

UNIVERSITÀ DI PISA

CENTRO DI SERVIZI - POLO UNIVERSITARIO
SISTEMI LOGISTICI di LIVORNO

Master Universitario di I° livello in
GESTIONE DEI SISTEMI LOGISTICI

Tuscany mobility needs analysis

Relatore:

Prof. Paolo Pagano

Allieva:

Dott.ssa Silvia Antonelli

a.a. 2017/2018

1	INTRODUCTION.....	2
1.1	STRUCTURE OF THE REPORT	2
2	TUSCANY MOBILITY NEEDS ANALYSIS.....	3
2.1	TUSCANY MOBILITY NETWORKS.....	3
2.1.1	<i>Roads.....</i>	4
2.1.2	<i>Railways.....</i>	6
2.1.3	<i>Maritime transport – Focus: Livorno, Piombino and Tuscan Archipelago.....</i>	7
2.2	TRANSPORT DATA.....	10
2.2.1	<i>Province of Livorno.....</i>	10
2.2.2	<i>Tuscany Region.....</i>	11
2.2.3	<i>Livorno Port Authority (AdSP MTS).....</i>	14
2.2.4	<i>“Elba Apps”.....</i>	14
2.3	TRANSPORT DATA FORMAT	15
2.3.1	<i>Province of Livorno – “B On Time”.....</i>	15
2.3.2	<i>Tuscany Region – “Muoversintoscana”.....</i>	16
2.3.3	<i>AdSP-MTS – “MoniCA service”.....</i>	16
2.3.4	<i>Observations: GTFS data format</i>	16
2.4	ADSP SCHEDULED AND REAL-TIME SERVICES.....	18
2.4.1	<i>Technical specifications.....</i>	19
3	THE “MOBIMART” PROJECT.....	21
3.1	INTERREG EU INITIATIVES	21
3.2	WHAT IS MOBIMART	21
3.3	MOBIMART INNOVATIVE ASPECTS.....	22
3.3.1	<i>CNIT contribution in MOBIMART project.....</i>	22
3.4	STATE OF THE ART ANALYSIS	23
3.5	SUGGESTED SOLUTION.....	23
3.5.1	<i>Use case – Info-mobility service</i>	26
3.5.2	<i>MOBIMART web-app for the Port of Livorno.....</i>	26
3.6	MOBIMART SWOT ANALYSIS	28
3.7	MOBIMART FINAL CONSIDERATIONS (RECAP)	29
4	MOBIMART AS A MAAS SERVICE ENABLER.....	29
4.1.1	<i>Data standardization.....</i>	30
4.1.2	<i>Measures and best practices – compliance</i>	31
5	CONCLUSIONS	32

1 Introduction

People mobility is taking on a new challenge: disrupting technologies are turning the traditional passengers' mobility paradigms upside-down. New technologies can be considered as new tools to help people mobility among different typologies of transport networks, with focus on public transport alternatives, with special attention to the need of disabled people and increasing societal and economic well-being. This new concept is called “*smart mobility*” and it involves both public and private actors, which must be always committed in innovation and sustainable national and international projects.

The aim of this analysis is to study the mobility needs in Tuscany starting from the existing infrastructures (in a Trans-European Network) with the related transport services, in order to create the preconditions to build a “*Mobility as a Service*” (MaaS) smart-mobility environment. The MOBIMART Interreg project is considered as a smart mobility enabler in the maritime Italy-French coastal regions.

1.1 Structure of the report

The analysis starts, in *Chapter 2*, with a “list” of all the transport infrastructures in Tuscany (roads, railways and maritime transport) with particular emphasis on the Tuscan Port System: Livorno, Piombino and Portoferraio ports. Afterwards, we can see a detailed description of the public transport information system based on the open data¹ and travel plan portal called “Muoversintoscana”.

Chapter 3 talks about MOBIMART project. As already specified, the Interreg MOBIMART project is considered as the MaaS enabler for the Tuscany area. CNIT is the technological partner of the North Tyrrhenian Port Authority, so it is designated to develop a data interchange platform for maritime passengers' mobility in Tuscany. As to know the project business value, SWOT analysis has been defined.

In *Chapter 4*, MaaS requirements are strictly defined: data must be standard, reliable, kept up-to-date and anonymized, according to the new GDPR EU privacy regulatory.

¹ In the GTFS standard format

2 Tuscany mobility needs analysis

2.1 Tuscany Mobility networks

Tuscany territory is situated in a very strategic position, that's a privilege according to the importance of mobility and logistics networks: Located in the barycentre of Mediterranean Sea, Tuscany is crossed by one of the core logistics corridors²: “the Scandinavian-Mediterranean” one.

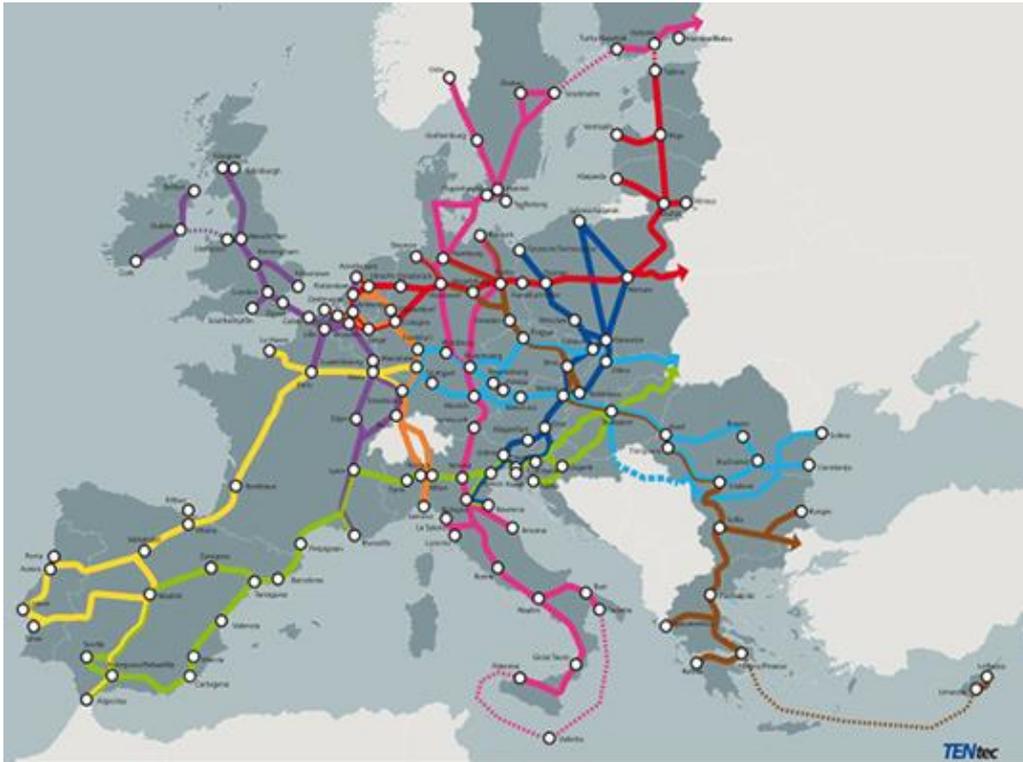


Figure 1 - TEN-T Network. in fuchsia the "Scandinavian - Mediterranean Corridor"

Moreover, Tuscany has important infrastructures: roads, railways, ports and airports. These facilities help Tuscany's competitiveness.

² What the term "Corridor" we mean "TEN-T Networks" ("Trans European Network – Transport), an integrated system of transport infrastructures useful for enforcing a free movement of people and goods in the European territory, also known as single European market.

2.1.1 Roads

Road transportation is made easier thanks to a very capillary network, in fact almost all the localities belonging to the regional territory can be reached without difficulty.

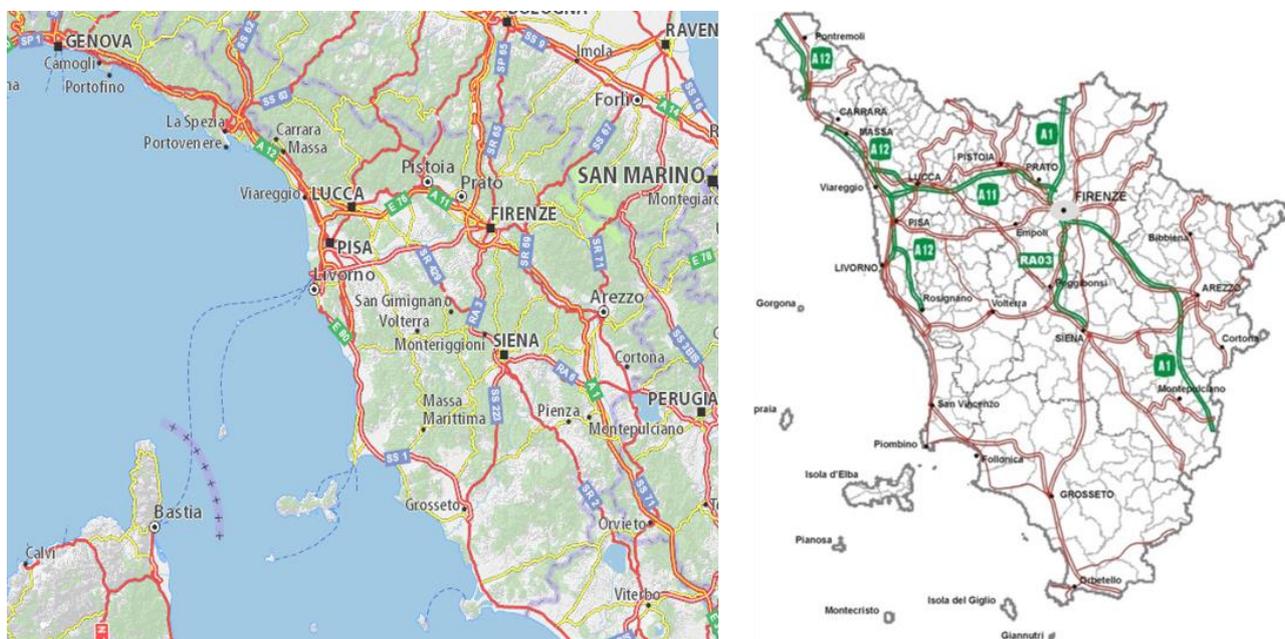


Figure 2 - Tuscany road network. Complete (left), with details concerning to principal roads, motorways and highways (right)

When talking about road networks in Tuscany, it is right to mention the motorways: Tuscany is crossed by four motorway branches (the Firenze-Siena connection, *RA03*, can be considered as a freeway³).

