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Sustainable port development:

towards the Physical Internet concept

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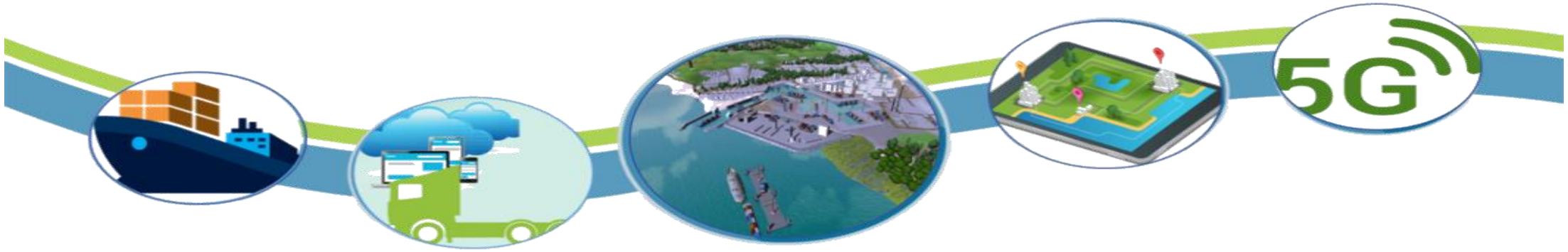
COREALIS
THE PORT OF THE FUTURE



COREALIS Overarching Goal

COREALIS proposes a strategic, innovative framework, supported by disruptive technologies, including Internet of Things (IoT), data analytics, next generation traffic management and emerging 5G networks, for **cargo ports** to handle upcoming and future **capacity, traffic, efficiency and environmental challenges**.

Full-scale implementation

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1. Antwerp Port, Belgium

2. Valencia Port, Spain

3. Piraeus Port, Greece

4. Livorno Port, Italy

5. Haminakotka Port, Finland

PI & Port of the Future

- **PI** basic concept is an open global logistics system based on the physical, digital and operational **interconnectivity** enabled by smart modular containers, interfaces and protocols for increased **efficiency** and **sustainability**[1]

- **Port of the Future** has been introduced as the one that has **no negative impact on the ecosystem** and recognises environmental systems as a mix of elements that **interact with each other**' in the maritime environment, **maintaining a balance in economic, environmental and social** extent for the surrounding local region[2]

