Roadmap and Progress for the Implementation of C-ITS Services at the Port of Livorno

The first C-ITS-ready sea port in Italy

ETSI 10th ITS Workshop

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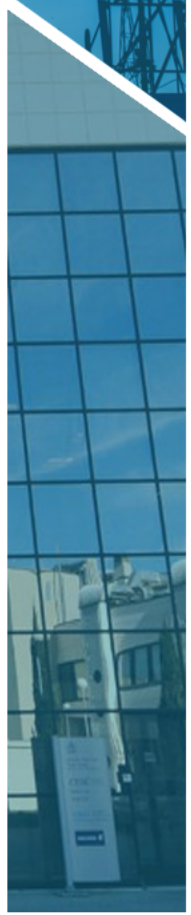

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Porti di Livorno, Piombino, Capraia Isola, Portoferraio, Rio Marina, Cavo

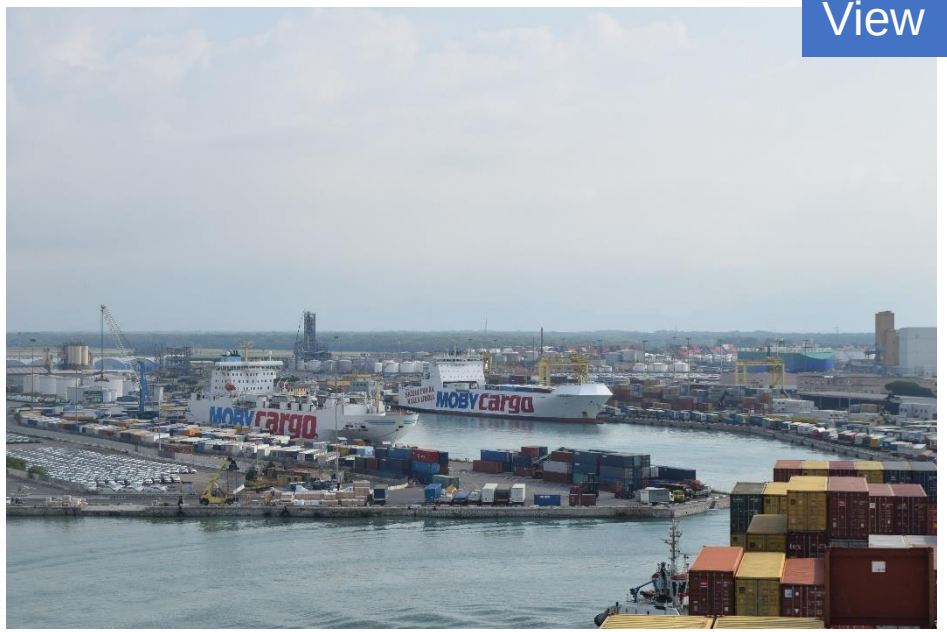
Outline

- Port of Livorno
  - description of the (multi-purpose) port profile;
  - the (standardized) ICT stack;
  - on-going innovation actions.
- C-ITS background activities:
  - the AUTOPILOT testbed;
  - Use Cases;
  - Public Demonstrations.
- ScanMed corridor:
  - Ursa Major Neo project description;
  - action being implemented by the Port Authority;
  - design of C-ITS infrastructure and mobility services;
  - C-ITS components being procured.

Port of Livorno

- The Passenger Port: ferry and cruise terminals (100,000 m2), ship repair and ship building
- The Commercial Multipurpose Port: 2.5 million m2 (850,000 m2 customs boundary) 90 berths and 13 km of quays, 3 railways & 60 km of tracks, freight traffic fully separate from the urban one
- The Industrial Area: refinery, oil stock areas, energy power stations, chemical and automotive component industry
- The Freight Village "A. Vespucci": 2.8 million m2 , cargo consolidation with multimodal access, distribution centres, packing firms, customs clearance and scanning area, railstation, 3 MWh PV park, etc.
- The Dry port "Il Faldo": car stocking and distribution area fully automatised , 640,000 m2, capacity 25,000 cars, road and rail

View



ESPO conference 2019

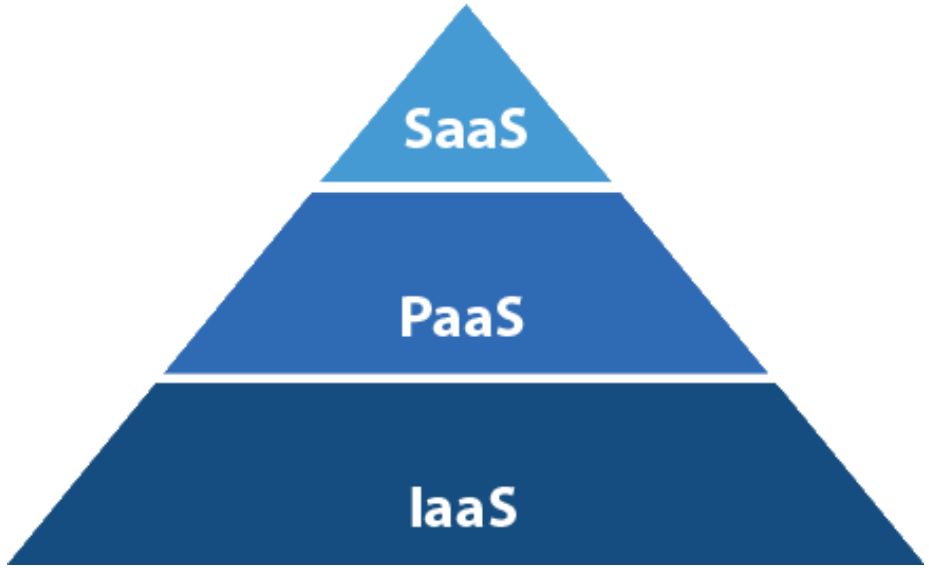
Port of Livorno

The Port Authority of the Northern Tyrrhenian Sea in collaboration with CNIT is conducting a deep digital revolution that is already transforming port industrial activities.

