



TENDENCIAS DE I+D+I EN LOS PUERTOS LOS SMART PORTS

R&D AXES TO REACH THE PORT OF THE FUTURE

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JORNADA: LOS PUERTOS DEL FUTURO. SMART PORTS
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Outline

1. R&D axes to reach the Port of the Future

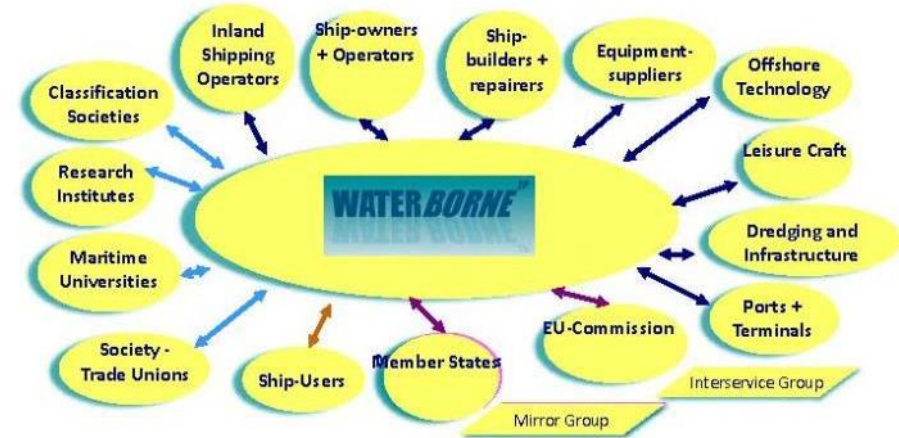
1. WATERBORNE Technology Platform (TP) and the FP7 Maritime Europe Strategic Action (MESA)
2. E-Maritime R&D Roadmap

2. ICT research projects towards the Port of the Future

1. Smart ships
2. Smart ports
3. European Marine Digital Highway
4. Innovation in Hinterland Connectivity

WATERBORNE Technology Platform (TP) and the FP7 Maritime Europe Strategic Action (MESA)

- Waterborne Technology Platform (TP): <http://www.maritime-rdi.eu>
 - Set the Agenda for Maritime Research in Europe
 - WATERBORNE's Vision for 2030
 - WATERBORNETP R&D Road Map for Energy Efficiency, Safety, Production, and e-Maritime
- Maritime Europe Strategic Action (MESA): <http://www.maritime-rdi.eu/about/about-mesa/>
 - Thematic Technology Group (TTG) 4 – e-Maritime
 - Four main focus areas: Ships Operation and e-Navigation; Port Operations; Logistic Chain; Regulations



e-Maritime is defined as the use of information exchange technology to establish more efficient cooperation between ships and the parties onshore, including ship operations, ports, authority functions, transport logistics and others, for the facilitation of maritime transport.

e-Maritime will increase the competitiveness of maritime transport, improve safety, security, environmental performance and increase the attractiveness of the seafaring profession. e-Maritime is implemented through development of information exchange technology as well as through improvements in organisational and legal constraints.

E-Maritime R&D Roadmap

- **MESA outcomes:**
 - MESA's Foresight Support Group (WP5): **Forecasted trends and trend Interdependencies**, based on market intelligence, predicted societal trends and the future regulatory framework, for all waterborne sectors
 - MESA's Integration Group (WP6): principal outcomes from the trends and **likely demands on the maritime industry through to 2030**.
 - MESA TTG4 (e-Maritime):
 - Analysis of the knowledge and development gaps for the 4 main focus areas: Ships Operation and e-Navigation; Port Operations; Logistic Chain; Regulations Management
 - R&D Road Map for e-Maritime : Deliverable D4.2 <http://www.maritime-rdi.eu/media/20006/ mesa-d4-2-final-issue-june-2016.pdf>
 - Selected research priorities for e-Maritime:
 1. Smart ships
 2. Smart ports
 3. European Marine Digital Highway
 4. Innovation in Hinterland Connectivity

Smart Ships

- **Challenges:**
 - Improved protection against hacking
 - Flexible and adaptive ship operation
 - Continuing drive for greater energy efficiency
 - Greater ship autonomy
 - More autonomous ship operation
- **Research pathways:**
 - Real-time monitoring of ship performance with automated information management and **surveillance**.
 - Improved integration with shore support centers for technical operation and remote maintenance.
 - Data networks, data management, and sensors protected from cybersecurity risks.
 - Development of a Decision support tool for e-Performance, incorporating AI and an energy efficient operation index (EEOI), adjusted for the actual vessel and voyage particulars.
 - Development of Decision Support and monitoring for on-board operations to capture information from machinery and bridge systems for a more efficient, safer and environmentally friendly operation.

