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Procurement 1.0 of STM ship systems
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**TEN-T PROJECT NO:** 2014-EU-TM-0206-S

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Executive summary - Procurement 1.0 of STM ship systems

This document comprises the entire documentation from, what turned out to be the first, procurement of STM ship systems in the STM Validation project. It encompasses both how the procurement was conducted, the tender documentation sent out and the results of the procurement including how systems were distributed among tenderers.

Scope and objective of the procurement
The objective of the procurement is to validate and operationalize STM services and to boost efforts by system manufacturers to develop STM functionality in prototype systems such as onboard navigation systems. Another aim is to provide data for evaluating the effects on the maritime transportation system as a whole as well as benefits and costs for shipping companies when utilizing STM services. This is done in two major test bed areas, one in the Mediterranean and one in the Nordic encompassing the Baltic Sea and the western parts of the Swedish and Norwegian coast and stretching out to the North Sea.

STM services, especially within flow management, build on analyzing the overall traffic situation and suggest optimized solutions to the ships in densely trafficked areas or where there are particular navigational challenges. The test beds need to include a large number of ships in order to validate the Flow Management concept. The target number of merchant ships that will be engaged in in the test bed is 300.

The goal was that major providers of maritime navigation systems should develop interoperable systems which support route exchange and other information exchange as defined by the STM concept. The onboard installations will include either a software upgrade of existing ECDIS (Electronic Chart Display and Information System) which supports the specified STM functionality and/or planning station or installation of a dedicated planning station for STM functions which is connected to the onboard ECDIS. The scope of the supply is further described in the STM ship system technical specification and tendering form. The actual realization of the functional specifications with regards to technical solutions, user interfaces etc. is up to each system manufacturer to decide upon, even though it is recognized that some standardization in this area may be beneficial for both users and system providers.

The budget for the procurement was fixed at 1,2 MEUR and the goal was to reach several/as many as possible manufacturers in order to get as wide market spread as possible to facilitate international acceptance for the proposed standards and formats.

Choice of procurement form
Swedish Maritime Administration (SMA) as contracting authority made an early choice to perform the procurement of STM ship systems according to Swedish procurement act (“LOU”) which is in line with Directive 2004/18/EC. According to Article 30 section c a negotiated procurement procedure with prior publication can be applied under specific circumstances:

“in the case of services, inter alia services within category 6 of Annex II A, and intellectual services such as services involving the design of works, insofar as the nature of the services to be provided is such that contract specifications cannot be established with sufficient precision to permit the award of the contract by selection of the best tender according to the rules governing open or restricted procedures;”

Given the complex and innovative nature of the project, budget roof restrictions, multiple contracted suppliers etc. (for full justifications see STM prototypes, - EU-PM v3.) these
specific circumstances were deemed fulfilled and the project management as well as SMA internal and external procurement specialists and legal counsels agreed that this procurement form would be the most advantageous choice to fulfill the project goals.

The procurement process
The procurement was open to all type-approved ECDIS (Electronic Chart Display and Information System) manufacturers and to make sure all manufacturers were aware of the procurement contact lists were acquired from CIRM (international association for marine electronics companies) and all companies with type-approved ECDISes were contacted. The following companies responded to the Invitation to apply for tendering:

- Adveto Advanced Technology
- Raytheon Anschuetz GmbH
- SAAB AB
- Signalis GmbH
- Transas Marine Limited
- Wärtsilä SAM Electronics GmbH

All applicants were successfully qualified to further themselves to the tendering phase. Before the tendering phase, Signalis Gmbh however informed SMA that they had decided not to submit a tender.

As the same time as the pre-qualification was on-going the project work to establish specifications and requirements for the tender were intense. The requirements and specifications comprise both performance requirements, installations schedule, standard payload formats and SeaSWIM (Sea System Wide Information Management) services specifications. The complete tendering documentation, invitation to tender and tendering form plus appendix 1-8, is included in this document.

Three ECDIS manufacturers responded to the tender and after examination of applications all three were found qualified and subsequently SMA invited them to negotiations and presentation of their system descriptions. The three manufactures were Adveto Advanced Technology, Transas Marine Limited and Wärtsilä SAM Electronics GmbH. Evaluation of tenders were then performed according to the method “most economically advantageous”, i.e. both quality and price were considered, using the evaluation model described in the invitation to tender. Finally the evaluation result was entered into the distribution key that had been custom designed to suit the purpose of this procurement.

Based on the budget limitation, examination and distribution key the final allocation were awarded according to the following:

- Transas Marine Limited – 129 system installations
- Wärtsilä SAM Electronics GmbH - 63 system installations
- Adveto Advanced Technology - 33 system installations

This gives a total of 225 STM ship systems which means that the pricing from the tenderers led to that the original objective of 300 systems could not be achieved. SMA project management decided that the goal of 300 systems was crucial and that it was desirable to include even more manufacturers. After SMA internal budget reallocation, an additional budget, to be used in a supplementary procurement, was approved. This procurement is reported in Deliverable 2.7.2.
Choice of procedure and scope distribution key in procurement of prototypes for Sea Traffic Management Validation Project

Background

The Swedish Maritime Administration (“SMA”) is planning to procure prototype systems for sub-activity 2.3 of the Sea Traffic Management (“STM”) Validation Project.