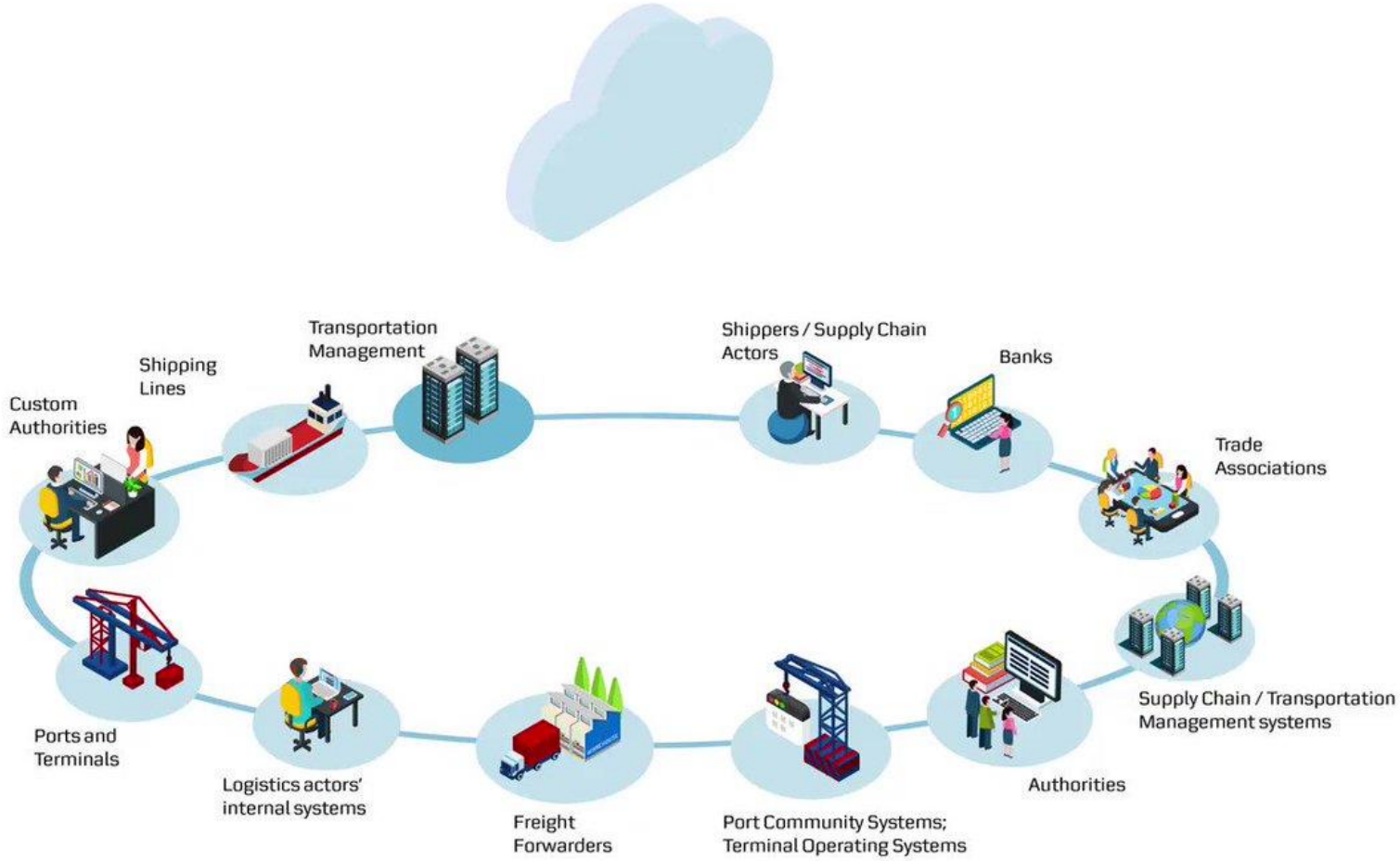
Provide services

Provide platforms

Connects the port



Reference community in sea ports



Standardization process

Integration need at **Infrastructure**, **Platform**, and **Software layers**.

New IT solutions (ESB, DV)

Service Oriented Architecture (SOA)

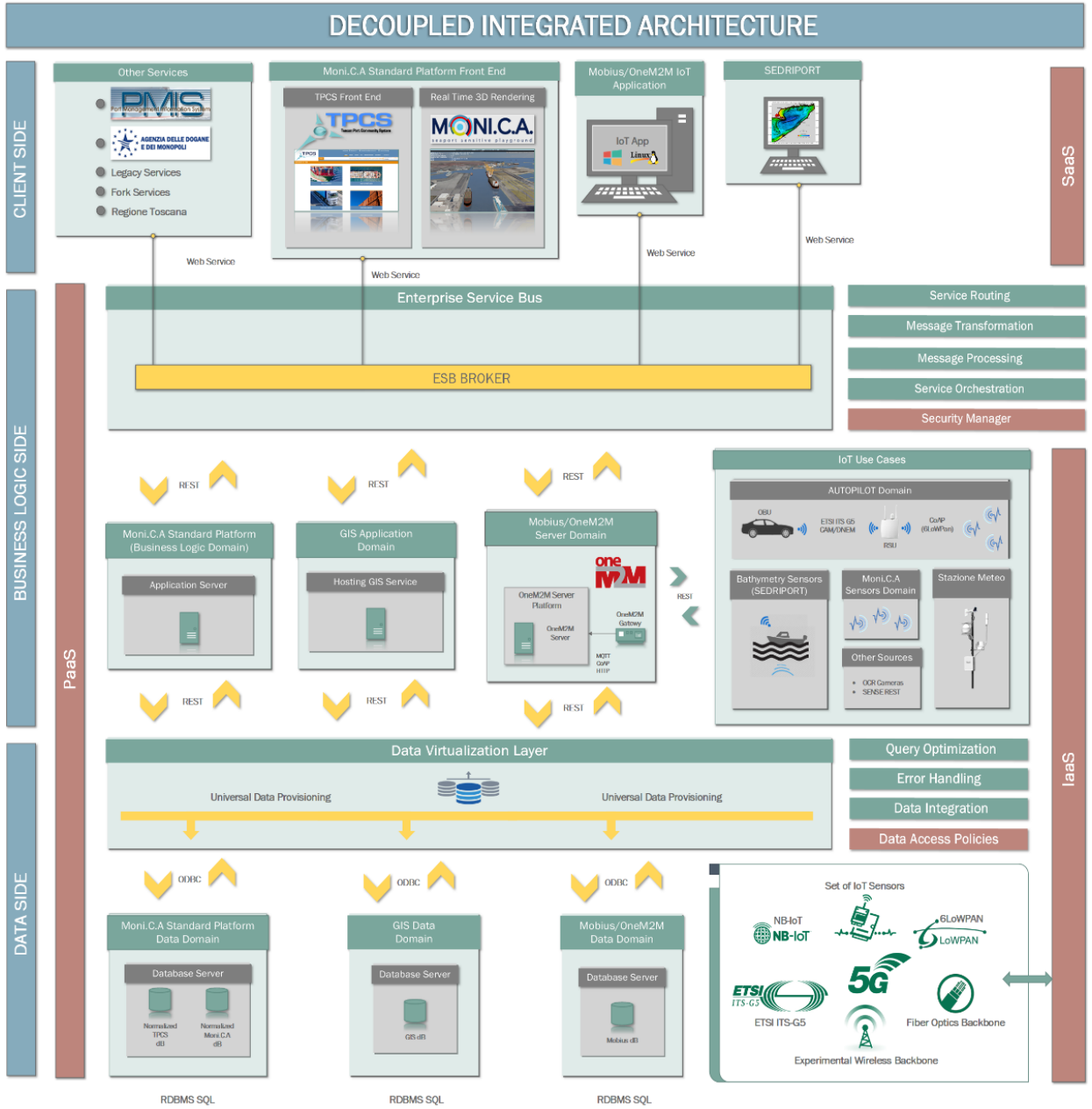
Innovative Services

Supporting IoT devices (M2M)

Coexistence with legacy functions

New security policy

Standard Platform



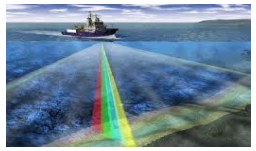
MONI.C.A. seaport sensitive playground

Cross-fertilization and Innovation Actions

- The result is a strong and structured collaboration with the main port innovation and scientific initiatives in Europe and beyond;
- The authority is an active player towards EC and EU most relevant lobbies (ESPO, Corridor Forum, ERTICO).

AUTOPILOT

SEDRI PORT



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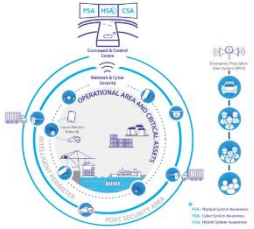
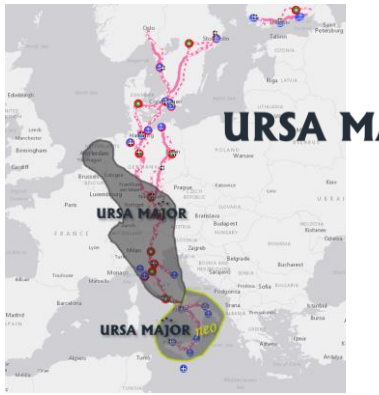
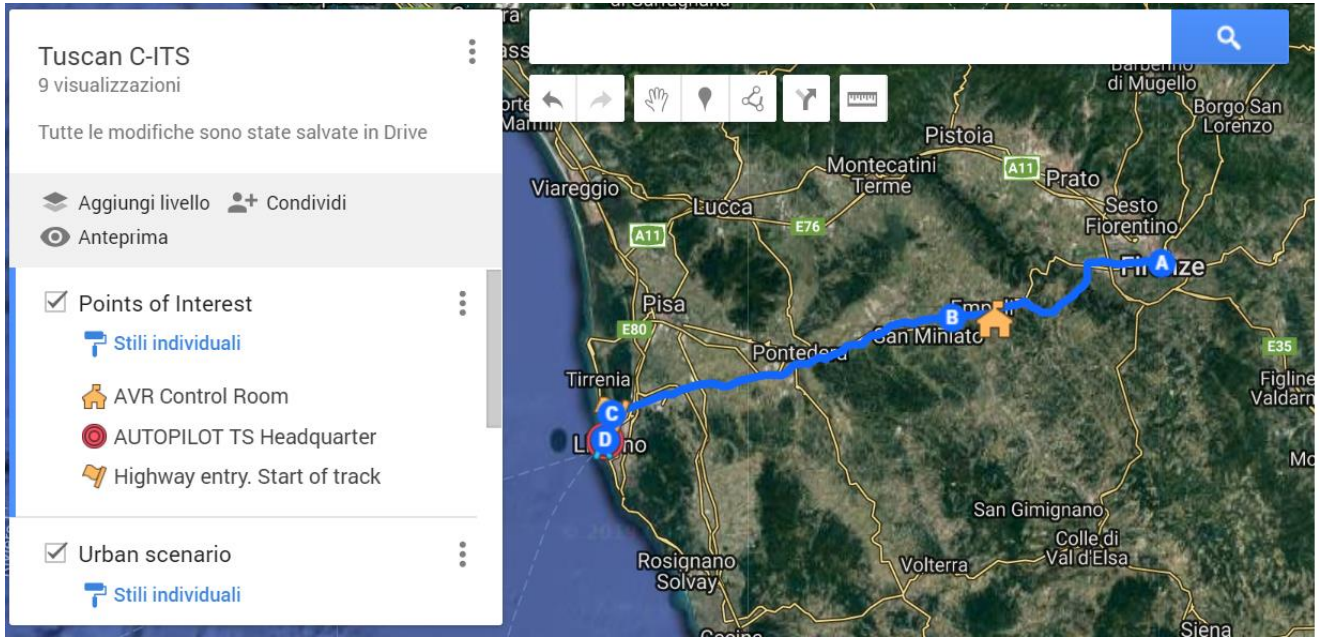