Highways play a fundamental role too, in particular the Firenze-Pisa-Livorno highway (*SGC FI-PI-LI*), which directly connects that three main cities. Thanks to the latest adjustments, the *SGC* is completely connected with the port of Livorno.

Via motorway links, the Firenze-Pisa-Livorno Highway is linked to the following motorways:

- *A1* – “Autostrada del Sole”
- *A11* – “Firenze-Mare”, also known as “Firenze-Pisa”
- *A12* – “Genova-Rosignano”

SGC FI-PI-LI is also linked to the “*Variante Aurelia*” (road variant for the *SS1 “Strada statale via Aurelia”*) which goes from Roma to Ventimiglia, the Italy-France state border. The “*Via Aurelia*” links Livorno with Roma.

³ Special motorway “without tolls”

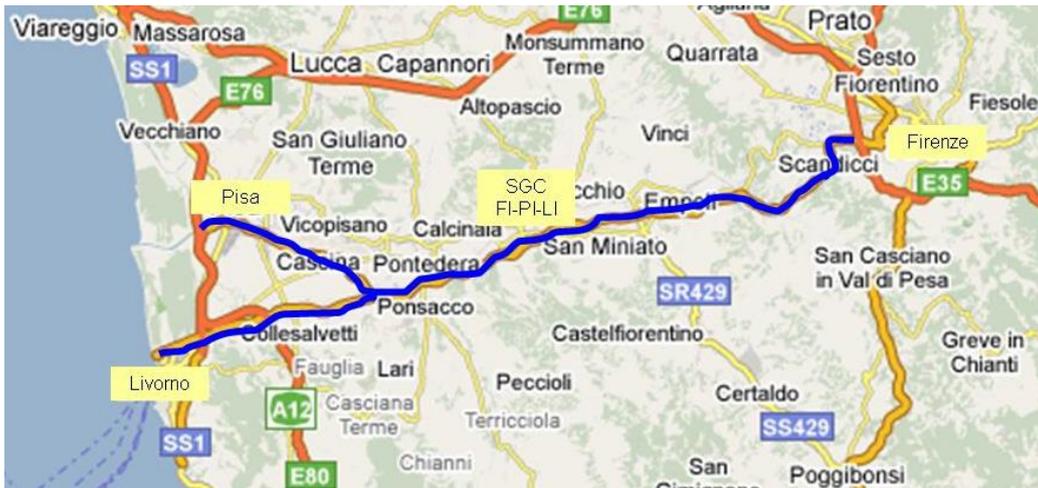


Figure 3 - SGC FI-PI-LI. As we can see in the figure, the highway branches off at the “Pontedera-Ponsacco” exit (“Pisa” and “Livorno” branches)

At last, there are several secondary highways, “strade statali” that cross Tuscany:

- SS2 – “Via Cassia” o “Senese” (Firenze-Siena)
- SS12 – “Dell’Abetone e del Brennero” (Lucca-Modena)
- SS67 – “Tosco-Romagnola” (Pisa-Ravenna)

2.1.2 Railways

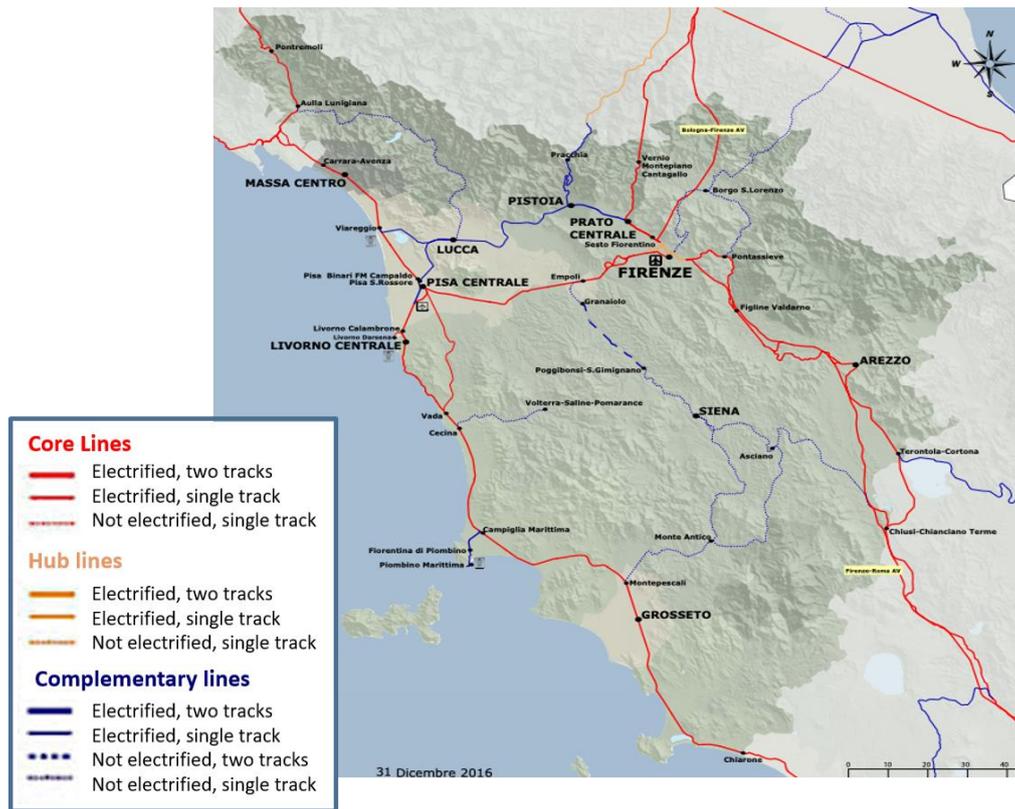


Figure 4 - Tuscany railway network. (Data source: RFI)

Tuscan RFI railway network includes the high-speed line (AV) Firenze-Roma and Firenze-Bologna. In the main Tuscan railway stations, people can take high frequency “InterCity” or a “FrecciaBianca” trains which can lead to other principal Italian cities. In the “Firenze Santa Maria Novella” and “Firenze Rifredi” stations, people can also travel using the most speed Trenitalia train service, “FrecciaRossa”, or the competitor, “Italo”.

Trenitalia is the main transport carrier in Tuscany. The only exception is the province of Arezzo, where the railway operator is “TFT” (*Trasporto Ferroviario Toscano*)

Regarding the train-sea multimodal transport, the complementary railway line Campiglia Marittima - Piombino Marittima plays a fundamental role, because it directly leads to the Piombino ferry terminal.

Talking about the Pisa railways and stations, passengers can easily reach the Pisa international airport “Galileo Galilei – San Giusto” taking the new people mover (APM) “Pisa Mover” from the “Pisa Centrale” railway station. “Pisa Mover” has a large capability: thanks to continuous journeys, it can transfer about 1,210 people per hour. The people mover is also linked with an

ample parking called “*Parcheeggio scambiatore*” (close to the *SS1 Aurelia*), that facilitates the road-railway multimodality.

At the contrary, Firenze “*Peretola – Vespucci*” airport is not equipped with an own *APM* or with a dedicated railway station. Passengers who travel by train should take a “*BusItalia*” shuttle bus from the “*Firenze Santa Maria Novella*” station to the Florence airport terminal. This kind of service is called “*Vola in bus*” (runs every 30 minutes). A new *ATAF* tramline (*Line 2*, from “*Firenze Santa Maria Novella*” station to the airport) is under construction. Works started in 2005 and are expected to end in 2020.

The Livorno Cruise Terminal is not directly connected with the “*Livorno Centrale*” railway station. Passengers who arrive in Livorno by train should take a “*CTT Nord*” city bus.

2.1.3 Maritime transport – Focus: Livorno, Piombino and Tuscan Archipelago

The core of our analysis is Livorno area, which includes Piombino and the Tuscan Archipelago too. Then, find illustrated the maritime infrastructures’ state of the art.

2.1.3.1 Port of Livorno

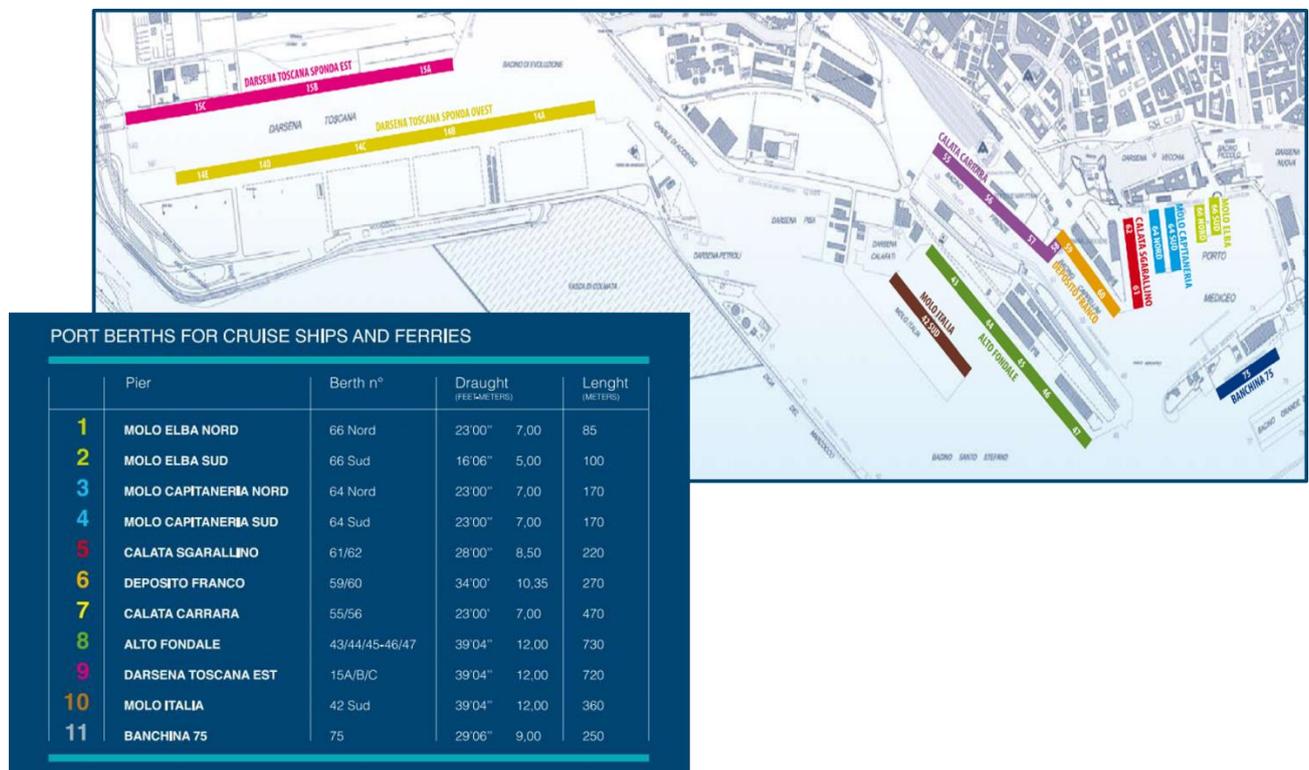


Figure 5 - Livorno cruise terminal “*Porto di Livorno 2000*” (Data source: company website)

The Livorno passengers' traffic is managed by a company, "Porto di Livorno 2000", equipped with two terminals: the cruise terminal and the maritime ferries station.

