Pilot action final report
Ports of Venice and Chioggia
D.4.2.3

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1. Ex-ante situation – Background of the pilot action

Taking as reference the 2018, the railway traffic generated by the Port of Venice was about 5.543 train equal to 2.6 million tons of freight moved (about 100 trains/week), showing a growth of 13% in respect to the year before. Also, the constant traffic growth of the last 6 years leads to suppose that the trend is structural. This stated and in line with the prescriptions included in the "National Plan for Ports and Logistic", acknowledged by the the Port Operational Programme 2018-2020, the Port of Venice is carrying on a series of investments aiming at improving its railway infrastructures and easing the port's railway accessibility services, with the aim to increase its multimodality.

This will be functional to strengthen the railway traffic in relation to road one, that is still predominant, allowing to overcome one of the weakness emerged within the TNA and SWOT analysis.

Besides several infrastructural investments oriented to increase the railway traffic capacity, there is a need to improve also the services and the systems that manage the railway traffics in order to finally increase the Port of Venice logistic and multimodal efficiency.

As broadly outline in the TNA, the pilot action proposed by the Ports of Venice and Chioggia within the PROMARES project is devoted to re-engineering the current railway **telematics systems for shunting operations (SIMA)** in order to introduce new and better tailored functionalities.

Currently, the SIMA IT system retrieves, processes and stores data during the manoeuvring procedures and the wagons positioning operations inside a port area or a railway hub, aiming to support management and real time monitoring of the operations. SIMA comprehends the following functional modules:

- manoeuvres Management;
- manoeuvres Monitoring;
- reporting;
- account management;
- mobile and GPS infrastructure.

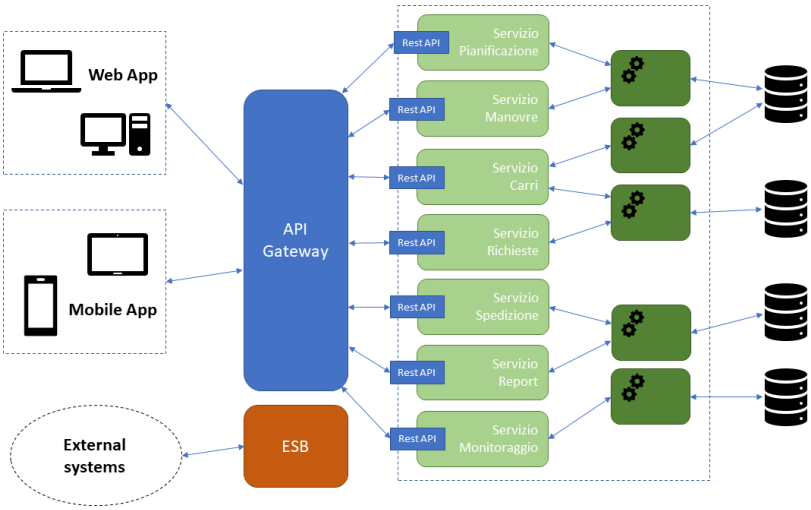
SIMA offers the following macro-functionalities:

- data acquisition, i.e. during the start-up phases of the manoeuvring procedures, through the insertion of the annual, weekly or daily schedules of the single manoeuvres, by entering data from the user interface;
- data processing, through application of rules, constraints and suggestions for the benefit of the various users of the system (Business Logic);
- notification of the status change of a procedure, through certified (timestamps based) and traceable communications;
- data archiving and database query functionality, through facilities such as affinity search or recent history;

- system log recording for tracking all events and who did what;
- automatic interface with GPS-EGNOS satellite tracking system, installed in locomotives;
- representation, through a synoptic table, of the entire railway park area with real time monitoring of:
  - tracks and relative occupation status;
  - locomotives (pushing or pulling) together with wagons, tugs and trains, each with its state (to be unloaded, repaired, departing, etc.);
  - recent, in progress or imminent operations.

