5G Port of the Future

TIM, Authority Port of Livorno, CNIT, EU Commission, Italy

Challenge

Increase efficiency, productivity and sustainability in Italian ports' operations.

Solution

Ericsson deploys 5G networks, AR solution and AI operation system to optimize efficiency, productivity and sustainability.

Impact

Secure efficiency of port by minimizing transit time of goods meanwhile securing workplace safety and less pollution with 8.2% CO_2e saving.

Speed up loading/unloading operations to reduce idle times for ships travels through enhanced logistics.

The project has been selected as best practice by UN SDSN and presented at UN Global Goals Week 2019.

Port' logistic operations Europe and Tuscany Livorno today

Europe's ports are vital gateways, linking its transport corridors to the rest of the world. Ports play an equally important role to support the exchange of goods within the internal market and in linking peripheral and island areas with the mainland of Europe.

— **74% of goods** entering or leaving Europe go by sea
— **1.5 million workers** are employed in European ports, with the same amount again employed indirectly across the 22 EU maritime Member States
— **147 million tons of CO2e** is the impact of the maritime transport in EU in 2018 (16% of the world ones).

Tuscany Livorno Port plays the most important role as gateway to exchange goods towards/from Italy central regions, including Rome area and the Adriatic side cities. Tuscany port area has

— **3600 direct workers**, with 44% of them employed in the port's operations, producing 267Mil euro as total added value, i.e. 74000 euro per worker.
— **7000 local private companies** involved in the local port logistic value chain.
— **150000 tons of emission** estimated in the port of Livorno over one year (May 2018 - May 2019). More than 97% of all emissions produced are carbon dioxide. 56% of all CO2 was produced directly by ships during port logistic manoeuvres.

EE TIM

— ICT and digital transformation have the potential to save 15% CO2e in all other sectors, including Logistics and Transport (*)

— 5G technologies can accelerate positive impacts in environmental footprint, workers and growth

(*) Exponential Climate Roadmap Action, Report 2019

EU-H2020 5G Corealis for the Port of the Future (*) Scope

EU Sustainable Development Targets for port:

- CO2 emissions decreasing
- Air quality
- More safety for workers
- Employment

Ports' Authority and Terminalists

- Investment Volumes
- Stakeholder satisfaction
- Accessibility
- Intermodal Split
- Terminal-oriented KPIs

Demonstrate sustainable innovation with potential to be a **best practice at scale**

Ericsson and TIM involved in Italy to enable new use cases for port's logistic operations with 5G, AI and IoT/AR

— Strengthening efficiency and productivity of port by minimizing transit time of goods, meanwhile keeping workplace safety and decreasing pollution

— Speed up loading/unloading operations to reduce idle times for ships travels through enhanced logistics enabled by 5G.

(*) Part of European Commission Horizon2020 Corealis project within the frame "Port of the Future" research & innovation programme under grant agreement No 768994.

5 for 1
# 5 entities for 1 goal

Sustainable Innovation towards UN SDGs

1. TIM: Telecom service provider
2. Ericsson: private company in ICT sector, 5G technology provider
3. AdSP: public port authority of the Northern Tyrrhenian Sea, including Port of Livorno
4. CNIT: non profit Inter-Universities Consortium for Telecommunications
5. FEEM: non profit international research center, representing UN SDSN in Italy