Smart ports

- **Challenges:**
 - Improved port and logistics infrastructure and operations
 - Robust port infrastructure and operations
 - Improved protection against hacking
- **Research pathways:**
 - Development of **digital infrastructure, ICT innovation**, and automation:
 - Robotics, automation, and autonomous vehicles;
 - The **Internet of Things** and **Big Data Analytics**;
 - **Simulation**, virtual reality, and cybersecurity.
 - **Improved interoperability of existing port related systems** (PCS, SW, CCS, TOS, TMS, etc.) and the integration between transport modes.
 - Integration of national single windows with trade portals and port community systems
 - Development of advanced logistic chain management systems and operational tools to facilitate very fast sea/land interchange.
 - Development of Intelligent holistic solutions for the efficient management of ships in ports for freight, passengers and workers, integrated with Urban Mobility Plans and solutions.

European Marine Digital Highway

- **Challenges:**
 - Greater shore based monitoring and surveillance
 - Improved vessel routing
 - Better design codes and modelling
- **Research pathways:**
 - Integration of ship navigational and communication facilities aboard ships, including the bridge systems, other ships, VTS and SAR, for interfacing with a European marine digital highway information system.
 - Integration of **navigation technologies** with shore based data networks and centres: (SafeSeaNet, (AIS, LRIT), GNSS, National Single Window, VTS, route planning etc.)
 - Development of new interfaces for integration between bridge systems and the operator, including alarm management, in order to improve the human factor.
 - Development of information standards for data, data transmissions and data networks for increasing the innovation rate in the e-Navigation area.
 - Development of a shore-based European marine digital highway information management system to provide e-navigation support and e-services for different levels of the transport chain, interfaced with SafeSeaNet, e-Freight, e-Customs, Intelligent Transport Systems, and the Motorways of the Sea.

Innovation in Hinterland Connectivity

- **Challenges:**
 - Displacement of paper systems
 - Greater integration of the logistics chain
 - Improved protection against hacking
- **Research pathways:**
 - **Improved interconnectivity and integration between transport modes and established systems**, such as: Maritime national Single Windows, RIS, e-Customs, TAF, rail one stop shop, "access points", "data pipelines";
 - Digitalisation of transport documents and acceptance of e-transport documents.
 - Safe, secure, and interconnected systems for data exchange
 - Big Data and Analytics, offering quality data to all interested parties.
 - Integration of the e-Maritime tools to include logistics operators, rail operators, short sea shipping providers and inland waterways operators.



ICT RESEARCH PROJECTS TOWARDS THE PORT OF THE FUTURE



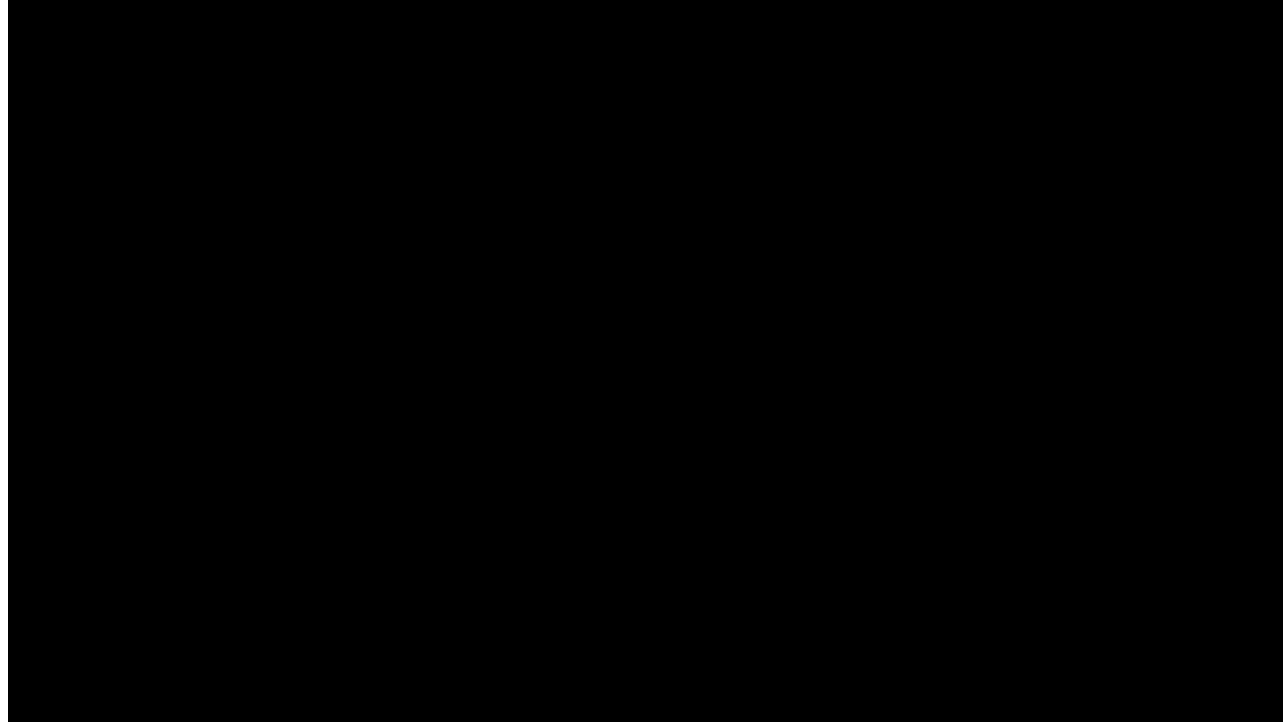
ICT research projects towards the Port of the Future