Our analysis will emphasize on the maritime station, which connects Livorno with the following destinations:

- Tuscan Archipelago – Capraia, Gorgona
- Sardinia – Olbia, Golfo Aranci
- Corse – Bastia
- Other national and international destinations (Palermo, Valencia, Barcelona)

2.1.3.2 Port of Piombino



Figure 6 - Port of Piombino: the yellow areas identify passengers' piers (Data source: infoelba.it)

Due to its industrial and commercial history, the Port of Piombino is multipurpose and it's equipped with five passengers' berths.

The "Piombino port developing plan", in addition to the maritime infrastructures' improvement, aims to provide a complete conjunction with roads and railways too.

The Maritime station offers seasonal and not seasonal ferry services from and to the following destinations:

- Elba island – Portoferraio, Rio Marina, Cavo
- Pianosa island
- Sardinia – Olbia

The informative system in use is “*PortoFacile*”⁴, which is also useful to know all the arrivals and the departures to and from Piombino.

2.1.3.3 Port of Portoferraio (Elba Island)



Figure 7 - Port of Portoferraio - Elba Island, Tuscan Archipelago – Passengers berths.

Elba island is a very popular summer tourist destination. The city of Portoferraio owns Elba’s main port. There are Variable Messages Panels with information about arrivals and departures (the Port Information System is the same as Piombino, “*PortoFacile*”).

⁴ www.portofacile.eu

2.2 Transport data

In order to create an integrated info-mobility platform, it is necessary to dispose of all the transport data, which must be always up-to-date and interoperable.

Local transport offices have been called to fill a questionnaire with details about data availability and digital applications' state of the art. The outcomes of The Tuscany Regional transport office, the Province of Livorno office and the Livorno Port Authority (AdSP-MTS) represent the most relevant information for our analysis purpose.

In the Livorno district, public transport services are offered by the company “*CTT Nord*” (which acquired the precedent company, *ATL*). In the Piombino and Val di Cornia zone, the service is offered by “*Tiemme Spa*” – *Toscana Mobilità*.

2.2.1 Province of Livorno

The Province of Livorno offers an info-mobility service in the form of website and mobile app for iOS and Android devices. Its name is “*B On Time*” and it can be used both in Livorno, Piombino, Elba and Val di Cornia territories to get information about the scheduled estimated times of arrival (ETA) regarding public transport services. “*B On Time*” calculates an optimal and integrated travel plan. It is also possible to book and buy a single-trip bus ticket through sending an SMS to the proper phone number.

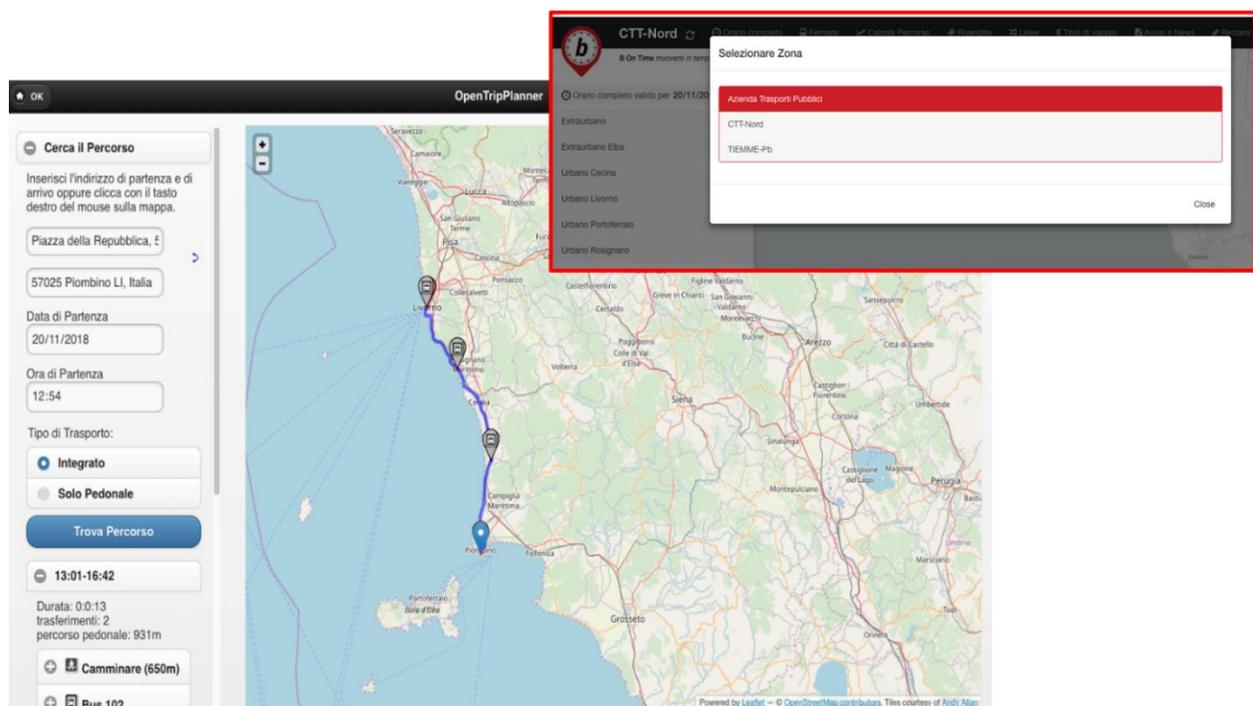


Figure 8 - B On Time web travel planner

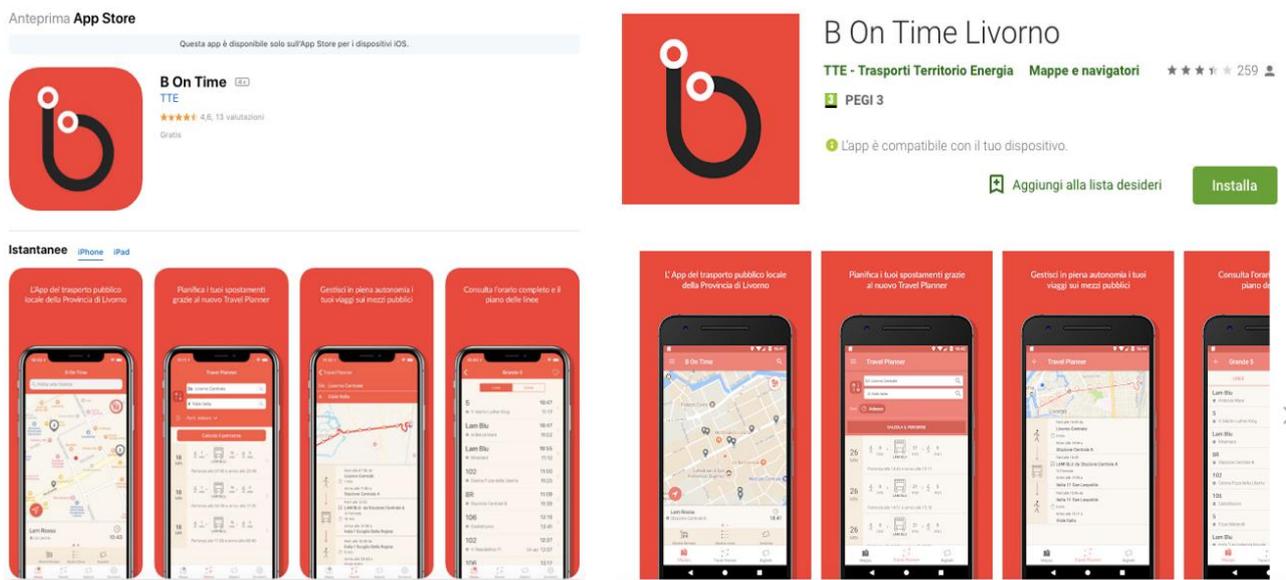


Figure 9 - "B On Time" app on App Store (iOS) and Google Play Store (Android)

It is important to highlight that “B On Time” manages scheduled data only, that means that information about the real-time status of the service (delays, vehicle position and other important info) is missed. With “B On Time” people can only obtain information about lines, stops and time schedule.

2.2.2 Tuscany Region

The Tuscany Region has been committed for years in the provision of integrated info-mobility services to the passengers, promoting several projects to create important information infrastructures.⁵

The project mentioned above have been the mobility portal “Muoversintoscana” enablers, which offers intermodal transport solutions (car, trains, buses, trams and ferries) in the form of travel-plan and calculates the “Pegaso” tariffs⁶. People can connect to the proper webpage or can download the iOS and Android mobile app.

⁵ E.g, the “I-Mobility” project, about on-demand accessibility. All the transport-related data is collected in the regional real-time transport information and integration centre, called “MIIC” (Mobility Information Integration Centre).

⁶ A discounted rate reserved to people residents in Tuscany.

