D6.2 Route reporting to VTS service

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Document Status

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Contents

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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. Route plans and SRS reports together form vessel's Voyage information.

The Voyage-Query service enables external shore 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 service enables a single window approach for reporting, as a vessel may only need to report once as the reported Voyage information may be retrieved by several shore-based systems connected to the service. Particularly in an area like Baltic Sea, where the distances are relatively short, all the reported information mainly remains the same, including vessels draft. If changes occur, the vessel can update the altered information to only one address, thus reaching all participating shore stations.

Compared to current reporting practices, on vessels point of view, this reduces the administrative burden, by taking away the need to find the contact details to all different mandatory Ship Reporting Systems enroute, sort out the slightly different reporting practices, compile different messages with same payload and report them one by one, often by voice over radio in areas where the focus should be on navigation. For shore stations, this offers an error-free way to receive mandatory ship reporting information, extended with route plan, and a possibility to choose the moment when to deal with the information.

Although the basic Voyage information service, ENSI, has been operative in several years, it has been a local implementation serving only one VTS centre. In EfficienSea2 efforts has been focused in organizing and preparing the connections between additional shore stations and the route exchange service. One of the main goals of the task 6.1 could be summarised as follows, to reach additional shore stations thus making the route reporting beneficial for vessels in true life, and thus lowering the threshold for real implementation of route reporting.

For the purpose of the EfficienSea2 project, Vissim AS has developed the first third party integration with ENSI Service. The purpose of the integration is to test and prove the possibility of integrating information from existing and future cloud based services into commercial operating VTS system and to demonstrate the viability of ENSI service as a common route reporting service.

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1.2 Relation to Maritime Cloud (MC)

ENSI Voyage Service will be described using the specification templates developed in EfficienSea2 project (D3.4). By the time of writing this deliverable, the development of MC compatible service specifications is in progress, well in schedule with respect to the project. Identification of further development needs related to the support of the MC Identity Registry based certificates are also in progress. The current implementation of the Voyage information service does not support any external user authentication but in the future MC authentication is envisioned to be supported and trusted.

The service and its interfaces are already operational, open and in no collision with the MC and its paradigm, having no dependencies on other tasks. In practise, this means that the service can be used immediately, and the changes caused by implementing certificates granted by MC will be easy to update to the earlier implementations later on. The operational model remains the same.

1.3 Testing of the integration

The Sound VTS will test the use the Voyage information service as a part of EfficienSea2. A Vissim workstation will be delivered to the traffic centre and the information provided by the system is given for the use of operators, as a part of task 6.2 VTS and SRS reporting. The technical testing has been completed as a part of building the integration.

1.4 Intended use of this document

This deliverable document focuses on the technical description on how to get connected to the ENSI server as a shore end point user, giving system developers tools to integrate ENSI service in monitoring systems. The service will provide all consumer systems with the same vessel reporting information. The presentation and ways of exploitation the information is entirely for the shore system itself to decide.

The overall description of the ENSI service is to be found in separate deliverable document **D6.1 Basic route handling / exchange service**, and it is highly recommended to read it in connection with this document, especially if the reader does not have a solid knowledge of the background. The deliverable D6.1 attends mainly to explain how the service operates and how it appears to the vessel end point users. The shore end point is only shortly described in D6.1, chapter 5.3 'Voyage query Interface'.

This deliverable document also describes another existing implementation to inspire users and developers of VTS systems to create their own ways to exploit the data delivered via ENSI service or another service similar to it. The reader shall understand that the route exchange as a routine means of reporting is a new-born approach in maritime context, and

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the early implementations should not be experienced as Standard Operation Procedures in any way.

Furthermore, it should be noted that even though the whole maritime related reporting scene is a complex task to digitize and automate, the first steps are not necessary complicated, expensive or difficult and time consuming to implement. The ENSI service is available to VTS and SRS operators in Baltic Sea Region regardless of them being a partner in a project or not. The service is also vendor independent. Expanding the coverage of vessel reporting points will increase the value of the service for vessels, and thus hopefully raise the amount of vessels participating the service.

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2 ENSI services for shore users

All the services available in ENSI are not in the centre of development in EfficienSea 2 project, e.g. weather services and pilot ordering, due to the complexity of scaling related to the benefits to be achieved, or simply because other actors are developing same kind of services. The focus is in the very core services, that is the route exchange, the route cross-check (validation), and the SRS (Ship Reporting System) reporting. All existing services are still available through ENSI Gateway in the extent they appear and have been described in D6.1. However, there is no particular reason to expand the descriptions to all subjects. Thus in this document, only the core services are described.

2.1 Voyage Query Interface

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 be retrieved from the server using the IDs supplied in the response.

The specific description of the interface is in the **Voyage-Query-Interface-specification-2016-05-06.pdf** (Annex 2)**.**

2.2 Route exchange service

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 detailed information on how to make queries for routes is described in **ENSI-Voyage-Service-specification-2016-05-06.pdf** (Annex 3)**.** At the moment of writing, the format of the route file is following the *route-exchange.xsd*, but expected to change to follow the latest version of *iec_rtz.xsd*.