The scope of the procurement is for supply of STM on-board equipment, including:

- Development of interoperable On-board System (Hardware/software)
- Assembly/installation/configuration of equipment and software
- Training/education of ship’s personnel (CBT with examination)
- Necessary upgrades, updates and service of the System during the test period

The purpose of this document is:

- To outline and justify the use of negotiated procedure with prior publication as the choice of procurement procedure, and
- To outline and justify the planned strategy for distributing the contract scope among several contractors.

Applicable procurement legislation – EC directive and LOU

Grant Agreement (AGREEMENT No INEA/CEF/TRAN/M2014/1034312), section II.9 stipulates requirements on the procurement of services and goods for the project. Specifically II.9.2 stipulates that beneficiaries that act under procurement legislation shall procure according to their national legislation for public procurements.

The SMA is the contracting authority. The SMA adheres to the Swedish Public Procurement Act (2007:1091) (“LOU”). LOU is the Swedish application of EU Directive 2004/18/EC, and it will be applied in the procurement.

Use of negotiated procedure with prior publication

Negotiated procedure with prior publication can be applied under specific circumstances, those of relevance are listed below.

Swedish Procurement Act, (“LOU”), 4th Chapter, 2§, section 3 stipulates:

"for finansiella och intellektuella tjänster som är av sådan art att det inte går att utarbeta tillräckligt exakt förfargningsunderlag för att kunna genomföra upphandlingen genom att välja det bästa anbjudet enligt bestämmelserna för öppna eller selektiva förfaranden, […]"

This is in line with Directive 2004/18/EC, Article 30, section c:

"in the case of services, inter alia services within category 6 of Annex II A, and intellectual services such as services involving the design of works, insofar as the nature of the services to be provided is such that contract specifications cannot be established with sufficient precision to permit the award of the contract by selection of the best tender according to the rules governing open or restricted procedures;"
With reference to LOU 4th Chapter, 2§, section 3, the following are the reasons and justifications for using negotiated procedure in the procurement of STM Prototypes:

1. Even though the supplier market (hardware and software services within maritime applications) is not new, the final application of the procured prototype installations are based on newly developed standards, which implies that precise specifications for the procurement are difficult to formulate before-hand.

2. The procurement is a small milestone in a larger project, which means that the pre-conditions for the procurement may change, for example changed delivery time frames need to be negotiated and tenders adapted likewise.

3. The project has an openness to innovative solutions regarding new technical solutions, which means that negotiations will be needed to fully understand and evaluate tenders with such solutions.

4. The project operates under a budget roof restriction, which means that flexibility in scope coupled with negotiations to remove over-quality may be needed to find the right balance of price and quality.

5. The project has a goal of 300 installed prototype systems distributed among multiple contracted suppliers. To allocate the contract scope to multiple suppliers in a way that both fulfills the basic procurement principles and at the same time does not overexert the supplier’s delivery capacity within the projects delivery time schedule necessitates negotiations.

In negotiated procedure there is also an increased tolerance for handling misunderstandings or unclear tender answers through adaption of tenders to tendering requirements. This has the additional positive side effect of increasing the possibility for Tenderers who are not industrial partner (beneficiaries) to participate in the tendering procedure.

There is little Swedish legal precedence in choice of procedure. However, the Swedish Competition Authority (Konkurrensverket) has given their opinion regarding when negotiated procedure can be applied. The Swedish Appeals court (Kammarrätten) and Supreme Administrative Court (HFD) has also ruled in a relevant case regarding this.

Legal precedence establishes that IT-services are normally considered intellectual services, this should without a doubt include the current procurement scope. Further, it is firmly believed that also the second part of section 3 in LOU 4th Chapter, 2§ is fulfilled, i.e. that contract specifications cannot be established with sufficient precision.

As final remarks, it should be noted that previous experience shows that filing for review happens less frequently for procurements using negotiated procedure than in open or restricted procedure; and also that a supplier has to be able to show that they were caused damage by the choice of procurement procedure. This will usually be difficult for a supplier.

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1 http://www.konkurrensverket.se/beslut/12-0507.pdf
2 http://www.hogstaforvaltningsdomstolen.se/Domstolar/regeringssratten/R%C3%A4ttssfall/HFD%202013%20ref.%2053.pdf
Distributing the scope to several Tenderers

LOU stipulates that contracts shall be awarded to the best supplier\(^3\). However, there are court verdicts that have ruled otherwise regarding the applicability of distribution models.

An important project success factor and goal is to receive a wide technology spread, which means that multiple suppliers need to be contracted for the scope of 300 installations. Allocating the whole scope to a singular supplier would not fulfill project goals.

The SMA therefore wishes to award the highest volume of installations to the winner, and decreasing volumes to other qualified Tenderers. The details of the distribution model are not decided yet, however, it is likely that

It is likely that the final supplier contracts will be formulated as delivery contracts with a scope described in its entirety (in contrast to framework agreements which utilizes later call-offs).

The distribution model will be clearly described to Tenderers in the procurement documentation.