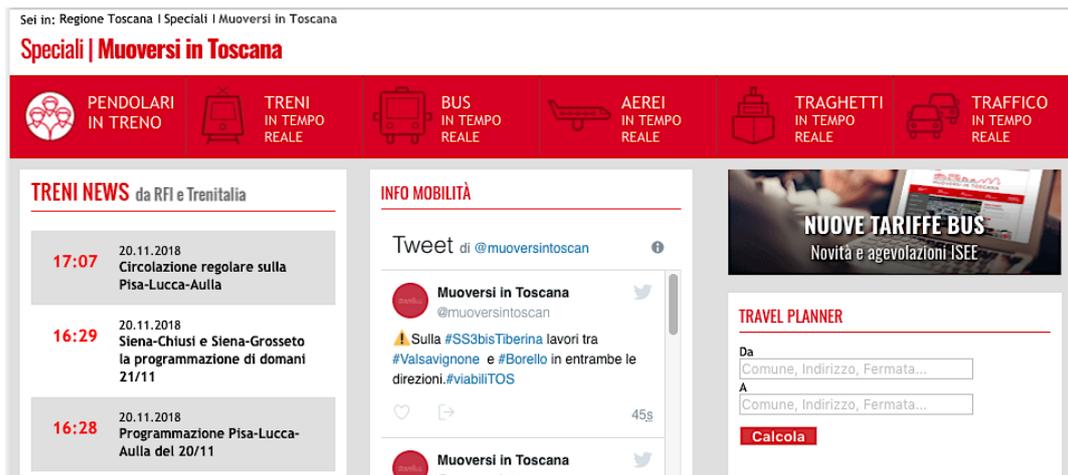


Figure 10 - "Muoversintoscana" webpage

All the data about transport routes, itineraries, bus and tram stops are provided by the local *TPL*⁷ companies, while railway transport data are directly provided by *RFI* and *Trenitalia*.

Thanks to the latest updates, "Muoversintoscana" can also provide real-time information about some main services.

The picture below shows scheduled information and real-time information (in green) in the *CNR*⁸ Area (Pisa).

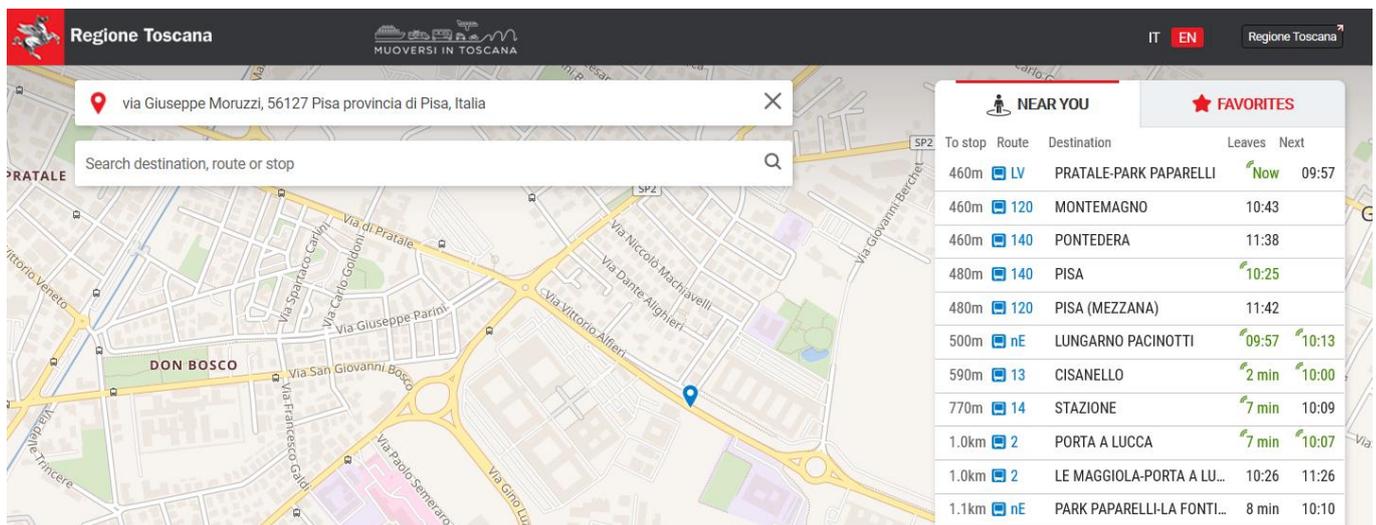


Figure 11 – Tuscany public transport georeferenced information (static and real-time)

⁷ Local (urban and regional) Public Transport services

⁸ CNR, "Consiglio Nazionale delle Ricerche" – Italian National Research Council.

With the web portal is otherwise possible to calculate the best public transport option from origin to destination, combining different transport means. Here we can see an example of multi-modal transport from Pisa to Portoferraio.

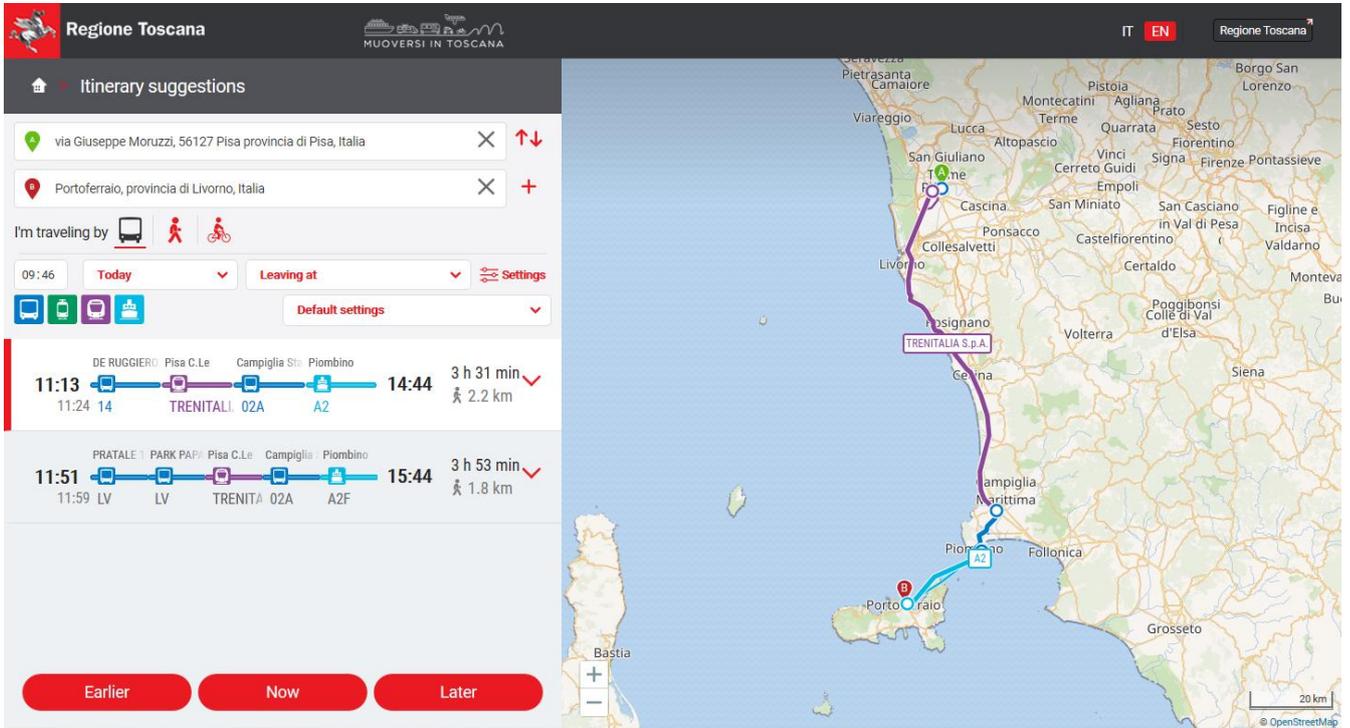


Figure 12 - Muoversintoscana multi-modal travel planner example

Muoversintoscana app can also be used on mobile devices such as Smartphones and Tablets.

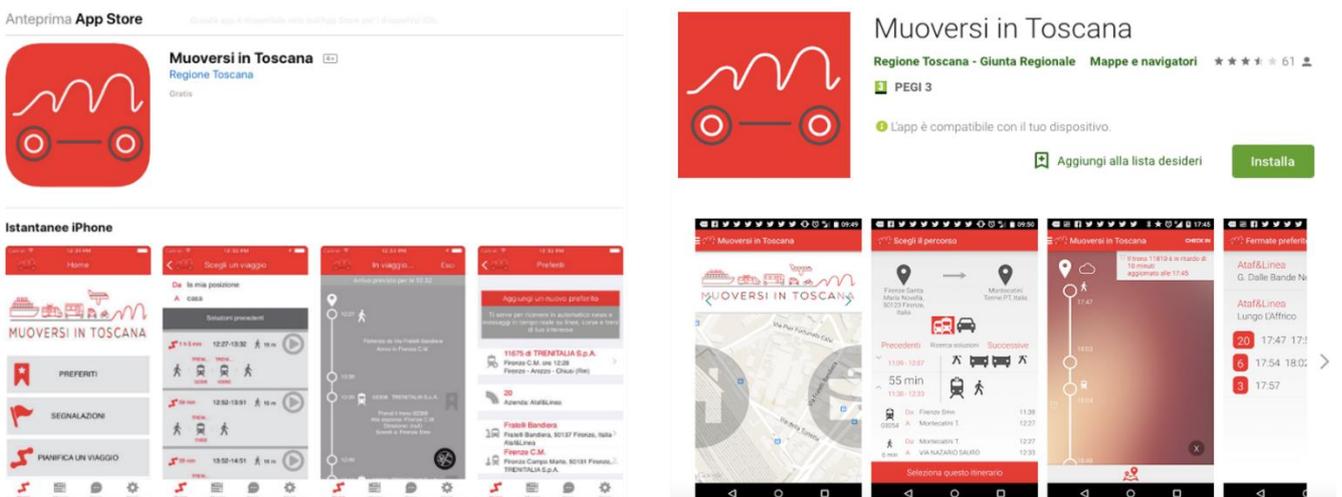


Figure 13 - Muoversintoscana Mobile apps (iOs App Store and Google Play Store)

2.2.3 Livorno Port Authority (AdSP MTS)

The AdSP MTS information system settle inside “*MoniCA Service*”, which is the Livorno Port Monitoring System. MoniCA monitors and controls all the port and the port-related areas by collecting information coming from different sources like sensors, gateways or applications (for example the *TPCS*⁹). “*MoniCA Service*” wraps all the real-time monitoring applications to manage the port system through the elaboration and integration of the data collected by the “*MoniCA platform*”.