2.3 Ship Reporting System (SRS) reporting service

The mandatory SRS reporting can be performed using the ENSI Gateway, to SRS / VTS systems connected to ENSI. VTS clients retrieve the SRS information as a part of the Voyage report.

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The detailed information of the SRS is described in **ENSI-SRS-Specification-2012-11-13-livi.pdf** (Annex 5)**.** The SRS file is a XML as in *srs.xsd* schema (Annex 9).

While the *srs.xsd* is originally created to serve the GOFREP area, some information needed in other SRS areas might be missing, e. g. the air draught. This or any other additional information can be added to the extra information field, which enables 200 characters of free text.

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

The warnings include the triggering reason and position.

The route cross-check is a service that is offered for vessels in support of route planning. The monitoring shore operators are expected to make visual checks for the routes of vessels arriving the area, and thus execute a cross-check of a true local expert. For gaining experience and as a demonstrator, ENSI Service offers the outcomes of route-checks for the shore operators as well for an indeterminate period. Individual shore services shall build their own route validators if deemed valuable.

It is to be noted, that until wider adoption of the service the coverage of cross-check is in relation to the monitoring areas that has implemented ENSI service and expected to be active in reporting. New areas are not necessarily automatically covered. Please ensure the arrangements to cover the area of your interest.

The response of the cross-check can be retrieved by the VTS. The response file is a XML as in *vessel-waypoint-exchange-response.xsd* schema (Annex 11).

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3 Vissim VTMS software

Introduction

Vissim offers products and support for integrated marine and offshore operations supplying software for VTS, surveillance and asset protection systems and oil spill detection, voice communication and support for routing and logistics.

Vissim adopts a design concept of fully integrated VTMS systems based on IP communications and distributed networks. The systems are built from modular components that are added as required to achieve the functional requirements.

The Traffic Displays software present the real time situation within the coverage area. Information about vessels can be quickly accessed through the on screen functions and databases can be interrogated to find further details of past visits etc. Special areas of interest can be defined where warnings will be provided if certain rules are not correctly implemented or if there is a risk of collision or a “near miss” situation.

Figure 1: Vissim AS. product history

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4 Integration between Vissim and ENSI systems

For the purpose of the EffficienSea2 project Vissim has developed integration components that allow interaction with 3rd party cloud based services, enabling Vissim system to fetch required data from future and existing services.

The services used for the integration are provided by ENSI Gateway which is established and operating in the Baltic region.

The purpose of the integration was to show possibility of integrating useful information from existing and future cloud based services into commercial operating VTS system.

4.1 Interfaces used for integration

4.1.1 Use of PKI for authentication and authorization

The ENSI system uses standard PKI solutions (https and client certificates) to encrypt data and authenticate the ENSI clients.

The description of the client authentication used is in **ENSI-eNavigation-PKI-Specification-2015-06-26-final.doc** (Annex 1).

A client certificate was generated by Finnish Transport Agency and provided to Vissim. At present the whole chain of trust is managed by the Finnish Transport Agency, and certificates are manually generated for each user. The process contains the creation of a user account containing all necessary information depending on the users' role, and the generation of the actual certificate binded to that particular user account. A certificate can be requested via website https://ensi.fta.fi or emailing ensi@fta.fi. Different certificates are used in the developers' test-server and operational server.

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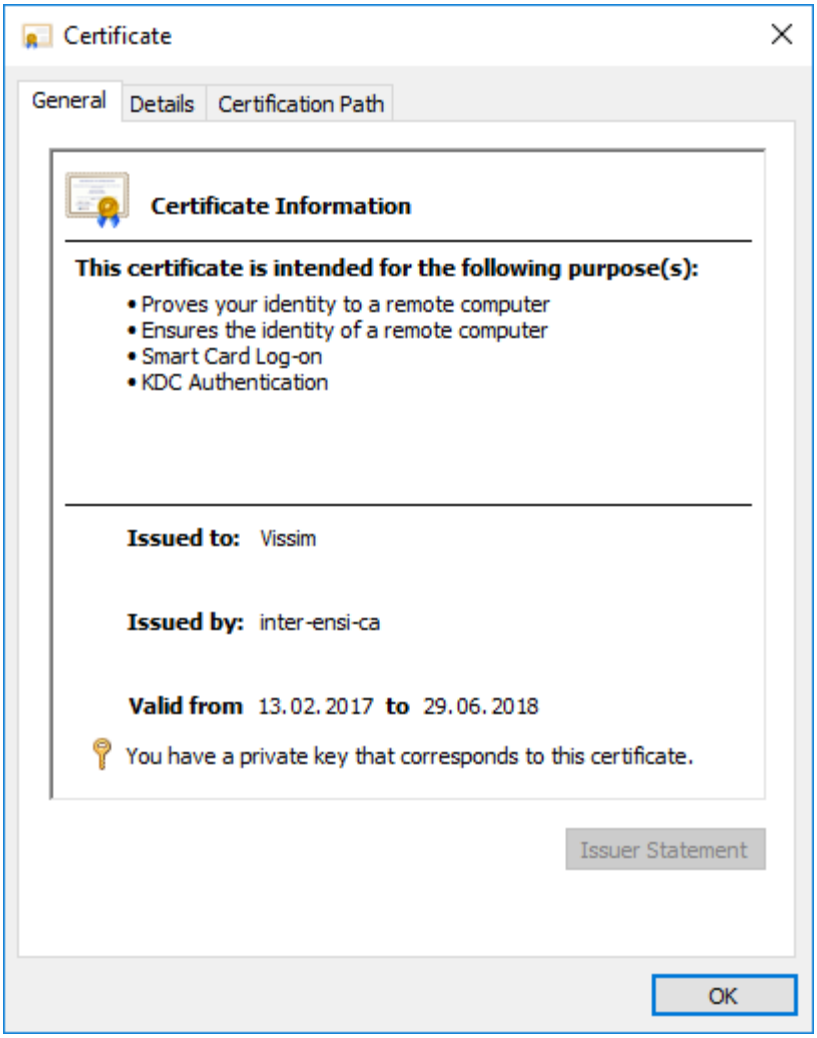

