

Use of 5G in improving port operations at the Port of Livorno

Paolo Pagano

Head of Research Area

<http://jlab-ports.cnit.it>



*L' agenda digitale dei porti del futuro
MIB (Trieste), 8 luglio 2022*



REGIONE AUTONOMA
FRIULI VENEZIA GIULIA



CENTRO DI FORMAZIONE
LOGISTICA INTERMODALE

- Sea ports in 2030:
 - high capacity and efficiency,
 - highly integrated with inland transport and logistic nodes,
 - capable of sustainable growth without further infrastructure investments.
- following the European models:
 - for the circular economy;
 - to reduce the environmental footprint (more renewable, less pollutants);
 - to improve the navigability of port channels, operational efficiency, optimize the capacity of docks yards, and flows;
 - transform the port into a local and national innovation hub.



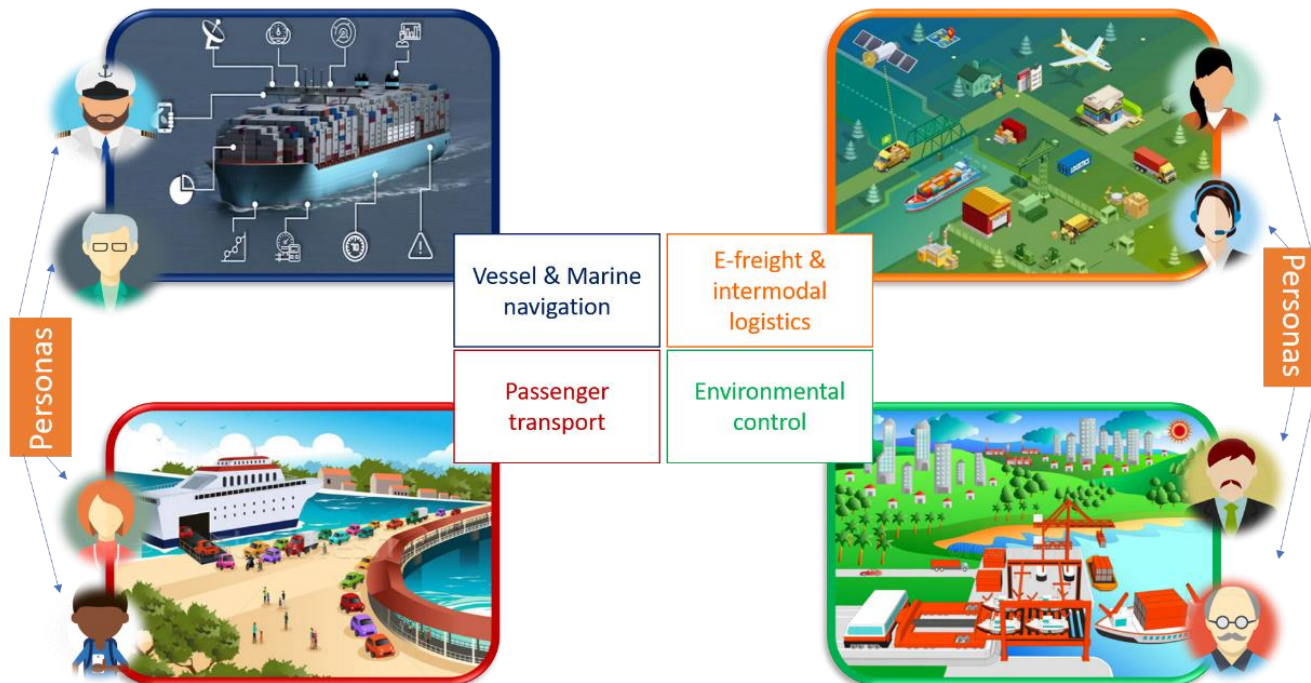
Image – Port of the Future Serious Game
(C) Deltares

- Mid-size historical port:

- passengers and freight;
- multipurpose(containers, break/dry/liquid bulk);
- freight village, car stocking (25,000 cars capacity);
- along TEN-T SCANMED corridor (core node);
- door of Tuscany;
- minor ports (Piombino, Elba) under the same organization.



