



COREALIS Livorno Demo/Training Webinar

# 5G-enabled IoT smart terminal operations (RTPORT)

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# Agenda

- Project Goals
- Infrastructure in the Port
- The General Cargo Logistics use case
- Main Innovation- RTPORT
- Livorno Living Lab





# Project Goals

***Adapt and introduce new technologies, tools and methods to increase the port capacity, efficiency and safety with a positive environmental and societal footprint.***

## Real Time Port (RTPORT)

A set of IoT devices connected through 5G network will enable new disruptive port logistic operations

Ericsson's developed main control system will improve automation in cargo operations

Closed loop communication and collaboration between machines will increase efficiency

Sustainable Port concept: Carbon footprint reduction and improvement of environmental sustainability





## Focus: bulk goods

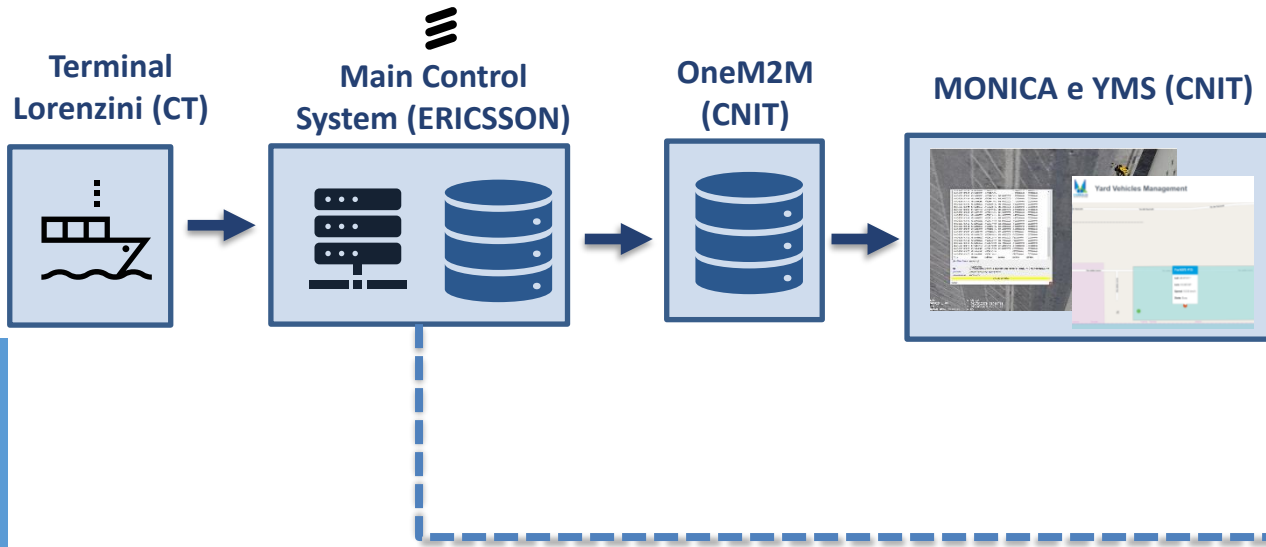


### Bulk good handling

- No standard size
- No standard weight
- No automation on handling
- Difficult to optimize logistic operations for loading/uploading and optimize storage capability