Background in C-ITS

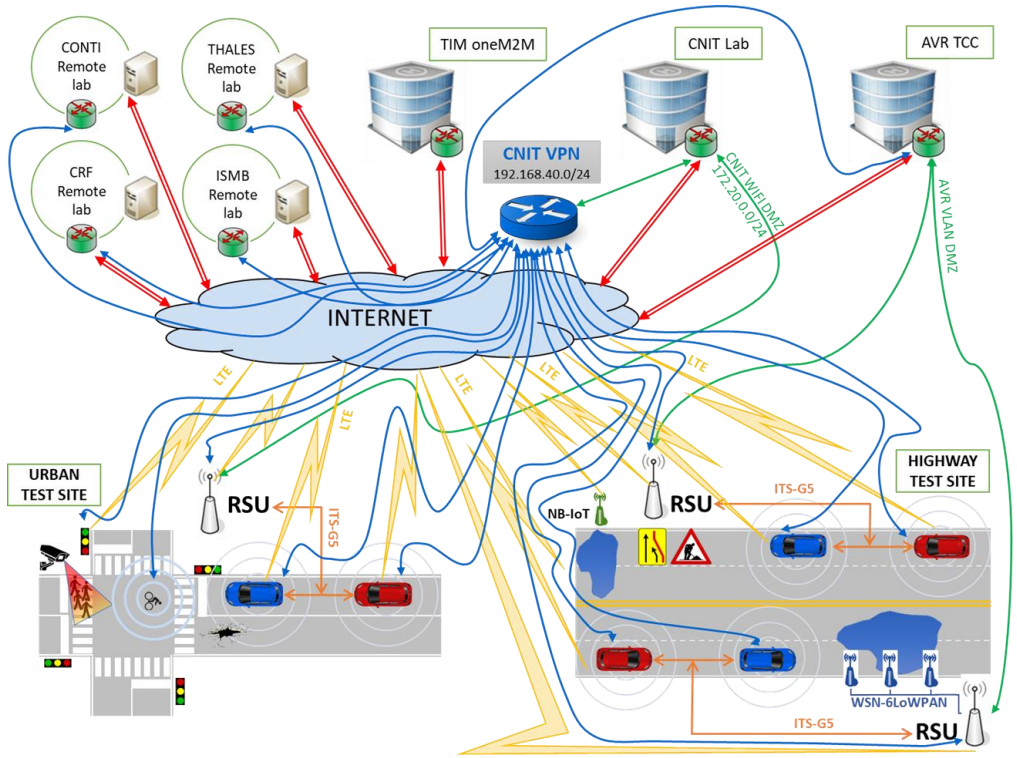
Asset: Tuscan Cooperative ITS

- What is it?
  - It is a Large-Scale permanent testbed deployed in the sea port of Livorno and along the free-way Livorno – Florence.
- When has it been set-up?
  - Starting from ETSI Plugtests 2016 experiments.



- What services is it featuring (as from AUTOPILOT run 2018)?
  - It implements some Day 1 and Day 1.5 C-ITS services;
  - It supports IoT-sensors integration via OneM2M;
  - It supports C-ITS assisted autonomous driving.

Autopilot: Network Architecture



- Large Scale Hierarchical Network Infrastructure:
  - Tier 0:
    - Urban and Highway test sites.
  - Tier-1 service providers:
    - CNIT lab (Livorno);
    - AVR TCC (Empoli);
    - TIM IoT OpenLab (Turin).
  - Tier-2 remote labs:
    - Continental (Toulouse);
    - Thales (Florence);
    - FCA-CRF (Trento);
    - ISMB (Turin).

Autopilot : Network Coverage

LTE- Freeway Port Area

LTE- Livorno Port Area

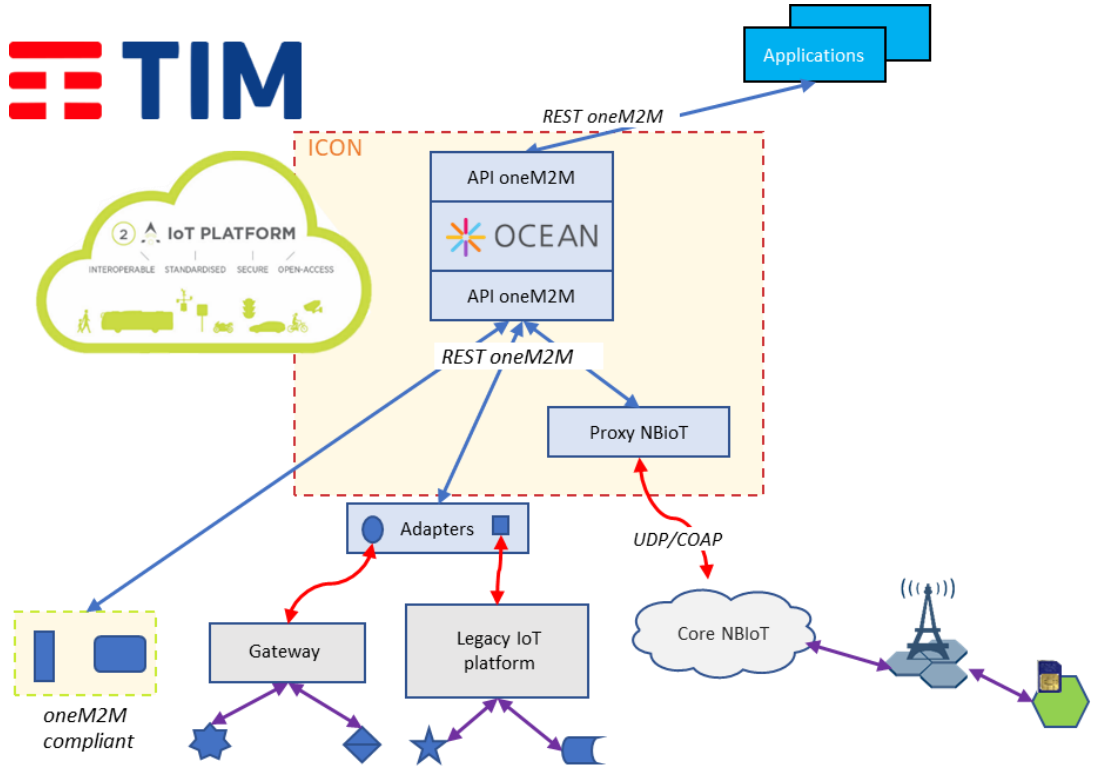
WiFi – Maritime Terminal

NB-IoT – Livorno City / Freeway

G5 - Freeway

G5 – Maritime Terminal

Autopilot Platform



- Compliance with the oneM2M standard
- Southbound and northbound Rest APIs for data storage and sharing
- Data sharing by means of pull/push (subscription/notification)
- URIs for identifying resources
- Web console for resource management and provisioning
- Web console for administrators