Possible PoC area in Livorno Port

Corealis 5G Network & Use case

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## High Level Solution Layout
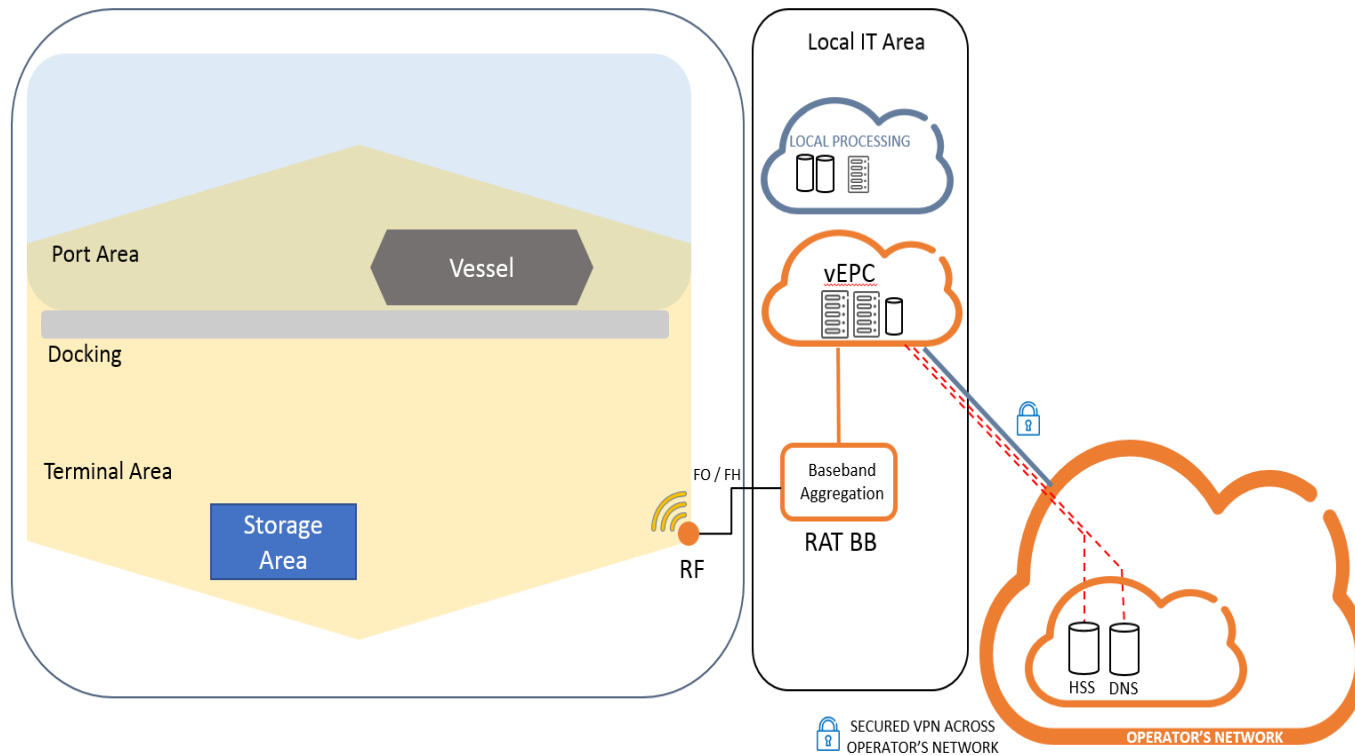
Infrastructure 5G Network

- Dedicate coverage of the Port Area and Terminal Area with antenna connected to RAT BB and proper Cloud vEPC solution

- Interconnection to local processing infrastructure and to the application server dedicated to the Logistics use case

- HSS & DNS will be granted by Operator (TIM)

Enhanced Logistics

- **A set of IoT devices (e.g. HDR cameras, LIDARs),** connected via 5G to the local cloud, **will be installed on forklifts and other infrastructures to identify and localize goods, workers, cranes and forklifts to allow the control functionalities**, running in the local cloud, to optimize and facilitate the different logistic tasks improving efficiency and safety based on AI-system operation.

Ericsson 5G Use case for Integrated Logistics

TIM ≈
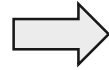
Objectives ⟹
- Reduce "transit time of goods" in the Port
- Reduce operations per unit
- Reduce vessel operation completion
- Keep safety conditions
- Reduce environmental impact
- Control system automation
- Ease service flow with enhanced technology

Main Requirements	Enhanced Logistics
Assumptions	Remote video processing, image and context recognition and AI processing to guide drivers and workers with augmented reality info in real time. Feedback to driver in <100 ms opt. 200 ms acceptable (human perception time: 100 ms, reaction time 200 ms) In 300ms a forklinft can run between 1 and 2.5 m at top speed Remote processing applications require most of the time budget due to complex processing
Bandwidth	Up to 15 Mbps/camera Several cameras can be placed on vehicles and poles
Latency (e2e)	Recommended <10 ms (Local Core & dedicated RAN layer) Acceptable < 20 ms (Operator Centralized Core)
Traffic Shaping	Yes
Technology	5G (beamforming, massive MIMO)
Coverage	Outdoor (min 50x50 m^2)

Enhanced Logistics – Use Case Description

SCOPE: Speed up loading/unloading operations to reduce idle times for ships travels, in particular for goods with diversified dimensions, size, shape, etc.

Here the detailed description of use cases from users perspective:

— The workers at the docks find the proper pallet/box or container to take in front of the crane for the loading.

