ELIAS

IT Prototype to bundle public RIS Information on a web-based application

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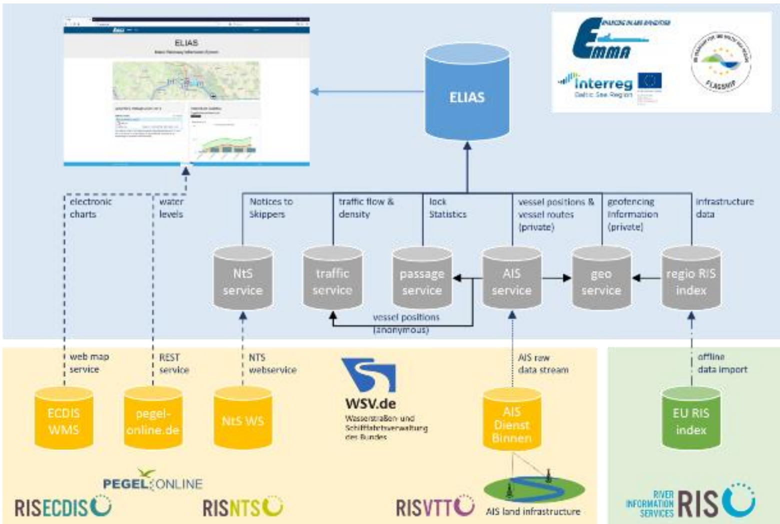

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EMMA – Report

Content

1 ACTIVITY 2.3

1.1 Functionality of the IT prototype in the Elbe region

The German EMMA IT-prototype collects and aggregates a number of data sources from existing River Information Services (RIS) and displays the information in the integrated web application called ELIAS.

ELIAS is split into two separate sections, one publicly accessible and the other one password protected for registered users. The functions in the public section allow an easy access to the information publically available in distributed external RIS or RIS related systems. The private section comprises functions that process and display sensitive data, such as vessel positions, which are visible only to the data owners and those with proper authorisation.

1.1.1 Map Service

The central part of ELIAS is a map based web application displaying relevant information on the inland waterways. Some external information sources are integrated directly into ELIAS. The available electronic navigational charts (ENCs) who are provided the by the German Federal Waterways and Shipping Administration (Wasserstraßen- und Schifffahrtsverwaltung des Bundes, WSV) via a standard web map service (WMS)[1] can be displayed as a map overlay.

1.1.2 Water Level Service

In addition, water levels at numerous water level gauges in the region are available via a REST service on the website https://www.pegelonline.wsv.de/, also operated by the WSV. This offers a REST API[2] that is used by ELIAS to retrieve and display the current water level as well as a chart of the past and where available predicted water levels.

[1] https://atlas.wsv.bund.de/clients/desktop/?parameter=visible&value=iencwms
[2] https://www.pegelonline.wsv.de/webservice/guideRestapi