\(^3\) LOU chapter 5, 6§ (for framework agreements) and chapter 12, 1§ (for delivery contracts)
INVITATION TO APPLY FOR TENDERING

The Swedish Maritime Administration (SMA) invites you to apply for tendering for:

Installations of Sea Traffic Management (STM) compliant onboard system prototypes for the STM Validation Project. The onboard installations which supports STM functionality will include either a software upgrade of existing ECDIS (Electronic Chart Display and Information System) and/or planning station or installation of a dedicated planning station, tablet or other device for STM functions. The STM functionality) shall be transferable (at least regarding bi-directional transfer of voyage plans to the onboard ECDIS.

The Invitation to apply for tendering documentation comprises:

- Invitation to apply for tendering (this document)
- STM Validation Project information brochure

TendSign

For this procurement SMA uses the online procurement portal Visma TendSign, www.TendSign.com. Through TendSign the complete procurement documentation is made available, as well as any notifications and updates regarding the procurement. TendSign provides an easy way for you to ask questions regarding the procurement. Your application/tender shall also be submitted electronically through TendSign.

For access to TendSign you need a login, which is provided by registering on www.TendSign.com. It is advisable that you register your TendSign account with an e-mail address that can be accessed by more than one person. All communication during the procurement will be linked to this e-mail address. There is no cost associated with submitting an application/tender.

If you have questions or need support regarding TendSign, please contact Visma TendSign helpdesk on +46 771 440 200, weekdays during office hours.

It is the responsibility of the Applicant/Tenderer to check that all documents in accordance with this specification have been received and to also keep updated on the procurement through TendSign.
1. INTRODUCTION AND PROCUREMENT INFORMATION

1.1 Contracting authority

Swedish Maritime Administration

Swedish organizational number: 556487-2751

The Swedish Maritime Administration (SMA) is a governmental agency and enterprise within the transport sector and is responsible for maritime safety and availability. This means a collective responsibility for achieving the government’s transport and economic policy goals in the field of shipping. The goals of the transport policy, guiding our operations, are to attain an accessible transport system, a high level of transport quality, secure shipping, a favourable environment, positive regional development and an equitable transport system.

SMA’s services include, for example:

- Pilotage
- Fairway Service
- Maritime Traffic Information
- Icebreaking
- Hydrography
- Maritime and Aeronautical Search and Rescue
- Seamen’s Service

Our activities focus primarily on merchant shipping, but also take the pleasure boating and fishing interests into account.

For further information, visit our webpage: www.sjofartsverket.se.

1.2 Definitions

Applicant - a company that submits an application to tender
Tenderer - a company that submits a tender
Supplier - a Tenderer that has been awarded a contract
Requirement - mandatory demand that must be fulfilled by the application/Applicant
1.3 Background

Based on MONALISA (2010-EU-21109-S) and MONALISA 2.0 (2012-EU-21007-S), www.monalisaproject.eu, significant steps have been taken in bringing advancements in technology and innovation into the maritime sector. Both projects have defined and tested core STM components and shown very promising results.

The STM concept sets a focus upon enabling safe, sustainable, and efficient sea transports. STM is a response to the need to increase efficiency in operations within and between ports. The concept takes a holistic approach to services putting the berth-to-berth voyage in focus and uses that as a core element for process optimisation, stakeholder interaction and information sharing. An enhanced sharing of information ship-to-ship, ship-to-shore, and shore-to-shore is also an important enabler for increased situational awareness and safety during sea transports. STM has already shown that substantial savings of bunker costs could be earned and that high utilization of resources of the facilities in ports can be reached while the degree of safety is increased.

The information sharing principles in STM leads to improvements in:

- Predictability of arrivals and departures enabling better planning for all parties
- Just in time operations by better predictability and information sharing in and between ports and ships
- New innovative services that are non-vendor dependent, interoperable and with low cost
- Situational awareness – knowing others intentions optimises resource utilisation and reduces number of accidents

The next step in this development, Fig. 1, is to validate the STM Target Concept. This is mainly done in the STM Validation Project, running from 2015 to 2018, by establishing large-scale test beds in order to test and validate different STM concepts. The output will be a validated target concept for STM and additional quantitative and qualitative support for the broader development of STM.

Fig. 1 The Development, Validation, and Deployment of STM
STM Validation Project

The STM Validation Project, see project information brochure, co-financed by the EU (Connecting Europe Facility/Motorways of the Sea) shall demonstrate and validate STM by using the European Maritime Simulator Network and by establishing large-scale test beds in both the Nordic and Mediterranean Seas, encompassing 300 ships and 13 ports. Key strategic services of STM will be tested and validated. The project encompasses:

- **Validation of Voyage Management** in two test beds. In the Nordic region, the application of STM for more efficient winter navigation will be tested and validated. In the Mediterranean Sea, the application of STM for crisis management (i.e., Search and Rescue) will be tested and validated.
- **Validation of Flow Management** utilizing the European Maritime Simulator Network and the test beds for Voyage Management. This simulator network was developed within the MONALISA 2.0 project and will be used both to simulate different traffic conditions and further test and validate other parts of STM, which are not possible to test and validate in real life at this stage, such as area management.
- **Validation of Port Collaborative Decision Making** (Port CDM) by expanding the network of ports and Port CDM services developed in MONALISA 2.0 in the Nordic and Mediterranean regions. The contextual differences between different port approaches will be gathered and analysed, together with other information that will serve as a basis for the concept’s refinement. The test beds will also constitute a first step towards inviting both commercial and public service developers/distributors to further develop Port CDM Services.
- **Validation of System Wide Information Management** (SeaSWIM) using the Maritime Cloud as the infrastructure for information exchange in the validation test beds. (Further information regarding Draft SeaSWIM Requirement Specification based on needs from PortCDM and Voyage Management can be found here:  http://monalisaproject.eu/documents/ )

Extensive Analysis and Evaluation will be carried out and the different perspectives used in MONALISA 2.0: business, socio-economic, risk, technological, legal and institutional will be incorporated. Competencies and training requirements for STM implementation will also be considered within this activity.