Figure 2. Client certificate released by ENSI for integration with Vissim

The ENSI system uses three-level PKI certificate hierarchy:

- Root CA certificate
- Intermediate CA certificate
- Client CA certificate

As the ENSI root CA certificate is self-signed, both root and intermediate certificates need to be installed in the certificate storage on the client side. The root CA certificate need to be trusted in order to allow secure connections towards the ENSI Gateway.

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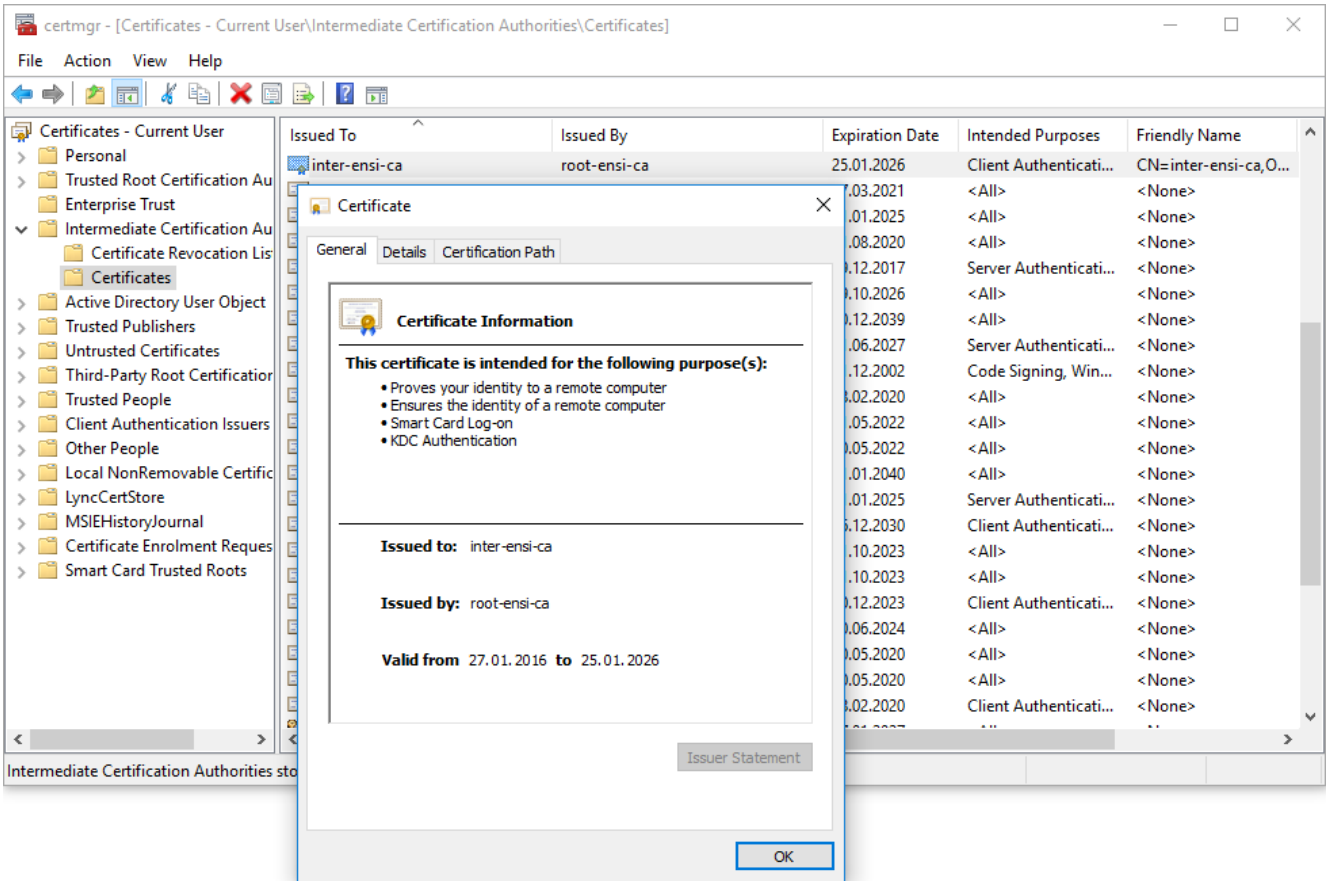