All the real-time transport data, with details about delays and alternative trips, are potentially useful data for a regional multimodal travel-plan.

Compagnia	Nave	Porto di Provenienza	Arrivo		Accosto		Partenza		Porto di Destinazione
			Previsto	Effettivo	Previsto	Effettivo	Prevista	Effettiva	
TOREMAR	LIBURNIA	CAPRAIA	ieri, 19:45	ieri, 19:51	-	64/5	8:30	8:32	CAPRAIA
MOBY	MOBY AKI	OLBIA	6:00	6:25	-	59	10:00	10:04	OLBIA
SARDINIA FERRIES	SARDINIA REGINA	GOLFO ARANCI	6:30	-	-	-	21:00	-	GOLFO ARANCI
GRIMALDI LINES	CRUISE OLBIA	OLBIA	6:30	7:10	-	14/E	13:00	-	OLBIA
GRIMALDI LINES	EUROCARGO PALERMO	VALENCIA	7:00	-	-	-	18:00	-	SAVONA
GRIMALDI LINES	EUROCARGO PALERMO	BARCELONA	9:00	9:53	-	24/5	18:00	-	SAVONA
SARDINIA FERRIES	MEGA EXPRESS FIVE	BASTIA	12:30	-	-	-	14:00	-	BASTIA
TOREMAR	LIBURNIA	CAPRAIA	14:30	-	-	-	16:00	-	CAPRAIA
MOBY	MOBY WONDER	OLBIA	18:00	-	-	-	22:00	-	OLBIA
GRIMALDI LINES	ZEUS PALACE	PALERMO	18:00	-	-	-	23:30	-	PALERMO
GRIMALDI LINES	CRUISE BONARIA	OLBIA	18:30	-	-	-	22:00	-	OLBIA
GRIMALDI LINES	GIUSEPPE LUCCHESI	GENOVA	Domani, 2:00	-	-	-	Domani, 6:00	-	CATANIA

Figure 14 – MoniCA service, timetable display

2.2.4 “Elba Apps”

There are three info-mobility apps to help passengers’ information in the Elba island.

1. *MareBus Elba* – with “*MareBus*¹⁰” and “*Chicchero*¹¹” timetables;
2. *L’app Elbana* – the app, developed by Maurizio Palmieri, provides ferries timetables, news, information about the upcoming events, weather and wind forecasts;
3. *Isola d’Elba App* – developed by “*ElbaShop*”, the app offers georeferenced information about how to reach Elba island and what are the transport services in the island. Moreover, it shows photos of the island seashores with characteristics and detailed maps,

⁹ Tuscan Port Community System used by freight forwarders, maritime agencies, terminal operators, control bodies, road hauliers, shippers for dispatching the import-export documental procedures.

¹⁰ Rio Marina – beaches shuttle service

¹¹ Small vessel which connects Portoferraio with two small villages: San Giovanni and Bagnaia

advice about places to visit; information about where to stay (hotels, campings, B&Bs...), where to eat, where to shop, where to park, pharmacies, useful phone numbers.

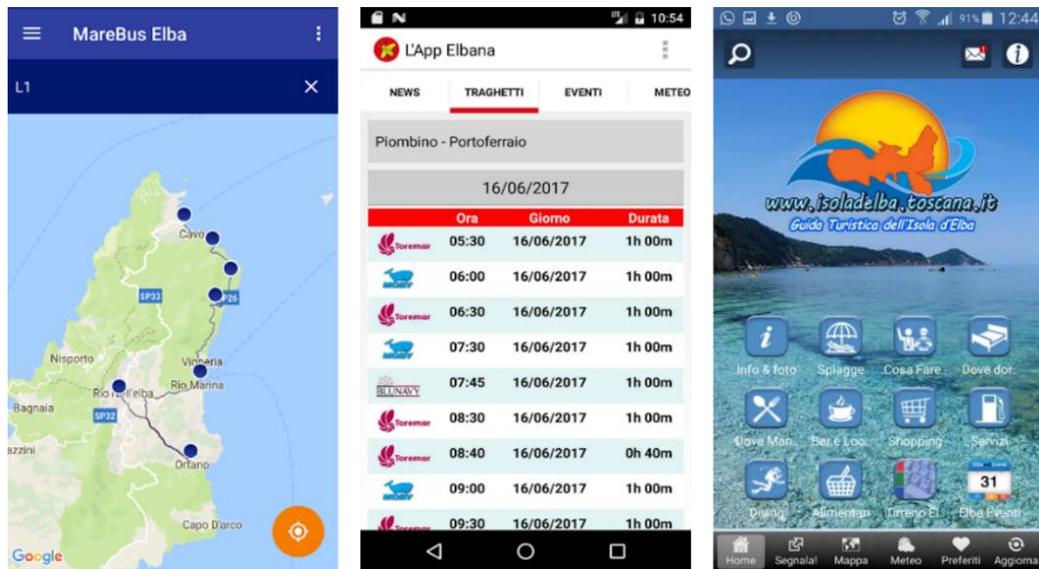


Figure 15 – Elba Island apps

2.3 Transport data format

All the partners which are involved in the info-mobility system can bring its own info-mobility experience in the shared web platform. Every system, based on a server architecture, works consuming standard data.

2.3.1 Province of Livorno – “B On Time”

Every day, almost 5,000 users benefit of “B On Time” website and mobile application.

The application runs on a “Nginx” server equipped with the “Debian 9.x” operating system and a “PostgreSQL¹²” database. The Application server is "proprietary" and developed applying “NodeJS” and “PHP” technologies. The reference transport data come from the Tuscany “DBCXML Database” and the data standard is *GTFS (General Transit Feed Specification)*.

¹² PostgreSQL allows to handle geographical data (it is not possible using MySQL)

2.3.2 Tuscany Region – “Muoversintoscana”

“*Muoversintoscana*” is used by residents, commuters and tourists which travel by public means of transport, even combined with private car transport (this kind of transport is considered as “multimodal”).

The reference data standard is *GTFIS* too and the server is based on *OTP (Open Trip Planner)*. The integrated database is managed by the *Tuscany Transport and Mobility Observatory*, based on “*Oracle Weblogic Application Server*”, “*Oracle BI*” and “*Tomcat*”.

2.3.3 AdSP-MTS – “MoniCA service”

Both system administrators and passengers can have access to “*MoniCA*”, the Livorno *PMS*, which is located in a “*Windows 2016*” server, based on a database “*Microsoft SQL 2016*”. *MoniCA* platform runs utilizing the following web services: “*Windows IIS 7*”, “*ASP.NET*” and other dedicated Windows services.

2.3.4 Observations: GTFIS data format

All the public transport data coming from the Tuscany Region and the Province of Livorno are in *GTFIS* format. Due to ensure a complete interoperability, data must be standard and “open”¹³.

For this purpose, the goal of “*dati.toscana.it*” web-portal is to collect all the regional datasets, including the transport sector’s ones, in a regional fully accessible website.

¹³ “Open data paradigm”: In agreement with the AGID (Agenzia per l’Italia digitale) three-year plan to enforce people right to a digital culture, with the consequent CAD update (the Italian code of digital administration)

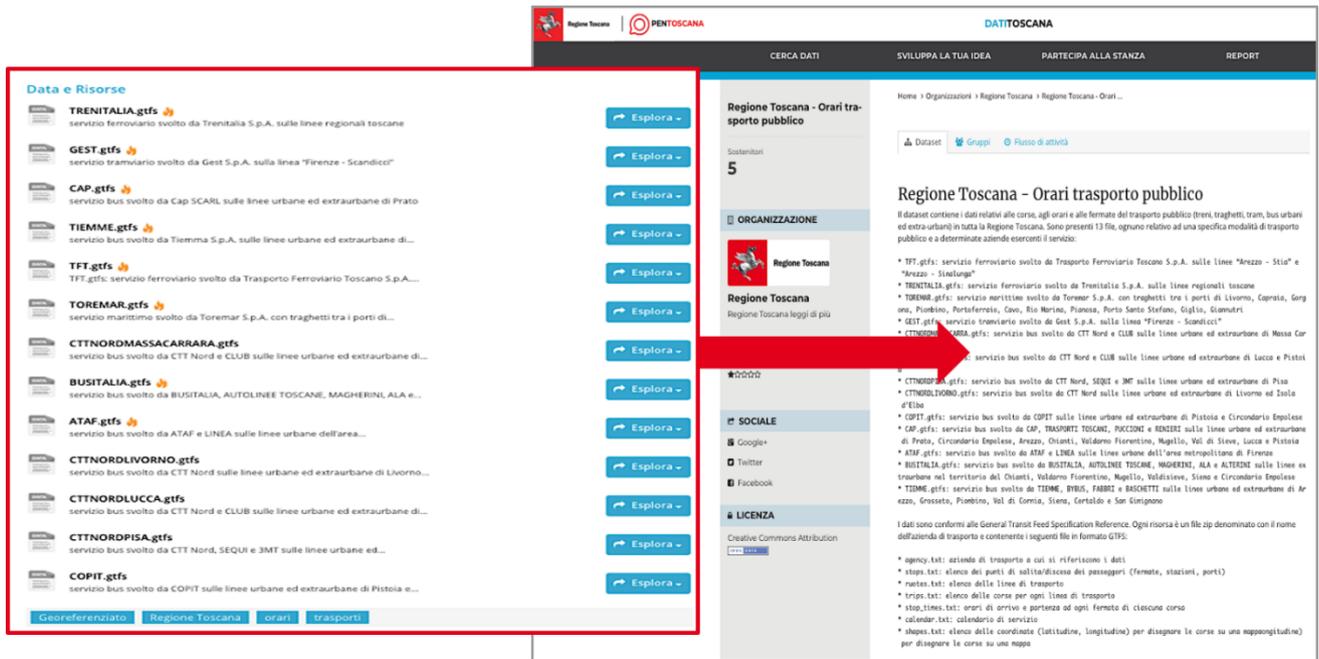


Figure 16 - "Dati Toscana" webpage – GTFS dataset

The *GTFS* standard has been initially developed by Google and it represents one of the most common formats adopted for public transport feeds. *GTFS* is also used to represent public transport on *Google Maps* and *Google Transit*.