The results from testbeds, which involve rigorous, transparent and replicable testing of, for example, route exchange, route optimization, scientific theories, computational tools and new technologies. As there are linkages between STM and IMO’s e-navigation Strategy Implementation Plan (SIP), these test beds would allow for early detection of new system functionality, operational usability, areas of enhancement and identification of weakness. The results will be submitted to IMO in accordance with the format outlined in MSC.1/Circ.1494 on Guidelines on Harmonization of Testbed Reporting. The results of the project will thus also form the basis for policy making, further research and development of STM services and concepts and pre-deployment of STM services and concepts.

This procurement is a part of the STM Validation Project. The project include fulfillment of the terms of the Grant Agreement(GA) (https://ec.europa.eu/inea/sites/inea/files/model_grant_agreement_en.pdf) whereby the European Commission has decided to award a grant for the STM Validation Project. The following parts of the GA should therefore also apply to the future supplier agreements.
II.3 – LIABILITY FOR DAMAGES

II.4 – CONFLICT OF INTERESTS

II.5 – CONFIDENTIALITY

II.8 – PRE-EXISTING RIGHTS AND OWNERSHIP AND USE OF THE RESULTS (INCLUDING INTELLECTUAL AND INDUSTRIAL PROPERTY RIGHTS)

1.4 Standard formats development

Already in MONALISA 2.0 several major manufacturers of navigational equipment joined forces in order to develop a format allowing route/voyage plans to be seamlessly exchanged irrespective of the equipment brand. A standardized route exchange format, RTZ, has been developed and approved as an international standard by IEC (International Electro technical Commission) in its IEC 61174 ed. 4.

Further development and verification of operational and technical aspects, arising from the usage of the RTZ-format, such as route exchange between ships and shore centre, route optimization and enhanced monitoring supported by route exchange are important steps towards future deployment and will be included in the STM Validation Project.

In addition to this the need for other new standards, necessary for STM applications, will be identified, developed and implemented in the STM compliant onboard prototypes. SMA invites more companies to join this work group and participate in the standard development to shape the future of on-board systems.

Benefits for system manufacturers in STM validation project

- Possibility to be in a leading position with developing new services.
- Affect and create development of new standards that are beneficial for the market.
- Opportunity to test and get feedback from users on the prototype functionalities.
- STM Validation Project offers free services, for safer and more efficient voyages, to participating ships that will create goodwill to system manufacturers from participating ship owners.
- The Maritime Service Infrastructure/SeaSWIM will improve communication with customers for existing and future planned services.
- Possibility to combine prototype installations with other already planned tests and updates.

Interested system manufacturers are welcome to contact the Swedish Maritime Administration through the procurement portal TendSign. SMA will also provide updates of the work group’s progress on the following web page: www.monalisaproject.eu.

1.5 Description of scope.

The scope of this procurement is to contract the supply of 300 STM on-board systems including
- Installation and configuration of STM compliant (according to requirements in the tendering phase, see section on procurement process over view) on-board systems (Hardware/software)
- Recruiting of test ships for the test bed
- Training and education of ship’s crew including a manual on system usage
- Necessary upgrades, updates and service of the system during the test period
- Report on system technical functionality after the test bed period is finalised
- Possibly options for further modification of system functionality during test beds

Further information regarding STM Onboard system can be found here: http://monalisaproject.eu/documents/

1.6 Number of suppliers

The total 300 system installations will be distributed among several different suppliers. Thus several Tenderers will be awarded contracts, according to a distribution key which will be described in the tendering phase of the procurement. The reason why the delivery must be distributed among multiple Tenderers is that a spread of different technologies and interoperability is needed to meet the needs of the project.

1.7 Contract period

The contract period shall be from contract signing by both parties until the end of the project (2018-12-31)

1.8 Cancellation/Alteration of the call for tender

The SMA reserves the right not to make an award and/or to cancel the invitation to apply for tendering, to issue a new invitation to apply for tendering, to adapt the procedure for the invitation to apply for tendering and/or to introduce alterations to the nature of those according to unexpected economic, political or organizational changes.

1.9 Procurement form

This procurement is conducted in accordance with the Swedish Public Procurement Act (2007:1091) as a Negotiated Procedure with prior publication.

