

About this document

This document was written by Roland Beeres of the department of E-Navigation at the Danish Maritime Authority, as part of the EfficienSea2 project.

The purpose of this document is to describe the ReX model and the possible implementation of the ReX model, using the BalticWeb prototype interface as an example platform.

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This document assumes understanding of the document: “Vision for the Reporting eXchange format (ReX).pdf”, and general understanding of the Maritime Connectivity Platform (MCP).

Background

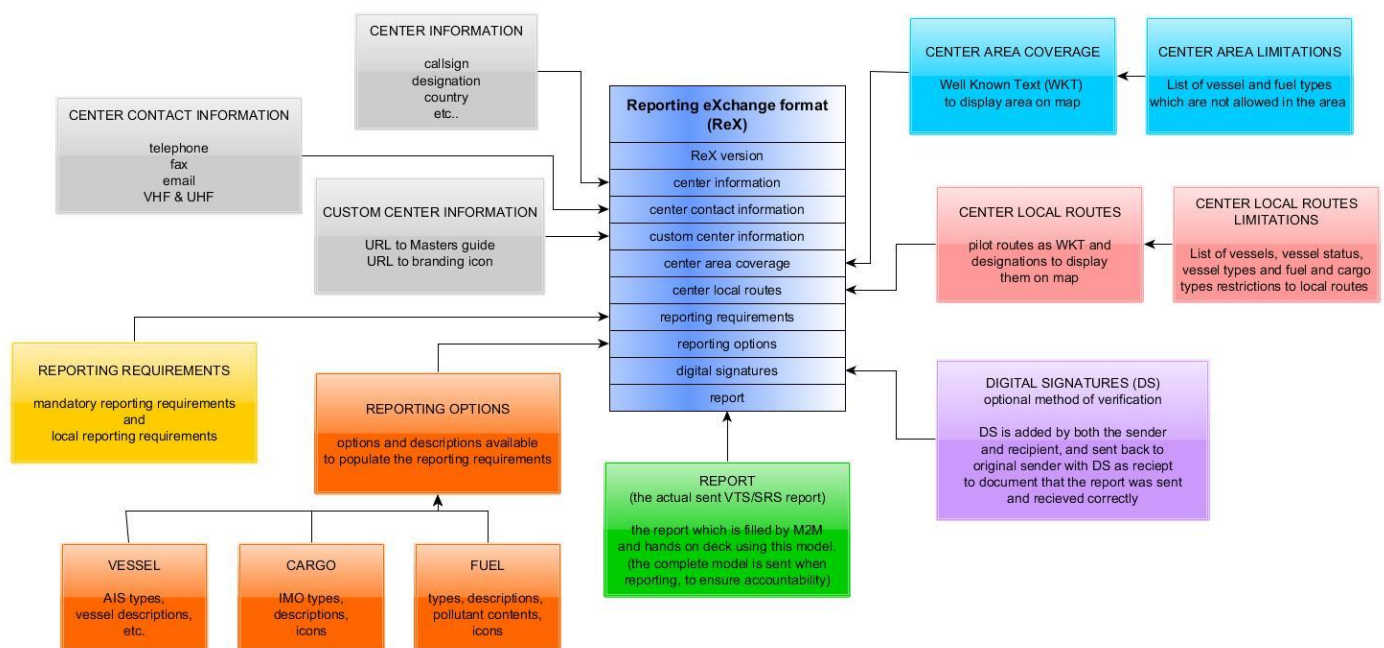
Any vessel sailing through international waters face a vast number of reporting requirements, defined by individual countries or regions according to their respective national legislation, and international requirements. This includes reports to the various Vessel Traffic Service Centres (VTS) passed along the route containing information on the cargo being transported and the ships' intended route, and also Ship Reporting Systems (SRS) with information on the crew of the vessels and other details which may be difficult to decipher from masters guides and other paper based or online sources which do not follow any standard layout.

The described model, ReX, aims at delivering a model for a reporting interface, providing the end user, the ships' captain or master mariner for instance, with a tool which automatically includes required information which must be sent to any VTS or SRS centre passed along the ships' route in national or international waters.

Description of the ReX model

The "Reporting eXchange format" (ReX), is a model which describes the contents and defines the requirements of a report, either as an SRS report (Ship Reporting System), or VTS report (Vessel Traffic Service), and could possibly also include port reporting as the model matures. The model is projected to be open source.

The model is written in XML using XSD, and can from there be converted to different interpretable formats, all defining the same model.