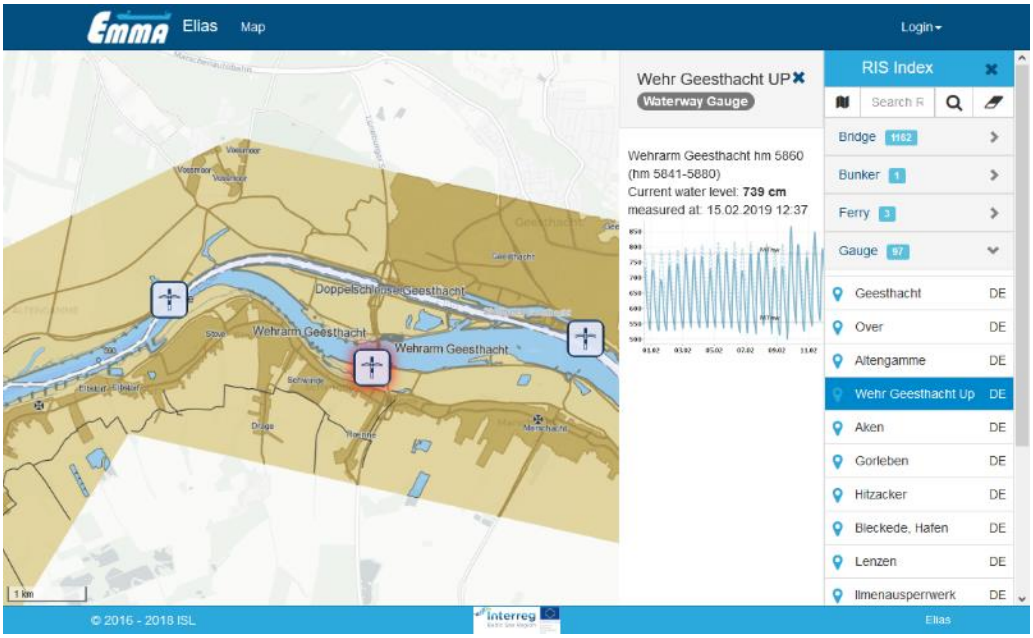

Figure 1 display of electronic navigational charts and water levels

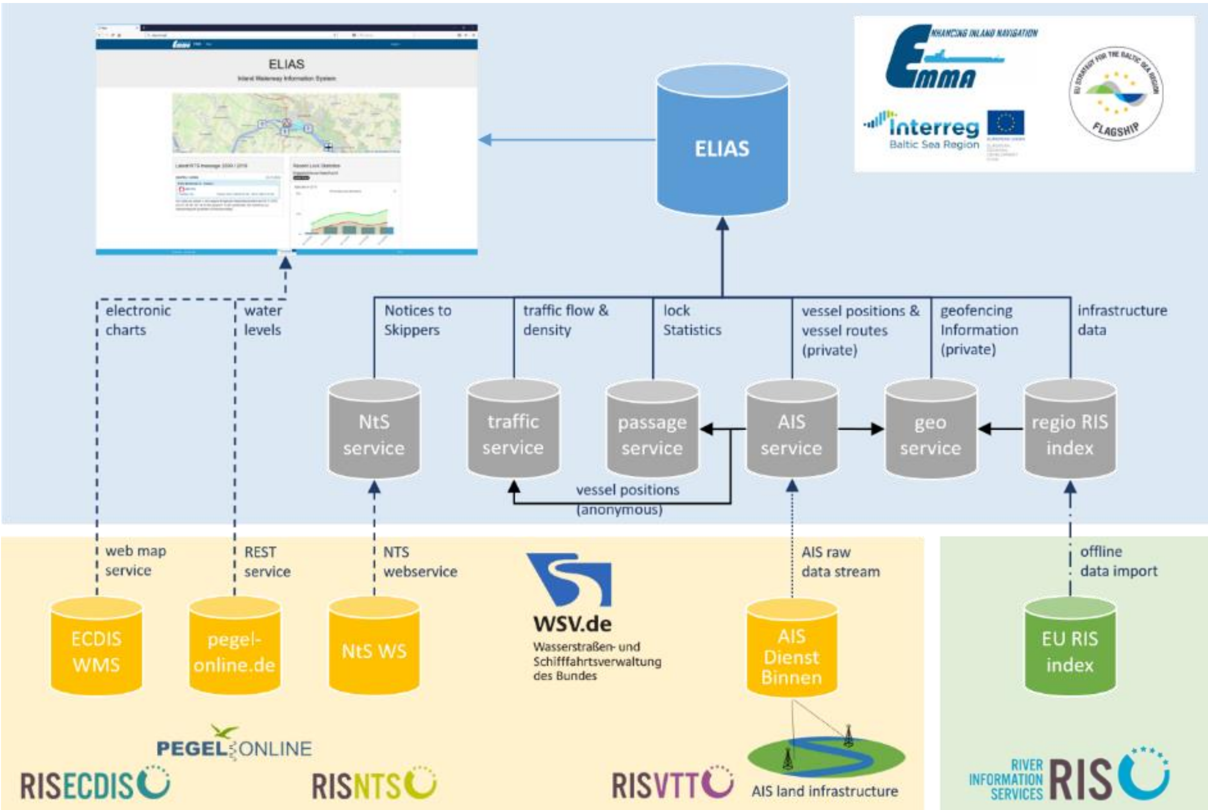

Figure 2 display of electronic navigational charts and water levels

The collection and aggregation process of additional required data is handled by a number of micro services and data repositories. In the following sections, these services and their functionality will be described in brief.

1.1.3 Regional RIS Index

Information on the waterway infrastructure is gathered from the European RIS index[3], maintained by the EU RIS expert groups and populated by the national waterway authorities. The RIS index contains static information on all relevant objects such as locks, bridges, gauges, ports and terminals. The EMMA regional RIS index maintains a copy of and provides access to this data allowing the filtering on object types and on geographic area.