- Service independent, interworking with legacy platforms and non-OneM2M platforms by means of Adapters/Proxies
- Multi-tenancy: each tenant has credentials for access to its data

Everything (i.e. IoT) on the platform

CNIT IoT G5 OBU

CNIT NB-IoT Water Level Sensor

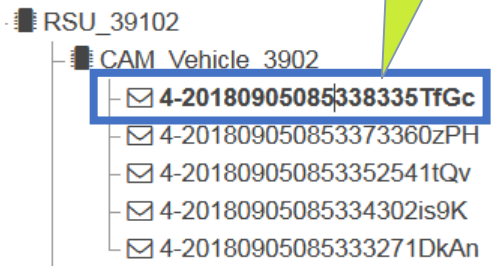
CNIT IoT G5 RSU

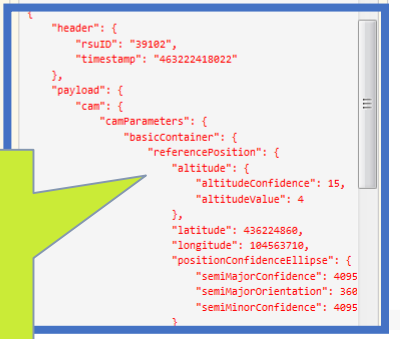
oneM2M attributes: Name, ID, time, type of content, etc.

Attribute	Value
pi: parentID	SkG9OYG6wm
ty: resourceType	4 (contentInstance)
ct: creationTime	2018-09-05 10:53:38
ri: resourceID	SJf5qYfpPm
rn: resourceName	4-20180905085338335TfGc
lt: lastModifiedTime	2018-09-05 10:53:38
et: expirationTime	2028-09-05 10:53:38
acpi: accessControlPolicyIDs	AccessControlPolicyIDs: /onem2m/acp_autopilot
st: stateTag	29
cs: contentSize	1135
cr: creator	autopilot_prod
cnf: contentInfo	application/json:0

Values of attributes

Identifier

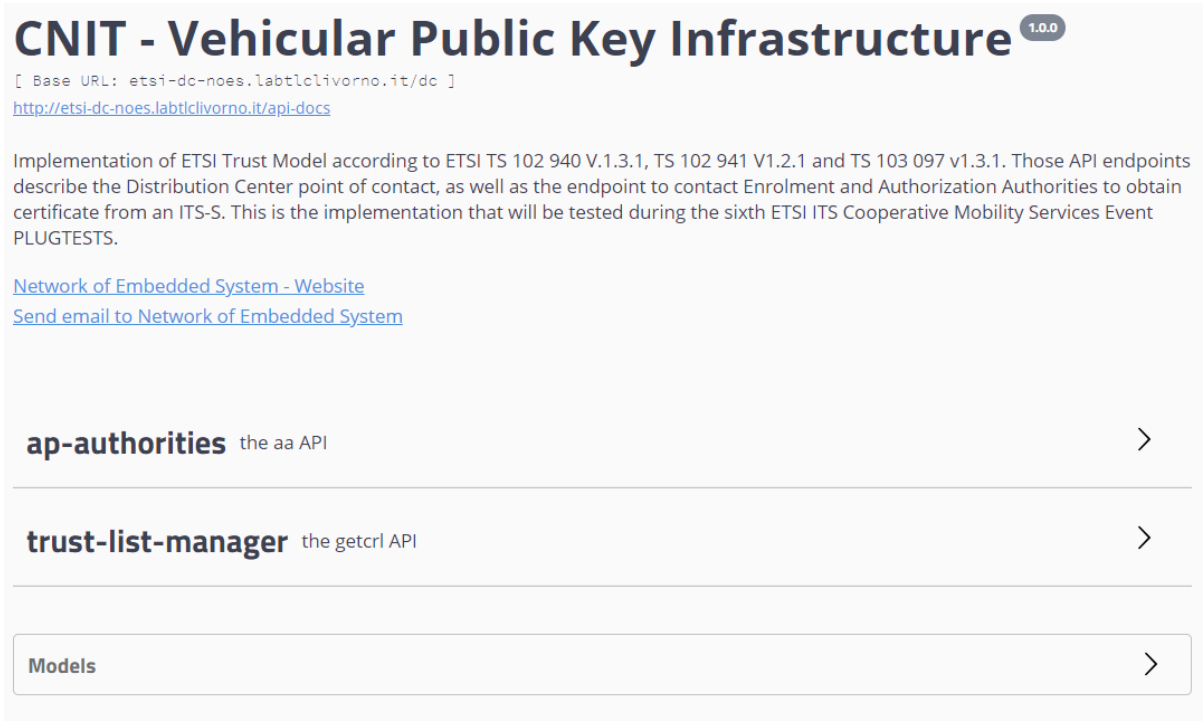




A CAM message that is the content stored on ICON

Securing the C-ITS infrastructure

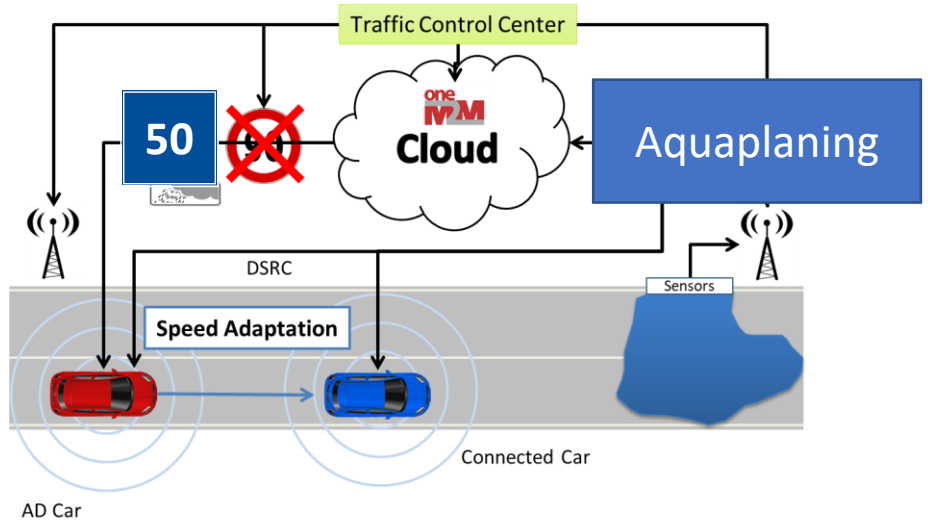
- Tested during the ITS Cooperative Mobility Services Event 6, Sophia-Antipolis, 25 February - 1 March 2019