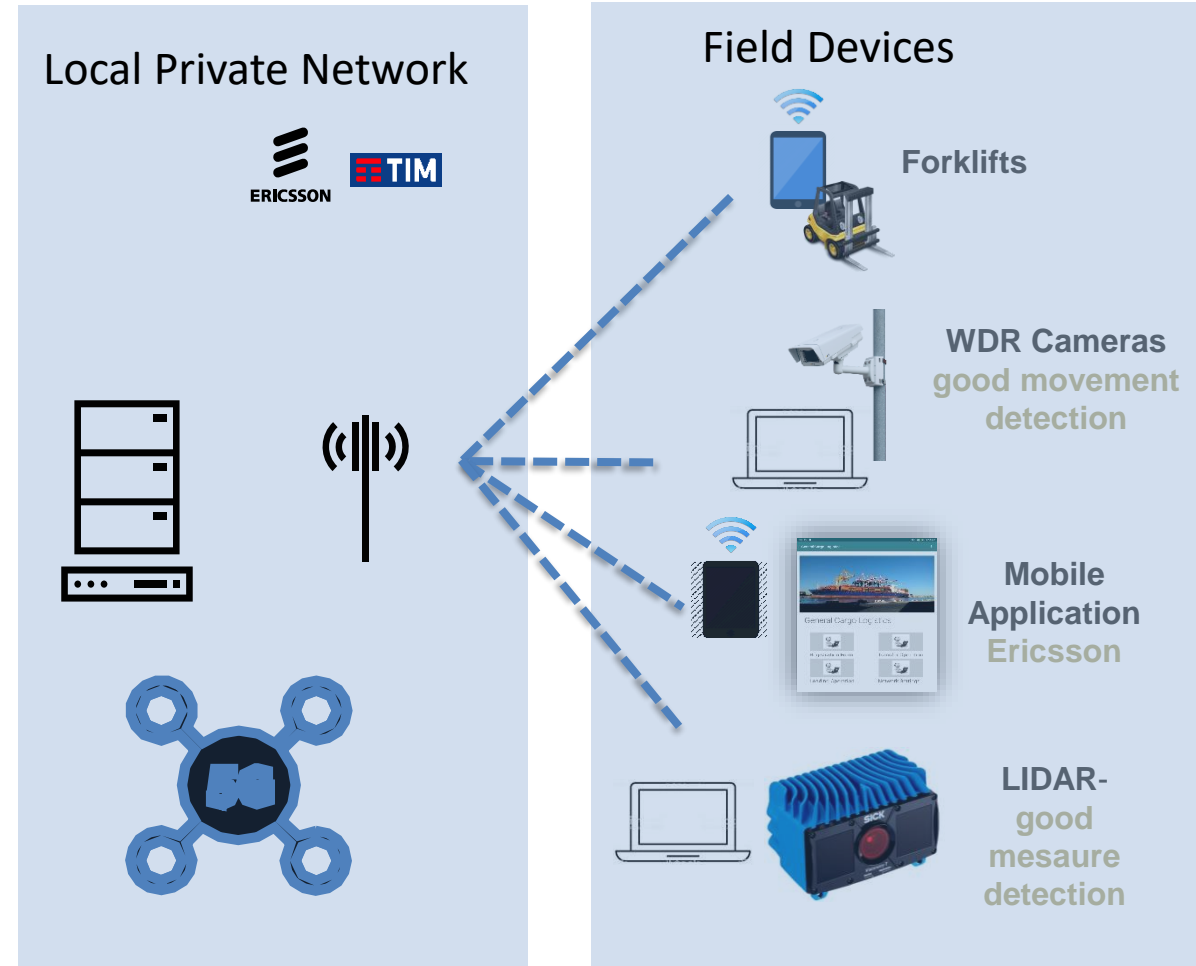


# Infrastructure



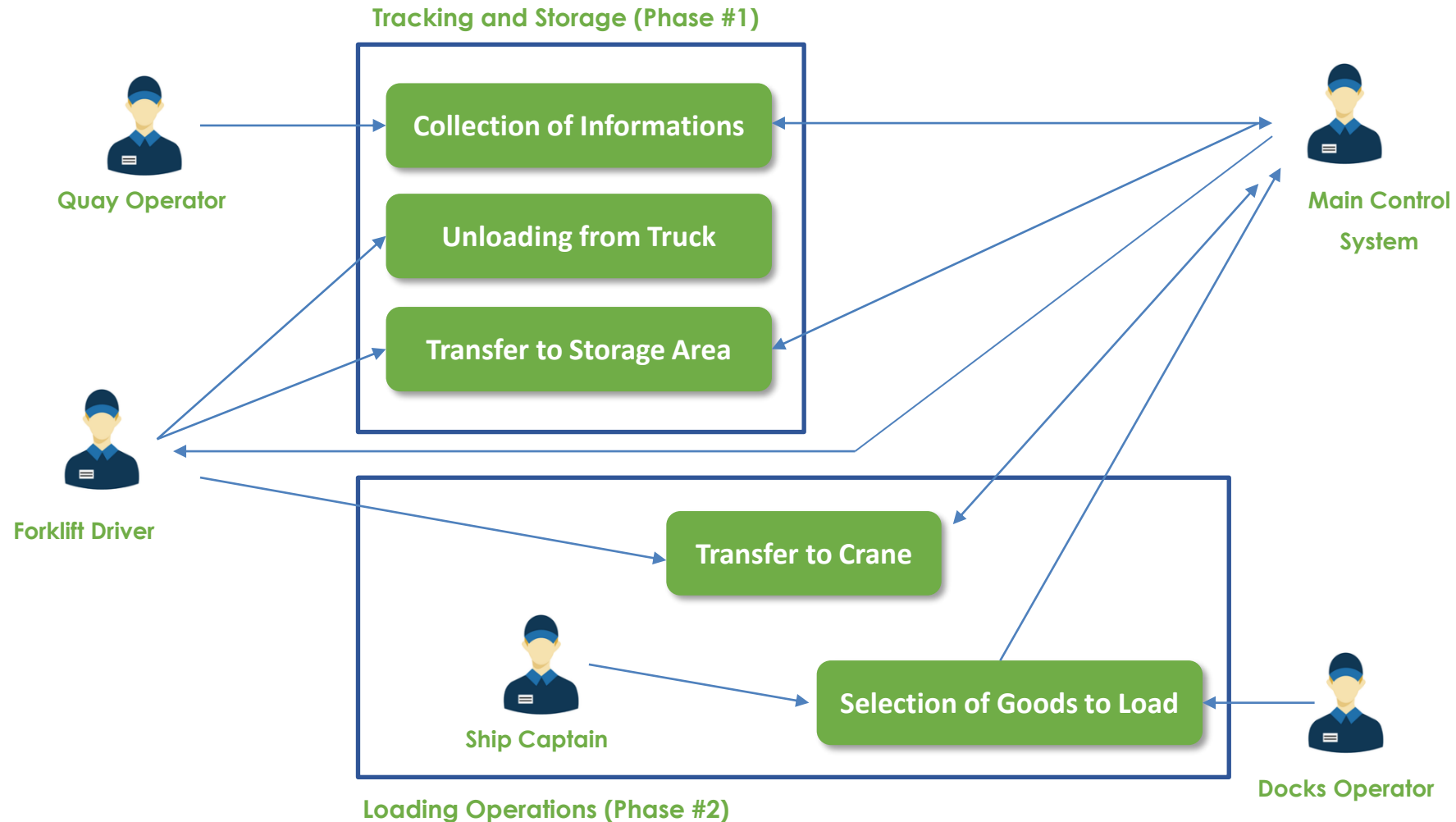
## Logistic chain for bulk cargo handling

