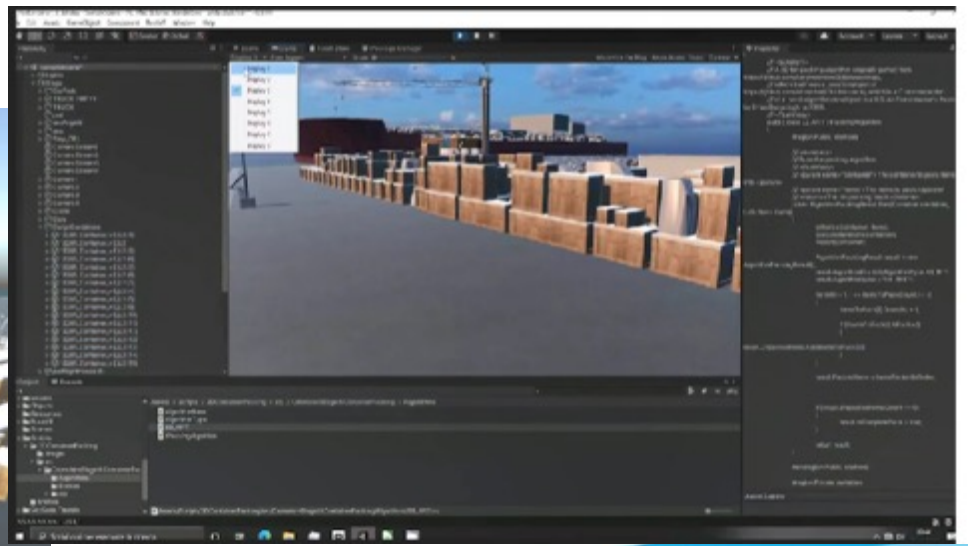
The Digital Twin technology is versatile and it can be used for different purposes:

- *to optimize port operations to increase efficiency;*
- *for strategic reasons simulating port changes;*
- *to reach a higher level of safety and security in the port area.*

A best practice: Port of Livorno

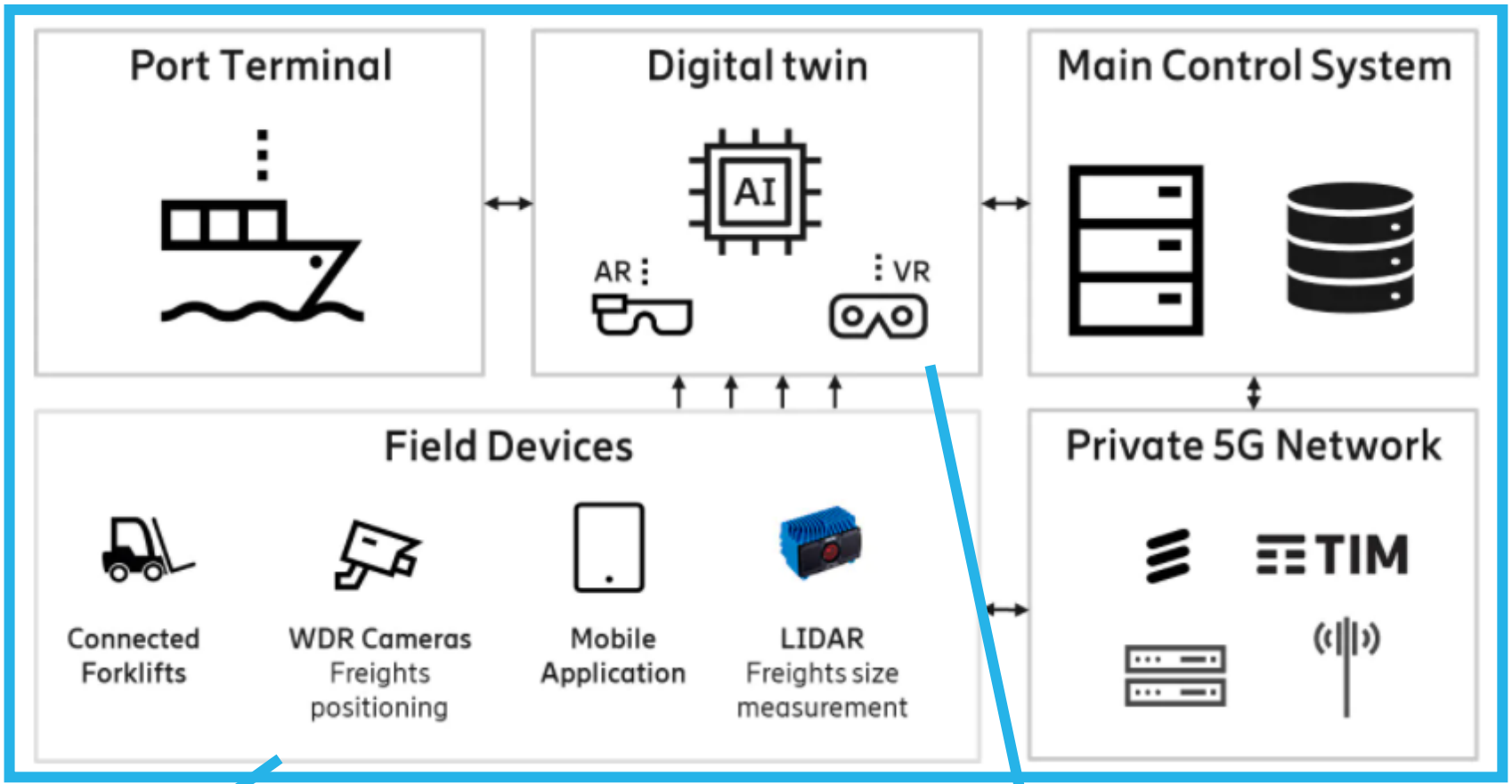
The port of Livorno implemented the Digital Twin technology with Ericsson applying it to the **general cargo** trade cathegory to provide a realistic digital representation of the port area with the objetcives of:

- ✓ ***Real time monitoring*** of the complete port site
- ✓ ***Simulation*** of optimal strategies for storage and loading operations
- ✓ Easy and ***safe training*** of terminal operators



Source: www.ericsson.com

Best practice: Port of Livorno



5G connected objects feed a Digital Twin engine which works in real time.

- AI (Artificial Intelligence) determines a sequence of optimal logistic tasks and activities, provides data to supervisors and delivers updates to the dock and quay operators.
- It is also possible to virtually navigate the port area using the Oculus headset.

Source: www.ericsson.com

Best practice: Port of Livorno

POSITIVE IMPACTS:

AUTOMATION

- Automated solutions to handle the seaport general cargo process
- Computer aided solutions to support general cargo goods handling and identify specific activities as “high risk” such as moving larger loads increasing SAFETY

EFFICIENCY

- Increase operational speed
- Reduce operational costs

SUSTAINABILITY

- Reduction of movements in cargo handling reducing environmental impacts

INNOVATION

- The project benefits from the use of disruptive technologies, including IoT, data analytics, AI (Artificial Intelligence), image recognition and emerging 5G networks to achieve its goal

Source: www.corealis.eu

Thank you for your kind attention!