Currently, the software solution includes, for the web part, the two client applications:

- a web application (front-end) complete with user interface aimed at the various actors of the system (infrastructure managers, railway company and customers) and organized in a way that is intuitive and easy to use and which must allow the management of the whole maneuvering process;
- a Mobile application, aimed primarily at maneuvering operators and installed on special devices, which must allow management and monitoring of operations.



At today, SIMA does not fully meet the operational management needs that are upcoming together with the scenarios. The most critical aspects concern above all the non-intuitive graphic interfaces, the absence of wizards, the absence of some useful correlations between the different modules of the system and the presence of unused data and functions. In addition to the critical issues on the use of the system, there is also the need to update the technologies used for its development. Moreover, it is also necessary to introduce a component with process optimization and decision support functions that, through the

processing of time series of data stored by the system and data received in real time, give indications on the most effective solutions to process management problems.

1 Pilot action description

The enhancement of railway **telematics systems for shunting operations** (SIMA) and its integration with PCS and information systems of other subject involved in developing rail services is the main goal of the Port of Venice pilot action.

The system architecture, at today based on the restful model, will have to be updated to more effective models such as micro services based architecture. At the very least, the architecture will have to be rethought for an easy future migration. As for the user interface, it must be subject of a careful analysis on usability and user experience, ensuring an easy start up of the system in the environment where it will be used. Interfacing with the new external systems is another critical aspect to consider, for more details regarding these systems.

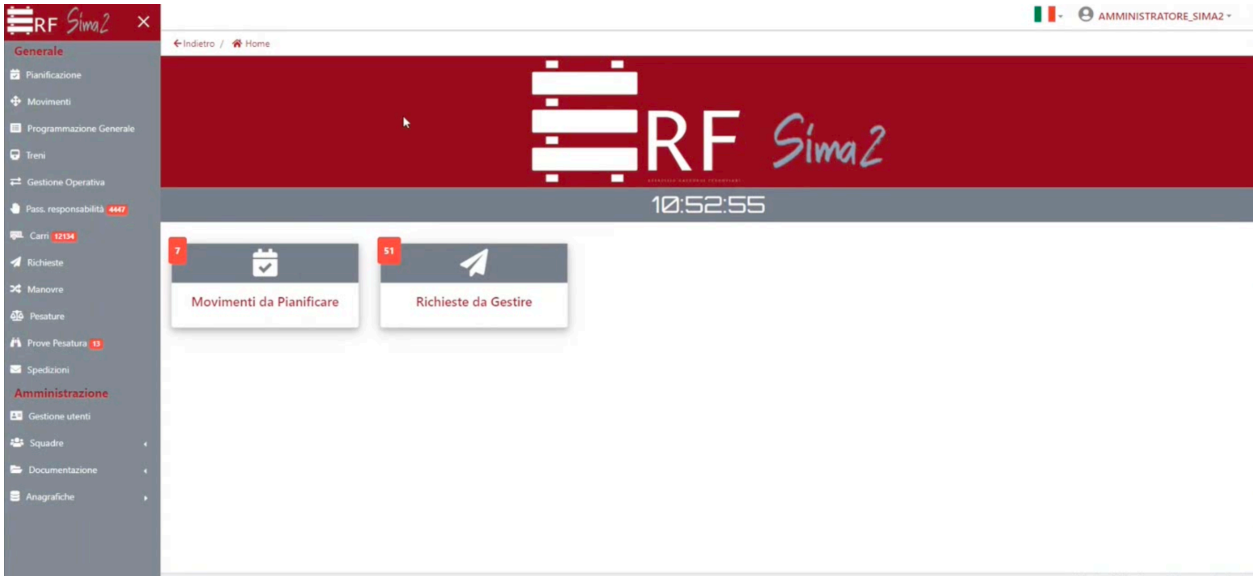
In practical terms, the redesign intervention involved the analysis of the current situation (AS IS) with the mapping of the primary process and the support processes, the identification of critical issues and points that can be improved, the study of solutions and the consequent redesign of the process in an organic way.