1 - Montreuil, 2011
2 - Schipper et al., 2017

COREALIS Layered Approach

Physical Communication Layer

Direct PI related innovations

PI based extended innovations

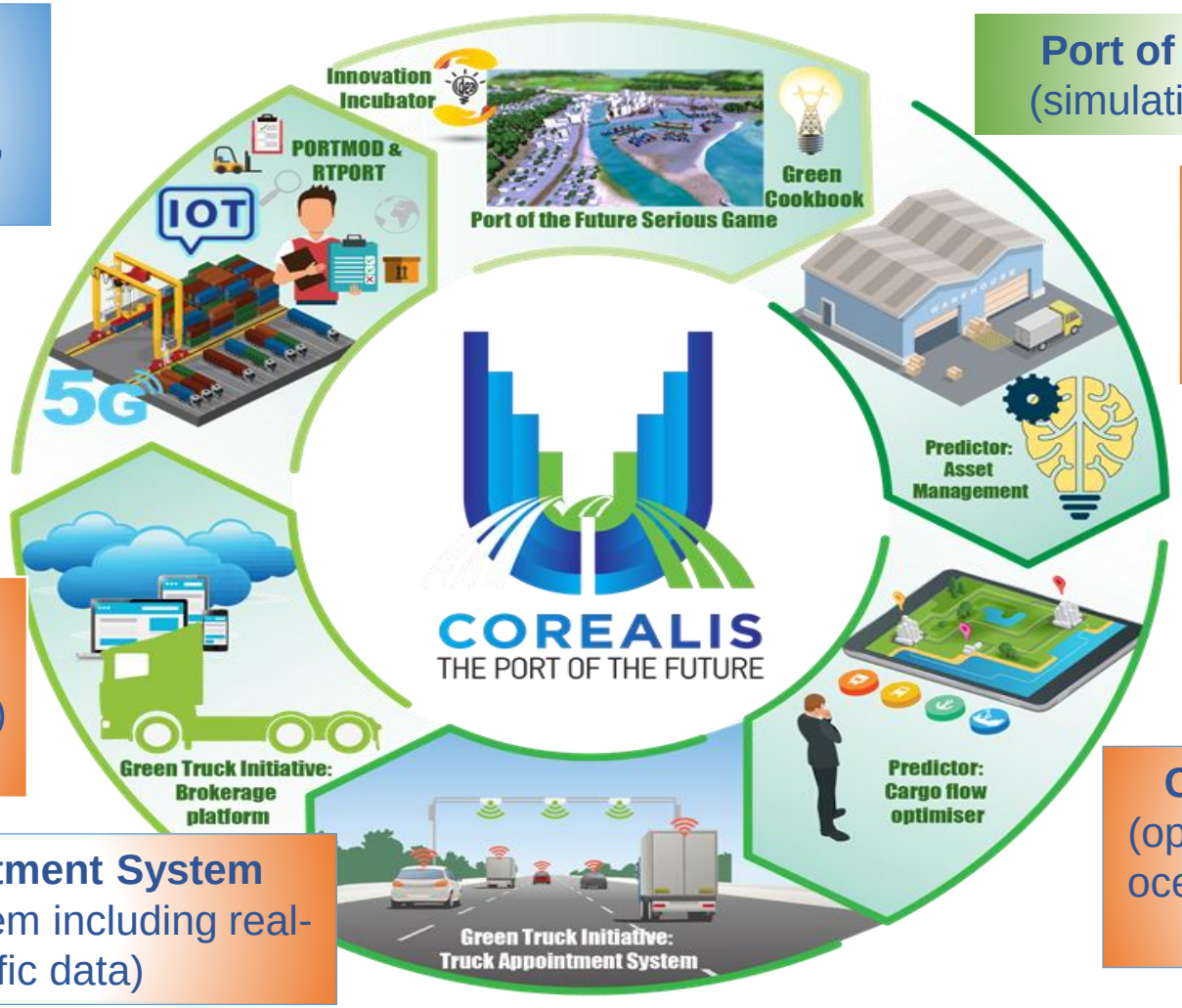
Port-driven technological innovations

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

PORTMOD
(optimization planning tool for CT operations)

Brokerage Platform
(cloud based marketplace for leasing intra-CT trucks)

Truck Appointment System
(reservation system including real-time traffic data)