- RDBMS
- Application server
- Mini PC Ericsson





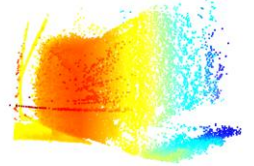
# The General Cargo Logistics Use Case





# RTPORT: Main Innovations (1/2)

- Computer aided solution to automate the identification and registration phase of the arriving pallets in the docking area
  - 3D LIDAR for goods size acquisition
  - Real time 3D cloud of points analysis for freight size measurement
- Computer assisted location of goods in the docking area
  - Solar powered Wide Dynamic Range cameras 5G connected for multi-stereoscopic vision of objects to detect their position
  - Image recognition and tracking
  - Operational research algorithms for finding targets positions
- Automated solution to support workers at the docks in finding the proper pallet/box to take in front of the crane for the loading
  - AR applications for improving efficiency in sparse goods handling in the enabled port area
- IoT Android Apps used as HMI with the smart control system
- Use of a relational database and a rule based expert system to handle the seaport process
- VR application for optimal sorting of freights in the yard and remote quality check



Solar powered 5G connected camera on a pole





## RTPORT: Main Innovations (2/2)

5G, providing more flexibility, higher bandwidth and low latency, is a key enabling technology for RTPORT:

- Enable through 5G network AR application for improving efficiency and safety in goods handling in the port area
  - Need to correlate real-time information captured from sparse sensors and provide feedbacks to operators with very low latency
- Enable through 5G real-time positioning of vehicles and freights using cameras
  - Cameras for AR and positioning check requiring high bandwidth (about 10 Mbps) and low latency (10 ms)







# RTPORT - Livorno Living Lab Activities



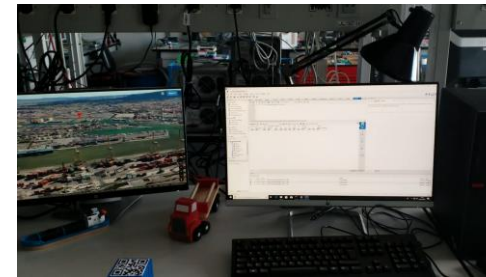
# RTPORT: Livorno Living Lab Activities (1/3)

Already tested at the port of Livorno:

- The main control system of the logistics system was installed and integrated and tested with the 4/5G mobile network using the App developed as HMI to handle the operations.
- The relational DB managing the terminal data was installed and integrated and is operational.
- The interwork among the App, the main control system and the relational DB was tested using the mobile connectivity, verifying the steps required by the registration and the loading phases.