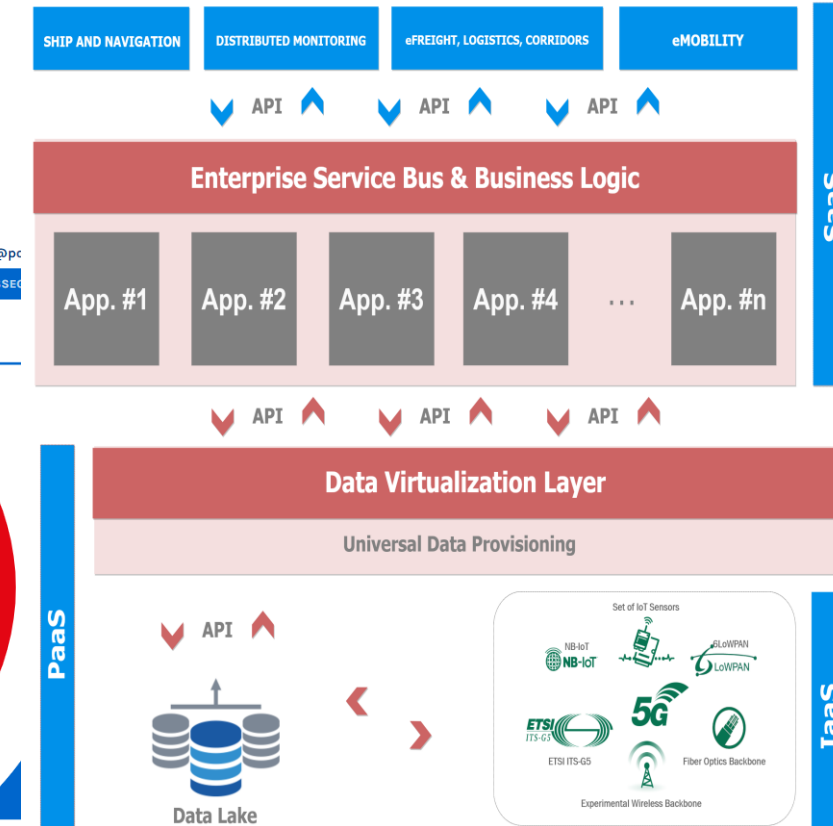
- collect the requirements from the communities and design innovation services;
- follow (and steer) EU standardization for data, networks and services;



- allow the procurement from the digital market of innovation services;
- check the conformance against the requirements (included in tenders).

- Layer separation:
 - Infrastructure, Platform, and Software
- Data Lake (vessels, freight, carriers)
 - Document-based, RDBMS, GIS, and M2M
- Backward compatibility with legacy systems
- New cyber-security policies
- Application layer implemented by more providers (Digital Single Market)
- Internal Integration Test & Validation