Therefore, the pilot action conducted to a radical overhaul, rethinking the entire "Web App" and "Mobile App" from scratch, and not just simple adjustments, calibrations, or operational improvements. The goal was the re-engineering of the SIMA software system and the removal of obstacles that influence the process.

This stated, the pilot action started from the "AS IS" context which, to evolve towards innovative technological standards that allow to overcome the current architectural constraints, taking into account, in parallel, all the continuity needs of the service, regulatory compliance and both functional and architectural innovation that will emerge during the term of the contract.

The activities included in the overall re-engineering of the SIMA are:

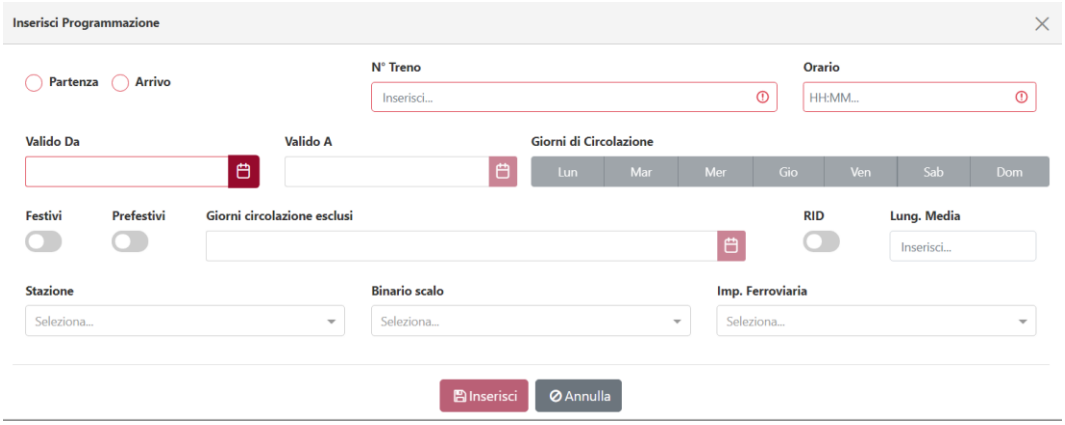
Implementation of a new architecture for the Web and Mobile part

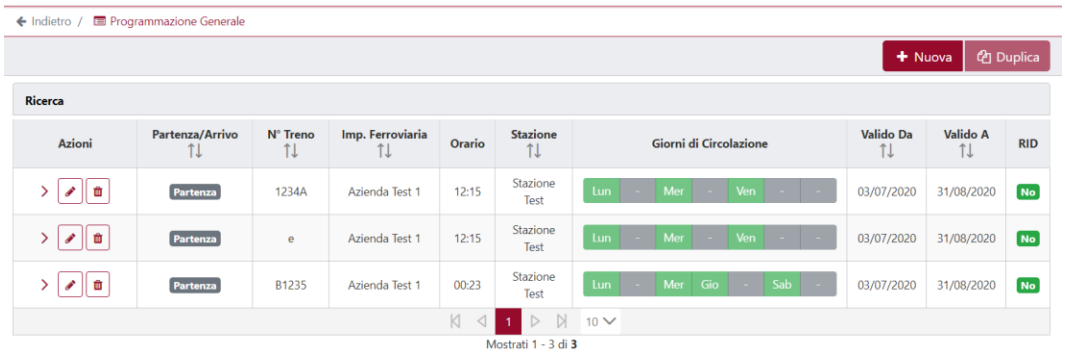


Development of ad hoc software, which includes:

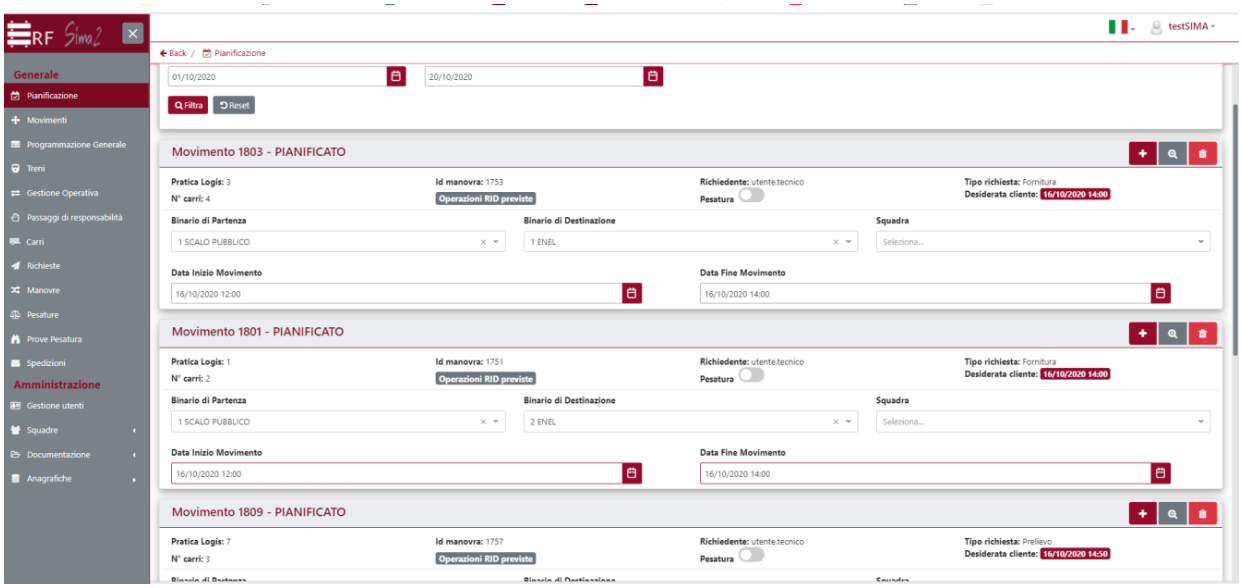
- remaking of software modules or individual applications;
- the development of entire software modules, or autonomous parts of the same that solve specific needs in the face of new features to be computerized, also to be implemented on the new architecture, i.e. the following ones:

  - Management of internal directories
  - Census automation with time prediction on maneuvers and movements/ Team shift management
  - Push notifications
  - Operational management through frontend of the movement of convoys