1. Smart ships
 - APPS
2. Smart ports
 - DICE
 - POSIDONIA SPACE
 - INTER IOT
3. European Marine Digital Highway
 - DOCKING ASSIST
 - POSIDONIA OPERATIONS
4. Innovation in Hinterland Connectivity
 - STIMULO

Smart Ships (real-time surveillance): APPS



- Advancing Plug & Play Smart Surveillance
- Plug & play platform for sensor processing and intelligent decision making capabilities for the smart surveillance in large spaces such as coastal areas and harbours with critical infrastructures, in particular:
 - Collaborative surveillance
 - Detection of small vessels
 - Determining the ship class and type
- Command and Control System; PTZ Tracker and Camera; Thermal camera and detector; Onboard plotter (Electronic Navigation Chart-based); Fixed Wing and LTA UAV; Generic UAS control unit; Chemical sensor (Air and Water); Acoustic Vector
- Pilot at the Port of Rotterdam




Smart Ports: DICE

DICE
GA 644869



Horizon 2020
European Union funding
for Research & Innovation

- Developing Data-Intensive Cloud Applications with Iterative Quality Enhancements
- Quality-driven development methodology and related tools to accelerate the development of business-critical data-intensive applications running on public or private clouds (MDD, UML, MARTE, TOSCA, DevOps, BigData)
 - Deployment modelling  flexiant Cloud Orchestrator
 - Cloud deployment automation 
 - Monitoring tool on performance metrics
 - Trace checking tool on event detection
 - Simulation tool for predictive computational costs
 - Big data technologies: Spark, Kafka, Cassandra, Openstack, Elasticsearch, Storm, etc.

Pilot on POSIDONIA OPERATIONS (vessel tracking system)



Smart Ports: DICE

DICE
GA 644869



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 - Deployment modelling
 - Cloud deployment automation
 - Monitoring tool on performance metrics
 - Trace checking tool on event detection
 - Simulation tool for predictive computational costs associated with each processed ship, architecture components, etc.
- Pilot on POSIDONIA OPERATIONS (vessel tracking system)



flexiant
Cloud Orchestrator



EC2



Smart Ports: POSIDONIA SPACE



- Port Property Management and Billing Information System
- Creation, tracking and management of individual properties and **infrastructures**, agreements, tenants, rent, **conservation, control and maintenance**
- Remote control on sensors (actuators published as widgets): smart cameras (automatic surface occupancy computation), security cameras, lights, Access barriers, wifi, alarms, etc.
- Multiple layers: operations (bollards, berths, etc.), assets, buildings, energy efficiency, cadastral, etc.



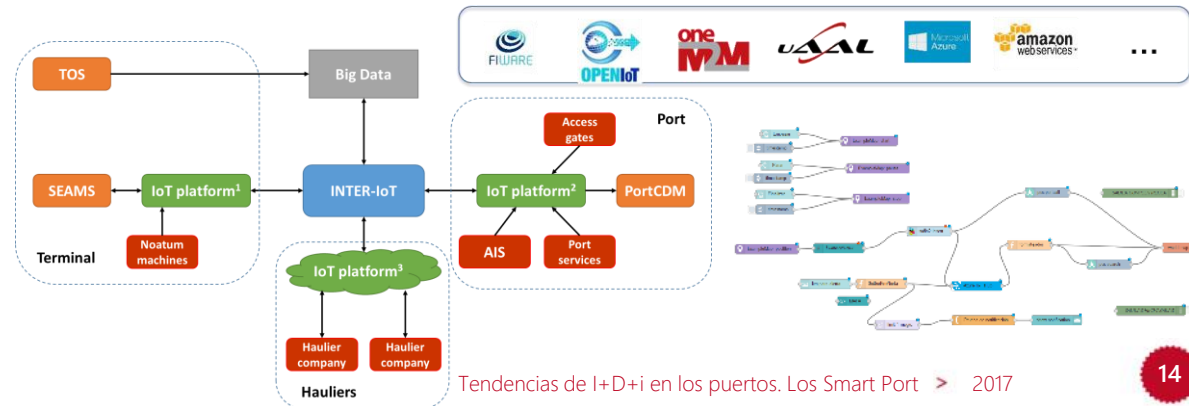
Smart Ports: INTER IoT

INTER-IoT
GA 687283



Horizon 2020
European Union funding
for Research & Innovation

- Interoperability of heterogeneous IoT Platforms
- Multi-layer integration of IoT and smart environments
 - Device
 - Network (NFV)
 - Middleware (rabbitMQ, ActiveMQ, Kafka)
 - Semantics/data model (OWL-RDF)
 - Application (RESTful API, libraries)
- Pilots in two domains: health, transport and logistics (ValenciaPort)
 - Cross domain pilot
 - Open call for third parties
- Open platforms: FI-WARE, Open-IoT, Sofia2, OM2M
- Reference architecture, framework and tools for interoperability