1.1.4 AIS service

In Germany, the WSV operates an array of AIS antennas collecting AIS signals broadcasted by AIS transponders of inland vessels. With this land infrastructure, the WSV feeds the vessel positions into the central „AIS Dienst Binnen". From there, the EMMA AIS service receives a raw data stream of (anonymized) AIS data, decodes it and stores the information in a local data repository. The service is then used by consecutive services like the passage service or the traffic service.

In addition, the AIS service is able to collect and process non-anonymised AIS data, which is used to display the positions of the fleet of registered users in the private (password-protected) section of the ELIAS system. The consent of the data owner is required.

From the history of the vessels' positions, the AIS service can also produce the route that the vessel has travelled in the past.

1.1.5 Geofencing service

The geofencing service is able to reverse-geocode the vessels' positions. From the latitude and longitude, it determines the nearest infrastructure object such as waterway section, lock, port and terminal or city area. For this, the geofencing service accesses the regional RIS index.

This information is displayed in the private section of ELIAS.

[3] http://www.ris.eu/library/expert_groups/ris_index

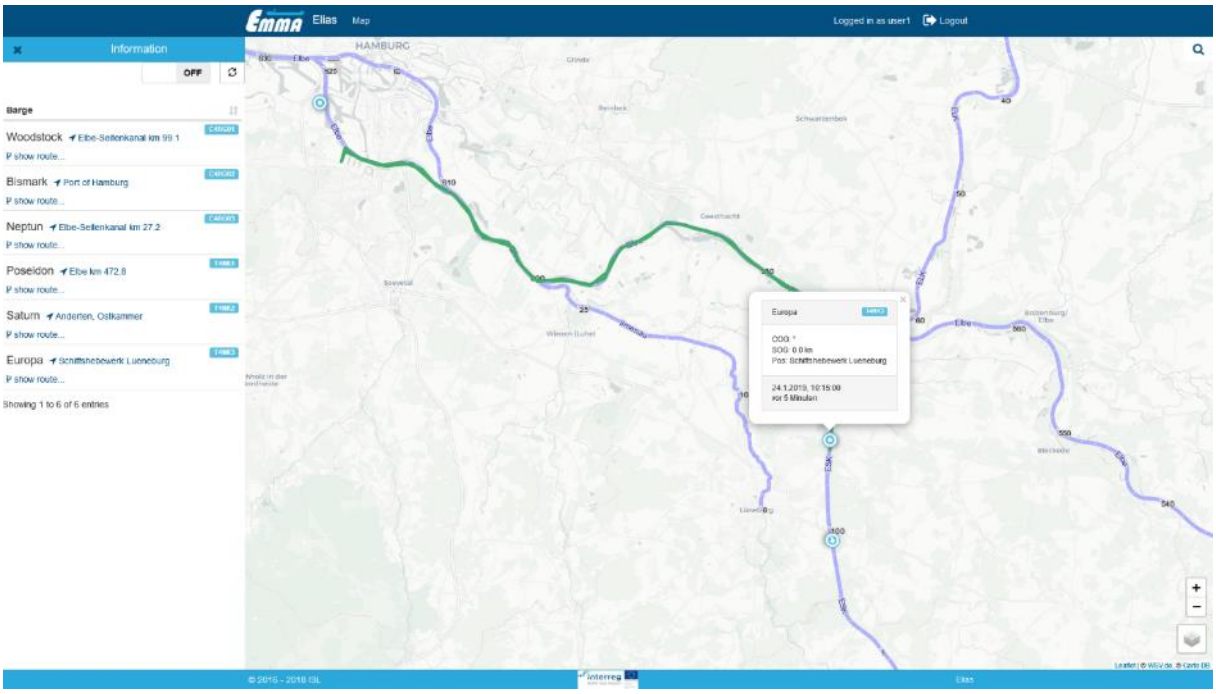

Figure 3 display of vessel position, vessel route and geofencing information (names changed for illustration purposes)

1.1.6 Traffic service

From the anonymised vessel positions received via the AIS service, the traffic service is able to determine the traffic density (number of vessels per waterway section per time) and the traffic flow (average speed of vessels per waterway section per time).

This information can be displayed as an overlay on the ELIAS system where the traffic situation is colour coded: from green = low traffic density / fast traffic flow to red = high traffic density / slow traffic flow.