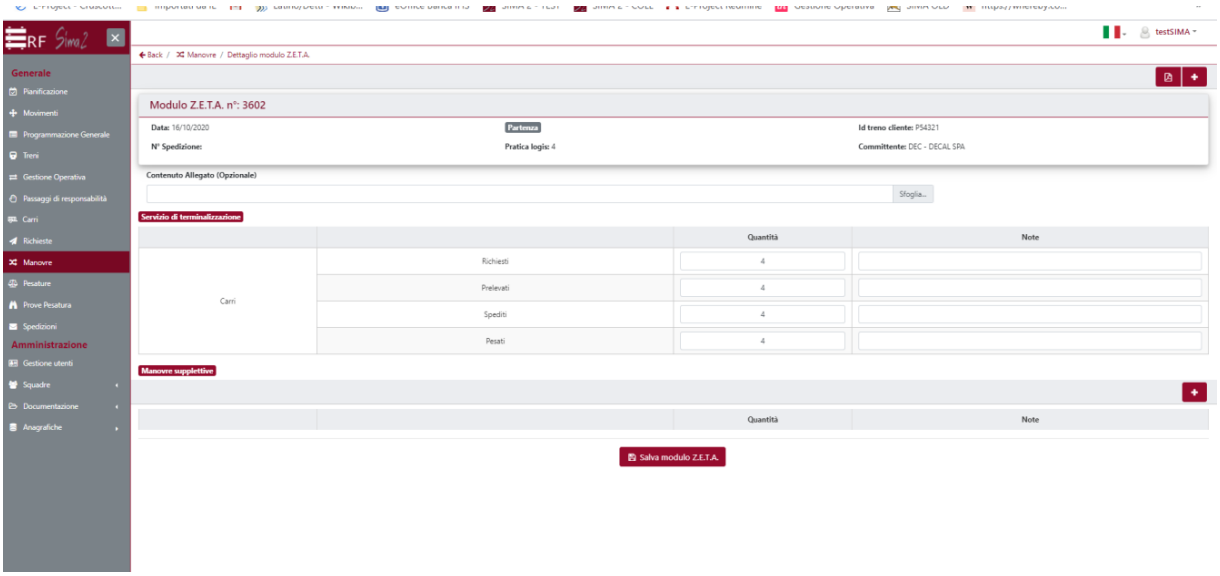


- Management of delegations between companies
- Management of security / generic documents
- Personnel management
- Movement planning