- The central blue box is the model container.
- Grey boxes in the diagram above contain all available information needed to contact and identify the reporting centre of that service instance.
- Yellow box contains the definitions of options to report, mandatory and optional.
- Orange boxes contain all the options and descriptions needed to report according to the settings in the yellow box.
- Light-blue boxes contains map overview and restrictions of the reporting area as a whole.
- Pink boxes contain map overview of the local routes to navigate and the limitations of each route.
- Purple box is optional, containing digital signatures to verify authenticity of sender and recipient.
- Green box is the actual report which is populated with the input, which is sent with the entire model as a report.

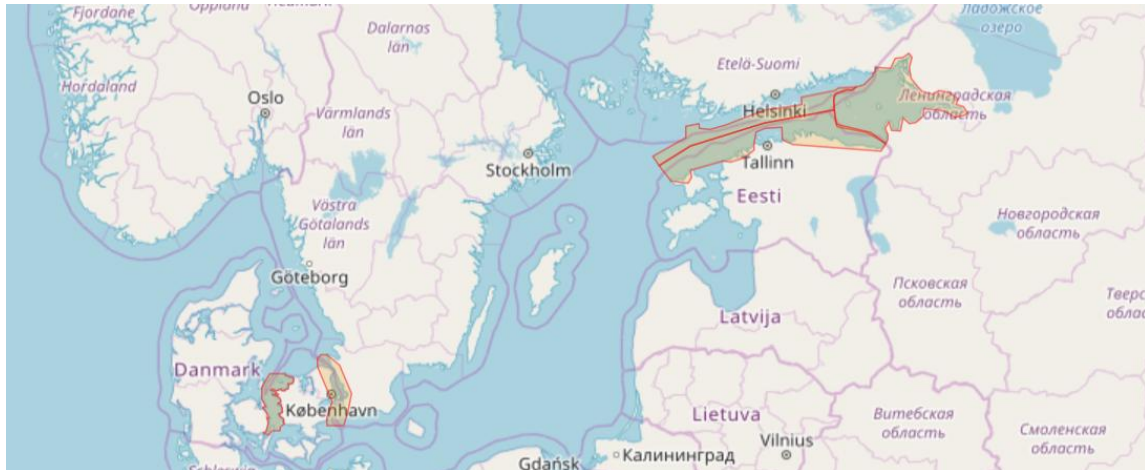
The "reporting requirements" in the yellow box and the "reporting options" of the orange boxes work in tandem to populate an interface. This is possible by defining components as described in this document under "Usage of ReX in BalticWeb".

Once the "report" segment has been filled according to the "reporting requirement", the report, and the rest of the model in its entirety, is sent to the endpoint as described in the service specification, as found on the MCP.

ReX in the Maritime Connectivity Platform (MCP)

The MCP, formerly known as the Maritime Cloud, is a service lookup platform which can return service designs by searching through the service descriptions. The service design of each of the search results can then be used to return the endpoints of each reporting service which hosts the ReX model.

The image below is a screenshot from the BalticWeb where 5 VTS/SRS reporting areas have been drawn on the map to give the user of the interface a simple overview, using the WKT



There are no intellectual property rights considerations in regards to VTS and SRS, so any single player registering other VTS or SRS centres out of their legal responsibilities should probably be considered in a form of regulation. There may be other security and governing aspects which need to be reviewed.

BalticWeb and MCP

The BalticWeb is a prototype interface platform to demonstrate services in the MCP and was created for the purpose of the EfficienSea2 project. The BalticWeb is split into two distinct areas, the frontend and the backend. The frontend covers the interface, meaning everything which is displayed on a screen, the text, menus, buttons and the map. The backend is responsible for retrieving data and the majority of the data manipulations in preparation to rendering the frontend for the user of the interface. BalticWeb can be found at <http://balticweb.e-navigation.net>

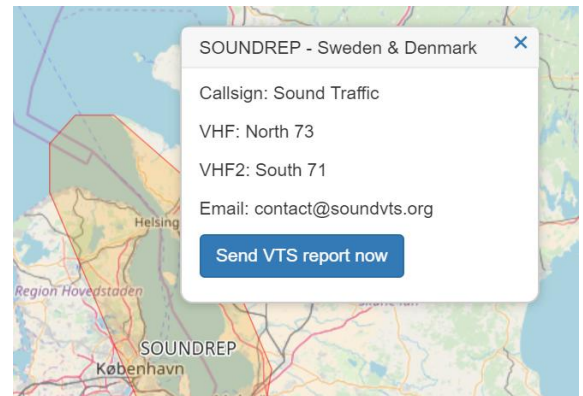
When a user is logged in on the MCP, services are made available to the user. The BalticWeb has buttons that enable or disable some of the services available on the MCP, which have been integrated into the frontend through the backend handling. Once the VTS & SRS service has been activated, moving the map around will trigger the backend of the BalticWeb to retrieve any VTS and SRS centres located within the area of the map, as can be seen in the image above.