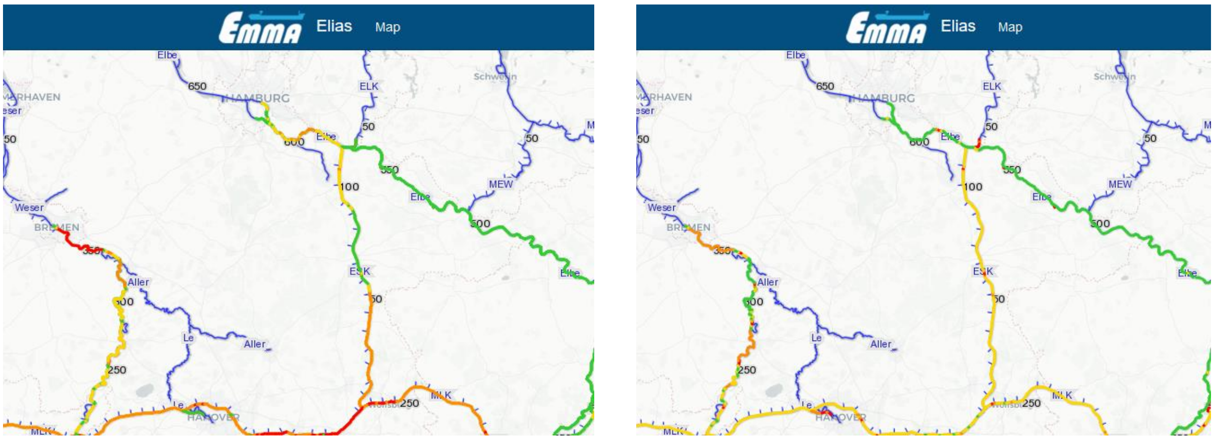

Figure 4 traffic density (left) and traffic flow (right)

1.1.7 Passage statistics service

Based on the anonymous vessel positions collected by the AIS service, the passage statistics service analyses vessel movements at places of interest, such as locks. The service determines the time when a vessel enters the waiting area, when it proceeds into the lock chamber and finally when it leaves the lock. From these timestamps, it determines the waiting and the passage time. The statistics are displayed as a continuous timeline per hour, day, week or month as well as an aggregated average as a diurnal curve per weekday.

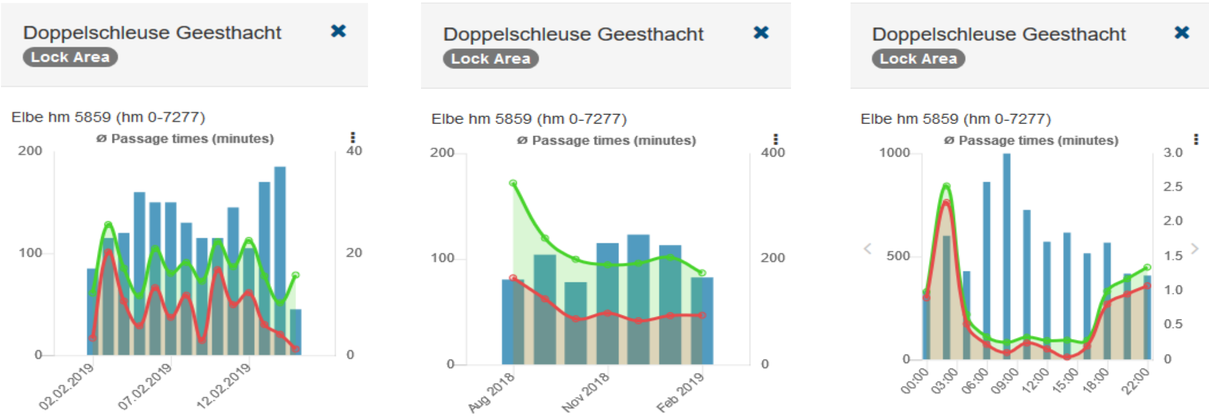

Figure 5 lock passage statistics per day (left) per month (middle) and as diurnal chart per weekday (right)

1.1.8 NtS Service

National and local fairway authorities have the obligation to inform waterway users about issues regarding the waterway that might influence safety and accessibility. Notices to Skippers communicate for example the status of the inland waterway infrastructure (i.e. bridges and locks), failures of aids to navigation, temporarily blockages of waterway sections or other types of infrastructure, etc.[4]

The WSV publishes NtS messages via a web service. ELIAS receives and displays the messages on the map.