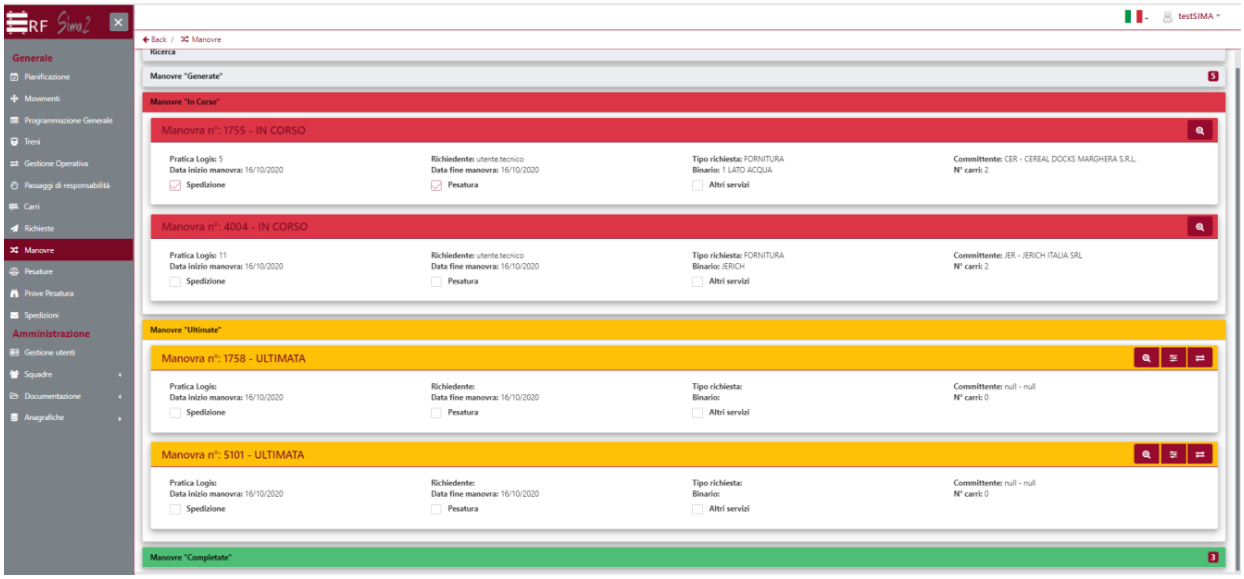


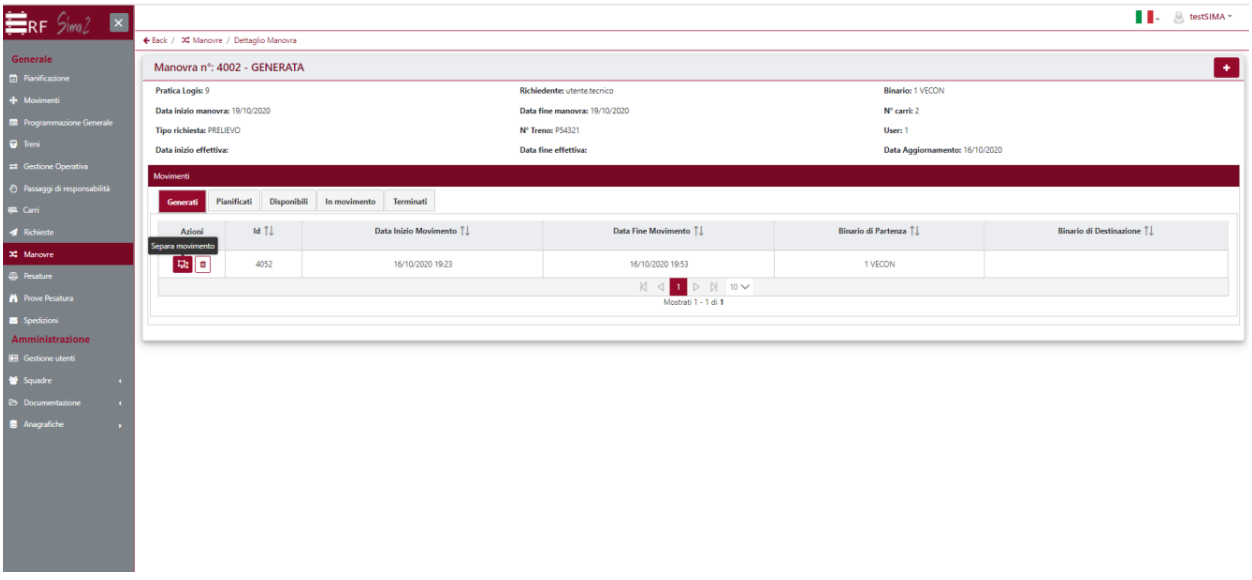
- composition in operational management / maneuver detail

- zeta module detail



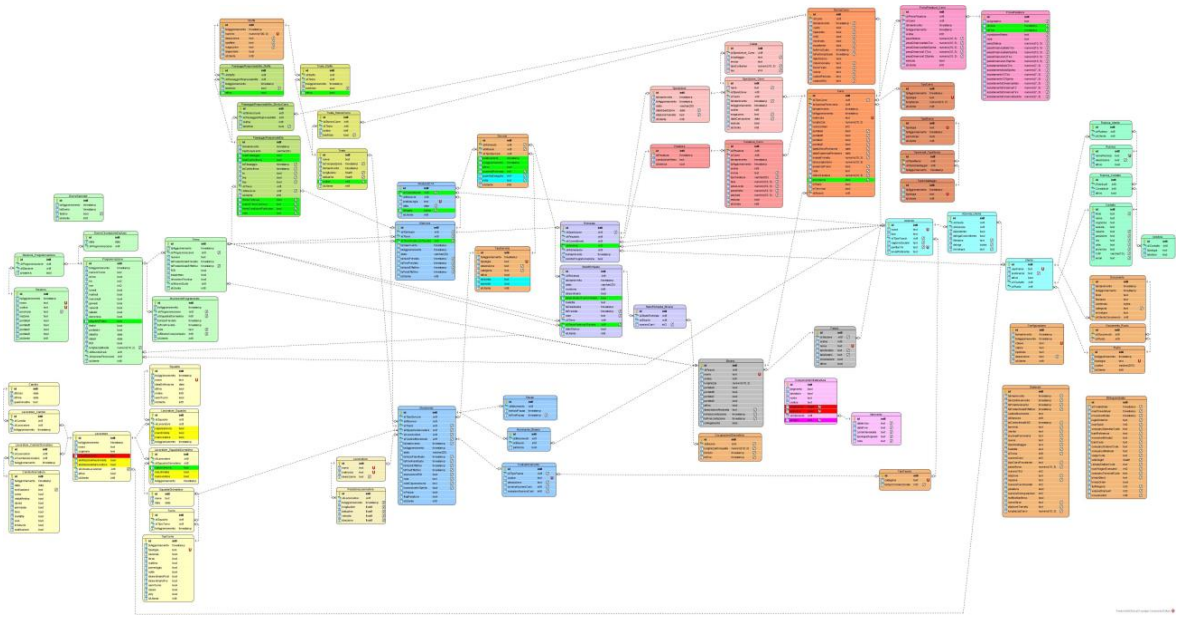
- shift management change
- erf worker management
- Maneuver management





