D6.1 Basic route handling/exchange service

Project no.	636329
Project acronym:	EfficienSea2
Project full title:	EFFICIENSEA2 – efficient, safe and sustainable traffic at sea

Funding scheme:	Innovation Action (IA)
Start date of project:	1 May 2015
End date of project:	30 April 2018
Duration:	36 months

Due date of deliverable:	01.06.2017
Actual submission date:	01.06.2017
Reject date:	16.03.2017
Due date for revision:	01.06.2017
Revision submit date:	01.06.2017

Organisation in charge of deliverable:	Finnish Transport Agency (FTA)

"This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 636329".

Document Status

Authors

Name	Organisation
Mikko Klang	FTA
Kaisu Heikonen	FTA
Per Löfbom	SMA

Document History

Version	Date	Initials	Description
0.1	17.10.2016	mck	First compilation for review
1.0	26.10.2016	mck	First released version
1.3	1.6.2017	mck, pl	Second release

Review

Name	Organisation
Tomas Groth Christensen	DMA
Rickard Nilsson	SMA
Dmitry Rostopshin	Transas
Alexander Legkikh	Vissim

"This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 636329".

Contents

"This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 636329".

"This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 636329".

1 Introduction

1.1 Route exchange and information service

The ENSI (Enhanced Navigation Support Information) Service allows vessels to send their route plans and mandatory SRS (Ship Reporting System) reports to a Route-Exchange-Server electronically and authorized partners (e.g. Vessel Traffic Service systems) to retrieve the information from the server. In addition, the service executes a cross-check for the route plan and allows both the vessel and authorized partners to get the results of the cross-check as well as other information tied to the particular route and local conditions.

The existing system uses common ENSI Rich-Client software module as a vessel end-point to transfer the Voyage reports to the Route-Exchange-Server and to retrieve and display the provided information. The other present end-point of the service is the Finnish VTS system which connects to the Route-Exchange-Server through documented interface. The system has been installed and tested on-board about twenty vessels sailing frequently in Gulf of Finland. The information received from vessels through the ENSI service has been used especially by GOFREP (Gulf of Finland Ship Reporting System) operators. If vessel's SRS report is available through ENSI service it can be transferred electronically to the GOFREP database and the route plan can be used for monitoring ships passage automatically in addition to other methods.

The heart of the service, the ENSI server, is interoperable also with third party vessel-end-point-clients and VTS-end-point-clients. The first third party clients are under development within the EfficienSea2 project. The vessel side client functionality is currently being integrated into Baltic Web service and the first third party VTS side client is being tested. The integration with Maritime Cloud is studied. This will require further harmonisation of the user authentication methods used by Maritime Cloud and ENSI.

1.2 Relation of ENSI service and EfficienSea 2

It is to be noted that unlike many of the services created inside and for the project ES2, ENSI service has been created outside and before the project and it is originally developed as a stand-alone service. The ENSI service related work within ES2 project has been focused on developing interfaces between the existing ENSI service and the third party clients. The development of compatibility with third party vessel navigation systems and especially shore-centres with third-party monitoring systems has been seen to have as important role as the development of the core service itself. Compatibility also includes the mechanisms of strong identification. Building and arranging interoperability issues to the level that makes using existing services a true, rather than theoretical, option, is the main purpose of task 6.1.

"This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 636329".

Compatibility with Maritime Cloud identity and identification mechanisms has been studied in detail. It has been important to find out and learn more about the changes/updates that are required to be done with services that are not created for Maritime Cloud, but which already exist and should be made available via Maritime Cloud.

1.3 Maritime Cloud compatibility

1.3.1 Identity Registry

The PKI infrastructure implemented in ENSI service is technically similar with the one used in the Maritime Cloud Identity Registry. However, the implementation of PKI in ENSI service was done before the development of the Maritime Cloud. In practise, using the certificates is identical in both infrastructures, but the certificates are not interchangeable.

Implementing the MC certificates to ENSI still needs maturing. The technical changes required would be just a matter of work, but the operational effects would not necessarily be beneficial. While for ENSI service, it is essential to issue only one certificate per ship, or MMSI, Maritime Cloud certificates can be issued more freely, since there are many users of other types than ships or VTS stations. Thus there might be several MRN id's issued on the same MMSI, even from different issuers, leading to possibility of obscurity and one ship having several MC certificates with different disposition. Because registration to ENSI service requires adding some extra information to the MC certificate, establishing a user account would in any case demand more actions than just the registration to MC Identity Registry. Considering this, having a separate certificate solely for ENSI service in the system of several certificates, might even keep things clearer than trying to keep in track to which MC certificate of the ship is the one that works with ENSI service.

The most important part, to define the infrastructure for strong identification, will be achieved with both solutions.

1.3.2 Service Registry

ENSI service is in process of producing full service specifications following the template created for MC Service Registry. The first version of upper level specifications in both human- and machine readable format are ready, and the Service Design Specifications as well as the Service Instance Specifications will follow. The service will be registered and thus available via Maritime Cloud during the project.

The MC compatible specification in human readable format is in the **D3.4 - Service Specification for the ENSI Voyage Reporting Service.pdf** (Chapter 6.1, Item 6).

The MC compatible specification in machine readable format is in the **ENSI VRS Specification as XML to SR_v1.0.xml** (Chapter 6.1, Item 7).

"This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 636329".

1.3.3 Development in other tasks

Further integration to MC will take place in other tasks as well, especially in task 6.2 VTS and SRS reporting.