Figure 3. ENSI intermediate CA certificate imported to the certificate storage

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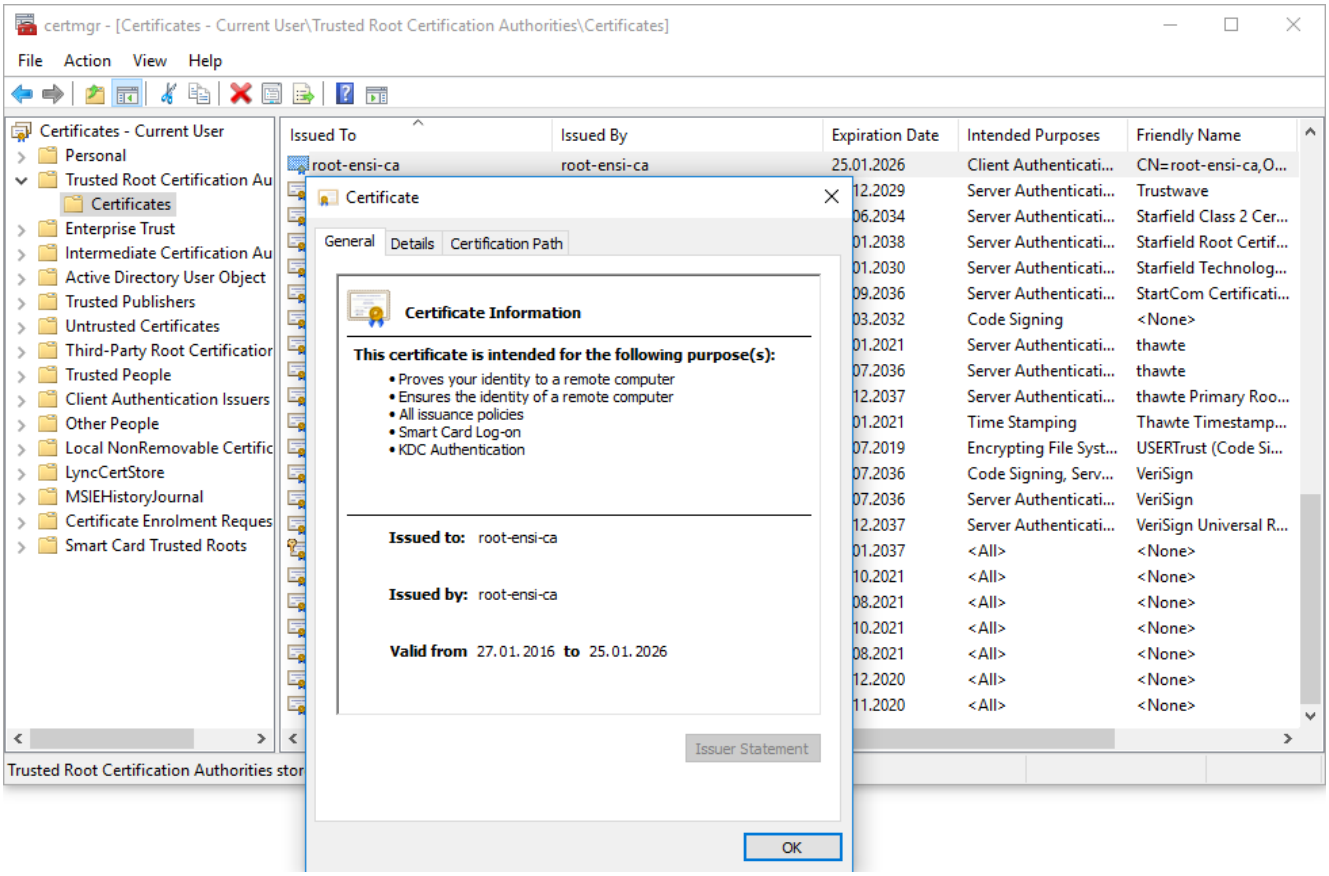

Figure 4. ENSI root CA certificate imported to the certificate storage

4.1.2 Getting the list of active voyages

For the publicity of this document, the complete URL's are removed to lower possible harassment threat. Completed URL's will be provided on request from the same sources as the certificates.

In order to receive the list of active voyages the Voyage Query Interface is used.The POST HTTP request containing XML data that corresponds the voyage-query.xsd scheme is being sent to the https://[host]:[port]/core/service/admin/voyage/query/ interface.

```
<?xml version="1.0" encoding="utf-8" standalone="yes"?>
<voyageQuery xmlns="http://www.navielektro.fi/ns/formats/voyage-query">
    <latestOnly>true</latestOnly>
    <maxResults>1000</maxResults>
</voyageQuery>
```

In response to the sent request the ENSI Gateway is providing the list of active voyages as an XML data conforming the voyage.xsd schema.

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4.1.3 Getting the routes for active voyages

For each of the active voyages provided by the ENSI Gateway, route information is queried by the means of the https://[host]:[port]/core/service/route/ interface by sending a GET HTTP request.