— An automated logistics system (integrating data provisioned through LIDAR scanning system and cameras in storage area) can provide automatically information to vessel's personnel (provisioned with a specific App) about where the proper good is located, with associated size, dimension, shape.

— Using augmented reality, the forklift drivers are indicated where the pallet to be moved is located.

— Cameras are placed on the forklifts to allow the automated logistics control system to identify the position of each forklift, then select the proper one and send the forklift driver on a tablet the information about the path he has to follow

— The control system also highlights on the scene on the tablet screen the target to pick and, in case, other stuff to be moved away, to reach it.

— It is possible to visualize information from the field

5G and contribution to UN SDGs Agenda 2030

TIM

Purpose

- UN SDGs 2030 - Smart Port Model
- 5G impact analysis and benefits leveraging on 5G Corealis Port of the Future innovation project

Results

SDGS-SMART PORT MODEL

Developed model for the port which consider the digital transformation enabled by 5G as main lever for the port performance evaluation and sustainable development

Impact:
Reference model to govern and make decisions for sustainable development of port area

SDGS-SMART PORT ANALYSIS

Analysis of enabling power of 5G technologies to evolve port's processes with respect to the UN Sustainable Development Goals Agenda 2030

Impact:
65 benefits identified for the port related to the 2030 agenda Authority Port empowerment to innovate with 5G

SDGS-SMART PORT AND 5G POSITIVE IMPACTS

Impact:
SDG 8: Competitiveness and safe workplace
SDG 11: Sustainable growth for the port-city
SDG 12: Responsible business in logistics
SDG 13: Estimated environmental 8,2% CO_2e saving* **

(*) Corealis project who received funding from the European Union's Horizon 2020 research & innovation programme under grant agreement No 768994
(**) To be validated following the on the field trial

#Selected by UN SDSN among the best 10 cases to show the advancing towards SDGs and presented during UN Global Goals Week 2019

5G and contribution to UN SDG 9 and SDG 17

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE


17 PARTNERSHIPS FOR THE GOALS

Enhanced mobile broadband coverage with 5G network infrastructure and trial in the port area.

Technologies and applications such IoT, AI and AR digitalizing and integrating port's sea-ground processes

AdSP public entity could increase its own awareness, empowerment and leadership to evolve port logistics activities through innovation and sustainability actions with 5G thanks to the fruitful public-private-partnership approach and open collaboration with Ericsson, TIM and the other involved partners.

Sharing and crossing each-own knowledge with the others' ones and the joint-purpose to understand the enabling effects of 5G for sustainable development in the port have been the two major drivers to convey on the technological and sustainability initiatives.

5G and contribution to UN SDG 8 and SDG 11

8 DECENT WORK AND ECONOMIC GROWTH

11 SUSTAINABLE CITIES AND COMMUNITIES
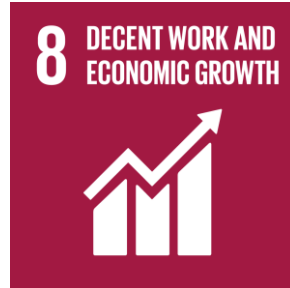
— Increased productivity with minimized transit time of goods.
  In fact optimized activities in e.g. shorter ships stop time in seaport for loading operations of general cargo goods, optimized general cargo goods storage and handling in seaport terminals, automated handling of information about goods positioning, tracking and monitoring, all make the port more attractive for commercial transportations, which then generate growth in the territory

— Secured safety for workers through AI-based real-time control of movements of humans, devices and goods.

— Improved job profile with use of new ICT tools supporting operational tasks (e.g. AR, AI-based suggested actions)

Sustainable growth for Livorno port-city, where the enhanced port competitiveness and operational aspects (e.g. pollution, commuting ship-trucks/cranes-trains, etc.) impact positively territory economy growth (e.g. SMEs, jobs opportunities) and on city habitants lives

5G and contribution to UN SDG 8 and SDG 11

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

13 CLIMATE ACTION

Commercial logistic companies are enabled by the Port of Livorno to run their business logistics operations in a more "responsible" way both on environmental and safety for workers perspectives, thanks to the utilization of a more intelligent and connected logistic port area and availability of digital tools

Quantitative estimated environmental benefit:
8.2% CO2e saving (*) (**)

(*) Case study "EU H2020 Corealis 5G"
(**) Under validation as part of the on the ongoing field trial with collected actual data