2 Services

2.1 Introduction

The ENSI solution provides an information hub for conducting information sharing between various information providers and eNavigation actors. The services do not require human inputs when executed, but are highly automated functions collecting high quality data from well maintained, existing sources, filtered to serve the user's needs with the most relevant information only.

The responses are automatically generated and can be called by the user whenever needed. For example, a route plan can be submitted, crosschecked by a machine, responded, re-assessed against the weather and updated by the seafarer hours or even days before arriving to the monitored area. The VTS operator might be first time involved with the information an hour before the ship is arriving to the monitored area, calling the ships route plan for a visual cross-check, admitting the vessel for automatic deviation follow-up, checking the SRS information and saving it to common database with one mouse-click. The situational awareness at both end-points is dramatically enhanced, the administrative burden is reduced with lowered margin of errors, and less work is required.

The service is not designed to be an on-line service, but a means to share existing plans to other stakeholders to cross-check and take note of in good time before entering the actual venue. The usage of bandwidth is minimalized and can be exploited where data connections appear, e.g. in the port of departure.

In EfficienSea 2, not all available services are in the centre of development, e.g. weather services and pilot ordering, due to complexity of scaling related to the benefits to be achieved here, or simply because other actors are concentrated on them. The focus is in the very core services, that is the route exchange, the route cross-check, and the SRS (Ship Reporting System) reporting. All existing services are at disposal and therefore described here, through ENSI Gateway in the extent they appear, but there is no particular quest for expansion on all subjects.

All services can be used by ENSI client as well as other, yet unborn clients. Services are briefly presented below with references to correct Service Specification Documents and/ or schemas. Specification documents and schemas are attached and listed in chapter 6.

"This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 636329".

Specifications. Short description from ship-users perspective can be found in chapter 4. ENSI Rich-Client.

2.2 Route exchange service and Voyage query

The ENSI provides a machine-to-machine solution for a vessel to deliver its route plan to be cross-checked and monitored by VTS services connected to ENSI. The route is delivered as a part of a Voyage report compiled by client software on-board. Certified vessel client can retrieve its active route and VTS client can query for all active voyages. The format of the route plan is RTZ. The ETA's can be updated without making a new Voyage.

The detailed information for vessel-end-point is described in **ENSI-Voyage-Service-specification-2016-05-06.pdf** (Chapter 6.1, Table 1, Item 1) and for VTS-end-point in **Voyage-Query-Interface-specification-2016-05-06.pdf** (Chapter 6.1, Table 1, Item 3)**.** The message descriptions can be found in *iec-rtz_1_0.xsd, voyage.xsd and voyage-query.xsd* schemas (Chapter 6.2, Table 2, Items 1, 7, and 6).

2.3 Ship Reporting System (SRS) reporting service

The mandatory SRS reporting can be performed using the ENSI Gateway, to Ship Reporting Systems connected to ENSI. The report is compiled by the client. The client can collect the missing contents from a user questionnaire, as it is done in ENSI client, or automatically from other systems. The report is submitted as a part of the Voyage report, and can be updated without making a new Voyage. VTS clients retrieve the SRS information as a part of the Voyage report.

The SRS file is a XML as in *srs.xsd* schema (Chapter 6.2, Table 2, Item 3).

2.4 Route validator

The ENSI uses a stand-alone module for a cross-check of the route. The module compares the submitted route with maritime data, and creates a list of observations regarding the route. The validator uses the best S57/ENC data available.

The parameters of the validation can be adjusted. The route validator generates a warning for example when

- The draught of the vessel is greater than the depth range
- The draught of the vessel is greater than the clearance depth of a fairway
- The route crosses seabed obstructions
- The route crosses ODAS (Oceanic Data Acquisition System) buoys
- The route crosses a traffic separation zone
- The route crosses a traffic separation lane in the wrong direction
- The submitted route crosses the area of present chart coverage

"This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 636329".

The warnings include the triggering reason and position.

The response of the cross-check can be retrieved by the vessel and the VTS. The response file is a XML as in *vessel-waypoint-exchange-response.xsd* schema (Chapter 6.2, Table 2, Item 5).

2.5 Icebreaker Dirway service

Icebreakers define the waypoints ships have to follow in winter traffic. These waypoints, called dirways, may change depending on weather and ice conditions even several times a day. The ENSI service retrieves the latest information from the database maintained by icebreakers, giving the seafarer a certainty of latest information that is rather difficult to maintain by conventional methods.

The icebreaker routes use the same format as the submitted route plans. The retrieved response conforms to the *route-exchange.xsd* schema (Chapter 6.2, Table 2, Item 2).

2.6 Weather service

2.6.1 Observations

Observed weather includes wind, seawater level, wave height and sea-ice. The retrieved response conforms to the *weather.xsd* schema (Chapter 6.2, Table 2, Item 10).

2.6.2 Route weather

Route weather is a prediction for the submitted route for 24 hours if available. The retrieved response conforms to the *weather.xsd* schema as well.

2.7 Pilot ordering

Pilot ordering service is executed proprietary for Finnish Pilots. The pilot ordering practises vary between countries and may not be easily scaled as it is. The present service implemented in ENSI client uses a questionnaire to collect the data needed to compile the pilot order XML conforming to the *pilot.xsd* (Chapter 6.2, Table 2, Item 12)schema. Based on received information, the ENSI service compiles an email and sends it to the right Pilot Order Centre, and a copy for the vessel. Response to the order is carried out by using other means of communication.

2.8 Navigational Warnings

The ENSI provides Finnish navigational warnings in force. The retrieved response conforms to the *warnings.xsd* schema (Chapter 6.2, Table 2, Item 11).