European Marine Digital Highway: DOCKING ASSIST

DOCKING ASSIST



- FP7-SME-2011. Improved port efficiency and safety using a novel wireless network **IEEE 802.16-2009, WiMAX and Precise Differential Global Navigation Satellite System (PDGNSS)** providing enhanced vessel navigation (2011-2013).
- Cost-effective-environmental location system improving port traffic management (**Port of Cork**)
- **Sensor data:** AIS, Weather, RTK/DGNSS, VTS, MIS, ...
- HornetQ, NMEA, JSON, GeoJSON, Drools CEP, PostGIS, socket.io, Atmosphere server



European Marine Digital Highway: DOCKING ASSIST

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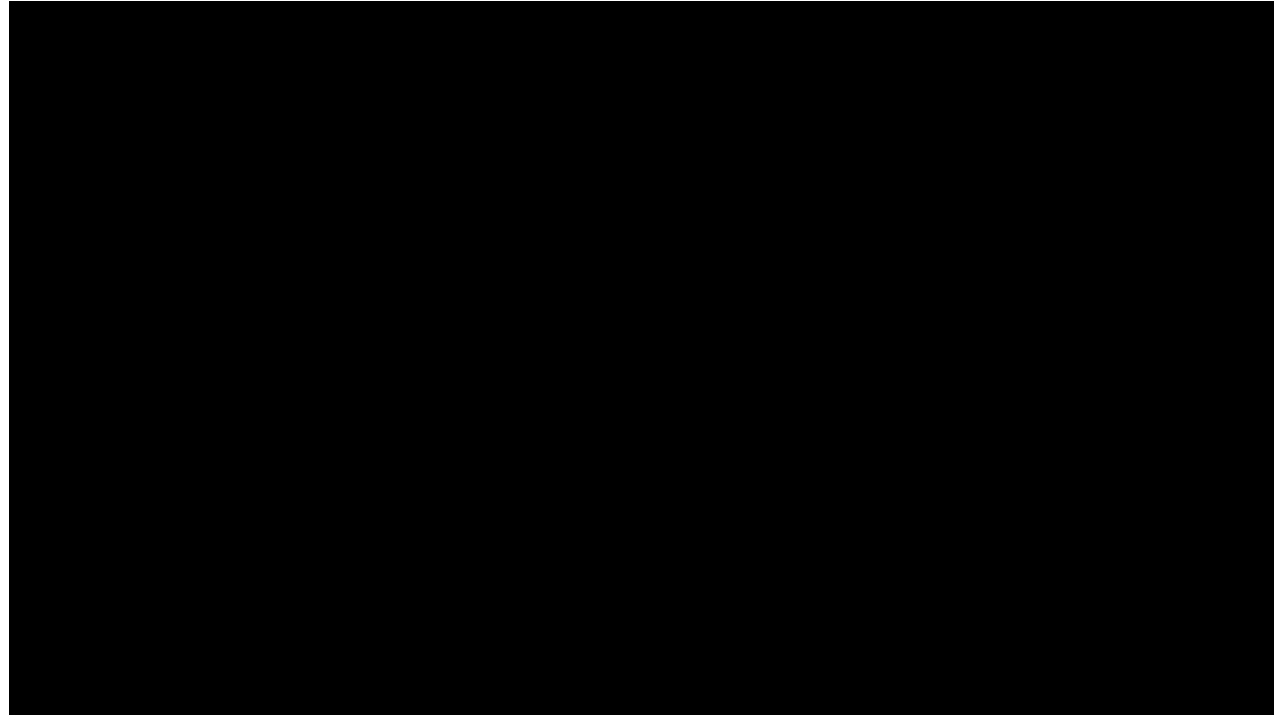
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European Marine Digital Highway: POSIDONIA OPERATIONS



- Solution for managing the sea-side operations of vessels and related services, integrating external sensor data, like AIS, VTS, radar, meteorology, communications, Port Management Systems, Port Community Systems, safety & security, cartography.
- Real-time vessel position, location of events on the map, map warning, 3D mobile application, etc.
- eXtreme Transaction Processing Platform (XTPP),
OMG - Data Distribution Service (DDS), Geo-CEP,
eXtensible Messaging Presence Protocol (XMPP)
IETF standard: RFC 6120, OpenLayers, etc.

