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

The first C-ITS-ready sea port in Italy

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• 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 automated, 640,000 m², capacity 25,000 cars, road and rail
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
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).
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 AUTOPILLOT 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

OneM2M attributes: Name, ID, time, type of content, etc.

A CAM message that is the content stored on ICON

Values of attributes

CNIT IoT G5 OBU

CNIT NB-IoT Water Level Sensor

CNIT IoT G5 RSU

Identifier

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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

• 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
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
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;
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).

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Components being procured

- 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

SOFTWARE AS A SERVICE
SaaS

INFRASTRUCTURE AS A SERVICE
IaaS

PLATFORM AS A SERVICE
PaaS

EXTERNAL SERVICES
- Public APIs & APPs

PRIVATE APIs

INTERNAL SERVICES
- Public APIs & APPS

THIRD PARTIES

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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.
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