STANDARD ARCHITECTURE



Ericsson White Paper
GFTL ER 20:003151
June 2020



5G spectrum for local industrial networks

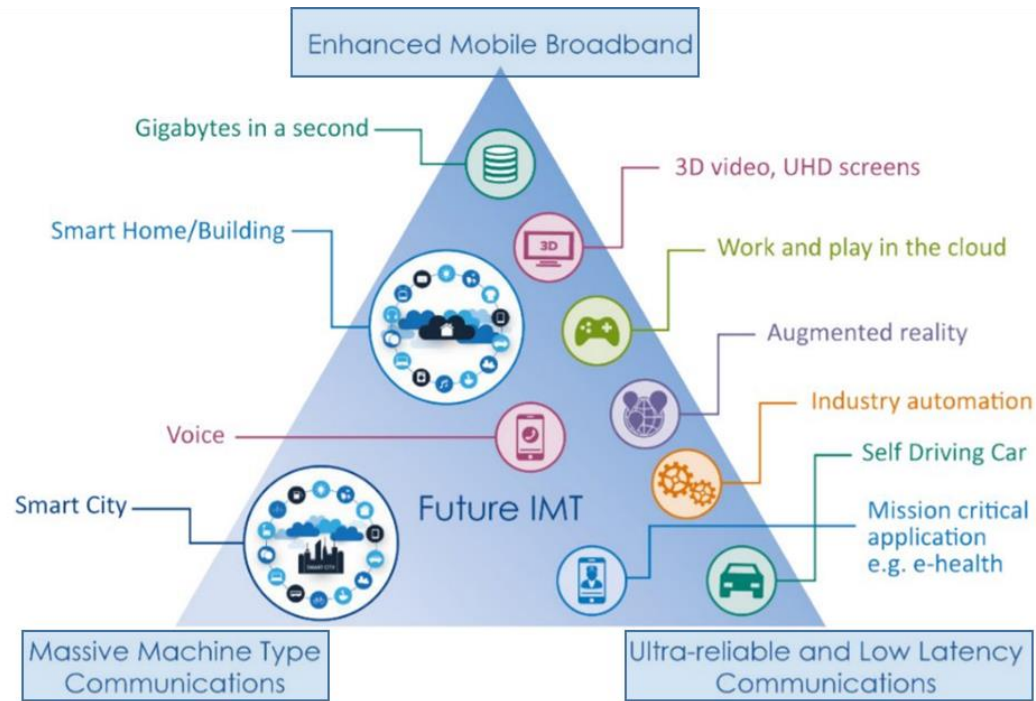


5G Network in Port



A final example can be found in the potential of the world's 835 actively active ports [8]. One case study examining the private 5G network trial for the automation of China's Port of Qingdao indicated that a 70-percent labor cost savings could be achieved if 5G automation were to be fully implemented [9]. Our own research engagements in Italy's **Port of Livorno** suggest much the same, with the potential for significant savings in port and quay operations as well as reduced berthing times for vessels and shortened cargo release times.

Livorno is an international reference for the design of 5G networks in industrial ports.

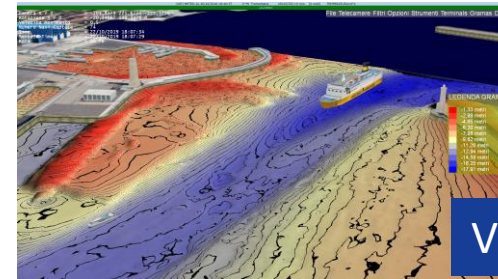


- mMTC (massive IoT):
 - Port (landside and sea) massive sensorization
 - Vessel (and cargo) sensorization

- eBB:
 - Touristic crowds
 - Assistance to people with disabilities
 - Emergency procedures



eBB



VR/AR

- UR-LLC (VR/AR - Digital Twin)
 - RT Port View
 - bathymetric data
 - RT Vessel View
 - RT Machinery status
 - RT Assisted docking



mMTC

- Use Case:
 - Freight Management for the unloading (from the truck) and loading (onto the ship) phases and handling in the docks.
- 5G RAN and Core;
- Enabled processes:
 - humans, IoT, robotics in the loop;
 - new RT functions for the haulers;
 - integration between ship and port and logistic information systems.