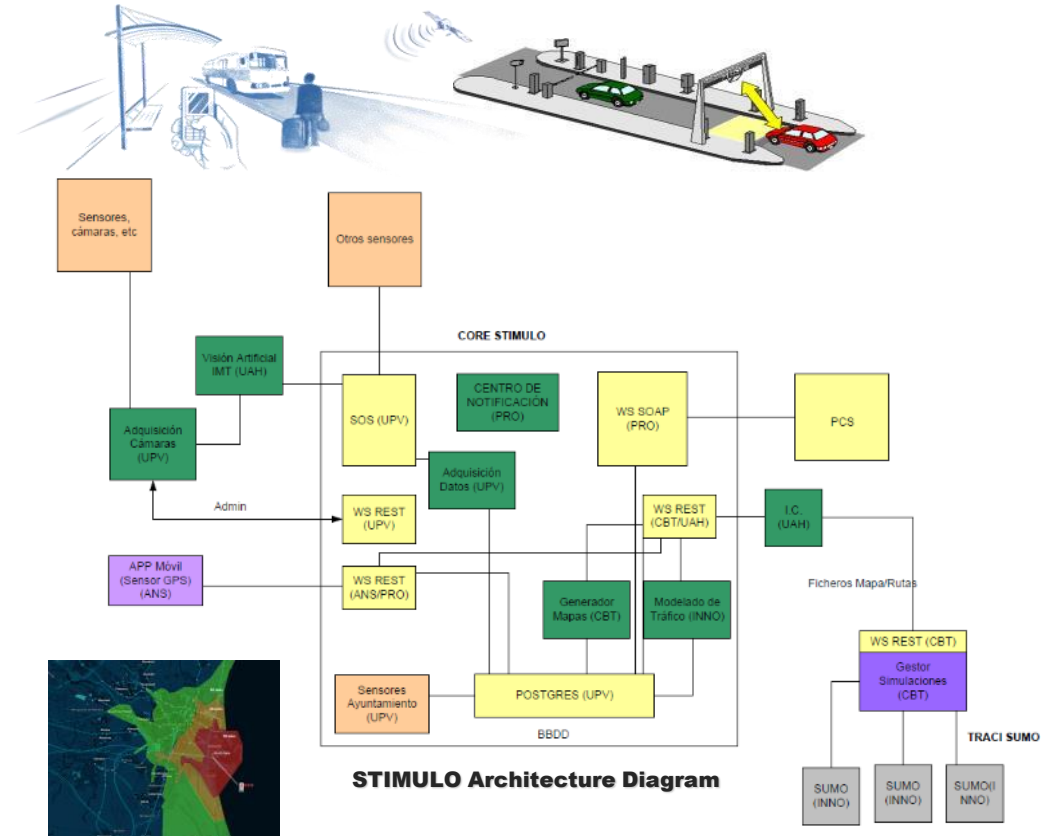


Innovation in Hinterland Connectivity: STIMULO

STIMULO



- IPT-2012-0808-370000. Multimodal **Smart** System for **Logistic** Transport. 2012-2015.
- City and road traffic services, weather conditions, incident or **traffic situation** coming from image processing out of video cameras (IMT Valencia), **image processing sensors** at Port's gate for detecting truck's plate and containers number.
- Real-time isochrones or time areas with automatic warnings to trucks through VALENCIAPORT PCS.
- **52North SOS server, WS REST, WS SOAP, ...**



