Scalable web services for exchanging maritime information among port community systems and/ or port stakeholders

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Abstract. Adriatic - Ionian Port Authorities emerge the creation of IT exchange systems to provide advanced interconnected business services. This work presents the methodology and experience to design and develop an IT maritime information exchange system that is proposed to serve among the heterogeneous and autonomous port community systems (PCS) in Adriatic-Ionian Sea. It presents the web service based methodology and the key points of the protocol inside the Trans-Adriatic Ports Informative Node (TAPIN) within the pAssengeRs and loGistics information Exchange System (ARGES) project. The services are separated in four groups: port community system to port community system (pcs2pcs), port community system to government (pcs2gov), port community system to business (pcs2b) and port community system to public (pcs2p). This works presents the advantages and disadvantages of the proposed methodology and its scalability for general potential adoption.

Keywords: Port Community Systems, Data exchange, Web services, Cross Border IT, Port Stakeholders

1 Introduction

Recently, there is an emerging tendency on cross border information exchange among port authorities as well as among port stakeholders. The majority of Port Authorities monitor their port processes based on Information Technology Port Community Systems aiming to provide better passenger and maritime services. Within the EU funded project, the pAssengeRs and loGistics information Exchange System (ARGES) [1], there has been explored and proposed an integrated methodology concluding and expanding previous data exchange interfaces based on relative projects i.e. APC [2] and GAIA [3] that it creates a solid general approach for future imple-

mentation. Known data exchanging and sharing procedures have been analyzed for the corresponding Adriatic-Ionian ports and there was been proposed a prototype interfacing web service.

Port Community Systems are based on IT solutions to facilitate and increase the efficiency of vessels traffic, goods, tourists and passengers movements. But at the same time they provide also data and information to all interesting governmental departments such as coast guards, customs, regional and local authorities, waste collection departments and etc., so that to better organize their businesses and the provided services. The proposed approach is based on a thorough review on PCS systems, maritime port IT logistics systems, Web services [4] and port authority obligations regarding the EU Directive 2010/65.

This papers presents the main outputs regarding the proposed exchange protocol for the Trans-Adriatic Ports Informative Node (TAPIN), which has been proposed within the project pAssengeRs and loGistics information Exchange System (ARGES) mainly for the Greek port authorities (ports of Patras, Igoumenitsa and Corfu).

2 Maritime port data exchange interface among Port Community Systems

This section presents the main web services that port community systems provide so that to support and allow communication and information exchange among various PCS modules and with the IT systems of relative port community stakeholders, passengers and any other affected stakeholders [5], [6].

Here, the main characteristics of such an exchange interface are defined and described. First of all, as core it is suggested the adoption of web services because they allow and support communication and exchange among different systems and technologies. Thus communication is independent of the technology that each system is implemented on. It is only required that each system has to use a communication interface service that guarantee the appropriate authorization. This is essential since various and different PCS have to exchange information.

Using web services for communication, the interconnected systems has to know nothing about the implementation of any interconnected PCS but they only need to use the same interface and make the appropriate calls. In addition to this, any updating of the web services automatically updates the interface but the client (PCS) of the service needs to make no changes.

The proposed structure of web services is organizing in four main subcategories:

- pcs2pcs – Services for direct communication between two PCS
- pcs2gov – Services accessed only by governmental IT systems.
- pcs2b – Services accessed only by port stakeholders/business IT systems
- pcs2p – Services accessed only by public IT systems

Hereafter the PCS that incorporates a complete set of the above proposed web services will consist a Trans-Adriatic Ports Informative Node (TAPIN). The participat-

ing port community systems create the TAPIN network and any port stakeholder who interacts through the TAPIN interface is called a TAPIN stakeholder.

The exchange interface system is based on web services that are referring to different user categories. In order these services to be distinguishable for each category; a toy character prefix is used for the cases with the same functionality call but different recipient. This is also used for the returning objects. This convention besides making them more easily distinguishable, it also allows the programmers to assign different values to the objects, depending on the data that will be returned to the final user. So for example web services referring to the customs office are prefixed with cO, web services referring to the coast guard use cG and etc.

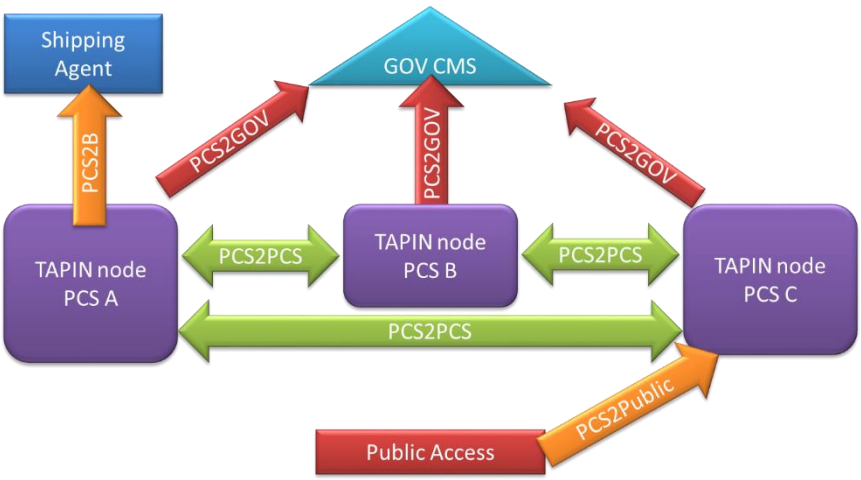

Figure 1: The structure of connecting three port community systems where their TAPIN nodes interact each other and each node with his port stakeholders.