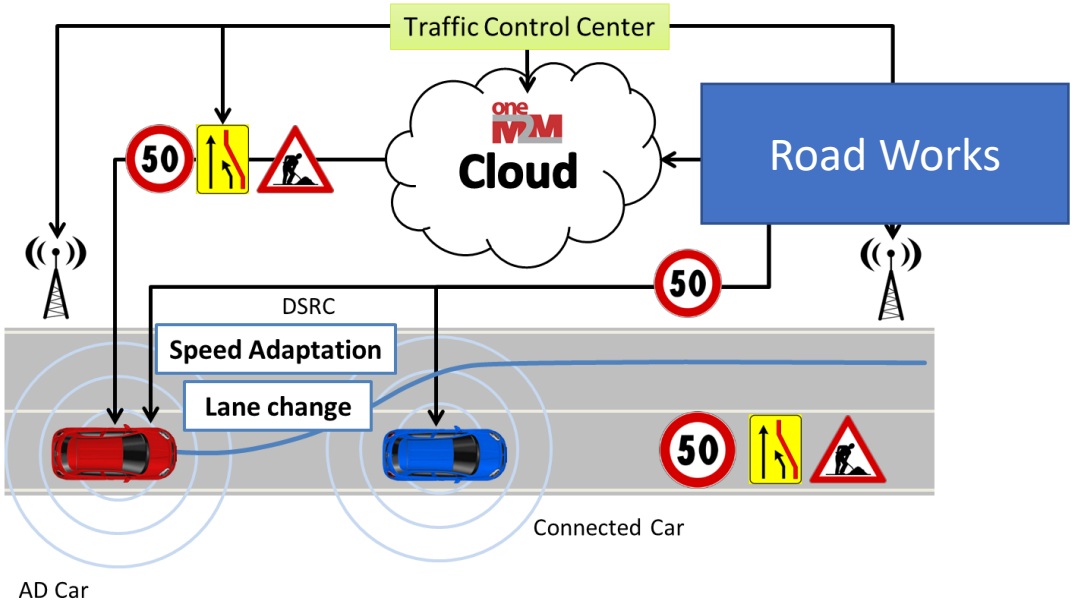


- Validation of the European trust domain concept described in the EC Security Policy Release 1:
  - Interoperability of multiple PKI
  - Support of CRL/CTL in message validation
  - Certificate requests
  - Pseudonym changing strategy and privacy protection
- Interoperability Testing
  - Security header and certificate formats (TS 103 097 v.1.3.1)
  - Trust and Privacy Management (TS 102 941 v1.2.1)
- Conformance Testing
  - ETSI CTI (Centre for Testing and Interoperability) will provide a test system to test the conformance of secured ITS-S and PKI implementations

Use Cases - Highway

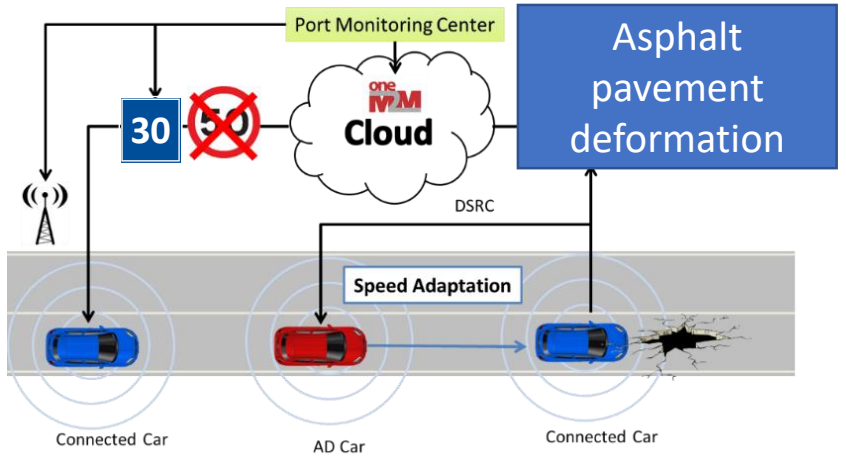
- **Scenario:**
  - Livorno- Florence public highway
- **Target:**
  - Avoiding accidents in a real-world dense environment featuring 40,000 vehicles / day (heavy trucks 20%)
- **Tackling with:**
  - common events:
    - road works (poorly flagged in case of urgent works)
  - specific events:
    - rain water standings (Tuscany is rainy in autumn/spring)

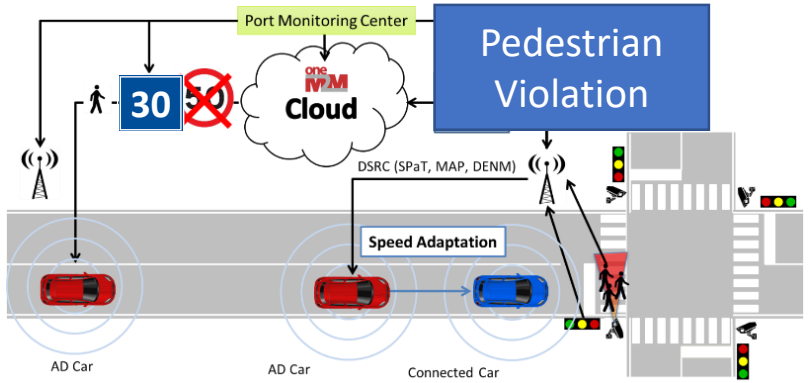


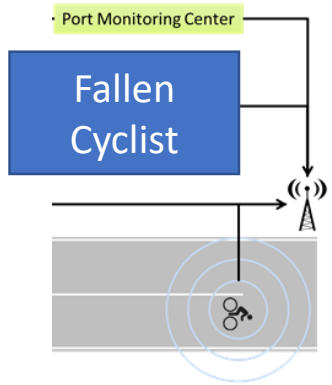


Use Cases - Urban

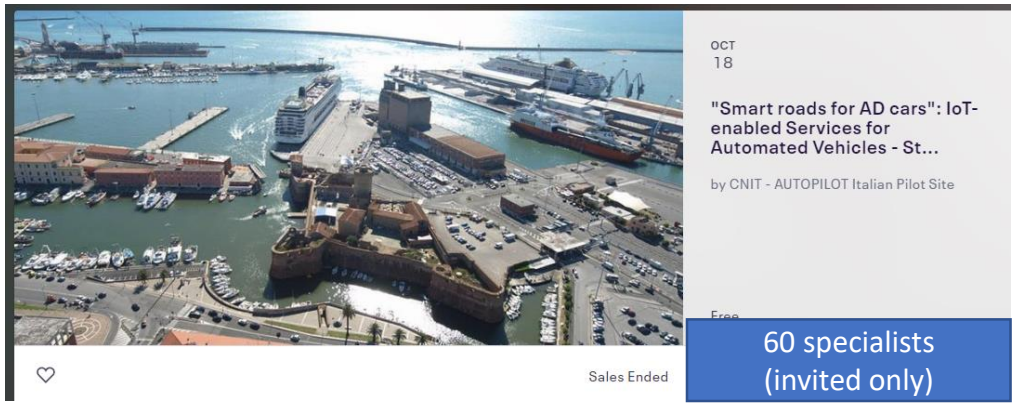
- **Scenario:**
  - Port of Livorno maritime terminal
- **Target:**
  - Avoiding accidents in the embarkment area of the cruise and ferry terminals (2 million passengers / year)
- **Tackling with:**
  - urban-like typical events:
    - pedestrian traffic light violation
    - fallen cyclist in the intersection
    - pavement deformation



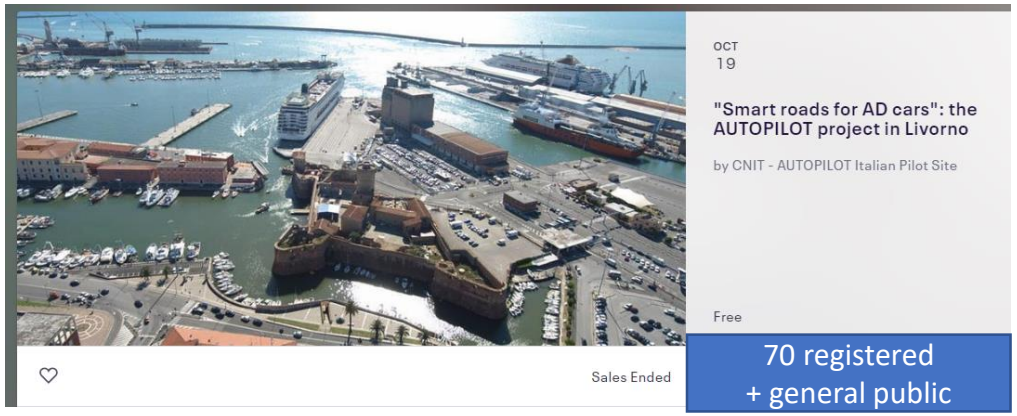




Stakeholders and Public Event



60 specialists (invited only)