1.9.1 Reasons for negotiated procedure

Negotiated procedure with prior publication are deemed applicable for the following reasons:

- The final application of the procured systems are based on newly developed standards, which implies that precise specifications for the procurement are difficult to formulate before-hand.
- The procurement is a milestone in the larger STM Validation Project, which means that the preconditions for the procurement may change, for example changed delivery time frames need to be negotiated and tenders adapted likewise.
- SMA has an openness to innovative solutions regarding new technical solutions, which means that negotiations may be needed to fully understand and evaluate tenders with such solutions.
The project operates under a limited budget, which means that flexibility in scope coupled with negotiations may be needed to find the right balance of price and quality.

Distributing the contract scope to multiple suppliers in a way that both fulfils the basic procurement principles and at the same allows for a test-bed environment where the interoperability between several different systems can be tested and evaluated. This necessitates negotiations.

Procurement process overview

Brief description of the negotiated procedure with prior publication.

- A “two-step” procedure, consisting of an application phase and a tendering phase.

- The application phase is conducted according to this Invitation to apply for tendering. It is openly published in a public database and all suppliers are invited to submit an application to participate.

- The SMA examines all applications and performs a qualification against mandatory requirements, as per this document.

- Applicants that fulfilled all requirements are invited to tender (they become Tenderers) according to tendering documentation which is distributed to the Tenderers.

- Tenders are submitted and SMA examines tenders for fulfilment of mandatory requirements and evaluation criteria.

- After tender submission the SMA may engage in negotiations in order to adjust tenders to correspond with SMAs requirements in order to reach the best balance in price and quality.

- Final evaluation is carried out after negotiations are completed.

- Contract award

- Stand-still period

- Contract(s) are signed

1.10 Time plan

This time plan might be changed during the process and it is the responsibility of the Tenderer to check when the application shall be submitted etc. Any updates to the time plan will be made known through TendSign.

Submission of applications tenders: as per section 2.1.2
Qualification and distribution of tendering documentation: March/April 2016
Tender submission deadline: May 2016
Examination and evaluation of tenders: directly after submission
Contract signing: June 2016
Installation date: March 2017
1.10.1 Point of contact for the procurement

Kristofer Åkesson
Kristofer.akesson@colligio.se

Eddie Salgado
eddie.salgado@colligio.se

Applicants may not communicate with the Contracting Authority’s employees through other ways of contact than described in this document.

1.10.2 Questions, clarifications and amendments

Questions regarding the procurement shall generally be submitted through TendSign, where all general responses, clarifications and amendments will be advertised and thereby notified to all Applicants/Tenderers. It is the Applicants/Tenderers responsibility to keep updated on TendSign. Answers to questions, clarifications and amendments published through TendSign become an integral part of the procurement documentation.

The SMA’s answers to questions will be published at the latest six days before the application deadline.

The SMA encourages Applicants/Tenderers to ask questions, especially if any information is unclear, appears faulty or even inappropriate.

However please ask questions in good time to allow the SMA to answer them, preferably not later than ten days before the application deadline.

Only clarifications and amendments announced through TendSign are valid.

Insofar as questions relate to solutions which the Applicant/Tenderer is considering to put forward, but which in their opinion should not be available for all Applicants/Tenderers, for instance, because of the need to protect their intellectual property rights the Applicant/Tenderer may request that Contracting Authority to deal with their question without notifying everyone. The Contracting Authority will decide on such a request and it will only be granted if deemed that it will not give information that will in any way give the requesting Applicant/Tenderer an advantage or information that might be useful to all applicants/Tenderers. If the Contracting Authority is of the opinion that it must provide the answer to a request for information to all Applicants/Tenderers, the Contracting Authority shall notify the requesting Applicant/Tenderer. The Applicant/Tenderer will then be entitled to withdraw its request. If the Applicant/Tenderer does not do so within the stipulated period, the Contracting Authority will publish the answer in the form of a clarification visible to all Applicants/Tenderers.
2. INSTRUCTIONS FOR APPLICATIONS

Interested parties submitting applications are obliged to do so in accordance with the instructions detailed below.

2.1 Form of applications

It is a fundamental principle for procurements carried out in accordance with the Public Procurement Act that all Applicants/Tenderers must be treated equally. As a consequence the possibility to elucidate or amend the information already submitted in an application/tender is very limited.

Thus please make sure that your application is complete and contains answers to all requested information.

Unclarities in your application may be interpreted to your disadvantage. If the application is incomplete, lacking in information or does not comply with the provisions of this Invitation to apply for tendering the application may be rejected.

The SMA prefers that

- Submitted electronic files are readable in Windows/Office.
- Documents are provided unlocked, for example text search should be enabled in pdf’s.
- Submitted electronic files have clear and logical file names.
- Your application is structured in a logical way, if cross-referencing please provide clear references.

2.1.1 Language

Requirement: The application shall be written in English or in Swedish.

Formal certificates and information leaflets etc. may be supplied in other languages only if accompanied by a translation. The SMA may by its own verify the translation.

2.1.2 Submission of applications

Requirement: Complete applications shall have been registered electronically on TendSign no later than 23:59 o’clock on January the 14th 2016.

The Applicant is responsible for the application arriving in time. Applications received too late will not be considered.

A submitted application may be modified up until and including the last day for submission of applications.

Please note that applications submitted by post, fax or e-mail will not be accepted.
2.1.3 Remuneration for submitting application

The SMA will not accept any costs or expenses incurred by the Applicant in connection with the application or tendering process.