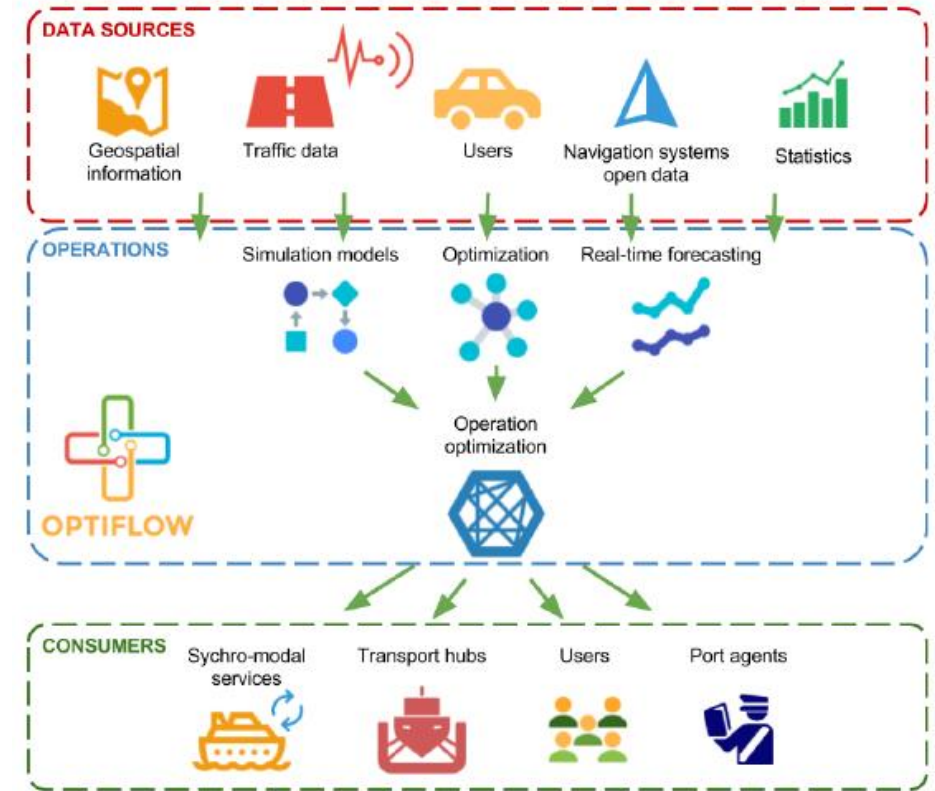


NEXT STEPS FOR SMART PORT



MG7.2 - Optimisation of transport infrastructure including terminals

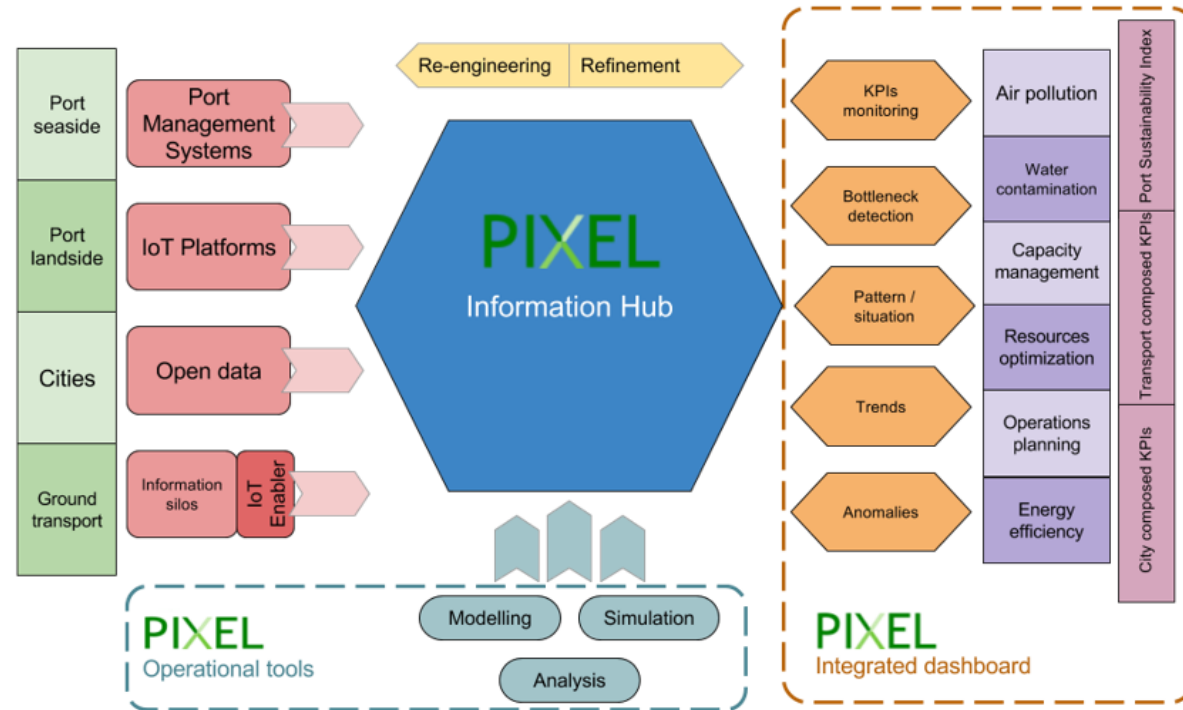
- Predictive analysis for precise, accurate and fine-grained **estimation of temporal migration movements**.
- Led by Prodevelop
- **Participants**
 - Port Authority of Algeciras Bay, TangerMed, Morocco National Port Authority, Spanish Road Authority, Balearia.
 - UPV, TU Delft, Polish Academy of Science, Bulgarian Academy of Science.
- Focused on the yearly pass of the Strait of Gibraltar, exploring generic and reusable algorithms to be used in other high congestion scenarios.
- Strongly based on **synchro-modality** and the **infrastructure sensor networks**.