"This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 636329".

3 Use cases

3.1 Use case diagram

The associated use case diagram presents a very high level view of the main use cases within the system.

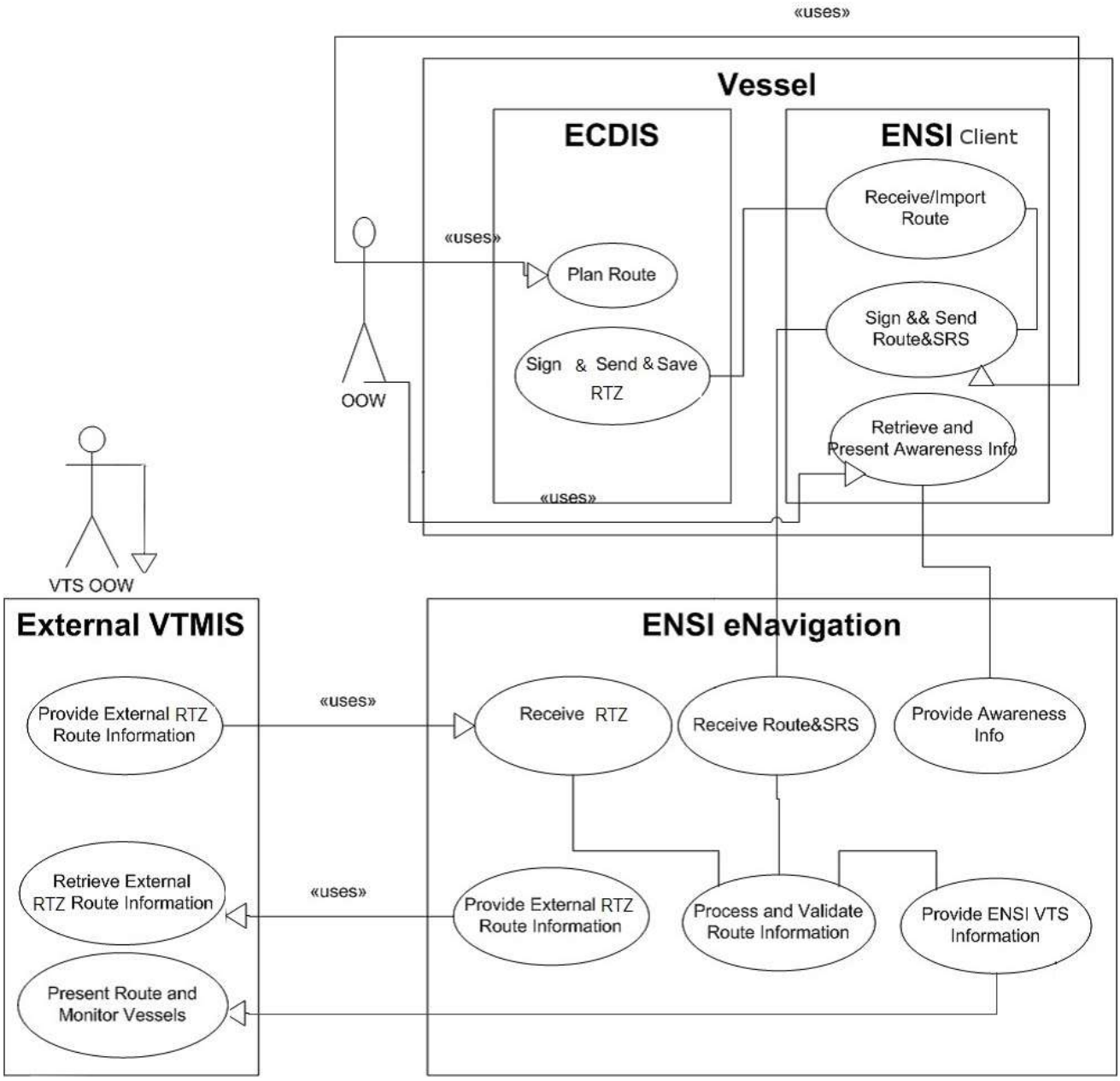

Fig. 1 The use case diagram presents a very high level view of the main use cases within the system

"This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 636329".

3.2 Vessel route planning and Route Exchange

In a typical use case scenario of the ENSI eNavigation route exchange, the route is planned using the on-board ECDIS or ECS system. Once the OOW (Officer on Watch) has planned the route and it has been validated by means of the ECDIS or ECS, the route information may be submitted to the ENSI service by four different means:

1. The user may decide to export the defined route as an IEC RTZ compliant XML-Schema to a file that may then be transferred on-board to the ENSI client. The user then uses the client on-board to insert the missing information to fulfill the SRS requirements.

2. The user may decide to export the IEC RTZ compliant route using the defined RTZ Web Service to the on-board ENSI client. The local ENSI client is capable of receiving the route without authentication, as the system trusts the system that is located in the same LAN.

3. The ECDIS system may itself be capable of both exchanging the IEC RTZ compliant route information using the defined ENSI Web Service and to retrieve situational awareness information that is associated with the provided route, assumed that the submitted route contains vital key information such as ETA and LOCODE. The situational awareness information consists of weather and environmental information as well as aids to navigation information.

4. The ECDIS system may be capable of posting the RTZ compliant route solely to the secured ENSI Web service. The route has to utilize ENSI IEC extension that enable passing of additional information such as LOCODE, that is needed for the system. The route also has to be digitally signed. This way the route is bypassing all the services, but can be delivered for the VTS.

The SYSML internal block diagram presents a picture of the various system interfaces and their relationships and how the communication between the different system components is to be conducted.