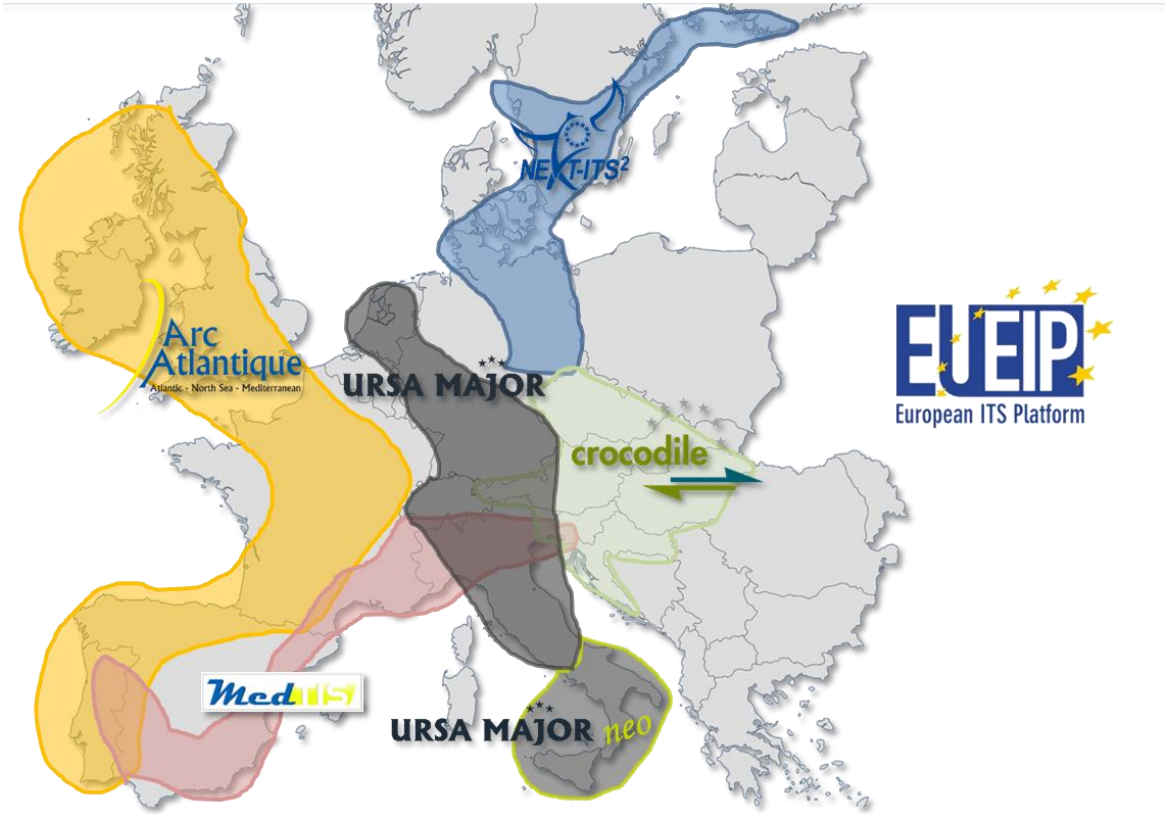
70 registered + general public

- AUTOPILOT events on Oct 18th and 19th:
  - on-the-field demos:
    - highway/urban.
  - invited talks:
    - Regione Toscana, Port Authority of North Tyrrenhian Sea
    - Municipalities of Rome, Turin, Verona;
    - Italian ITS association.
- On-line material on ERTICO web site.

Foreground: releasing C-ITS services for assisted driving and integrated logistics

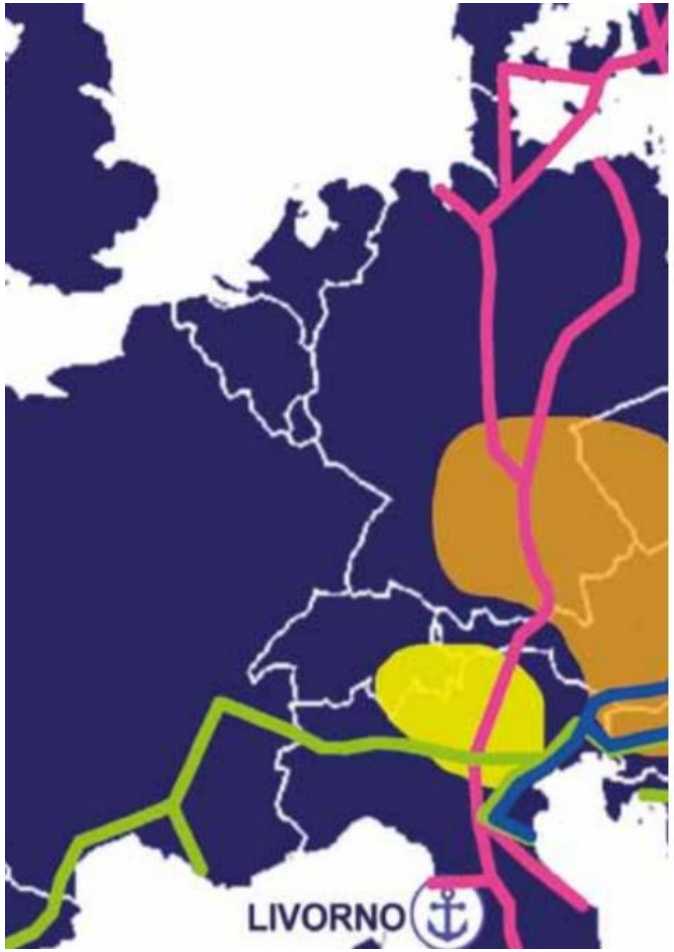
Ursa Major Neo in Livorno

- UMneo is part of the EU EIP
- UM started as an international cooperation primarily of Road Operators on ITS deployment
- After its first two Actions, UM is already in its 3rd phase
  (URSA MAJOR neo) with:
  - extended coverage: down to Sicily
  - extended profile: ports and RRT
  - extended scope: works & pilots
  - extended technology: Cooperative ITS
- 4 countries (DE, NL, IT, CH) with 35 beneficiaries total engage in 4 different major activities

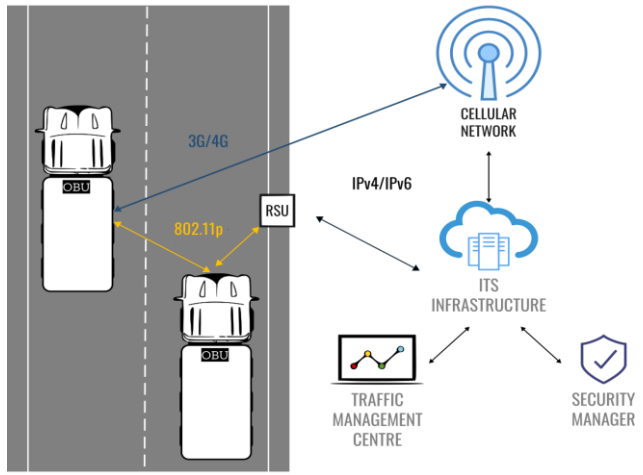


UMN Objectives in Livorno

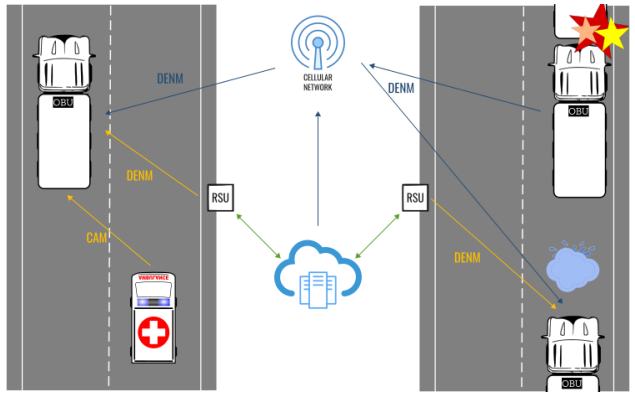
- Develop a series of C-ITS services, enhancing safety and efficiency in the port business
  - **Safety information**: real-time information about hazards detected ahead on the road;
  - **Bottleneck removal**: real-time and early notification about potential traffic congestion;
  - **Smart truck parking**: suggestion to drivers to use freight village smart parking depending on the real-time traffic conditions
- Implementation Phase Q1 2019/ Q1 2020;
- Testing Phase Q2 2020 / Q4 2020.