Example: https://[host]:[port]/core/service/route/06cb00eb-ea26-4357-af4f-5c2614d9cc29

The ENSI Gateway returns a route data for the requested route in the XML form that conforms the route-exchange.xsd schema.

4.1.4 Getting the SRS reports for active voyages

In addition to the route data, SRS reports are being fetched from the ENSI Gateway. The GET HTTP requests are issued towards the https://[host]:[port]/core/service/srs/ interface.

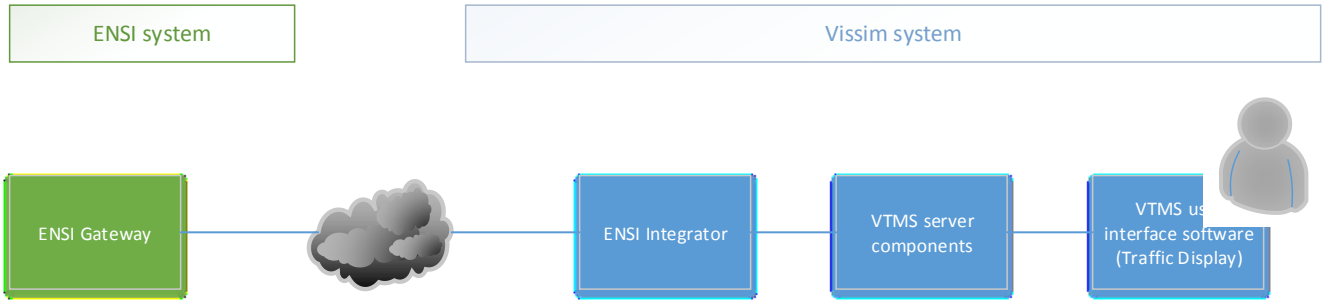
Example: https://[host]:[port]/core/service/srs/387daa50-697e-4953-ab54-38514c7ea015

As a result, the XML data that conforms the srs.xsd schema is being returned.

4.2 Software implementation

Integration with the ENSI system follows the standard integration design established in Vissim systems.

A new software component (ENSI Integrator) was implemented. The software module is interfacing the ENSI Gateway using the defined opened interfaces. On another side the ENSI Interface software module is communicating to the VTMS server software which is in turn providing required data to the user interface module. Traffic Display software is used for visualisation of routes and SRS reports received from the ENSI system.



4.3 Use cases

This section shows examples of use of data received from cloud based ENSI service in the Vissim VTMS system. Another use case by another system is found as (Annex 12), to keep well clear from the Vissim use cases.

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VTS Operator is able to get the list of all available routes provided with route names and MMSI number of the vessel who reported the route.