- team management
- movement available
- passage of responsibility – detail
- passage of responsibility - list

Evolutionary maintenance of the architectural layers from the API Gateway / ESB to the database, which includes interventions aimed at enriching the solution (with new features or other non-functional features such as performance, etc.) or in any case to modify or integrate the functionality of the solution. This maintenance involves writing additional functions for integration with existing information systems or applications or parts of functions (also replacing other already existing ones). In practice, these are implementations that will intervene on specific layers of the IT system.
The new architectural system is hereby represented:



2 Stakeholders

Even if the software is primarily used by ERF (Esercizio Raccordi Ferroviari), the holder of the service of general interest of rail shunting at the Port of Venice, all the relevant regional and international stakeholders will benefit from the improved logistic efficiency. In fact, the main benefit for the stakeholders is that third parties should interface with this system on a voluntary basis, using this technology on order to integrate their activities. In the port of Venice, the interfacing with the railway system should be useful for:

- The possibility to interact with the PIC system of the national infrastructure manager RFI (Rete Ferroviaria Italiana) that allows real-time communication of changes to the general planning of arrivals and departures (e.g. deletion or changes in the schedule) and the insertion of unplanned trains through an XML protocol or similar one;
- The possibility of interfacing with the Mercitalia Rail SIM system that allows the management of waybills through an XML protocol;
- The possibility of interfacing with the Railway Undertakings IT systems (such as SIR system of Mercitalia Rail) for the recovery of information regarding train composition (list of wagons and containers carried by each wagon), useful for the automatic management of wagon groups through an XML protocol or similar one.

3 Impacts and replicability

As descried in the TNA, the re-engineerign of the SIMA leads to:

- the possibility to create and manage the M.53 of District (called “M53 di Comprensorio”) model. The M.53 of District model will replace the M.53 Integrated model (now done by the Infrastructure Manager) and contains some additional useful data concerning operation of the Shunting Operator. These additional data could be used by the system to improve planning procedures efficiency through an optimization of train placement in railway yard and their relative movements using machine-learning techniques and logistic algorithms;
- the possibility to interact with the PIC system of RFI that allows real-time communication of changes to the general planning of arrivals and departures (e.g. deletion or changes in the schedule) and the insertion of unplanned trains through an XML protocol or similar one;
- the possibility of interfacing with the Mercitalia Rail SIM system that allows the management of waybills through an XML protocol;

- the possibility of interfacing with the Railway Undertakings IT systems (such as SIR system of Mercitalia Rail) for the recovery of information regarding train composition (list of wagons and containers carried by each wagon), useful for the automatic management of wagon groups through an XML protocol or similar one;
- the insertion of a new software component for the automatic calculation / optimization of the precedence on single tracks as Decision Support System, which assists manoeuvre planners in logistic decisions regarding train movements on the tracks beam by the proposal for the entire daily manoeuvres scheduled respecting both operational and infrastructural constraints using machine-learning techniques and logistic algorithms;
- the possibility to manage the shunting personnel through the system to assign each shunting team to their respective loco automatically.

The re-engineering of the SIMA into SIMA2 allow the Port of Venice to play a relevant role as a gateway and logistics service provider to the North of Italy and more specifically the Eastern Lombardy, and other international destinations, such as Central and Eastern Europe (e.g. Southern Germany, Austria, Switzerland, etc). In particular, the following elements have been highlighted as main results and positive spill-over effects:

- Decongestion of the internal railway system;
- CO2 reduction;
- Optimization of locomotives use;
- Increase of freight traffic by rail;
- Optimization of shunting services that can lead to considerable cost savings, more efficient planning of routes and resources, and increased transport quality (punctuality, predictability) and safety;
- Interface between application and other relevant IT systems permits the identification and deletion of useless outdated data function;
- Boosting further new investments in port facilities to increase the intermodal capacity.