"This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 636329".

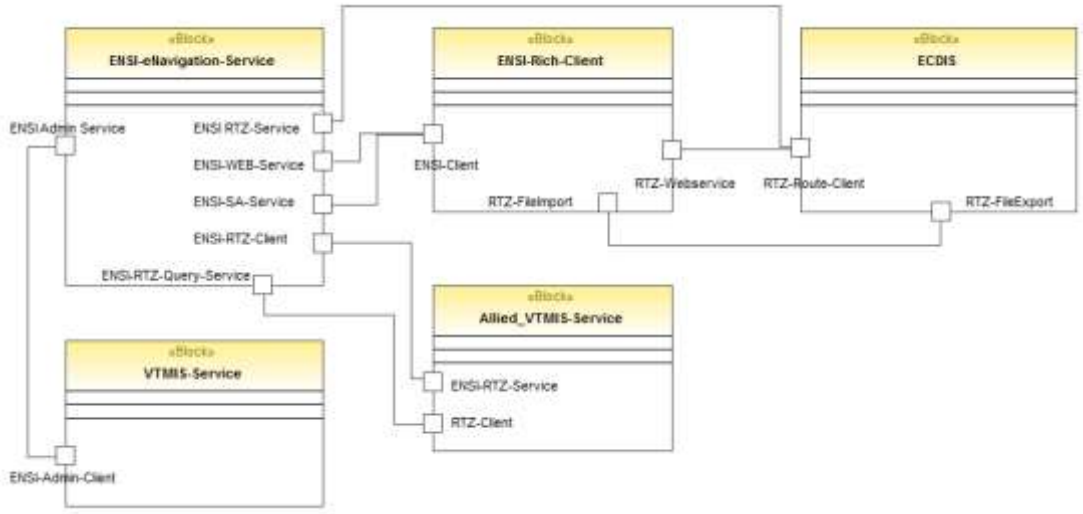

Fig. 2 ENSI eNavigation SYSML Internal Block Diagram

3.3 Shore-based Route Information Exchange and monitoring

The Voyage-Query service enables external systems to retrieve Voyage information using the PKI mechanism for authentication and by providing the query document. This enables a system to query the information for a specified vessel.

The Voyage-Query service solution enables a single window approach as a vessel may only need to report once as the exported Voyage information may be retrieved by several shore-based systems connected to the service.

In Finnish VTS system the information can be displayed at any time after the submission. Usually it is observed by the operator when the vessel is close to enter the monitored area. The SRS report is checked and saved to common GOFREP database, and the route plan is visually assessed. The points of electronic cross-check response are displayed with the route line on the operator's screen, and the textual response can be called to the screen if desired. If the observed information brings up issues, the operator contacts the vessel using regular means for communication, e.g. the VHF-radio. If no issues are detected, the vessel is moved to electronic follow-up, and the route line is dismissed from the screen. The monitoring of the area is continued as usual. If the vessel deviates the planned route above the given limits, the operator gets an alert and knows to focus on that situation. If the deviation doesn't have a natural explanation and continues, the operator contacts the vessel using regular means for communication.

"This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 636329".

4 ENSI Rich-Client

Although the ENSI service is seen to be used by mainly third-party clients, at some point hopefully directly via ECDIS, the only existing implementation of a vessel-client is so far the ENSI Rich-Client. The use of the client is simple and mainly self-explanatory and the utility in ship-environments is good.

The installation package can be downloaded from web, and the installation can be made from an USB memory as well.

The client software itself is very bandwidth efficient; all maps etc. are included as local copies and only dynamic data is exchanged. After sending in a new Voyage, which covers a few-second polling sequence, the only time anything is sent or received, is when the user wants information updates. The sizes of exchanged files are between kilobytes and hundreds of kilobytes.

All existing services for a ship-user are available via the ENSI client.

Below you will find a short description of how to join and exploit the ENSI service as a ship-user using ENSI client.

4.1 Applying for access

To join the ENSI service, vessel has to request for a user account by filling a registration form at https://ensi.fta.fi/extranet/web/ensi/registration-form . The form is received and assessed by FTA, and the user-account is created. A certificate-file is delivered to the vessel followed by login information and directions how to download related files.

4.2 Software installation

The software is distributed as a Microsoft Installer (MSI) package for Windows. The installation is supposed to be made on a ships bridge back-office PC or similar, with access to web. The installation requires System Administrator privileges and a Java Runtime Environment. The size of the MSI package (version 7.14.5) is 162 MB.

After a successful installation, the received certificate file has to be placed in correct system folder and the ENSI client is ready to be launched.

The installation procedure is described in **ENSI Installation Guide 7.14.pdf** (Chapter 6.1, Item 4).

4.3 The use of the client

The procedure for the first start is described in **ENSI Quick Start Guide 7.14.pdf** (Chapter 6.1, Item 5).

"This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 636329".

4.3.1 Start

The program is launched by double-clicking a shortcut appeared on the desktop. After the program has started, it is recommended to click the 'Update' icon to receive the latest information on weather and warnings. The time of latest update performed is in the low-left corner of the window. For any further information, a Voyage report has to be made. The first updated view is presented in Fig. 3.