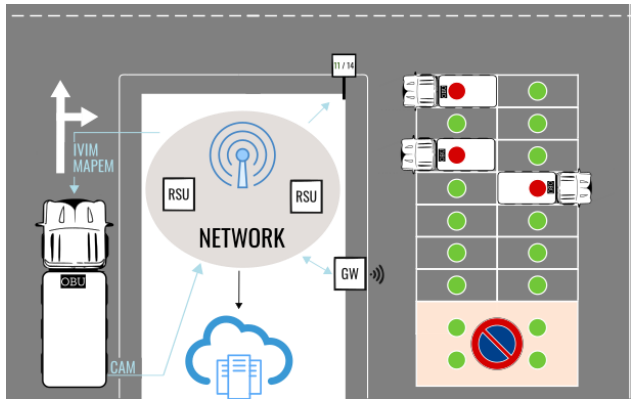


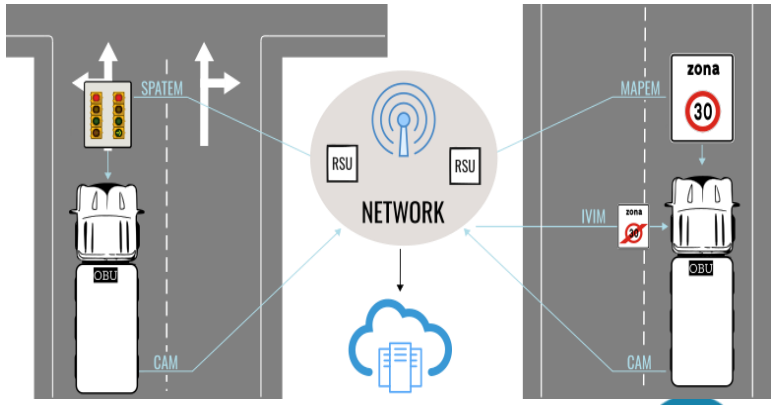
UMN Use Cases



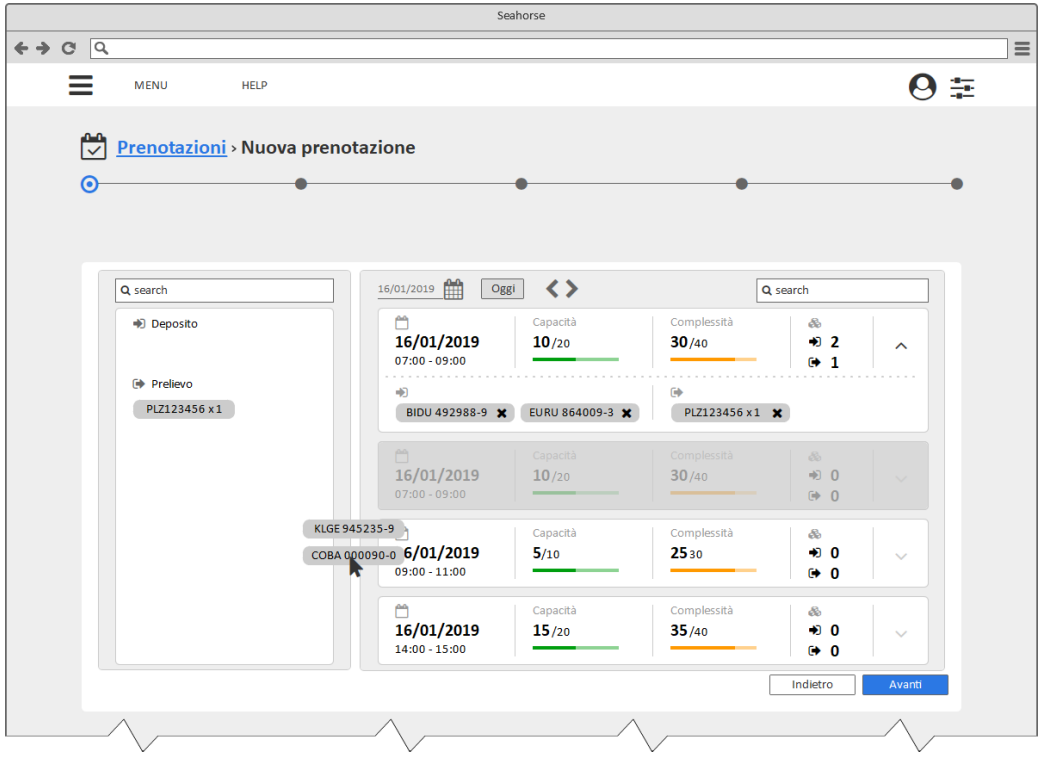
- Leveraging a corridor-wide C-ITS infrastructure:
  - Hazard location notification;
  - Smart Parking;
  - In-Vehicle Signage.







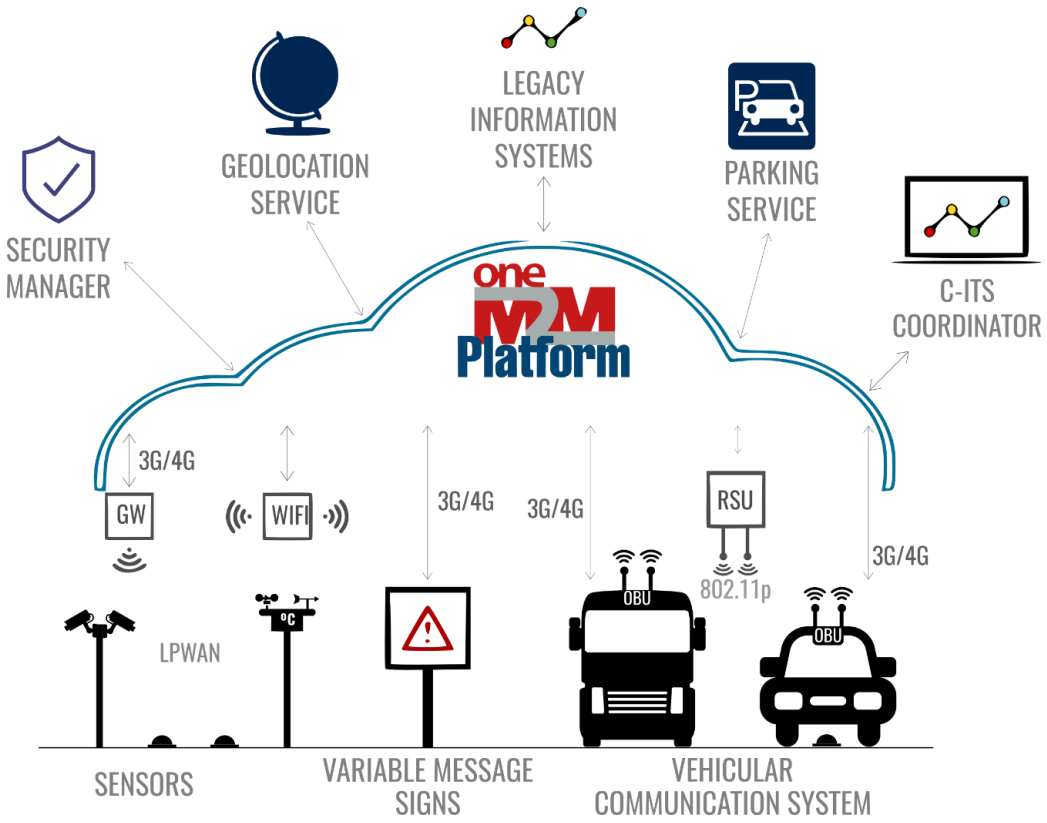
UMN allows to optimize truck arrivals



- Vehicle Booking System:
  - management of arrival slots (by terminals);
  - data aggregation with third-party sources;
  - M2M real-time adaptation;
  - implementation of contingency plans (in case of traffic, late arrival of vessels, accidents along the road).