<https://www.youtube.com/watch?v=nWrMDoN1z7g>

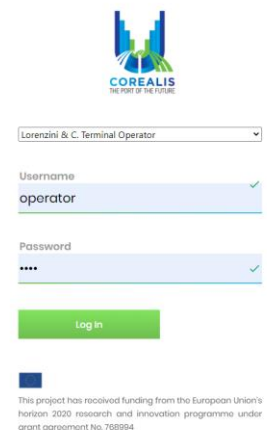
Coverage: **250x50 m²**

Frequency: **3.7GHz**

E2E Latency: **< 10ms**

Reability: **> 99%**

Availability: **99.999%**

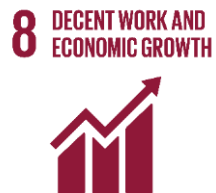



-8.2 %
In CO₂ emissions

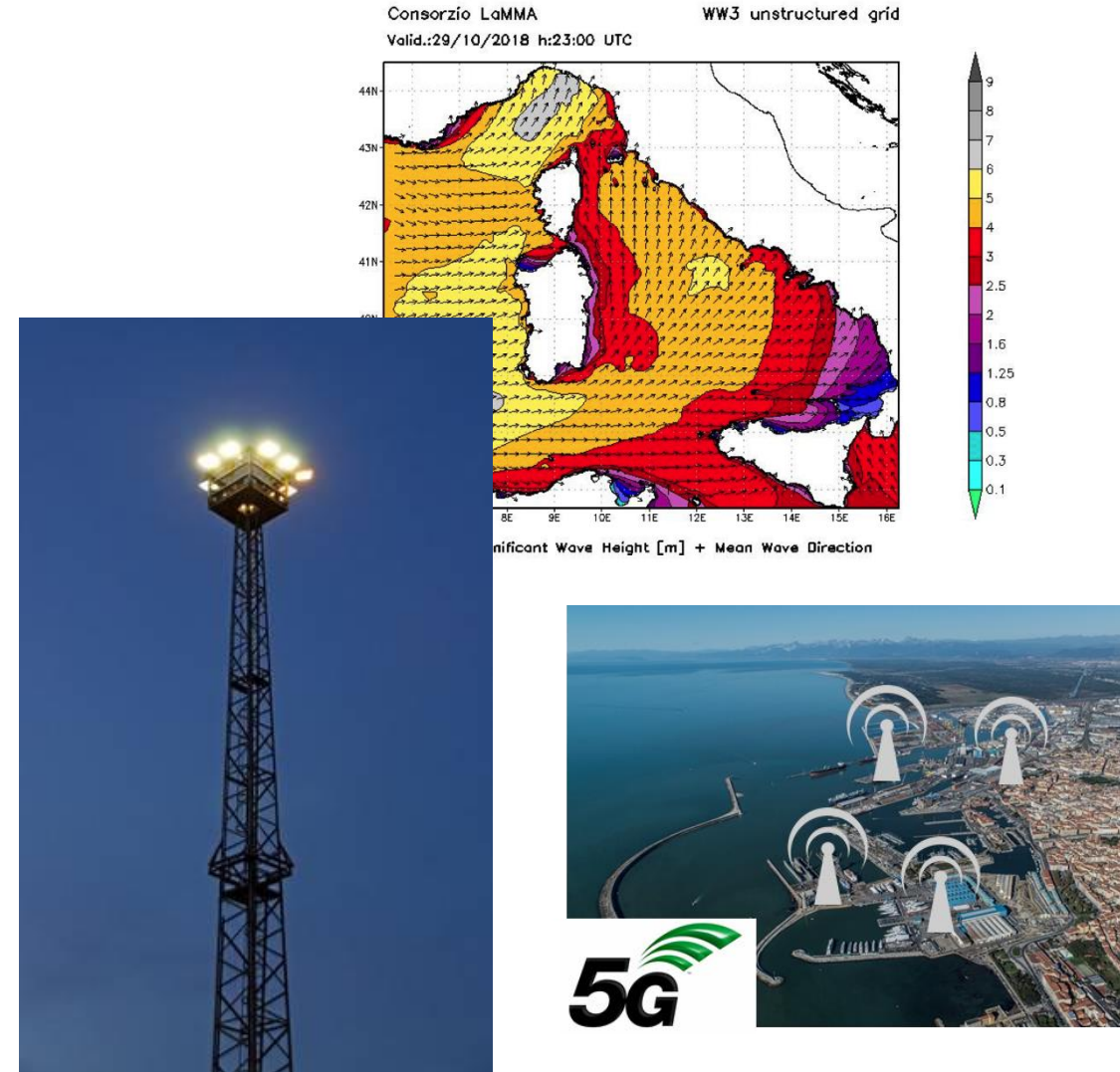
-2.5 m€
Operational cost reduction



+ 20-25 %
Productivity (5G cranes)



- 5G network (preliminary planning), IoT sensors in the port basin (current/wave meters), berth sensors (GHG, pollutants, noise)
- Services:
 - Monitoring and control of Light Towers;
 - Navigation aid system (pilots, captains, and coast guard) integrated with marine weather monitoring;
 - Real-time information system of port logistics, for full intermodality (sea-to-road, sea-to-rail);
 - Integration and harmonization of vertical applications (i.e. PCS, Gate Transit, etc.).