GTFS feeds are .zip files (with a .gtfs extension) containing .txt files. The mandatory *GTFS* tables (.txt files) are described below:

- *AGENCY.txt* – it contains the transport company details;
- *ROUTES.txt* – it contains all the journeys from the origin terminal to the destination terminal;
- *TRIPS.txt* – it contains the trips on the itineraries;
- *STOP_TIMES.txt* – information about the timetable (stop schedules, stop calls)
- *STOPS.txt* – there we can see the full stops list (geographic coordinates)
- *CALENDAR.txt* – service days

There are also other additional tables, such as “*shapes.txt*”, “*calendar_dates.txt*”, “*fare_attributes.txt*”, “*frequencies.txt*” and so on.

The picture below shows the E-R GTFS scheme:

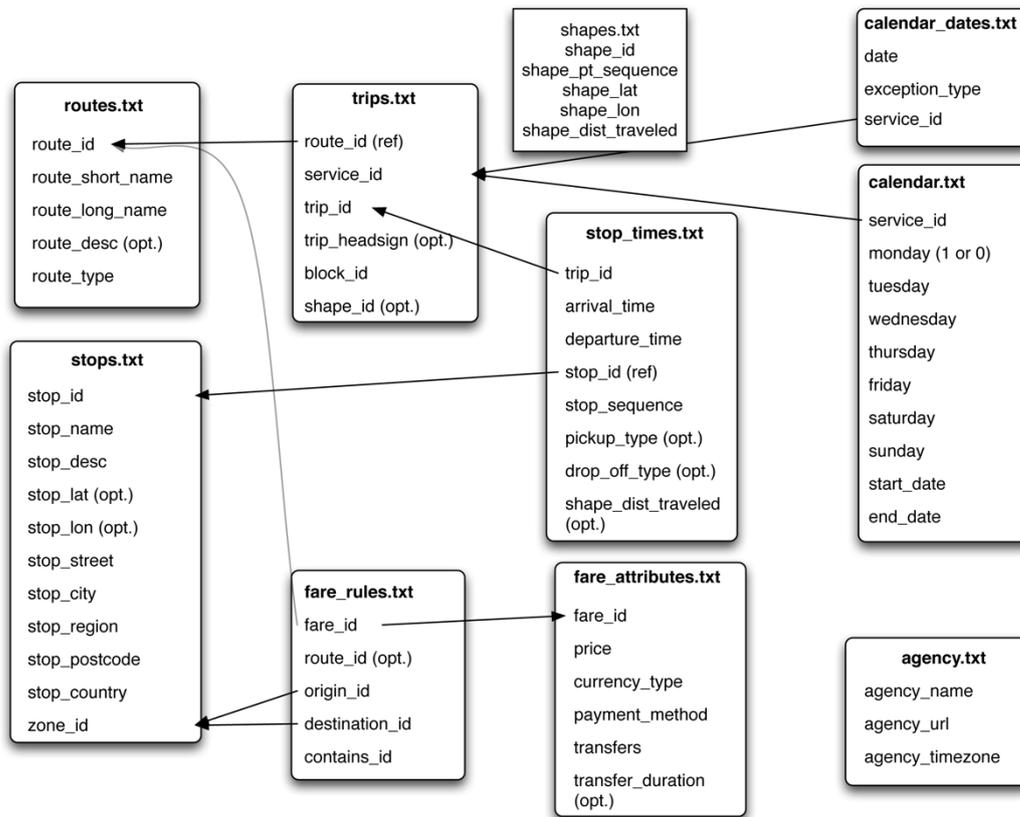


Figure 17 - GTFS files structure

GTFS can only be used to represent georeferenced public transport data (static information about trips, schedules, voyage options), a kind of digital timetable information system. GTFS cannot contain information about the real-time status of the service, like delays, re-routing options and other information. It is possible to add the “GTFS Real-time” extension, for adding real-time information.

2.4 AdSP scheduled and real-time services

The subject of “AdSP decree nr 110/2018” is “MoniCA platform integration with the AdSP institutional website”. It defines the way to operate to make all the service offered by MoniCA available on the Livorno Port Authority website.

The MoniCA platform tender has been won by the company “Datach Technology” (ex-decree nr 166 – 5.11.2014).

In particular, referring to passengers' traffic, we must focus on the “*Attached A – functional requirements for the MoniCA-AdSP website integration*” points A, C, D and E:

- A. Implementation of a digital passengers' timetable “Arrivals and departures” (cruises, ro-pax and ferries), with details concerning:
 - Ship data (*IMO*, name, company);
 - *ETA/ETD*;
- C. Implementation of a real-time *2D traffic map* (based on the AIS data coming from the national Harbourmaster network), with the possibility to obtain all the ship information by clicking on ship icons¹⁴;
- D. Implementation of user-interfaces, as to generate personalized statistics consuming data received from the *MoniCA* and *TPCS* databases;
- E. Implementation of a user-interface to enable the automatic customized alert and notification system (via *SMS* and/or e-mail) related to the events Monitored by *MoniCA*;

The new webpages that will be generated will have to meet the following specifications:

- They will rely on the *MoniCA* web portal¹⁵
- They will have a graphic interface compliant with the institutional website one.
- They will contain information about both the port of Livorno and Piombino

2.4.1 Technical specifications

The data transmission between the “*Porto di Livorno 2000*” passenger terminal and *MoniCA* will take place using a Web Service on *MoniCA* server. The client-side software (running on the “*PL2000*” client machine) will send a data package containing the following instructions:

- *IMO* – identification vessel number (mandatory for ships exceeding 100 tonnes)
- *ETA* and *ETD*
- Destination and Origin port code
- Ship approaching code and expected dock
- Company's abbreviated name
- Internal *PL2000* id code

¹⁴ Ship registry information, *ETA/ETD* and eventual other data are available thanks to the integration with the Harbourmaster's *PMIS* (Port Management Information System)

¹⁵ www.monicapmslivorno.eu

In case of data conflicts, data coming from *PL2000* will have precedence, instead of *PMIS*' ones, because they are considered more accurate.

MoniCA response (that will be sent to *PL2000*) will contain a field with the voyage id code and the information about the ship approaching.

The *PL2000* drop down menu will contain all the ship information. Sometimes it happens that *PL2000* dispose of *ETA/ETD* data only a few days in advance. In this specific situation, when the system refers to a "generic activity", *MoniCA* will discard the data. For this purpose, it is advisable to add a field for indicating if the ship approaching has been found or not.

It's important to focus on two main aspects:

1. *PL2000* should verify if the ship list effectively contains all the ships data, paying particular attention to possible coding issues: *PL2000* may use a different encoding system and not the international one. Eventual different encodings must be reported.
2. Only for accountancy reasons, for a while, if a ship changes its ownership, it will have two different registry information at the same time.

PL2000 will have access to the digital timetables and, will be able to modify the data on it (if necessary). The timetables value records will be made available in *MoniCA*, because the webpage containing the schedules must respect the physical timetable.

It is also possible to manage *OCR* cameras, because the company disposes of a plugin which can manage cars' license plates images, which will be sent to *MoniCA* using another additional protocol.

3 The “MOBIMART” project

3.1 Interreg EU initiatives

“*Interreg III*” is a *FESR (European Fund for Regional Development)* program to facilitate the cooperation between EU regions for the 2000-2006 period, then replicated for the period 2007-2013 and finally for 2014-2020. Interreg initiatives aim to avoid that national borders still represent an obstacle to the EU members’ balanced development. For this reason, varied cross-borders initiatives are financed (or co-financed) by the European Union to simplify the members’ integration, their commercial-social-cultural relationships and their rapports with their neighbouring countries.

Actually, the Italian regions are involved in many Interreg initiatives. Livorno is the Italian port which has been involved in the larger number of Interreg projects for Italy-France cooperation, with the purpose of improving the digitalisation and efficiency of the logistics processes, of monitoring the logistics port operation (as to make them more efficient) and of helping data interchange system, enabling the real time port operation control.

The projects that involve the port of Livorno are fully financed, so resource acquisitions and investments in port developing and innovation during the three-years 2018-2021 period are possible.

3.2 What is MOBIMART

«From Sardinia to Provence-Alpes-Côte d’Azur, across Corse, Tuscany and Liguria: a single info-mobility tool that will let citizens, tourists and commuters travel in these five regions making them real-time fully informed. This is the purpose of MOBIMART project – Intelligent Land and Maritime Mobility – suggested in the 2014-2020 Italy-France Cooperation framework. MOBIMART partners are eleven Italian and French public Authorities. »

MOBIMART is an “*Interreg*” EU “cross-border project”, its objective is to consider the transport services as “journeys” from origin to destination, independently from the transport mode and the morphological characteristics of the territories.

The project core purpose is to create an integrated platform that will allow an intelligent communication between all the different transport means (sea, road, railway and air transport) by simplifying people voyages and by helping people to access to the info-mobility data.

MOBIMART project leader is the Tuscany Region and the *AdSP MTS*' due is to improve the port info-mobility *ICT* services. That leads to realize a cloud layer that will manage all the information coming from the transport networks, starting from port nodes and consuming *TPCS* and *MoniCA* outputs. *MOBIMART* project will also provide Variable Message Panels in Livorno, Capraia, Piombino and Portoferraio seaports.

Anyway, new systems will not replace the already existing ones, new standard interfaces will be developed to manage all the data controlled by platforms, transport nodes and networks.

3.3 MOBIMART innovative aspects

The innovative aspects of the project stand in these two core elements:

1. information interchange between systems, in order to help additional solutions developing (even after the project last deadline) as to enforce cross-border relationships;
2. Many outputs will be realized (websites, travel-planners, mobile apps, social networks).
In order to reach this objective, *MOBIMART* will be structured in a three-years plan, made of two parts:
 - I. Mobility data standardization, which will be collected in a common platform;
 - II. New specific info-mobility systems with all the data coming from the eleven partners' territories.

The Livorno Port Authority has to realize an interoperable cloud platform for managing all the information coming from the port and from the other transport nodes.

3.3.1 CNIT contribution in MOBIMART project

Currently CNIT, on behalf of *AdSP MTS*, is involved in the implementation of a service-oriented architecture (*SOA*) at the port of Livorno, encompassing and integrating information into the Port Monitoring platforms. This architecture could be used in order to retrieve useful information regarding both sea side (*ETA*, *ETD*, Passengers Forecast, etc.) and passengers' mobility via *C-ITS*¹⁶.

CNIT could provide either a high integration level with the needed *ICT* component and the proper level of connectivity. In *MOBIMART*, it will be possible to include *C-ITS* and Traffic

¹⁶ Cooperative Intelligent Transport System - Digital connectivity between vehicles, between vehicle and road users, between vehicles and transport infrastructure to improve road safety, traffic efficiency, comfort and driving optimization.