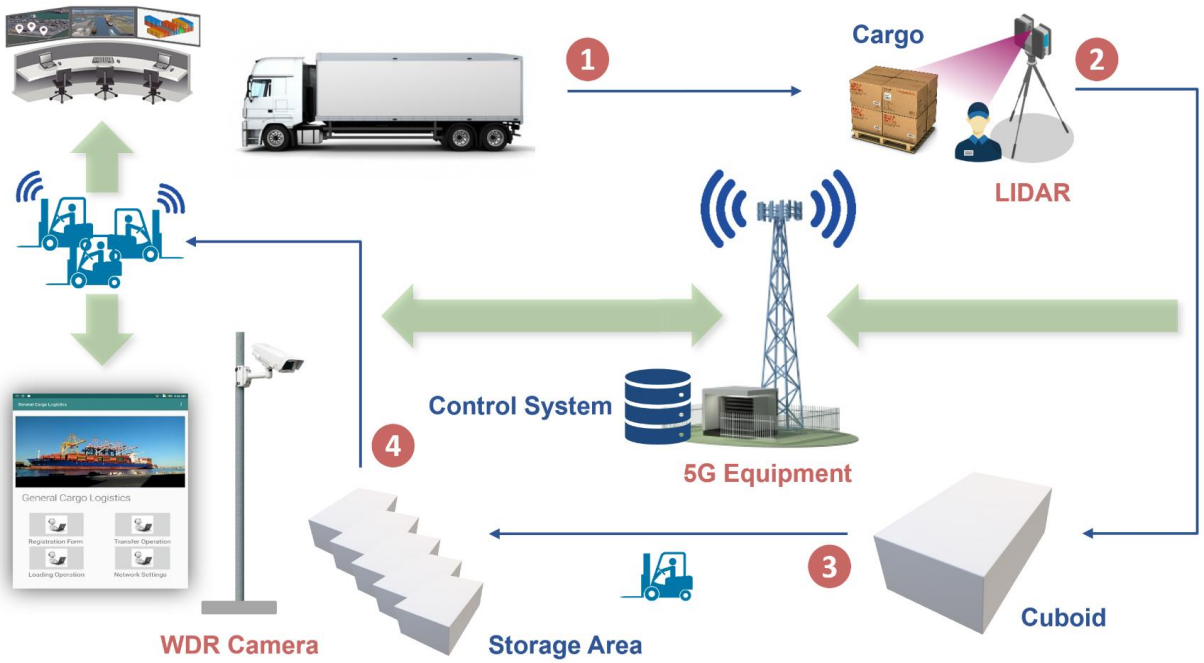
Port of the Future Serious Game
(simulation tool for decision making)

Just-In-Time Rail Shuttle Service
(feasibility study for key port-hinterland corridors)

Predictor for Asset Management
(machine learning based Just in Time inventory)

Cargo Flow Optimiser
(optimization of cargo flows ocean/rail/inland-waterway)

RTPORT - Model Driven Real Time Control Module



Real time control of operations, collecting data from both yard vehicles and implanted sensors (including cameras).

On-Line analytical processing.

Taking operating decision.