[4] http://www.ris.eu/expert_groups/nts

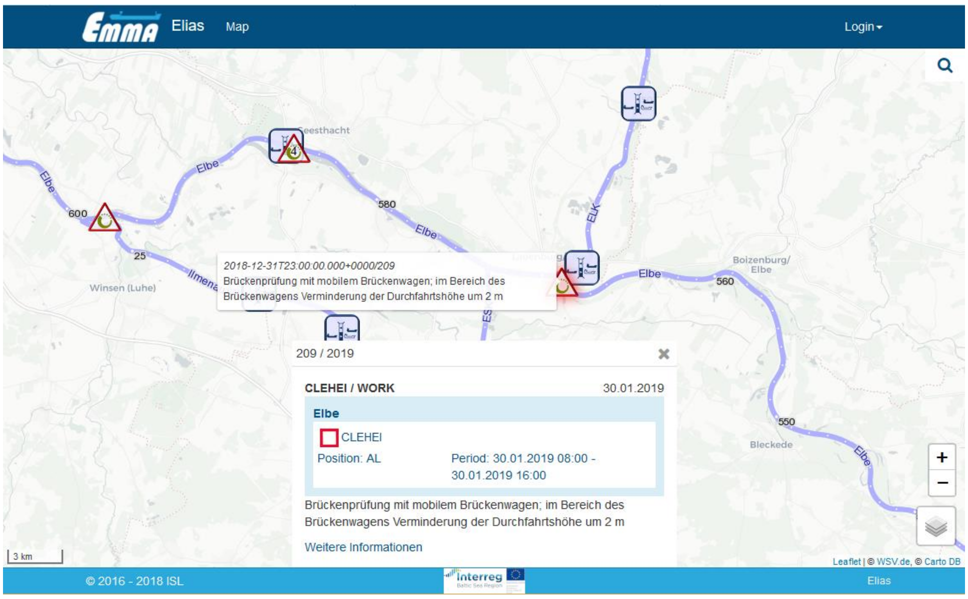

Figure 6 display of an NtS message

1.2 Data Formats & Interfaces

1.2.1 Map Service

The map layers used in ELIAS are based on the standard for Web Map Services (WMS) as defined by the Open Geospatial Consortium (OGC) in their Document 06-042 available at:

https://www.opengeospatial.org/standards/wms

The standard for Electronic Navigational Charts (ENC) is defined by the International Hydrographic Organization (IHO) in their S-57 and dependent standards:

https://www.iho.int/iho_pubs/IHO_Download.htm#S-57

The particularities and extensions of these standards for inland waterways are managed by the Inland ENC Harmonization Group.

“The Inland ENC Harmonization Group (IEHG) was formed in 2003 by North America and Europe to facilitate the development of international standards for Inland ENC data. [...] The goal of the IEHG is to agree upon specifications for Inland ENCs that are suitable for all known inland ENC data requirements for safe and efficient navigation for European, North and South American and Russian Federation inland waterways. However, it is intended that this standard meet the basic needs for Inland ENC applications, worldwide. As such, the Inland ENC standard is flexible enough to accommodate additional inland waterway requirements in other regions of the world. IEHG is recognized as a Non-Governmental International Organization (NGIO) by the International Hydrographic Organisation (IHO). For the proposal of IEHG for a standardized data exchange format for detailed water level information go to the Papers section."[5]

http://ienc.openecdis.org/?q=content/european-inland-ecdis-expert-group

The current version of specification if the edition 2.4 of the European Inland ECDIS Standard available at:

http://ienc.openecdis.org/content/ienc-product-specification-24

1.2.2 Water Level Service

The data format used for the water level service provided by the WSV on pegelonline.de is a proprietary format defined in the REST-API documentation available at:

https://www.pegelonline.wsv.de/webservice/dokuRestapi

This API provides both the numerical values of the gauge measurements in the JavaScript Object Notation (JSON) format as well as a hydrograph visualisation.