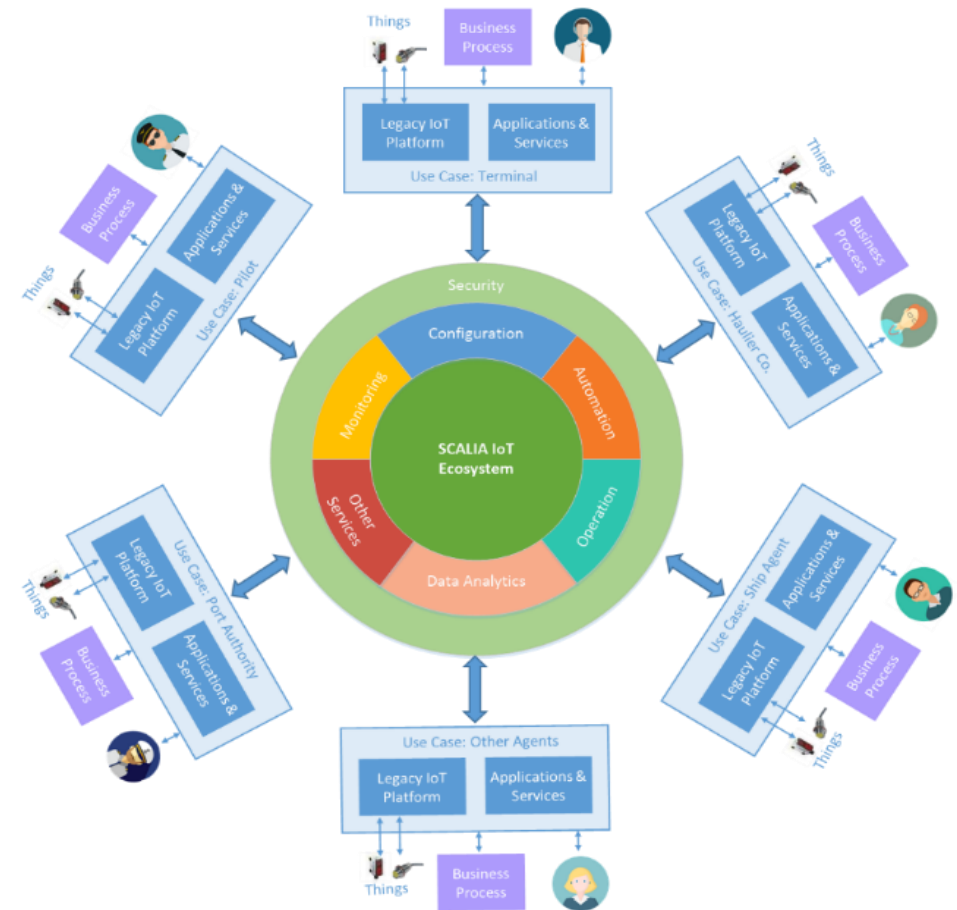
MG7.3 - Port IoT for Environmental Leverage

- IoT interoperable infrastructure to support and promote Environment related services.
- Port driven Use Cases
 - Port of Bordeaux → Smart and efficient clean energy generation
 - Port of Monfalcone → Smart synchronization with dry ports.
 - Port of Thessaloniki → IoT for city-port integration and efficient synchro-modality
 - Health Faculty of Rijeka → Port Environmental Index
- Expected impacts
 - Reduction of CO2 emission
 - Better use of port resources
 - Reduction of waiting time at port gates
 - Interoperability with smart city platforms



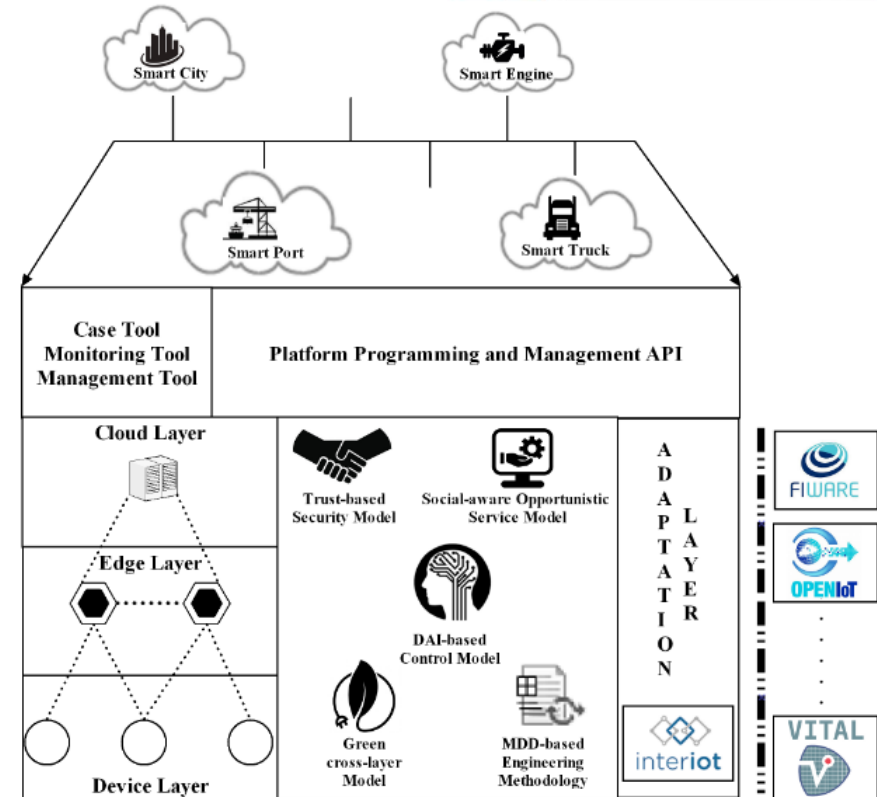
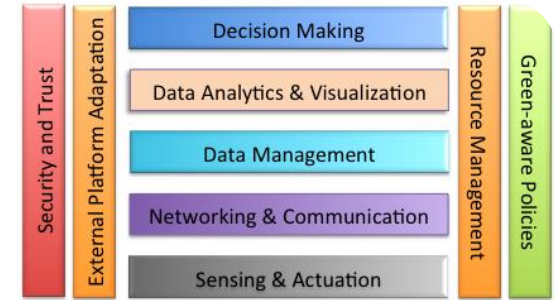
IoT3 - SCALable, semantic, self-*, durAble, secure and cross-domain IoT ecosystem