Management information (using *DATEX II* standard) in order to increment road safety. It will be also possible to calculate routes upon the occurrence of dangerous situations like accidents and roadworks.

3.4 State of the art analysis

Knowing the state of the art of all the current available mobility application in each node is fundamental, so partners have been called to fill a questionnaire due to explain what applications they use to inform passengers about public transport. We asked some questions in order to understand:

- Who are the applications' users?
- How many applications do they use? What are the applications' names?
- What is the potential useful transport data?
- What server-side technologies and standard data formats the applications are based on?
- What do they expect to achieve, as partners of *MOBIMART*? What type of data they need to reach their future info-mobility goals?

The global output of our survey shows that almost all the partners:

1. use Open Trip Planner (*OTP*) services based on *GTFIS* or *Transmodel* data;
2. would like to collect user feedback (want users to be part of the informative system);
3. urgently need to provide a strictly accurate information system about the real-time status of the service (in order to calculate alternative routes in case of fortuitous events);
4. aim to integrate a ticketing module to their mobility application.

3.5 Suggested solution

According to the Interreg requirements, the solution must be flexible, scalable and adaptable, not centralized (*MOBIMART* promotes a balanced cooperation among partners).

New systems will be developed (*MOBIMART* “*T4*” component: travel-planner, passenger information, *PMV* and so on), with an high-level cloud platform-layer development.

API (Application Programming Interfaces) will enable the interaction between all the nodes and the cloud platform. A specific port layer will be created to consent the interaction and data interchange with the project cloud platform.

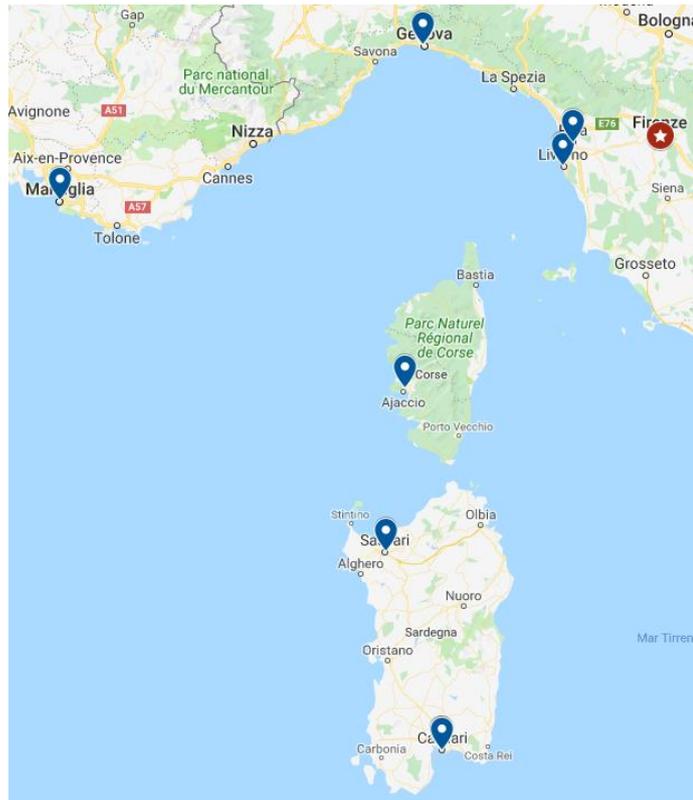


Figure 18 – MOBIMART nodes map

MOBIMART eleven Italian and French partners can be divided in two groups:

- A. Regional Transport Offices: Tuscany (project leader), Liguria, Sardinia, Corse, Provence-Alpes-Côte d'Azur (PACA);
- B. Other Transport Offices: Livorno Port Authority, Sardinia Port Authority, Province of Livorno, Province of Sassari, Municipality of Genova, Municipality of Pisa.

Every partner represents a transport node. The Tuscany region is the project-leader, which will be responsible of the project register.

The regional transport offices, in particular, have the responsibility to manage the “scheduled” data, the “others transport offices” have to manage all the real-time information.

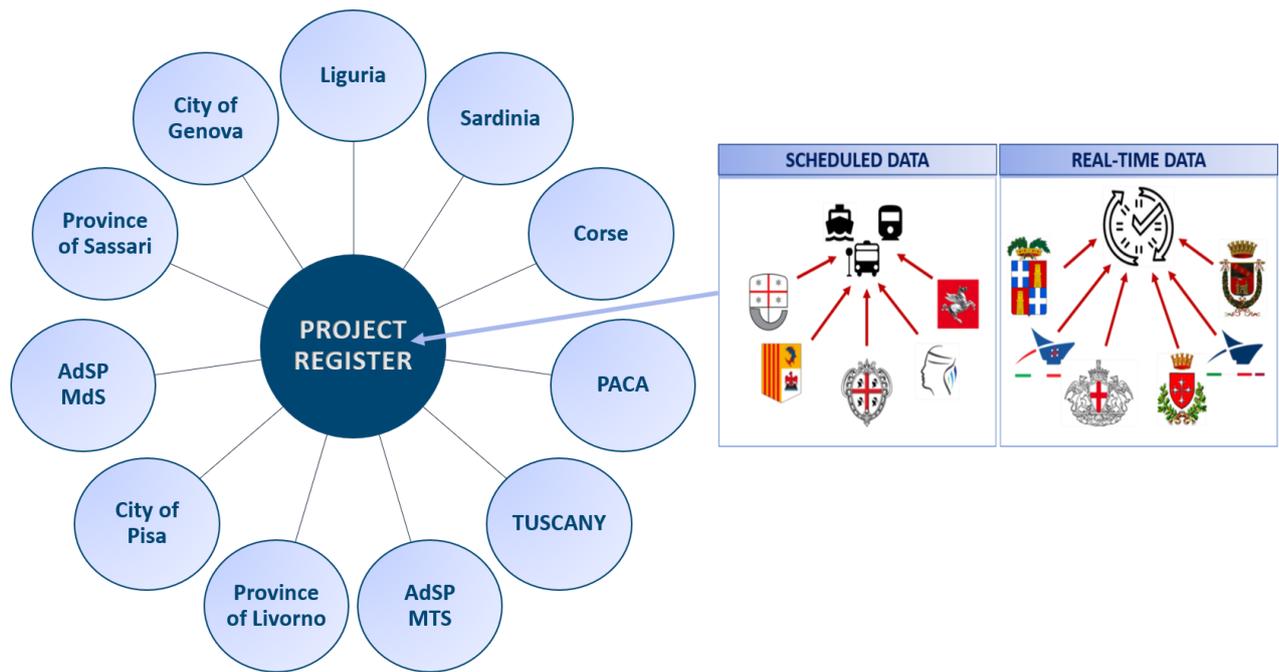


Figure 19 – MOBIMART partners scheme

Every node has to share its data with the Regional node which it belongs to. If not in the correct format (*GTFS*), the Regional Office will convert it. Regional transport offices will track all the available transport services with details about their status. Even the status of the digital service (“Active”, “Down”, “In maintenance” etc.) will be tracked.

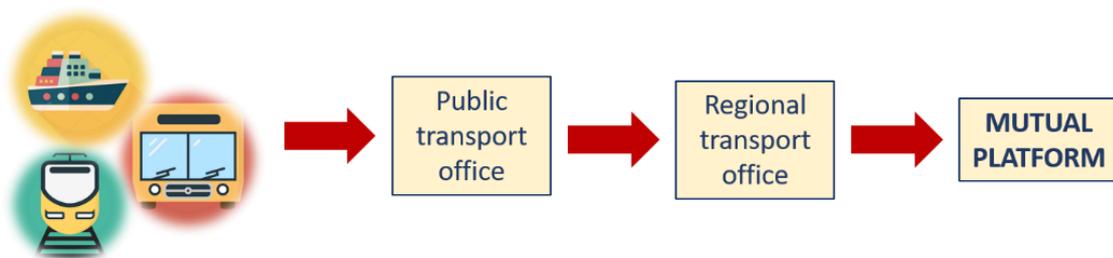


Figure 20 - MOBIMART real-time data flow

The “not-regional” transport nodes have to make sure that the real time status of the service is constantly up-to-date. The real-time status of the service is fundamental for a real-time user information, with details concerning eventual delays and other useful information.

For the municipality of Pisa and Genova it will be also possible to inform drivers about the city parking slots availability (data will be collected via real-time *REST* interfaces).

3.5.1 Use case – Info-mobility service

MOBIMART will offer an info-mobility service to passengers who will travel in these five-regions cross-border area. The project output will be a real-time integrated travel-plan, a suggested itinerary.

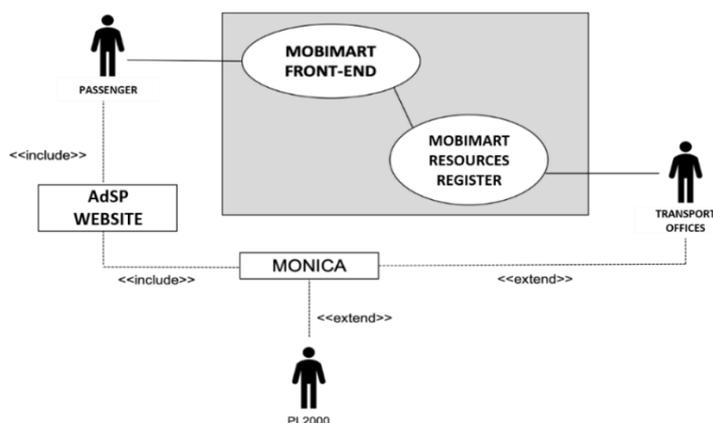


Figure 21 - MOBIMART use case diagram

As we can see in the use case diagram, passengers will use the *MOBIMART* app or the *MOBIMART* website writing search queries to obtain an itinerary based on the information received from the mutual platform database.

3.5.2 MOBIMART web-app for the Port of Livorno

MoniCA database will feed the *MOBIMART* info-mobility app.

The port monitoring system database has been fully analyzed in order to understand its structure and its ER scheme.

In particular, CNIT has to develop a Port web-app that will generate an *up-to-date GTFIS* and *CSV*¹⁷ file by clicking on the appropriate button. It's important to define the objects and the tables that *GTFIS* refers to, then it will be possible to extract the proper data from the *PMS*.