Integration with TPCS

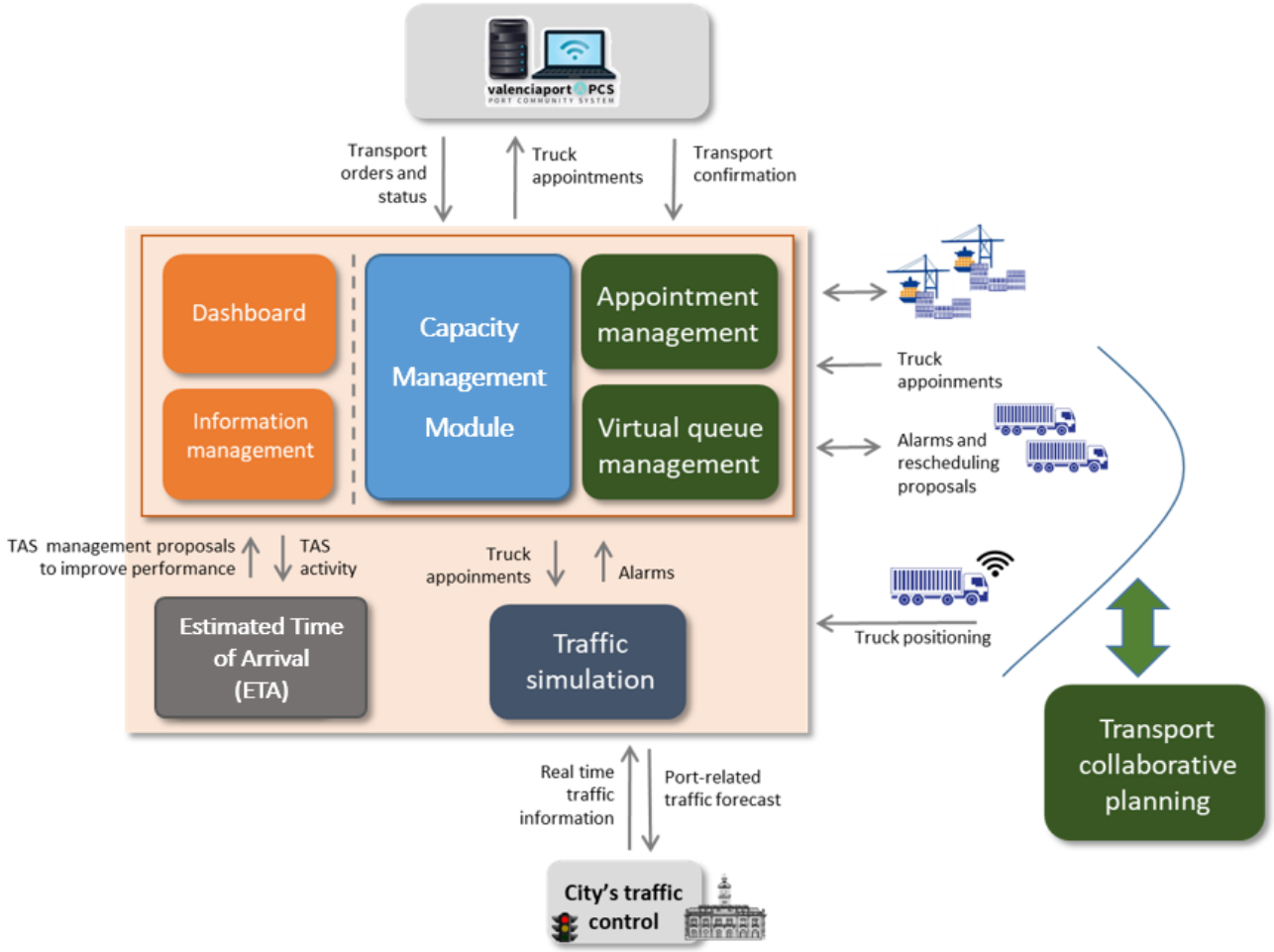
Snapshot Terminal Status

Livorno Port, Italy

5G

- ✓ High level of automation for the general cargo management process
- ✓ Increase of visibility of the cargo in the intra-terminal operations

Truck Appointment system



Valencia Port, Spain

- ✓ Cargo visibility
- ✓ Dynamic ETA and Re-scheduling
- ✓ Port operational flow optimisation

Cargo Flow Optimiser

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Antwerp Port, Belgium

Terminal input

- Terminal occupancy
- Containers arriving / leaving time stamp
- Inland mode of transport expected