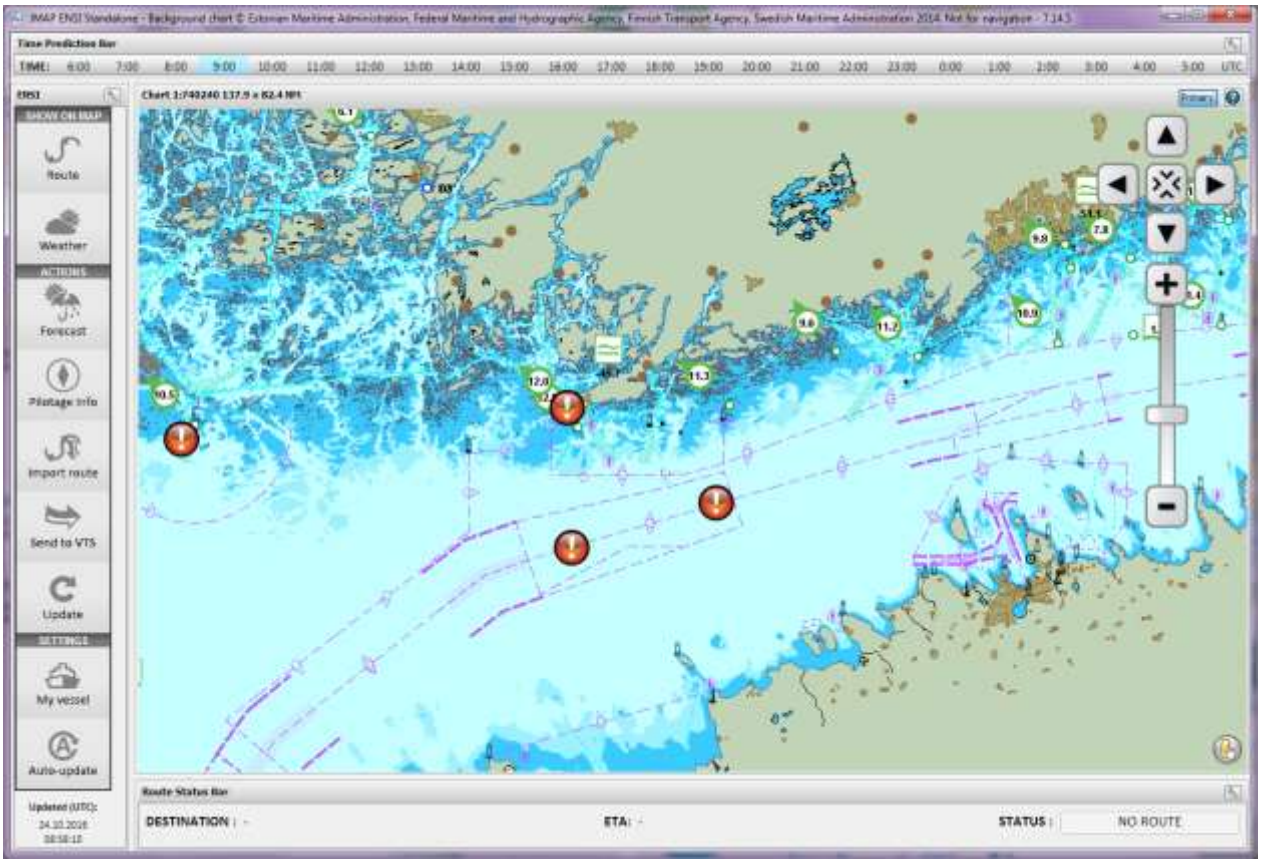

Fig. 3, Start view

4.3.2 Reporting a Voyage

Assuming that a route plan in a valid RTZ-format is in hand, the process of making a Voyage report begins by clicking the 'Import route' icon. The imported file is selected, and the SRS information is filled in the questionnaire form. The information covers

- The destination as a UN/LOCODE
- Cargo information
- Draught
- Deficiencies
- Pollution
- Quantity of persons onboard

"This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 636329".

- Extra information if needed

After filling the form, the Voyage report including the route plan and SRS information is submitted by clicking ‘Submit’. The system will give a respond when the submission is successfully executed, and automatically return a response of the route-check.

At this point the core work of the ENSI client is done, that is to collect and distribute vessels route plan and SRS report. All the information can now be retrieved from the ENSI server by the vessel or an allied VTS partner.

4.3.3 Updating Voyage report

The Voyage report can be updated excluding the actual route-plan if changes occur. This makes it possible for example for passenger vessels to submit their reports before the most intensive parts of departure, and update the quantity of passengers after sailing out from the harbor, if last minute cancellations occur.

The updating process starts by clicking the ‘Send to VTS’ icon and choosing desired options.

4.3.4 Exploiting the information services

Available information services are viewed by activating information layers on the icon tray on the left on the display window, or by dragging a time-line at the top of the window.

Icons

4.3.4.1 Route

Clicking Route icon allows to show or hide the warnings, waypoints on own active route, or the icebreaker dirways.

4.3.4.2 Weather

Clicking Weather icon allows showing or hiding the wind, sea level, wave height and sea ice.

4.3.4.3 Forecast

Clicking Forecast icon opens a textual description of latest weather forecast.

Time bar

4.3.4.4 Route weather

Clicking different timings in the time bar visualizes the weather forecast for different points at the route. Choosing e.g. ‘16:00’ displays the wave heights and winds at every waypoint of the route plan at 16:00 UTC, and the position of the vessel at that time, according to the route ETA’s in the active route. No other weather information is displayed in order to make the picture clearer for the seafarer.

The visual response of the ENSI client displaying the response of the route-check and route-weather is presented in Fig. 4.

“This project has received funding from the *European Union’s Horizon 2020 research and innovation programme* under grant agreement No 636329”.