Usage of ReX in BalticWeb



Zooming in on a reporting area activates the callsign property of the area to be displayed on the map, in this example "SOUNDREP" can be seen. Although all properties are already available to the user, information is visualized when appropriate to avoid cluttering the interface.

Information made available to the user can have a direct benefit when using design strategies to enhance user experience. In the example image to the right, simplified contact information is made available to the user by simply clicking or tapping on a VTS area drawn on the map. This feature alone is already a massive upgrade when comparing to VTS centre contact information availability today.




Sound Vessel Traffic Service
Vessel Traffic Service report form for SOUNDREP

Sweden & Denmark

Estimated Time of Arrival at SOUNDREP reporting area: Tue 09 May 2016 - 13:10 UTC

Vessel information
 IMO: 220862000
 Vessel name: [text field]
 Callsign: RUTE
 Port of destination: RUTNE
 Number of people on board: 42
 Draught (max. 8m): 3.8
 Air draught (max. 55m): [text field]
 Defects, deficiencies or [text field]

Fuel information
 Reporting all fuel carried on board is mandatory. please select a fuel type from the list, or "other" if you are in doubt:
 HFO LSPFO ULSPFO MGO MFO MDO LPG LNG Other
 Click mouseleft entry to add:
 Marine Gas Oil (MGO) - 45 t
 Medium Fuel Oil (MFO) - 50 t
 Ultra Low Sulphur Fuel Oil (ULSPFO) - 12 t

Total tonnage of fuel: 107 metric tonnes

Cargo information - detailed cargo description
 Chemicals [checkbox checked] Dangerous cargo on board [checkbox checked]
 Please select an IMO dangerous goods classification:
 Blazh Gas Lix Solid Chills Towent Pallets Corr Misc
 Dangerous Goods IMO class:
 3 Flammable Liquid - 300 t
 2.2 Non-Flammable, Non-poisonous Gas - 120 kg
 1.5 Explosives - 3000 t
 IMO classes of dangerous cargo on board: 3 - 2.2 - 1.5
 Total tonnage of dangerous cargo on board: 3,000,12 metric tonnes
 More information on dangerous cargo can be found at: [uneca.org](http://www.uneca.org)

Designated Person Ashore (DPA) or cargo agent:
 Name: John Connor
 Telephone: 005 13 62 2016
 Email: john@bentyma.se
 Additional contact details for information of cargo: [text field]
 Pollution or dangerous cargo lost overboard:
 (Please describe the pollutant and where it was)

The actual reporting interface is populated directly from the ReX model, using the "reporting requirements" to fill the interface with the available "reporting options". Validation is defined by the XSD, to ensure correct data input.

The reporting options are displayed in a manner which is interpretable and customizable by a UX designer who does not necessarily have to learn what all the different technical names and standards or requirements are, while also giving freedom of creativity to allow different designs or user interface (UI) versions to be created. This allows for a variety of interface layouts with different components to be created, which can be a powerful tool to allow any seafarer who must send reports, to decide themselves which UI they find easier to use, or by mandate of their shipping company, to use a specific reporting interface layout.

One of the core advantages of using the ReX model is the ability to add and remove reporting options without having to redesign the entire frontend or having to invest time to educate developers to have intimate knowledge of VTS and SRS reporting requirements.

Security aspects, validation of authenticity and changes to requirements

Once a report has been filled and validated by the frontend, a digital certificate can be added by the captain as a signature of authenticity before it is sent to the respective reporting centre. Upon receiving the report, the reporting centre can add their own digital signature to the same report and send it back to the sender, so that the captain aboard the vessel gets confirmation of reception, and a digital signature to verify that it was the correct recipient.

Authorization to send the report can be controlled by the MCP. This would be as simple as using the identity provider as a guarantee of identity, or by adding a filter at the receiving end to flag reports which do not contain digital signatures or unknown digital signatures. The general idea is for reporting centres to always accept reports, including incorrectly filled reports and reports from unknown sources, because human error should be anticipated. An empty or incomplete report is still better than no report.

Using the ReX and the MCP, changes to reporting requirements can be effectuated much faster than today, where shipping companies, vessel owners and navigators need to be updated somehow of new requirements, but using the ReX, the moment it is updated, any interface will use the new model immediately. This does require the interface to be prepared for any additions, but does not require the captain or person responsible of reporting to have prior knowledge of the changes.