- Architectural approach for scalability, self-adaptation and self-configuration.
- Semantics enabled interoperability.
- End-to-end **IoT Security** based on blockchain and semantic contract.
- Communication architecture for **5G enable networks**.
- Interoperability with **open platforms and legacy systems** based on INTER-IoT and VICINITY.
- User & Developer Experience (UX & DX), strong Community building.
- **Port use case:** IoT for hyperconnected logistics
 - Interoperation among players
 - Actuation policies
 - KPIs
 - Vessels waiting time
 - Vessel turnaround time
 - Truck/Rail Turnaround Time
 - Container Dwell Time
 - Added value provided by IoT actuations



IoT3 - Intelligent IoT Fabric for Building Smart and Trustable ECOSystems

- **Smart Port** Transportation Use Case
- Smart City-Port Interconnection Use Case
- Smart and **greener truck transportation for Port logistics**
 - Coordination of trucks arriving to the port
- Smart & greener vehicle/vessel engines
 - Self adapting engine profiles to reduce emissions
- Three layer architecture
 - Social-aware Opportunistic IoT Services
 - IoT Security based on a Distributed Reputation Framework
 - Cognitive & Autonomic Model for IoT Control and Management
- IoT Interoperability by Adaptation



Further challenges: TELEPORT, IoCPS, ADSwarm, SmartWare, etc.

External Agents

Administrations

- Customs
- Habitat
- Muster
- Physician Agents

Port Community

- Maritime Agent
- Terminal
- Carrier
- Freight Forwarder
- Custom Agent
- Deckit
- etc.

Citizenship

- Churches
- Institutes



Port Authorities

POSIDONIA Real-Time Event

PCS (PORT COMMUNITY SYSTEM)

- Calls
- Passenger Vis
- Visas
- Carriage manifests
- Dangerous Goods
- Professional Service Point

Communication Integrator (Messaging)

Virtual Branch

- Virtual Branch
- Digital Record
- Digital Signature
- Digital Notification

Document Management

Web

- Graphic Situation
- Ship Information
- Infrastructures
- Public Domain

POSIDONIA Smart App

- Vessels
- Facilities
- News
- Notifications

Port BackOffice

POSIDONIA Management

- Ships Calls
- Supplies
- Cargo Manifest
- Ledgers Boxes
- Dive Services
- Info. Commission
- Inner Maritime Traffic
- Permits
- Fish

Billing & Invoice

POSIDONIA Safety

- Dangerous Goods
- Incidents
- IO Control
- Emergency Management
- Environment
- Signage
- Communications

POSIDONIA Mobile

- Inspection and Surveillance
- Sanctions
- Supplies
- Surveillance Occupancy
- Ledgers Boxes
- Public Domain
- Access Authorizations
- Scanners & Boarding Bridges

POSIDONIA Operations

Ships: Graphical Situation / Operations

- Procs. Logs
- Masters
- Ship IO Operations
- Inner Traffic
- Ship Supplies
- Wastes
- Incidents
- Beacons
- External systems
- VTS
- Radar
- AXON
- Mellen

AIS Simulation

POSIDONIA Space

- Public Domain
- Conservation
- Infrastructures
- Public Works

POSIDONIA Business Intelligence

- Dashboard
- Statistics

POSIDONIA IoT

- Message Broker
- Gateway
- Big Data
- Data Analytics
- Rule Engine
- Event Correlation
- Monitoring
- Geospatial Viewer
- Posidonia Connector

Posidonia™
Port Solutions Suite



THANKS!

ANY QUESTIONS?





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