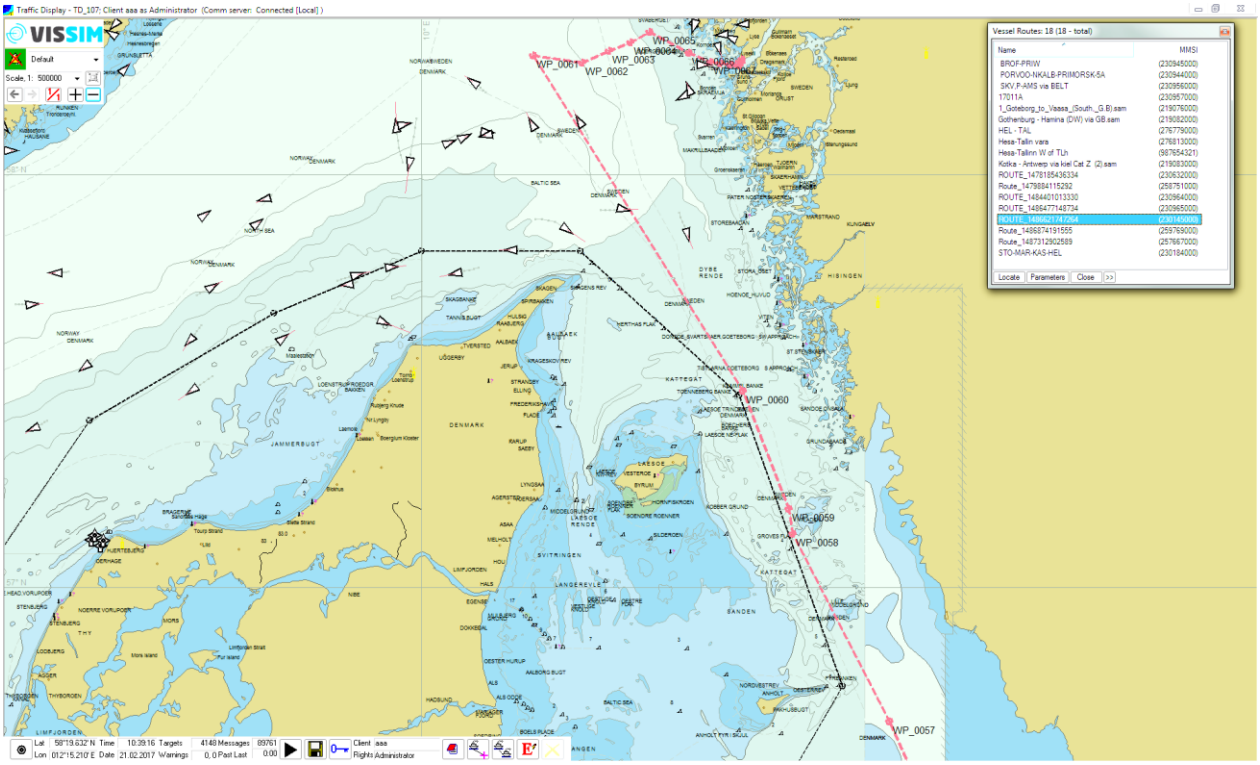

Figure 5. Overview example showing traffic around Denmark and Sweden with integrated route information obtained from the ENSI Gateway

In order not to overload the operator's view, routes can be hidden by default, and shown when selected in the list.

The standard functionality to locate a route and view its parameters is available.

Parameters window for the selected route visualizes the information received from the ENSI Gateway in a form of table.

Following route information is visualized:

- General
  - Name
- Route parameters
  - Created by
  - Destination name
  - ETA
  - Locode
- Vessel
  - Name

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    - Call Sign
    - MMSI
    - IMO
- Schedule
    - Waypoint name
        - ETA
        - Speed

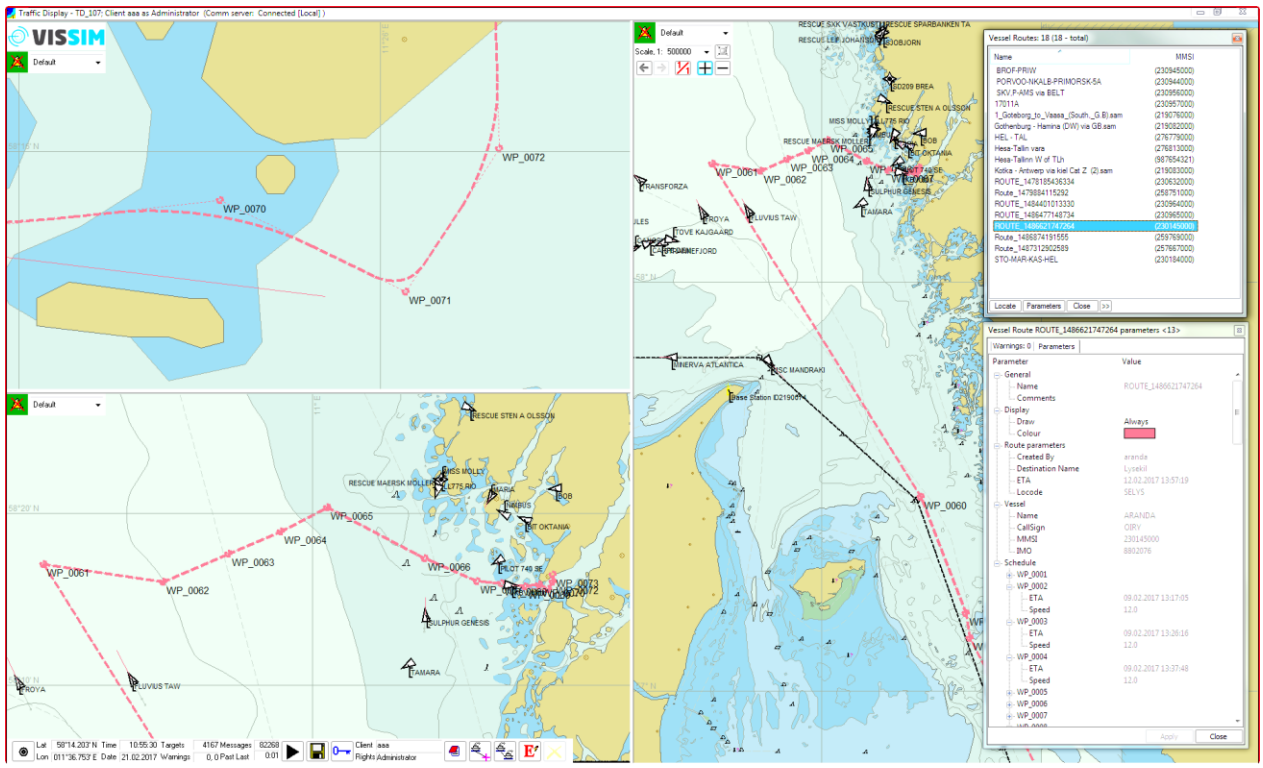

Figure 6. Information presented in several screens, allowing various level of detailing as well as parameters of one of the routes

The route data including geographical coordinates of waypoints and turn radius is used for the graphical representation of a route on the chart in correct scale.

Visualized route shape as well as text route information can be used by VTS operators for the analysis and risk assessment of the planned vessel move. Following checks can be a part of the analysis routine:

- Access to “no go areas”
- Violation of defined traffic rules like fairways

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Figure 7. Detailed information about route composition with waypoints and turn radiuses

SRS report fetched from the ENSI Gateway is provided to VTS operator in the tabular form as a part of the route parameters window.