2.1.4 Opening of applications

Applications will be opened electronically on the next weekday after the submission deadline.

2.2 Examination of applications

The SMA will examine whether submitted applications fulfil both formal Requirements on the application and the Requirements placed on the Applicant as a company, as per section 3 of this document.

Applications that do not fulfil all Requirements will be excluded from qualification.

Applicants that fulfil all Requirements are qualified, and will be invited to participate in the tendering phase.

2.3 Decision

A decision regarding the qualification will be made known only to each respective Applicant, i.e. no information is given regarding competitors. Such information will only be disclosed when the procurement is ended.

2.4 Applicants request for confidentiality

The below information applies both to the application and the tendering phase: During the tendering phase you will receive the same opportunity to request confidentiality.

Details provided in procurement matters are considered confidential in accordance with the Swedish Public Access to Information and Secrecy Act (2009:400) until such time as a decision is made and the procurement is made public, or the procurement is terminated. This means that details provided in procurement matters are only released to those requiring such information for the completion of work due to the procurement.

At such time as the procurement is made public, it is standard practice for all details to be considered official and open documentation.

Details may, in certain cases, continue to be considered confidential even after the procurement is made public. Applicants/Tenderers may claim commercial confidentiality for information pertaining to business or operational matters, and where there is particular reason to assume that disclosure of such information could damage the Applicant/Tenderer.

In those cases where an Applicant/Tenderer considers that the details provided in the procurement process satisfy that which is required for commercial confidentiality, the Applicant/Tenderer may submit a written request for such. Such a request must contain a specification of which details are being referred to, as well as the damage that aforementioned details could incur in the event of disclosure.
Please note however that information supplied for the purposes of tender evaluation can only be granted commercial confidentiality in exceptional circumstances.

In those cases where Applicant/Tenderers choose to request commercial confidentiality regarding parts of their application/tender, the Applicant/Tenderer should clearly indicate:

- which information is to be regarded as requiring protection and
- what harm should occur if the information is disclosed

The request for confidentiality will be examined by the SMA each time anyone requests release of the documents. Even if the SMA judges that the need for confidentiality exists, this decision can be appealed and examined in court.

Guarantees that the information will never be distributed can therefore never be given.

2.5 **Special conditions**

Below are listed a number of special conditions and/or requirements which will apply in the tendering documentation which is sent to the qualified Tenderers. This information is given already now as they may influence a supplier’s interest in the procurement.

- The relationship between the Contracting Authority and the Supplier will be governed exclusively by Swedish law in a Swedish court of law

Naturally, an important aspect of the project is that the installed systems actually produce data for the project, i.e. that the installed ships frequent the test beds (Mediterranean or North Sea/Baltic Sea) to some extent. SMA acknowledges the difficulty in phrasing this as a mandatory requirement and will thus attempt to be accommodating in phrasing a suitable contractual clause in the supplier agreements to fulfill.

3. **REQUIREMENTS PLACED ON SUPPLIERS**

To ensure that the Applicant is suitable as a Supplier, the following **Requirements** must be satisfied.

3.1 **Legal requirements**

**Requirement**: The Applicant shall have fulfilled its obligations related to payment of taxes as well as social security contributions in accordance with the legal provisions of the country in which the Applicant is located.

**Requirement**: The Applicant shall be registered with a company register, commercial register or similar in the Applicants country of operation.

**Required proof**
The SMA will check fulfilment of the above. At the request of SMA, the Applicant shall submit the following:

- A copy of a certificate of enrolment in a professional and trade register, and
• A copy of a certificate proving fulfilled obligations relating to payment of social security contributions and payment of taxes, issued by the appropriate authorities. The certificate should not be older than 3 months.

If an Applicant is unable to submit information as above due to it not being possible to obtain such information from the relevant authority, written confirmation of this from the authority must be enclosed.

3.2 Economic and financial capacity

Requirement: The Applicant shall have the financial strength, stability and liquidity to finance the contractual undertakings throughout the contract period.

The SMA reserves the right to exclude Applicant from further examination due to:

• Applicant failure to provide evidence confirming economic and financial stability
• Indications exist in the financial statement that the Applicant does not satisfy the requirements for economic and financial stability

A credit rating of at least 3 from the credit rating institute Upplysningscentralen www.uc.se or a similar rating (i.e. “A” or “moderate/low risk”) from a renowned credit rating institute is seen as sufficient to fulfil the above Requirement.

Required proof
The SMA will check that the requirement is fulfilled by contacting www.uc.se. If information about the Applicant cannot be provided by UC, the Applicant shall, at request of SMA, submit the following:

• An independent credit report or financial reports (balance sheet, financial statement for the last two years), or equivalent information.

The SMA reserves the right to ask Applicants to supplement their information or provide sufficient warranties if there are any uncertainties about the financial capacity. The SMA also reserves the right to supplement their examination of the Applicant by requesting a 3rd party credit report.

An Applicant who is not able to fulfil the Requirement for economic and financial stability may fulfil the Requirement by including, in addition to what is requested above, a bank or parent company guarantee or similar to the application. Such a guarantee must clearly show that the other party is willing and able to guarantee the Applicants economic and financial capacity throughout the contract period. The other party must also in itself fulfil the Requirement for Economic and financial capacity as well as the Legal requirements.