Registration phase



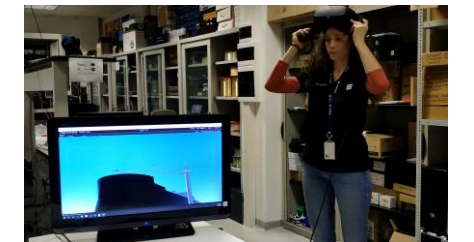
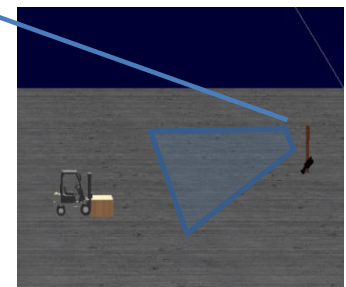
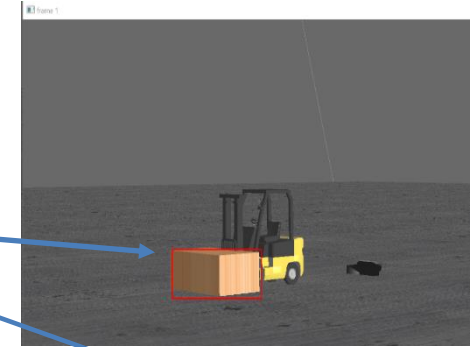
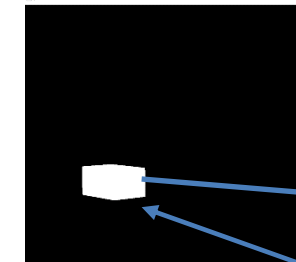
Loading phase



# RTPORT: Livorno Living Lab Activities(2/3)

Using virtual reality:

- VR #1 (Panda3D Carnegie-Mellon University/Disney)
  - Vision-based high precision freights positioning and tracking system
  - Cameras models behaves like real ones
  - Simulated the tracking and positioning of freights during transfer phases
  - Simulations allowed to tune algorithms for target acquisition and position estimation
  - Integrated all SW subsystems (main control system/ relational DB / positioning system)
  - Integration tests and performance tuning are running
- VR #2 (Unity 3D)
  - Freights optimized allocation operative research algorithms tuned and tested
  - Quality check functionalities with virtual exploration of the storage area tuned and tested

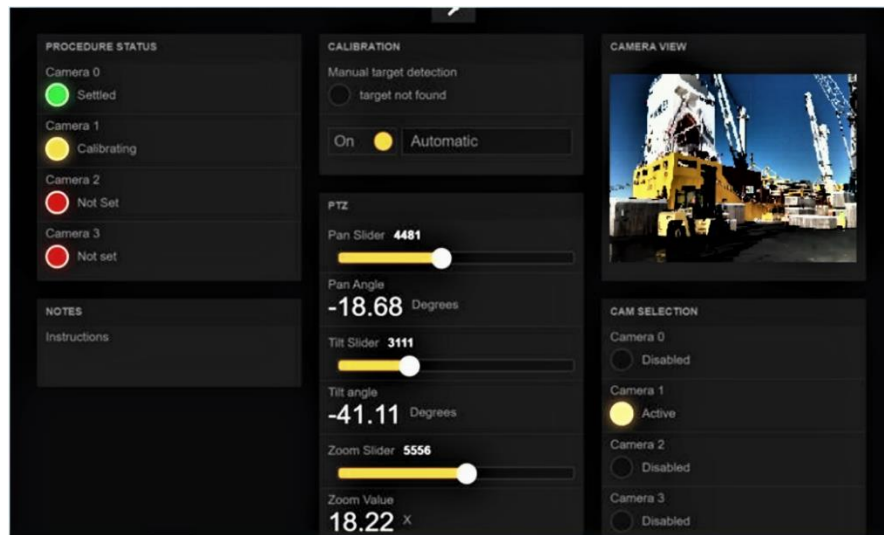


virtual exploration of the storage area



# RTPORT: Livorno Living Lab Activities(3/3)

- The interface between the main control system and the Port Authority control platform was developed and tested in a standalone environment. A test stub was provided to the Port Authority and CNIT for their testing and positively verified by them
- Automated calibration of WDR camera SW and procedures completely tested
  - Calibration: find affine transforms from camera to seaport area coordinate reference system



Calibration Dashboard



Servo- controlled QR code target used for calibration



# Expected outcome



## Port Automation

Digitalization of port operations thanks to disruptive technologies, including Internet of Things (IoT), data analytics, next generation traffic management and emerging 5G networks.



## Operational Cost reduction

Increase safety and efficiency in goods handling, optimize seaport operation, reduce vessel operation completion times minimizing waste of money due to idle time of the ship in the seaport.



## Sustainability

Creating a more sustainable Port environment



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# THANK YOU FOR YOUR ATTENTION



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