Current transportation environment

- Current inland connections
- Capacity of transport connections

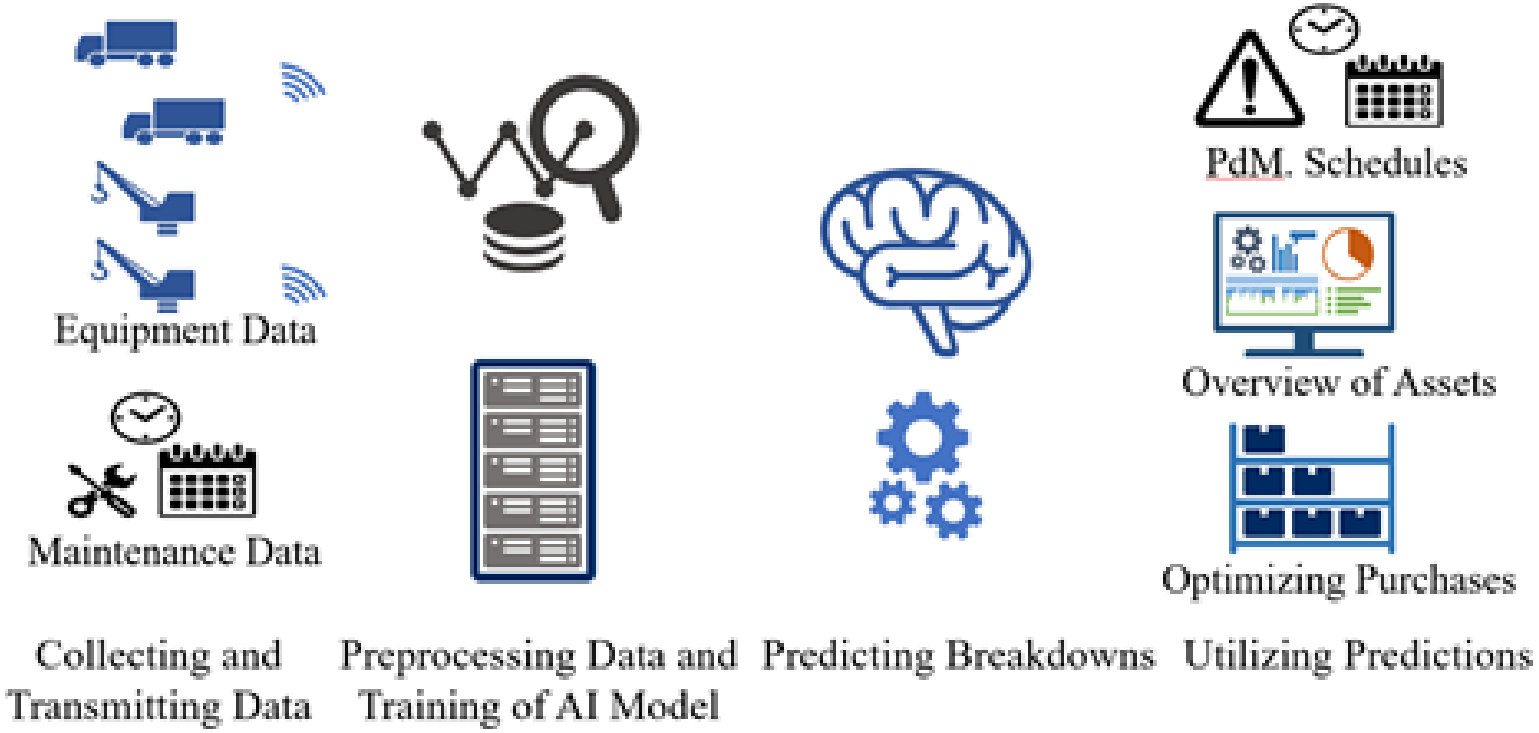
- Prediction availability of inland transport routes according to:
  - -Transportation time
  - -Cost of the route

Optimization model

- **Proposition of new transport shared services on-demand**

- ✓ Data multiplexing for cargo flow optimization
- ✓ Big Data analytics and prognoses based on barge and rail ETAs
- ✓ Container waiting times minimized, reducing cost and TATs

Predictive maintenance



Piraeus Port, Greece

- ✓ Contributes to a fully interconnected system with better estimations between the relevant logistic entities, closer to the vision of Physical Internet.

Methodology

Stakeholder driven approach

- Identification of the smart port-city stakeholders and
- Port of the future needs and requirements

Phase 1

Scenarios & Requirements

Phase 2

Technical Design and Development

- Full-scale deployment
- Integration to port infrastructure

- Impact Assessment

Phase 3

Full-scale implementation and Impact Assessment

Expected impact

1. Embrace circular economy models in the port strategy and operations

2. Improve operational efficiency, optimise yard capacity and streamline cargo flows without additional infrastructural investments

3. Reduce the port's environmental footprint associated with intermodal connections and the surrounding urban environment for three major transport modes, road, rail and inland waterways

4. Enable the port to take informed medium-term and long-term strategic decisions and become an innovation hub of the local urban space

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THANK YOU FOR YOUR ATTENTION

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