3.3 Technical ability and capacity

Requirement: The Applicant must prove in writing that it has the technical ability and capacity to deliver what is requested in the scope.

This includes:

• Being able to deliver ECDIS systems (i.e. which fulfill IMO RESOLUTION A.817(19))
• Have access to experienced and properly qualified personnel including manufacturing capacity for development, delivery and installation of systems
• Being able to recruit ships for installations
• Have access to experienced and properly qualified personnel for training and providing support to end users (the crew of the installed ships)

Required proof
• Enclose a copy of an ECDIS certificate
• Enclose information how each of the above are fulfilled.

3.4 Subcontractors

An Applicant is allowed to refer to a subcontractor’s capacity in fulfilment of technical and economical requirements. If a subcontractor is used the subcontractor must also fulfil Legal requirements (3.1).

If a subcontractor will be used, then the application must include information on the following:
- Subcontractors company name and VAT/organizational number
- Brief description of what parts of the supply that a subcontractor likely will provide

If a subcontractor is used to fulfil requirements, then the SMA may during the procurement process request proof that the subcontractor’s technical ability and/or capacity at the time of production/delivery will be available to the Applicant/Tenderer. This may be proven by, for example, a written verification from the subcontractor, through a formal agreement between the Application/Tenderer and subcontractor or by for example showing a working business relation between the companies.

Failure to prove this means that the subcontractors capacity cannot be referred to.

Additional subcontractors may be added during the tendering phase, in so far as new requirements are introduced, for example special expertise which was not obviously needed based on the scope in this invitation to apply for tendering. The requirements on subcontractors must also be met by any subcontractors which are added in the tendering phase.

Required proof
• If any subcontractor will be used please enclose information how each of the above are fulfilled.
INVITATION TO TENDER

The Swedish Maritime Administration (SMA) invites you to tender for:

Installations of Sea Traffic Management (STM) compliant ship system prototypes for the STM Validation Project as described in the Application phase.

STM ship systems refers to ECDIS functionality, communication with ECDIS, STM module, communication with access point and online access point according to description in requirement specification.

Only Applicants that have previously been qualified by SMA are entitled to submit a tender.

The Invitation to Tender documentation comprises:

- Invitation to Tender and tendering form (this document)
- Appendix 1 – STM Ship system technical specification and tendering form
- Appendix 2 – Main Contract
- Appendix 3 – SeaSWIM Specification
- Appendix 4 – Voyage Information Service Specification
- Appendix 5 – STM Voyage Management use cases
- Appendix 6 – Route Message Format
- Appendix 7 – Port Information Service Specification
- Appendix 8 – Route Planning process Flowchart

SMA uses the online procurement portal Visma TendSign, www.TendSign.com. Through TendSign the complete procurement documentation is made available, as well as any notifications and updates regarding the procurement. TendSign provides an easy way for you to ask questions regarding the procurement. Your tender shall also be submitted electronically through TendSign.

All communication during the procurement will be linked to the e-mail address which you have linked to your TendSign account. There is no cost associated with submitting a tender.

If you have questions or need support regarding TendSign, please contact Visma TendSign helpdesk on +46 771 440 200, weekdays during office hours.

It is the responsibility of the Tenderer to check that all documents in accordance with this specification have been received and to also keep updated on the procurement through TendSign.
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   1.1 Contracting authority .................................................................................. 3
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1 Introduction and procurement information

1.1 Contracting authority
Swedish Maritime Administration
Östra Promenaden 7
602 78 Norrköping
Sweden

Swedish organisational number: 556487-2751

1.2 Definitions
Applicant - a company that submits an application to tender
Tenderer - a company that submits a tender
Supplier - a Tenderer that has been awarded a contract
Shall - requirement - mandatory demand that must be fulfilled by the tender/Tenderer.
Should - requirement - non-mandatory demand that grants the tender additional value in the evaluation.

1.3 Background
See Invitation to apply for tendering.

1.4 Description of scope
As previously described in the Invitation to apply for tendering:

The scope of this procurement is to contract the supply of STM ship systems including

- The test period runs until 31 December 2018.
- Installation and configuration of STM ship systems
- Installation or utilization of all necessary communication links and associated services, including 200MB data transmission, required to achieve the specified capabilities for the duration of the project
- Recruiting of test ships for the test bed
- Training and education of ship’s crew including a manual on system usage
- Necessary updates and service for maintaining the system operational during the test period
- Report on system technical functionality after the test bed period is finalised
- Possibly options for further modification of system functionality during test beds

1.5 Project budget
The total budget for all contracts for the supply of the STM ship systems is limited to 1 200 000 Euro. At the same time SMA has made the assessment that an important factor for the success of the project is that the number of deployed systems reaches approximately 300 ship systems. SMA urges therefore that all Tenderers carefully consider their pricing strategy in order to contribute to the success of the project.
1.6 Number of suppliers
The system installations will be distributed among several different suppliers. All Tenderers, whose Tender fulfill the Shall-requirements and whose price does not exceed the maximum price, will be awarded contracts, according to the distribution key described in this document. The distribution key will give the Tenderer with the financially most advantageous tender the largest volume. The second best Tenderer will get the second largests volume and so forth.