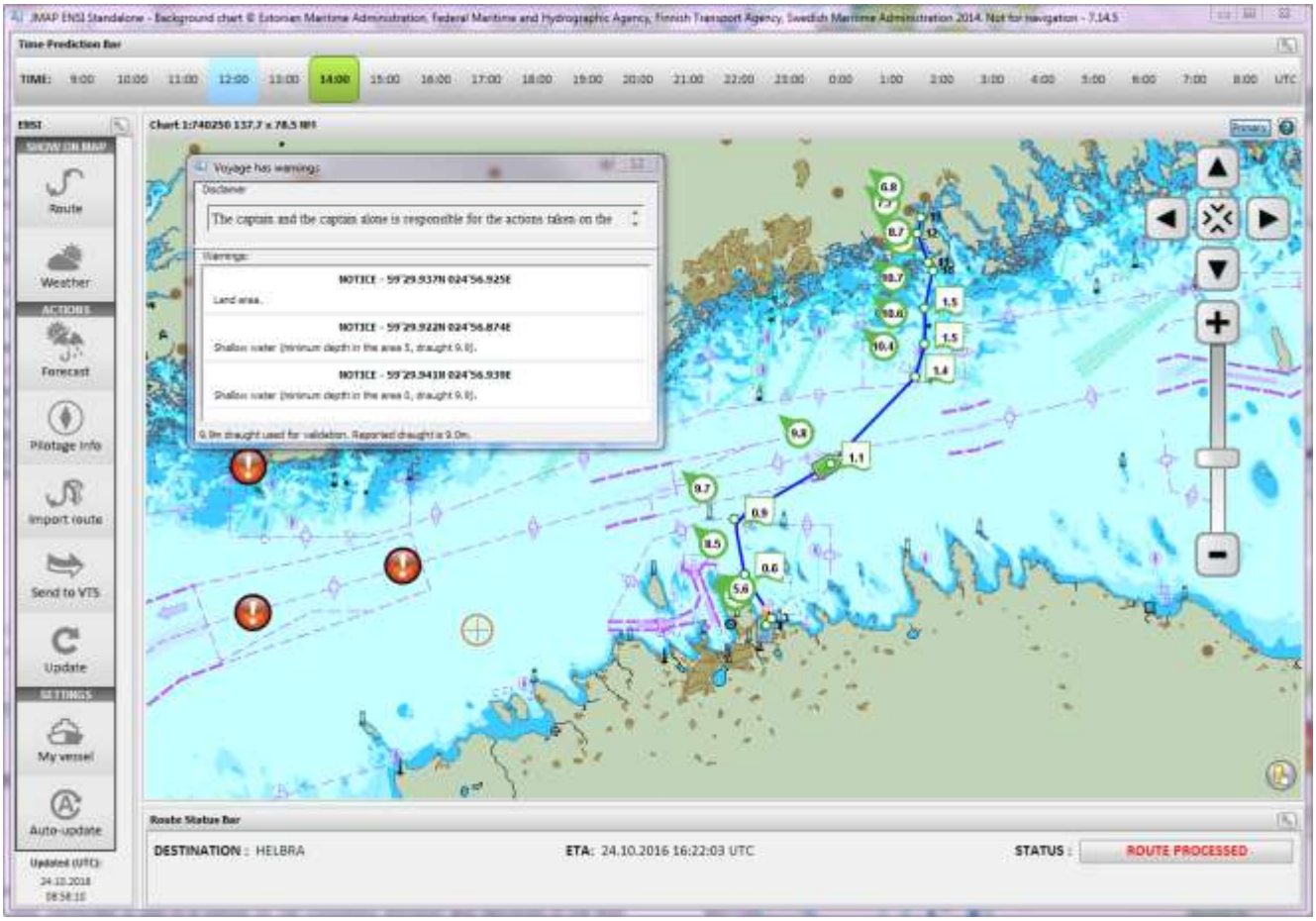

Fig. 4, Route response and route weather

5 Interfaces

5.1 Client Authentication

The ENSI system uses standard PKI solutions (https and client certificates) to encrypt data and authenticate the ENSI clients. In order to gain access to the ENSI service, the competent authority needs to generate a client certificate that will be used to authenticate the end-user. The user certificate is tied to a vessel by the competent authority and delivered to the end-user requesting access. The certificates will be provided by the Finnish Transport Agency at this point in time.

The present authentication arrangements are designed and implemented having the Maritime Cloud in mind but before there was any specifications to follow. The integration with the Maritime Cloud is studied. The philosophy behind ENSI is to allow as many different ways to share the Voyage as possible in a secure manner and a reasonable effort.

"This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 636329".

The description of the client authentication used is in **ENSI-eNavigation-PKI-Specification-2015-06-26.pdf** (Chapter 6.1, Item 2)

5.2 ENSI Voyage Service Interface

Public ENSI web interface

The ENSI Gateway provides interfaces for submitting voyages, retrieving weather, icebreaker dirways and maritime warnings that are e.g. provided by a VTS or similar authoritative source.

The ENSI Gateway is a HTTP server that supports HTTP compression. Information is exchanged between the client and the server using well-defined XML documents. All connections to the ENSI Gateway are SSL encrypted and valid user certificates and credentials are required to interact with the server. The Web Service is REST based web service that should facilitate an easy development path to the system using virtually any software platform or programming language that is available.

An ENSI voyage is split into three parts; the route (IEC-RTZ), the SRS report and the optional pilot order (not offered in EfficienSea2 as a comprehensive service). All three parts will return a unique ID that shall be tied together by the voyage document. The voyage document shall be submitted as a final step.

Upon submitting the final voyage document, the ENSI server will validate the route and send a vessel waypoint exchange response message back to the client. The response message will contain the results of the route validation.