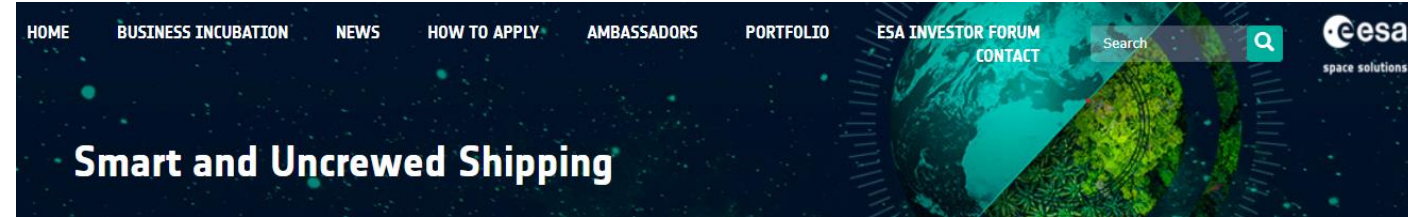
- CNIT is invited to comment on the «BEREC 5G radar» - BOR (20) 223:
 - private networks (NPN) managed by companies
 - ports as large companies in the sector;
 - creation of the global 5G digital market;
 - new players such as terminal operators, logistics operators, ocean carriers
 - a new “public procurement” and “concession” paradigm
- QoS guarantee and integration with satellite communications
 - for the same functionalities in the various world ports
- sustainable growth
 - reduction of the port's carbon footprint

https://www.youtube.com/watch?v=XEt3aAfxYgo&ab_channel=berec.europa.eu
(minuto 47:51)



3/6/2021

BEREC Workshop on 5G: Insights on Innovation, New Business Models and Value Chains



19/5/2021

<https://youtu.be/frmcmSOgBnU> (minute 46:50)



- Autonomous Ship;
- 5G NPN at Port and enhanced PNT;
- eNavigation Maritime Services;
- long-lasting trials in Livorno under the supervision of



IT Coast Guard

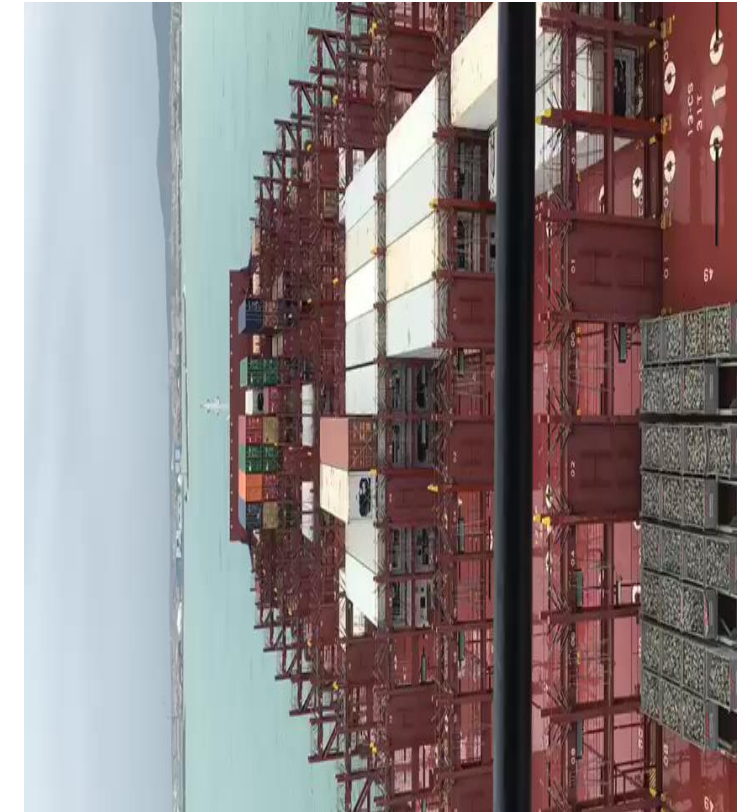


29/6/2022



<https://youtu.be/pZsw8srxp-0>

- Port of Livorno:
 - has enabled a digital infrastructure capable of validating innovative services targeted to port communities;
 - has an unquestionable recognition in the international domain and is considered an international “best practice” for 5G deployments in ports;
 - has proven the positive impact of 5G to sustainable growth;
 - is turning feasibility studies into execution;
 - is looking ahead to new services (tailored to smart and autonomous shipping).



Courtesy of:



CORPO PILOTI DEL PORTO DI LIVORNO