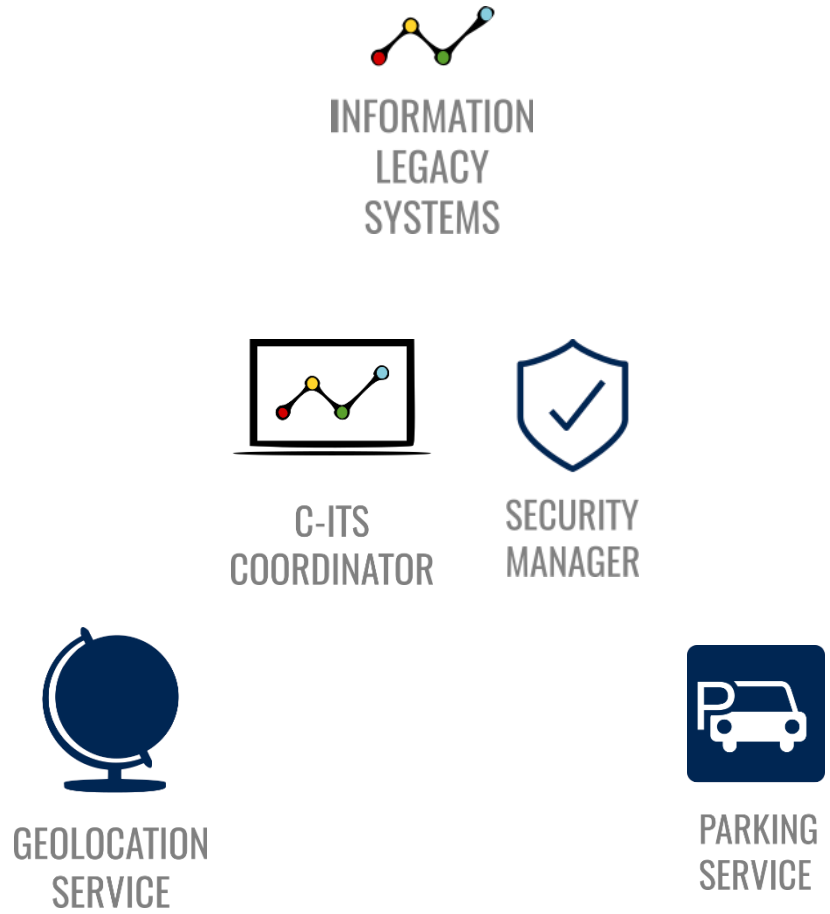
Components being procured

Credits: instituto de telecomunicações



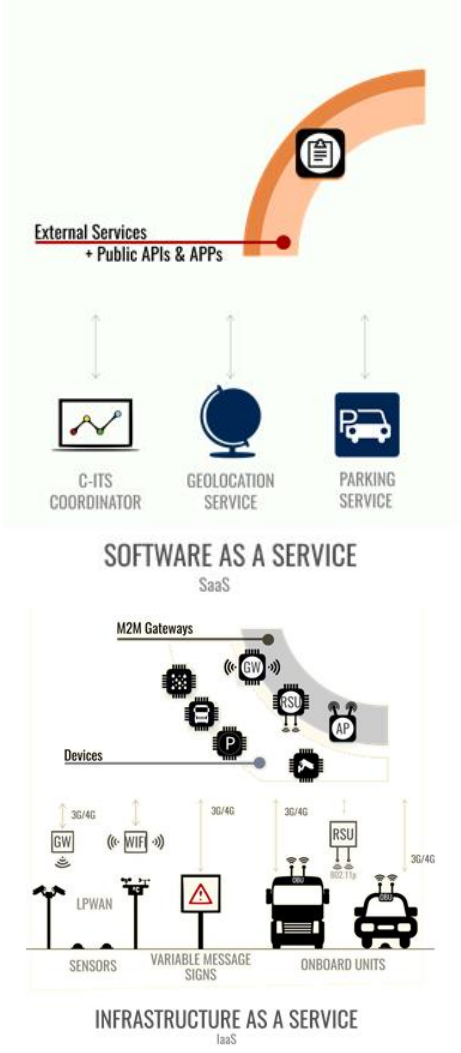
- C-ITS planning & tendering
  - Pilot C-ITS infrastructure and integration patterns with MoniCA are available;
  - Available now recommendations for tenders on:
    - IaaS components, i.e. IoT sensors, OBU and (eventual) RSU devices;
    - PaaS components, i.e. platform modules;
    - SaaS components for implementing the analysis framework;
    - Design of IaaS, PaaS, SaaS verification modules.

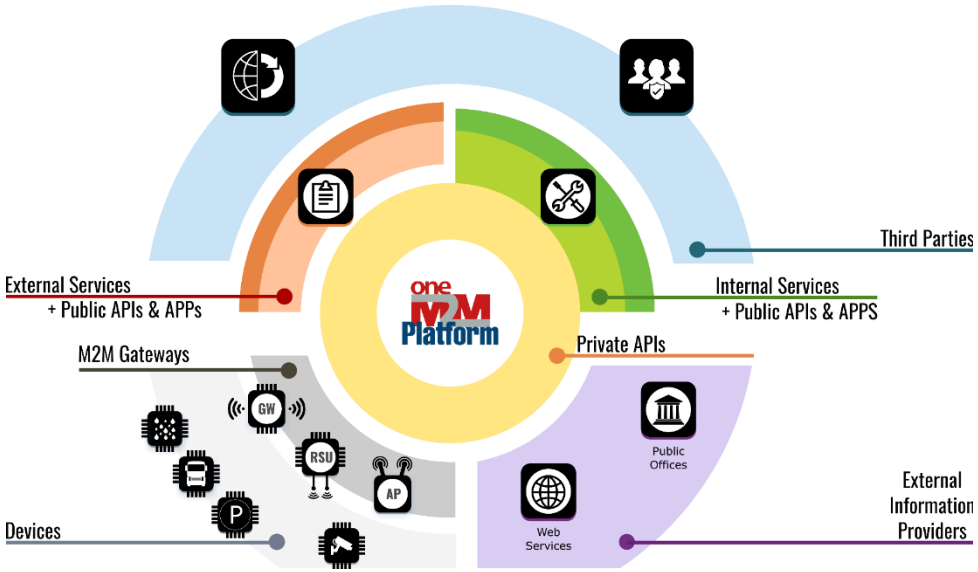
UMN software modules

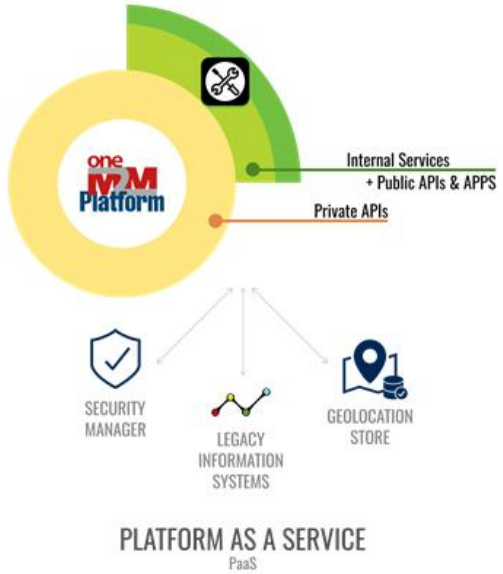


- C-ITS coordinator:
  - Frontend application for traffic management and overall ITS coordination (notably VBS).
- Security Manager:
  - Responsible for the life cycle management of enrollment credentials and certificates.
- Information Legacy System:
  - Allowing to share data from different Traffic Management Entities.
- Geolocation Service:
  - Receives and processes vehicle attributes in real-time and stores them in a geospatial database, sends information via geocast to interested vehicles.
- Parking Service:
  - Based on vehicle position/speed and routing information, it can provide the best parking spot.

UMN services in MoniCA







Conclusions

- The Port of Livorno is:
  - a valuable and recognized testbed at the European scope.
- Livorno is the first port in Italy:
  - ready for C-ITS;
  - exploiting R&D and rolling-out cutting-edge applications:
    - notably: C-ITS coordinator, Vehicle Booking System.
  - suited to:
    - regulators and port communities like truck drivers, haulers, fleet managers.

THANK YOU FOR YOUR ATTENTION

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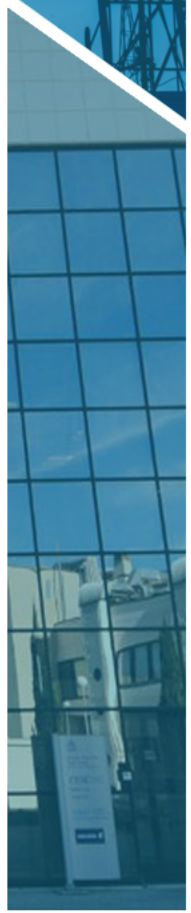

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