Figure 1 presents the structure of TAPIN network consisted of three TAPIN nodes. Each TAPIN node has a two way sharing information interface other TAPIN node. As an example the PCS A provides pcs2b services to shipping agents, PCS C exchange port information to the public through the pcs2public interface and all the three PCS share information to the same governmental content management system using the pcs2gov services.

The PCS to PCS web services in detail.

- *getPcsList* this service allows a PCS to retrieve a list of the other available PCS on the network along with a description of the services that they provide.

- registerPcs allows the registration of a new port community system in the network. A required input is the URL that addresses the services that the PCS offers
- *searchPassengerById* using the id of a ticket, system retrieves the information of the passenger provided that the passenger exists
- *searchPassengerByName* given the name of a person the system retrieves the data about the passenger provided that such a passenger exists
- *searchVehicle* given the license plate of a vehicle the system returns the relevant data about the vehicle
- *getPassengerList* takes as parameter an itinerary id and returns the list of all passengers
- *getVehicleList* takes as parameter an itinerary id and returns the list of all vehicles
- *getCargoList* takes as parameter an itinerary id and returns the list of allo cargo
- *getItineraryData* takes as parameter an itinerary id and returns the corresponding information about the itinerary

PCS to government web services

The second part of the web services is referring to exchange information with IT systems of governmental organizations. Such organizations are the customs department, the coast guard, environmental department, infrastructure department, transportation department local/regional authorities.

- *cOGetItineraryData* takes as parameter an itinerary id and returns relevant information
- cOGetCargoList takes as parameter an itinerary id and returns the list of cargo
- cGGetIncomingShips returns the list of incoming ships on a certain time period
- cGSearchPassengerById given the id of a ticket the systems retrieves the information of the passenger provided that the passenger exists
- cGSearchPassengerByName given the name of a person the system retrieves the information about the passenger if such a passenger exists
- cGGetEmergencySignal allows the coast guard to receive emergency signals that may be limited of an itinerary
- cGGetHazardousCargo given an itinerary id it returns a list with cargo that may be dangerous and requires special handling

- glGetGatesStatus return the status of a gate such as out of service, highly congested and can be used to divert traffic to another port etc. Can be used by the transportation department to inform drivers
- glGetShipInfo returns data regarding an arriving ship such as expected time, number of vehicles etc. Can be used by the transportation department of highway Operation Company to predict the expected traffic load.
- glGetPortStatus returns general information regarding the port such as traffic, congestion, weather etc.

PCS to business web services.

The third part of web services mainly connects the PCS with the IT systems of shipping agents and allow them to upload data about the tickets and relevant information for every itinerary. The same data could be used for ticket control system in port facilities.

- *addPassenger* shipping agent's system adds a new passenger each time a new ticket is added to an itinerary
- *updatePassengerByName* the shipping agent's system may update information to an already edited ticket and provides the passengers name as input
- *updatePassengerById* the shipping agent's system updates information to an already edited ticket and uses the tickets id as input
- *deletePassengerByName* used by the shipping agent's system each time a ticket is canceled and uses the passengers name as input
- *deletePassengerById* used by the shipping agent's system each time a ticket is canceled and uses the ticket's id as input
- *uploadTicketFile* allows the shipping agent' system to massively upload ticket data through a file of certain form
- *manuallyInsertTicket* allows the shipping agent to register a ticket directly (manually) in the web service in case that IT system is unavailable
- *addCargo* used by the shipping agent's system each time a new ticket for a cargo is edited for an itinerary
- *updateCargoById* used by the shipping agent's system each time changes to an already edited ticket for a cargo are made and uses the tickets id as input
- *deleteCargoById* allows the shipping agent to cancel an already edited ticket for a cargo

- *uploadCargoFile* allows the shipping agent to massively upload cargo ticket data through a file of certain form
- *manuallyInsertCargo* allows the shipping agent to register a cargo ticket directly (manually) in the web service in case that his system is unavailable

PCS to public

The fourth part of web services are used to provide information to the general public and they are used without any authorization control

- *getItineraryInfoByDestination* returns information about the available itineraries to a destination
- *getBusScheduleByDestination* returns the available bus schedules from the port town to another inland destination
- *getWeatherInformation* returns weather information for area around port for a specific time frame

3 Scalability for potential adoption

Here, the existing port services available at the ports of interest have been examined and there are proposed the structure and main services that lead to TAPIN network implementation. The network is expandable, actually in the PCS2PCS section there are two operations the *getPcsList* and *registerPcs* that they are used to register a new TAPIN node to the TAPIN network as well as to list all the available TAPIN nodes of the network.

The strength and the cohesion of the cross border community, both internally and with respect to external port community stakeholders (such as passengers) take advantage of the deployed network services that improve communication and exchange of information among Port Authorities. These services enhance common practices and enable secure and useful transactions. The proposed approach may further be expanded and used to improve passenger mobility, speeding up the disembarkation process, improve custom operations, encourage the last-mile services of the port, enhance the governmental services offered to the tourists and provide better security control for in-port parking and traffic.

4 Conclusions

This work provides to Port Community System's developers an illuminative case for upgrading TAPIN network where they can build their own generalization and expand the pcs2pcs applications. There has been taken into consideration the existing port processes, the PCs and the infrastructure of the interconnected Adriatic Ionian ports.

Furthermore, this work could be considered as a step forward to close the gap of sharing data among the IT systems of port authorities and all the relevant stakeholders. Nonetheless the next step is to expand the TAPIN network and create a real time platform networking more interconnected ports that will provide an expanded set of data sharing and features.

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