The following shows an example of the JSON format used to provide the numerical values:


```
{
  "uuid": "44f7e955-c97d-45c8-9ed7-19406806fb4c",
  "number": "5930060",
  "shortname": "GEESTHACHT",
  "longname": "GEESTHACHT",
  "km": 583.36,
  "agency": "WSA LAUENBURG",
  "longitude": 10.374502723680603,
  "latitude": 53.42650078096063,
  "water": {
    "shortname": "ELBE",
    "longname": "ELBE"
  },
  "timeseries": [
    {
      "shortname": "W",
      "longname": "WASSERSTAND ROHDATEN",
```


[5] http://ienc.openecdis.org/content/iehg

```
        "unit": "cm",
        "equidistance": 1,
        "currentMeasurement": {
          "timestamp": "2019-02-15T10:01:00+02:00",
          "value": 413.0,
          "trend": 1,
          "stateMnwMhw": "normal",
          "stateNswHsw": "unknown"
        },
        "gaugeZero": {
          "unit": "m. ü. NHN",
          "value": -0.008,
          "validFrom": "2008-11-01"
        }
      }
    ]
  }
```


The following shows an example of the hydrograph visualisation:

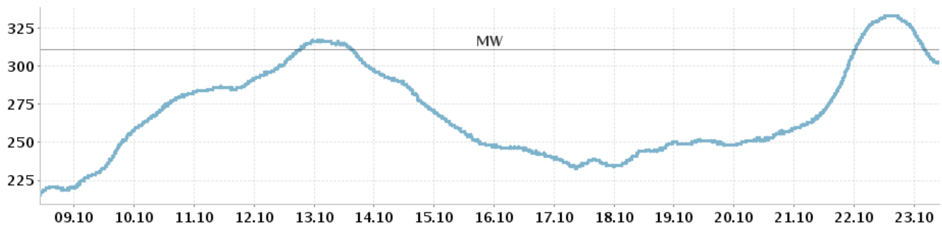

Figure 7 hydrograph visualisation of water levels [6]

1.2.3 Regional RIS Index

The RIS Index is a standardized structure for the description of geo-related RIS reference data maintained by the Joint Task Force on the RIS Index[7]. The RIS Index serves the purpose of addressing waterway objects unambiguously in RIS systems.

Reference data of objects relevant for Inland Navigation (e.g. gauge stations, waterway axes, lock

[6] Source: https://www.pegelonline.wsv.de/webservice/guideRestapi
[7] http://www.ris.eu/expert_groups/joint_task_force

chambers, bridges, harbours, berths, terminals) is maintained by member states within their area of competence.

The RIS Index is available for download per country in tabular form (Excels sheets) for the countries Austria, Belgium, Bulgaria, Croatia, Czech Republic, France, Germany, Hungary, the Netherlands, Slovakia, Serbia, and Romania at

http://www.ris.eu/library/expert_groups/ris_index/ris_index

The data format is described in the RIS Index Encoding Guide[8], which includes the structure of the RIS Index as well as provisions for encoding of waterway objects.

[8] http://www.ris.eu/docs/File/426/2015_12_15_ris_index_encoding_guide_v2p0.zip

The RIS Index contains following data items:

Columns	Elements	Brief Description
A – R	Official ISRS Location Code and Index data	These elements are the core elements of the RIS Index
S – U	Additional RIS data	The columns S - U, which are marked white in the template, contain additional RIS data
V – AF	Restrictions (if not provided in an IENC)	The columns V - AF can be used to provide the information on restrictions, which are caused by an object (e.g. a bridge or a lock)
AG – AP	Reference data for gauges	The reference data of gauges is very important for the safety of navigation and for voyage planning
AQ – AU	Operation times	The operation times of locks, movable bridges and other pieces of infrastructure (e.g. offices of waterway authorities, harbour masters, police, bunker services, fresh water supplies, refuse dumps, terminals, berths, pontoons) are important for voyage planning
AV – BQ	Additional data on restrictions	The columns AV - BQ provide a possibility to enter additional data on restrictions (e.g. additional possibilities of vessel dimension combinations)
BR – CA	Additional operation times	The columns BR - CA provide a possibility to enter additional data on operation times (e.g. for certain types of ships) Columns CB - CF Maintenance data The columns CB - CF contain the maintenance data of the RIS Index

1.2.4 AIS service

AIS Data is transmitted from ship to ship or from ship to shore using the NMEA 0183 standard published by the National Marine Electronics Association (NMEA) at:

https://www.nmea.org/content/STANDARDS/NMEA_0183_Standard

NMEA 0183 is not an open standard and the documents describing the format have to be purchased. However, a number of information sources are available such as Wikipedia[9] or open source projects such as gpsd[10], which provide the necessary information.