Following information is visualized from SRS reports:

- Vessel
  - The vessel's present maximum draught in metres
  - Brief details of defects or restrictions of manoeuvrability
  - Description of pollution or dangerous goods lost overboard
  - Total number of persons onboard
- Extra textual information (free text)
- Hazardous cargo on board
  - Tons of bunker
  - Cargo #
    - IMDG cargo class
    - Cargo weight in tons

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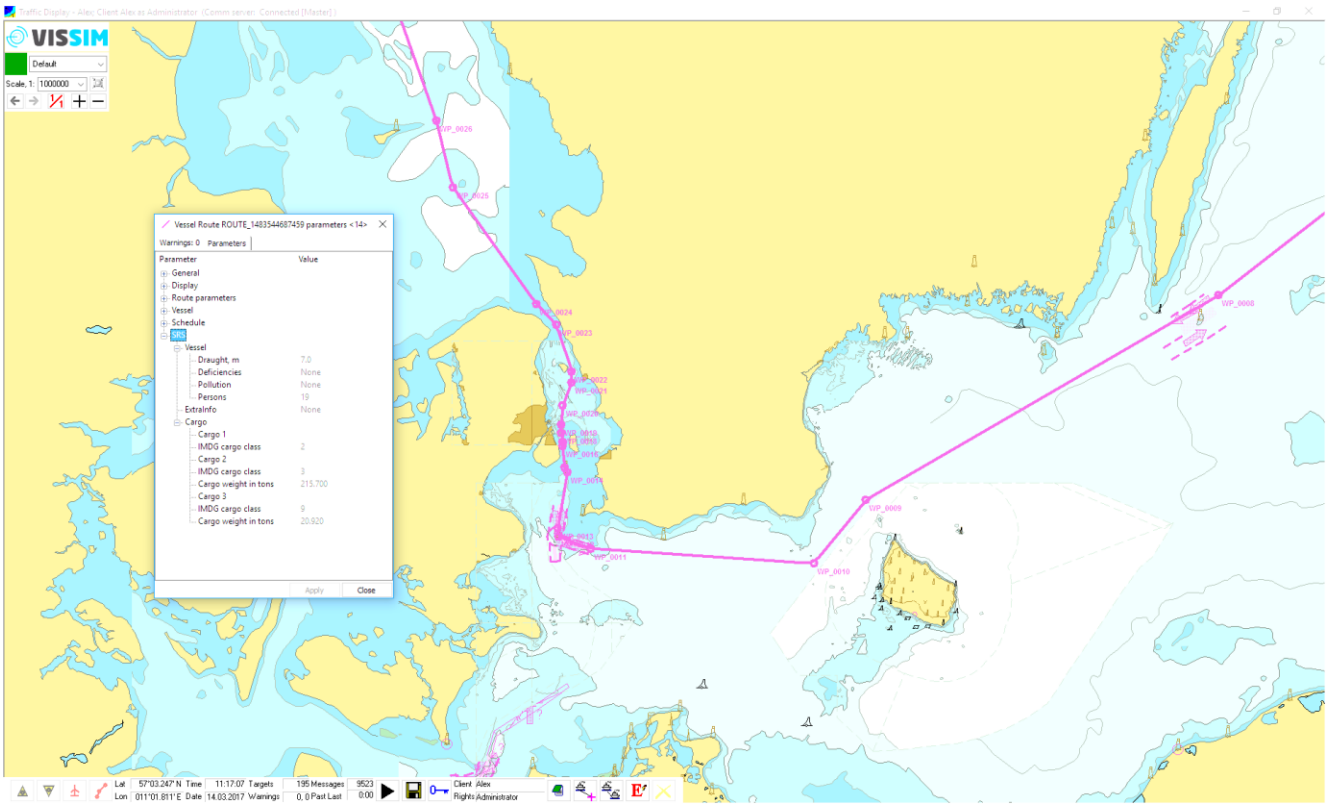

Figure 8. SRS information reported by a cargo vessel

SRS reports can have different content being provided by various types of vessels.