The detailed information for vessel-end-point interface is described in **ENSI-Voyage-Service-specification-2016-05-06.pdf** (Chapter 6.1, Item 1).

5.2.1 Submitting a Voyage

In the first phase a Route document (IEC RTZ) is submitted to the ENSI Gateway. If the route is valid, a common response XML file is returned containing the generated document ID. Due to the fact that the RTZ schema does not require certain information critical for ENSI to be provided, some assumptions regarding the submitted XML document needs to be made. This is still a far more lightweight and implementation-friendly solution than introducing separate schema extension documents. It is assumed that the ETA for each waypoint is provided in the *eta* field of the *calculated schedule element* of the *RTZ route* format.

It is to be kept in mind that the RTZ schema and the know-how is maturing in close future by the impact of on-going and future projects like ES2 and STM, and ENSI will follow the development. A system integrator should always check what is the latest documentation in hand.

"This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 636329".

As with the planned route document, the SRS report XML is submitted to the gateway and a Common Response is returned containing the document ID. When both parts of the voyage have been submitted to the ENSI gateway, the client must submit a Voyage XML document tying the parts together. By submitting the voyage XML document a validation of the voyage route is triggered. As the route validation process might be time consuming, the HTTP request will return immediately with a unique voyage ID. The client may then poll the ENSI gateway for a completed route response. If the route validation was successful a route response document containing observations about the route is returned. In case an error occurred during validation the route response document will contain an error description.

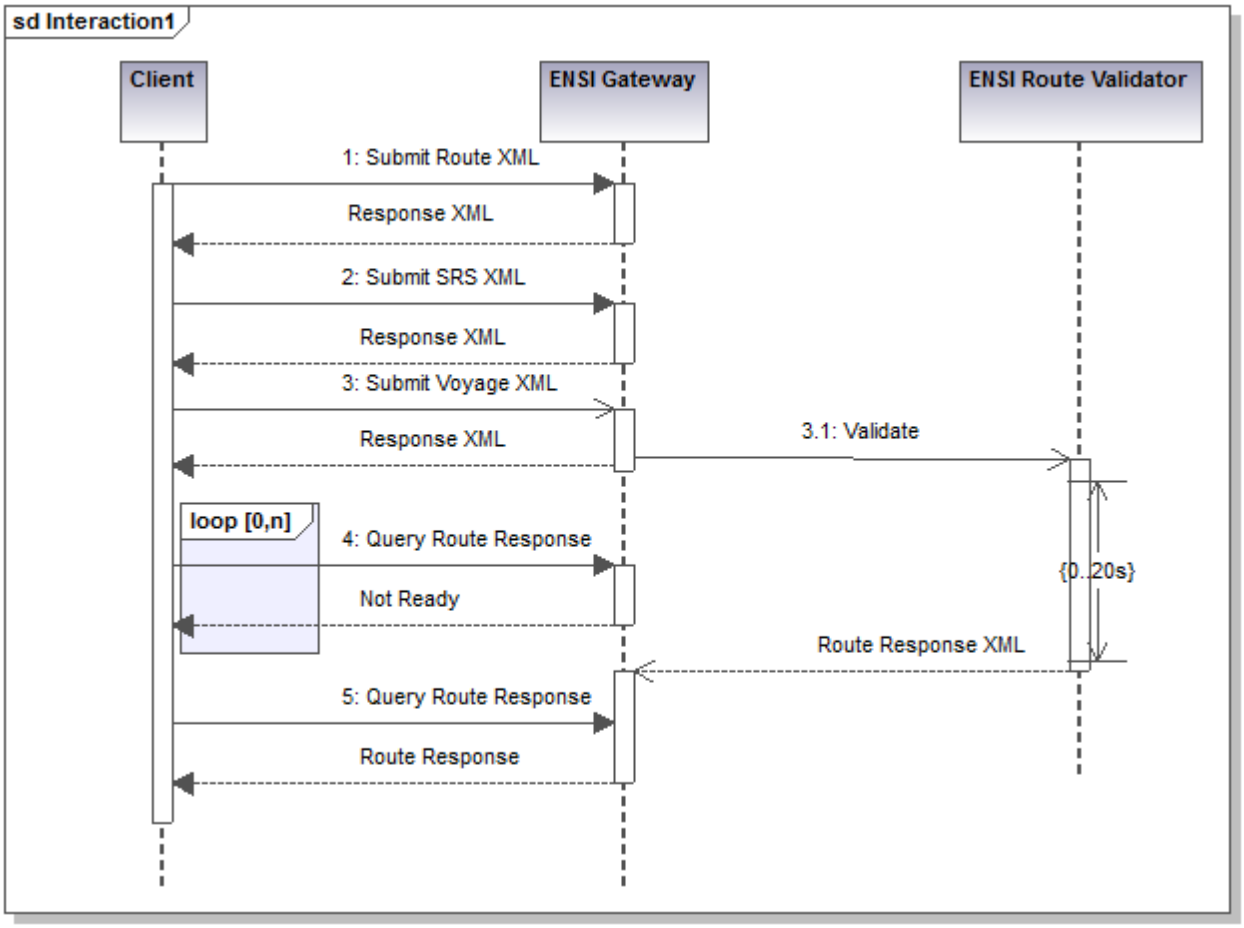

Fig. 5 Client - server communication

5.2.2 Retrieving information

As an example of the way of retrieving information from the ENSI server, the inquiry of vessels active voyage document is described below. The comprehensive description is in the **ENSI-Voyage-Service-specification-2016-05-06.pdf** (Chapter 6.1, Item 1)

"This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 636329".