In the NMEA 0183 raw data format, the AIS data is encoded. The following sample shows a typical data stream:

```
!AIVDM,1,1,,A,16:>Hi0P058bMobEVKLCuSHJ08>G,0*79

!AIVDM,1,1,,B,C69DqeP0Ar8;JH3R6<4O7wWPl@:62L>jcaQgh0000000?104222P,0*32

!AIVDM,1,1,,B,18Jobt001q0=2gPMICcJ1p8P089K,0*6A

!AIVDM,1,1,,B,403t?hAuho;N>`Pc:j>Kgq700D2D,0*2C

!AIVDM,2,1,8,A,569r?PP000000000000P4UQDr3737000000000000000400000000000,0*08

!AIVDM,2,2,8,A,000000000000000,2*2C

!AIVDM,1,1,,B,403tB81uho;N>85Ckv=2s=Q00D86,0*1D
```

1.2.5 Geofencing service

The geofencing service combines the data from the AIS service and the Regional RIS Index. It does not define a separate data format.

1.2.6 Traffic service

The traffic service aggregates data from the AIS service. It does not define a separate data format.

1.2.7 Passage statistics service

The passage statistics service aggregates data from the AIS service. It does not define a separate data format.

[9] https://en.wikipedia.org/wiki/NMEA_0183
[10] https://gpsd.gitlab.io/gpsd

2 COST CALCULATION

In House Server Infrastructure

The below cost calculation is based on a server architecture and system operation in Germany. It is assumed that a server room is available already. Otherwise additional costs will occur like over heads, security costs, verification etc.)

Please keep in mind that costs will vary regards different countries and their general price levels for electricity, working force etc. Also the size and kind of the company/organisation and its negotiation power with suppliers does play a role in cost models. Finally the technical server set-up also influences operational costs (e.g. energy efficiency of single parts).

Therefor the following cost calculation is exemplary only:

Initial investment

- Hardware: Rack Server 7,000.- EUR – 11,000.- EUR

Operational Costs:

- Electricity (operation and cooling) 100,- EUR p.M.
- Internet connections (e.g. SDSL) 120,- EUR p.M.
- 24/7 maintenance and services for the server 1,500.- EUR p.M:

In addition there will be spending for maintaining the IT system (staff working hours for coding etc.) and depreciation (server hardware).

Managed Server

Another model could be to decide for a cloud based managed server. This will reduce operational costs dramatically. Especially 24/7 maintenance and service, electricity, security and hardware investments are covered in a fixed monthly rate. A reasonable managed server accounts for approx. 150, EUR p.M.

In addition there will be spending for maintaining the IT system (staff working hours for coding etc.) and depreciation (server hardware).

3 INTRODUCTION OF A SINGLE BSR-WIDE STATE-OF-THE-ART INFORMATION SYSTEM

The information system described in chapter 7.5.1 is a prototype designed to work either nation-wide or even BSR-wide. One of the advantages of using a single system is the seamless traceability of cargo transports that cross borders. The vessel master or fleet manager does not have to change systems when crossing the border using IWT. This procedure is similar to trucks, where drivers also use one navigation system all over the continent having appropriate map information installed.

One requirement for such a system is compatible data provided by respective authorities which is not yet the case today. The Baltic Sea Region does not have the same prerequisites as central Europe e.g.

no inland waterways provide data according to the RIS Directive except the River Odra located in Poland. In Finland[11] no RIS services nor infrastructure exist but similar Vessel Traffic Services (VTS) systems, Automatic Ship Identification (AIS) and single window data sharing systems are in operation, which are partly also used for coastal sipping elsewhere.

The introduction might follow the path below:

1. The information system should be connected to existing Vessel Traffic Systems in countries where the system should operate.
2. Differences between maritime regulations and the RIS Directive are to be investigated regarding availability and usability of information.
3. In order to connect the new information system to existing VTS and RIS data, appropriate adaptors are to be developed.
4. Participating countries and/or regions should provide services and data repositories where existing VTS do not provide necessary information today, e.g. RIS index
5. The concept regarding a provider is to be determined. One idea is to have national instances of the information system, another idea is about a single BSR-wide instance

[11] EMMA A2.7_Information_Systems_in_Saimaa_FINAL.DOCX