¹⁷ “Comma-separated-values” plain text file. Each line of the file is a data record. Each record consists of one or more fields, commas are used as text separators.

Here are the (mandatory) *GTFS* tables which must be filled, with the specified Primary and foreign keys:

OBJECT	GTFS tables	GTFS fields
COMPANY	AGENCY	agency_id (PK)
		agency_name
		agency_url
		agency_timezone
		agency_lang
SERVICE DAYS	CALENDAR_DATES	service_id (PK)
		date
		exception_type
ROUTE	ROUTES	route_id (PK)
		agency_id
		route_short_name
		route_long_name
		route_type
		route_color
		route_text_color
PORT CALLS	STOP_TIMES	trip_id (FK)
		arrival_time
		departure_time
		stop_id (PK)
		stop_sequence
PORT OF CALL (AND BERTH)	STOPS	stop_id (PK)
		stop_name
		stop_lat
		stop_lon
		stop_code
VOYAGE	TRIPS	route_id (FK)
		service_id (FK)
		trip_id (PK)
		trip_headsign
		trip_short_name
		direction_id
		shape_id

Table 1 - MOBIMART GTFS file structure

As seen above, *GTFS* files are just *CSV* files collected in a *.zip* archive. It's strictly important to select the useful data automatically from the *MoniCA PMS* database, in order to transfer them to the *MOBIMART* project database. The Livorno Port database has been analyzed using "*Microsoft SQL Server Management Studio*" (*SSMS*).

All the data concerning to ferries and cruises come from the Italian AIS system (PMIS): we can obtain reliable ferries forecasts (from the current date, for the next fifteen/twenty days).

DATA PARTENZA	ORARIO PARTENZA	COMPAGNIA	PORTO DI DESTINAZIONE	COD. DESTINAZIONE	BANCHINA
13/03/2019	07:00	GRIMALDI LINES	CATANIA	ITCTA	20/R
13/03/2019	08:00	SARDINIA FERRIES	GOLFO ARANCI	ITGAI	62/R
13/03/2019	08:30	TOREMAR	CAPRAIA	ITCPA	64/SUD/R
13/03/2019	10:00	MOBY	OLBIA	ITOLB	59/R
13/03/2019	10:15	GRIMALDI LINES	OLBIA	ITOLB	14/F/R
13/03/2019	21:33	SARDINIA FERRIES	BASTIA	FRBIA	62/R
13/03/2019	22:00	MOBY	OLBIA	ITOLB	59/R
13/03/2019	22:56	GRIMALDI LINES	OLBIA	ITOLB	14/F/R
13/03/2019	23:53	GRIMALDI LINES	PALERMO	ITPMO	14/E/R
14/03/2019	00:38	GRIMALDI LINES	BARCELONA	ESBCN	24/SUD

Figure 22 - MOBIMART web app - Port of Livorno: ferries data

This first version of *MOBIMART-MoniCA* interoperability interface has two “triggered” buttons which generate a complete up-to-date *GTFIS* file using *MONICA* DB records.

3.6 MOBIMART SWOT Analysis

It’s important to focus on the internal and external factors which can impact on *MOBIMART* and its outputs. *SWOT* Analysis can help us to understand what kind of “business environment” *MOBIMART* belongs to.

	Helpful	Harmful
Internal origin	<p><u>STRENGTHS</u></p> <p>Mutual platform; Standard common open data format</p>	<p><u>WEAKNESSES</u></p> <p>Sometimes data transport is not up-to-date; Weak availability of open real-time data information</p>
External origin	<p><u>OPPORTUNITIES</u></p> <p>Transport data and itineraries will be useful to offer “one-ticket” services</p>	<p><u>THREATS</u></p> <p>Strong competition among MaaS companies; Changes in data-privacy legal aspects</p>

Figure 23 - MOBIMART SWOT Analysis

3.7 MOBIMART final considerations (recap)

As we can see in the use case diagram, the application user will enter a search query. The system will use the shared resources register which will contain all the data from all the transport offices.

PL2000 is one of the platform-feeding systems, because it will feed *MoniCA PMS*, which will share all the data to the Tuscany regional transport office. Monica will also be included in the *AdSP* website, so passengers will also be able to connect directly to the *AdSP* website.

4 MOBIMART as a MaaS service enabler

One of the main goals of the *MOBIMART* project is to investigate the technological aspects that can enable *MaaS* services provided by public authorities, following the TM2.0¹⁸ recommendations¹⁹.

MOBIMART represents the first step for building a *MaaS* platform: data from these five regions will match together in order to let people obtain an integrated travel-plan, that is the primary requirement for offering a *MaaS* service.

MaaS services consist on “user-centric” solutions based on apps which can offer multimodal trips with a single electronic ticket, from the starting point to the final destination.

MOBIMART project leader is the Tuscany Regional Authority, which has always been committed in innovation and sustainable mobility at national and European levels. The Region has also set up the “*Regional transport observatory*”, a full open-data repository with details about road graphs, traffic sensors, free-parking availability and real time information about traffic and real-time transport status.

¹⁸ The TM2.0 Innovation Platform was launched in 2014 under the ERTICO set of activities, bringing together 40 members from all ITS sectors to focus on new solutions for advanced interactive traffic management. The objective of TM2.0 is to provide a discussion forum on interactive traffic management for stakeholders in the entire Traffic Management Procedure value chain.

“ERTICO – ITS Europe” is a multi-sector, public/private partnership pursuing the development and deployment of ITS. It connects public authorities, industry players, infrastructure operators, users, national ITS associations and other organisations together and work to bring “Intelligence into Mobility”. (Source: <http://tm20.org/>)

¹⁹ <https://maas-alliance.eu/wp-content/uploads/sites/7/2018/11/Data-MaaS-FINAL-after-plenary-1.pdf>

The “Firenze – Pisa – Livorno Highway” has a *DATEX II* node and a traffic control center which monitor the real-time traffic status. The Highway control center is connected with CCISS (“*Centro di Coordinamento Informazioni sulla Sicurezza Stradale*”, the Italian Highway *TM* agency) which provides traffic information at any time. All the transport data collection from all the Tuscan transport offices is full available on the “*datiToscana*” web platform.

Due to offer a mobility solution, according to the characteristics of *MaaS*, *MOBIMART* project will offer a digital platform which will provide an integrated and intermodal travel-plan. Disposing of all the public transports open data, including the real-time state of the resources, is the fundamental precondition for implementing a *MaaS* offer atop.

4.1.1 Data standardization

MOBIMART will work with standard formats, in the first step the *GTFS* (“*General Transit Feed Specification*”) and *GTFS-RT* (*Real-time GTFS extension*) will be implemented. Further the *MOBIMART* platform will achieve a wider transparency, enabling the conversion in other eligible formats, like the *CEN Transmodel* standards: *NeTEx* (“*Network Timetable Exchange*”) and “*SIRI*” (“*Standard Interface for Real-time Information*”).

Open standard formats will be used for exchanging scheduled and real-time public transport information. Geographic and ticketing information will be included, and applications will utilize and consume data in in an interoperable way. This will let users be informed about the status of the service (if it is “on schedule” or not).

With *MOBIMART*, all the public transport timetables will be re-engineered, in order to offer an available and integrated service. In this sense, passengers who have just arrived in a seaport should take a bus or a train in a few minutes, car-rental and bike-sharing information will be integrated in the platform. Seaports will become similar to airports: information about the real-time status of the service will fill “*variable message panels*”, which are so useful to the passengers.

MOBIMART will offer a mobile-friendly service too: user will be able to download the *iOs/Android* apps.

4.1.2 Measures and best practices – compliance

Due to offer a Mobility as a Service solution, it's important to focus on *MaaS* requirements.

It's impossible to ensure a *MaaS* service provision without suitable data. *MOBIMART* will obtain all the transports data and users' preferences. Public authorities must collect, anonymize and aggregate all the incoming data, monitoring how they are managed and processed according to the *EU* privacy rule, the “*General Data Protection Regulation*” (*GDPR, EU regulation 2016/679*). User must be informed about personal data processing.

Data must respect established requirements (availability, accuracy, integrity, up-to-date) and structures, in order to ensure interoperability and trust.

Due to implement a mutual multimodal platform, it's important the sharing of best practices between partners, this is the reason why partners have to ensure the complete portability of both personal and non-personal data (according to *GDPR* art. 20, “*Right to data portability*”). If one transport service is unavailable, people should take another mean of transport or another vehicle without buying additional tickets.

Every dataset must respect detailed specifications. *MOBIMART* partners have chosen “*GTFS*” as the common data standard for all the transport data because almost all the transport companies are already sharing their data and information using *GTFS* structures.

MOBIMART platform will collect data coming from several information providers:

- port authorities for ferries data;
- railway companies for trains;
- public transport companies for local mobility (buses, metros, trams);
- municipalities for traffic management and road safety, parking slots information, car sharing and bike sharing.

MOBIMART platform will be an *OpenTripPlanner* service which will work on *OpenStreetMap* layers. Geographical data will be open and fully available without any restrictions. Standardizing data will be the first step for implementing a future “single-ticket” solution, based on the paths procured from the dynamic travel-plan.

New business processes can be generated, and also third parties, such as private transport operators will seamlessly participate to the *MaaS* ecosystem and increasing benefits.

5 Conclusions

Tuscany area has a very high logistic potential: the Pisa-Livorno-Piombino-Elba coastal zone can be seen as a single “complex logistics node” where the Livorno Port Authority plays a central and strategical role in a multi-modal transport ecosystem. Info-mobility innovation services will be part of the “*smart-port*” system with data coming from different sources. Optimizing logistics flows (both physical and informative ones) is strictly important to be compliant with the *ITS* paradigm.

The availability of *MaaS* services should be a convenient opportunity for the environment... and for users. In this sense, *MaaS* solution users (both tourists and commuters) should get economic benefits, such as discounts, special prices, tax reductions by travelling using public transport. In this way, *MOBIMART* project can be considered as a valid starting point, because it will help travelers while choosing the most suitable mean of transport. This is the reason why it’s crucial to insert port data and information in the complex regional mobility platform.

If we analyze the current trends, we can observe that our cities are evolving into smart cities, where public transport will play a strategic role. In this regard, using *MaaS* will be a valid alternative to the car ownership. *MOBIMART* could be a sort of first step for building an innovative and user-centric *MaaS* (“*smart mobility*”) platform.