The active voyage of a vessel can be retrieved with an HTTP GET request from https://[host]:[port]/core/service/voyage. The ENSI Gateway will use the client certificate provided in the HTTPS request as authentication information and to identify which vessel has done the query.

5.3 Voyage Query Interface

Interface for allied VTS partners

The ENSI server component provides an interface for searching submitted ENSI voyages.

The client generates an XML document with the desired query parameters that coheres with the Voyage Query Schema and sends it to the ENSI server.

The server will process the XML and in turn perform a query against the ENSI database. The results of that query are returned as a XML document. The XML document returned is based on the Voyage schema used in the public ENSI web interface. The XML document will contain a list of all voyages that matched the query. Each voyage in the returned document will have the route ID, SRS IDs and META information such as vessel identifications, vessel name, destination name, destination LOCODE and destination ETA.

The route and SRS data can then be retrieved from the server using the respective IDs supplied in the response.

The specific description of the interface is in the **Voyage-Query-Interface-specification-2016-05-06.pdf** (Chapter 6.1, Item 3).

6 Specifications

6.1 Table 1, ENSI specifications and guides

Number	Item	Comment
1	ENSI-Voyage-Service-specification-2016-05-06.pdf	Appendix 2, Released for Internet Transmisson
2	ENSI-eNavigation-PKI-Specification-	Appendix 3, Released for Internet

"This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 636329".

	2015-06-26.pdf	Transmisson
3	Voyage-Query-Interface-specification-2016-05-06.pdf	Appendix 4, Released for Allied VTS Authorities
4	ENSI Installation Guide 7.14	Appendix 5, Public
5	ENSI Quick Start Guide 7.14	Appendix 6, Public
6	D3.4 - Service Specification for the ENSI Voyage Reporting Service.pdf	Appendix 7
7	ENSI VRS Specification as XML to SR_v1.0.xml	Appendix 8

6.2 Table 2, Schemas

Number	Item	Comment
1	iec-rtz_1_0.xsd	Attached
2	route-exchange.xsd	Attached
3	srs.xsd	Attached
4	vessel.xsd	Attached
5	vessel-waypoint-exchange-response.xsd	Attached
6	voyage-query.xsd	Attached
7	voyage.xsd	Attached
8	common-response.xsd	Attached
9	common-geo.xsd	Attached

"This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 636329".

10	weather.xsd	Attached
11	warning.xsd	Attached
12	pilot.xsd	Attached

6.3 Table 3, Acronyms

Term	Definition
BW	Baltic Web
CIRM	Comité International Radio-Maritime
ECDIS	Electronic Chart Display and Information System
ECS	Electronic Chart System
ENC	Electronic Navigational Chart
ENSI	Enhanced Navigation Support Information
ES2	EfficienSea 2
ETA	Estimated Time of Arrival
DIRWAY	Waypoints in route assigned by an icebreaker
GET	HTTP request method
GOFREP	Gulf of Finland Mandatory Ship Reporting System
HTTP	Hypertext Transfer Protocol
ID	Identification
IEC	International Electrotechnical Commission
IHO	International Hydrographic Organization
LAN	Local Area Network
LOCODE	United Nations Code for Trade and Transport Locations
MSI	Microsoft Installer file
ODAS	Oceanic Data Acquisition System

"This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 636329".

OOW	Officer On Watch
PKI	Public Key Infrastructure
REST	Representational State Transfer
RTZ	Standard Route Plan Exchange Format
S57	IHO Transfer Standard for Digital Hydrographic Data
SRS	Ship Reporting System
STM	Sea Traffic Management
SYSML	Systems Modeling Language
WEB	World Wide Web
VHF	Very High Frequency
VTMIS	Vessel Traffic Management Information System
VTS	Vessel Traffic Service
XML	Extensible Markup Language
XSD	XML Schema Definition

7 Appendixes

7.1 Table 4, Appendixes

The Appendixes will follow the text in order as in table 4.

Number	Item	Comment
1	Review procedure	Appendix 1, procedure of review by EC
2	ENSI-Voyage-Service-specification-	Appendix 2, Released for Internet

"This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 636329".

	2016-05-06.pdf	Transmisson
3	ENSI-eNavigation-PKI-Specification-2015-06-26.pdf	Appendix 3, Released for Internet Transmisson
4	Voyage-Query-Interface-specification-2016-05-06.pdf	Appendix 4, Released for Allied VTS Authorities
5	ENSI Installation Guide 7.14	Appendix 5, Public
6	ENSI Quick Start Guide 7.14	Appendix 6, Public
7	D3.4 - Service Specification for the ENSI Voyage Reporting Service.pdf	Appendix 7
8	ENSI VRS Specification as XML to SR_v1.0.xml	Appendix 8

"This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 636329".

Appendix 1. Review procedure

No°	Reviewer Initials	Reference in document (General or Paragraph, Figure …)	Type (editorial, structural, formulation, error)	Reviewer's Comments, Question and Proposals	Editor's action on review comment.
1	EC	Introduction	Editorial	The work in this deliverable is not aligned with the Maritime Cloud.	Added chapter 1.3 Maritime Cloud compatibility
2	EC	Specifications	Editorial	It is not aligned with the specification templates developed in E2.	Added chapter 1.3.2 Service Registry, Appendix 7, Appendix 8
3	EC	Introduction	Editorial	It is unclear what has been achieved in E2 and what is part of ENSI development outside of the project.	Added chapter 1.2 Relation of ENSI service and EfficienSea 2