Benefits of defining area and pilot route limitations

The ReX supports definitions of limitations of reporting areas, and limitations of pilot routes, which can possibly add to safer navigation of reporting areas. Many reporting areas include traffic separation schemas, maximum draught limitations, maximum air draught limitations, and can include restriction of access to certain dangerous cargo types, and other restrictions. By adding these in the ReX, a report interface can also be used as a guide to navigation, for instance if person attempts to report maximum draught of 4.6 meters, but the specific pilot route which has been selected has a maximum depth of 3.8 meters, the person can be warned in the interface that selecting this route can have navigational safety concerns which should be addressed.

Changes and updates to the ReX

Updating the ReX for the area can be done relatively easy by VTS operators, so any permanent changes to safety of navigation such as seabed changes, traffic changes, fuel type and cargo type restrictions etc. can be described as limitations and implemented with immediate effect through the MCP.

Report sharing

A report can be shared between reporting centres who choose to have a collaboration amongst themselves, whether that be the maritime authorities of Brazil and South Africa having a report sharing agreement, or other countries or groups of countries. This can be done in a variety of ways, but ultimately, a report using the ReX format will be interchangeable without having to specify metadata describing sender, recipient, time of report etc., because it is all already inside the ReX model. This allows for a simple and traceable sharing option to be met.

Machine to Machine data collection potential using ReX

The ReX model was designed with the aim of being flexible in order to be able to incorporate several external data sources such as WKT, RTZ, AIS and other automatable data sources. In the BalticWeb, AIS and RTZ have been implemented to aid the user by pre-filling pertinent required information.

There is a potential to include data from existing external sources, such as

information of dangerous cargo from SafeSeaNet or fuel monitoring hardware interfaced to deliver mandatory fuel reporting data. This can be done without having to reinvent technology or legislation.

In the BalticWeb reporting user interface (UI), RTZ has been implemented to aid in filling the Expected Time of Arrival (ETA) at the reporting area, as displayed in the image to the right.



The RTZ has arrival times at waypoints, which are analysed to find the first waypoint placed inside the VTS reporting area. The arrival time is extracted and converted to a human readable time and date, which is represented in a datepicker which allows manipulation to manually override the ETA. It is essential that human interaction can supersede automated inputs.

Immediate improvements and advantages to using the ReX on the MCP

Compared to existing reporting schemas found in the Baltic Sea region reporting centres websites, the ReX could possibly solve several problems of mariners and reporting centres when trying to send a report:

- Central and up to date contact information of the reporting centres
- Reduced radio chatter and misunderstandings during reporting
- Visual rendering of reporting areas on a map
- Simple UI to input data, meeting all requirements
- Reporting input data validation to ensure correct input
- Verification of sender and recipient identity using the MCP and digital certificates
- Documentation "paper trail" of sending and reception of report
- No metadata required to share or long term store reports
- Possibility of machine to machine data attribution using AIS, SSN, fuel monitoring etc.
- Possibility to easily update reporting requirements
- Maintenance responsibility remains at each individual reporting centre
- No central governance required - reporting centres control their own ReX
- Open source availability of the ReX
- Incorporation of other standards such as RTZ

(The predecessor of the ReX model, SOUNDREP reporting interface, is not considered in the above list)

Potential worldwide adaptation scenario

The ReX is a prototype concept of a flexible reporting model, specifically created during the EfficienSea2 project, which is part of the European Union's Horizon 2020 Research and Innovation programme, and could be further developed to be implemented even worldwide, elevating the general standard of the current available reporting options, existing and non-existing.

This scenario could be achieved by further development of the ReX model under open source, and developing a "blank slate" user interface under open source as well, using other open source technologies. The "blank slate" user interface could be forked or copied from a software version maintenance site as for instance GitHub, and then styled or modified to fit the branding desires of companies who wish to create their own reporting interface, which can handle custom machine to machine interfacing. It is also possible that any individual reporting centre can do the same, to serve a default platform to report from, using their own style and branding.

Alternatively, an organization such as IMO could cater a globally accessible interface using their version of the "blank slate" user interface, to provide a free and trusted reporting interface, worldwide, which only requires VTS and SRS centres to adopt the ReX and register it as their instance of a service on the MCP.

Sources

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BalticWeb live environment: <https://balticweb.e-navigation.net/>

Source code: <https://github.com/maritime-web/BalticWeb>

ReX prototype model: <https://github.com/maritime-web/ReportingSchema>