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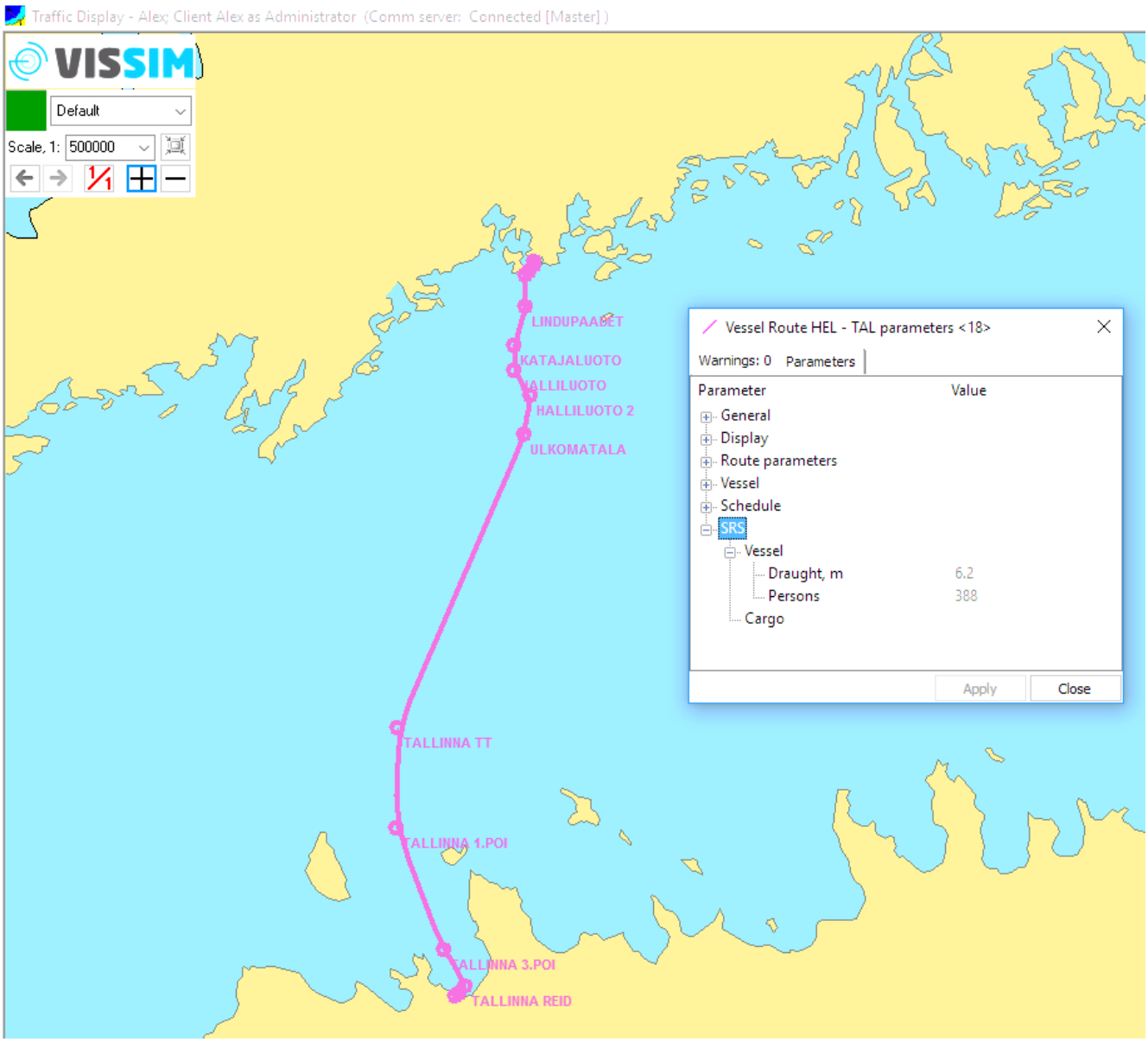

Figure 9. SRS report provided by a ferry

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5 Acronyms

Term	Definition
ENSI	Enhanced Navigation Support Information
GOFREP	Gulf Of Finland Reporting System
HTTP	Hypertext Transfer Protocol
PKI	Public Key Infrastructure
SRS	Ship Reporting System
VTMS	Vessel Traffic Management System
VTS	Vessel Traffic Service

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6 Annexes

6.1 ENSI Specifications

Number	Item	Comment
1	ENSI-eNavigation-PKI-Specification-2015-06-26-final.doc.pdf	Attached ENSI eNavigation PKI Specification Public for System Integrators – Releasable for InterNet Transmission
2	Voyage-Query-Interface-specification-2016-05-06.pdf	Attached ENSI Allied Authorities Query Interface Specification For Allied System Integrators – Releasable for Allied VTS Authorities
3	ENSI-Voyage-Service-specification-2016-05-06.pdf	Attached ENSI Voyage Service based on IEC-RTZ Specification Public for System Integrators – Releasable for Internet Transmission
4	ENSI-RTZ-Route-Service-specification-2016-05-06.pdf	Attached ENSI Route Service based on IEC-RTZ Specification Public for System Integrators – Releasable for Internet Transmission
5	ENSI-SRS-Specification-2012-11-13-livi.pdf	Attached ENSI SRS Specification Public for System Integrators – Releasable for InterNet Transmission

6.2 ENSI Schemas

Number	Item	Comment
6	voyage-query.xsd	Attached, http://www.navielektro.fi/ns/formats/voyage-query
7	voyage.xsd	Attached, http://www.navielektro.fi/ns/formats/voyage
8	route-exchange.xsd	Attached, http://www.navielektro.fi/ns/formats/route-exchange
9	srs.xsd	Attached, http://www.navielektro.fi/ns/formats/srs
10	common-geo.xsd	Attached, http://www.navielektro.fi/ns/formats/common-geo
11	vessel-waypoint-exchange-response.xsd	Attached, http://www.navielektro.fi/ns/formats/vessel-waypoint-exchange-response

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6.3 Use Cases of other implementations

Number	Item	Comment
12	Using ENSI route plans in VTS operations.pdf	A use case from Finnish VTS system

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Appendix <enter number here>. 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.