The reason why the delivery will be distributed among multiple Tenderers is that a spread of different technologies and proof of interoperability is needed to meet the needs of the project.

1.7 Cancellation/Alteration of the call for tender
SMA reserves the right not to make an award and/or to cancel the invitation to tender, to issue a new invitation to apply for tendering, to adapt the procedure for the invitation to tender and/or to introduce alterations to the nature of those according to unexpected economic, political or organizational changes.

SMA also reserves the right to cancel the project and consequently the tendering process if the combined result of the prices given in the tenders implies that the total number of deployed shipsystems will be to low to ensure a successful project.

The above also applies if the number of Tenderers will be to low to ensure diversity between different technical solutions.

SMA will not and can not give any indication in advance on what will be the lowest number of ships deployed and/or the lowest number of Tenderers for the continuation of the project.

1.8 Procurement form
This procurement is conducted in accordance with the Swedish Public Procurement Act (2007:1091) as a Negotiated Procedure with prior publication.

1.9 Procurement process overview
Negotiated procedure with prior publication is a “two-step” procedure, consisting of an application phase and a tendering phase.

- The application phase has already been concluded.
- Applicants that fulfilled all requirements in the application phase are invited to tender according to this Invitation to tender.
- Tenders are submitted and SMA examines tenders for fulfilment of shall-requirements and should-requirements.
- After examination of tenders, SMA will invite to negotiations and adjust tenders to correspond with SMAs Should-requirements in order to reach the best balance in price and quality. Tenderers should reserve time in their calendars for negotiations according to the time plan below.
- Final evaluation is carried out after negotiations are completed.
- Contract award
- Legal 10 day stand-still period
• Contract(s) are signed

### 1.10 Time plan
This time plan might be changed during the process and it is the responsibility of the Tenderer to check when the application shall be submitted etc. Any updates to the time plan will be made known through TendSign.

<table>
<thead>
<tr>
<th>Procurement Milestones</th>
<th>Description</th>
<th>Acceptance date (calendar months)</th>
<th>Percentage of Contract Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Development and finalization of the tender invitation</td>
<td>2016-05-12</td>
<td>NA</td>
</tr>
<tr>
<td>2</td>
<td>Submission of the tender invitation to the qualified applicants</td>
<td>2016-05-13</td>
<td>NA</td>
</tr>
<tr>
<td>3</td>
<td>Question and answers during the tendering period</td>
<td>Until 10 days before last day from submission</td>
<td>NA</td>
</tr>
<tr>
<td>4</td>
<td>Last day for submission of tenders</td>
<td>As stated in section 2.5</td>
<td>NA</td>
</tr>
<tr>
<td>6</td>
<td>Examination and preliminary evaluation of tenders</td>
<td>2016-06-27 to 2016-07-11</td>
<td>NA</td>
</tr>
</tbody>
</table>

**Holiday Stand Still**

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Description</th>
<th>Acceptance date (calendar months)</th>
<th>Percentage of Contract Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Negotiations and final evaluation</td>
<td>2016-08-12 to 2016-09-02</td>
<td>NA</td>
</tr>
<tr>
<td>8</td>
<td>Award of tenders</td>
<td>2016-09-02</td>
<td>NA</td>
</tr>
<tr>
<td>9</td>
<td>Last day of Stand Still period</td>
<td>2016-09-14</td>
<td>NA</td>
</tr>
<tr>
<td>10</td>
<td>Signing of contracts</td>
<td>2016-09-15</td>
<td>NA</td>
</tr>
</tbody>
</table>

The milestones for the project after signing of the contract are stipulated in the Main Contract.

### 1.11 Points of contact
Questions regarding the procurement shall be put forward through TendSign.
Only in urgent matters the contact person below may be contacted directly.

Per Kyhle
per.kyhle@colligio.se
+ 46 23 661 66 12

Anders Wiksell
anders.wiksell@colligio.se
+ 46 23 661 66 19

Switchboard
+ 46 661 66 10
info@colligio.se

Tenderers may not communicate procurement matters with the Contracting Authority’s employees through other ways of contact than described in this document.

1.12 Questions, clarifications and amendments

Questions regarding the procurement shall generally be submitted through TendSign, where all general responses, clarifications and amendments will be advertised and thereby notified to all Tenderers. It is the Tenderers responsibility to keep updated on TendSign. Answers to questions, clarifications and amendments published through TendSign become an integral part of the procurement documentation.

SMA’s answers to questions will be published at the latest six days before the application deadline.

SMA encourages Tenderers to ask questions, especially if any information is unclear, appears faulty or even inappropriate.

However please ask questions in good time to allow SMA to answer them, preferably not later than ten days before the tendering deadline.

Only clarifications and amendments announced through TendSign are valid.

Insofar as questions relate to solutions which the Tenderer is considering to put forward, but which in their opinion should not be available for all Tenderers, for instance, because of the need to protect their intellectual property rights the Tenderer may request that Contracting Authority to deal with their question without notifying everyone. The Contracting Authority will decide on such a request and it will only be granted if deemed that it will not give information that will in any way give the requesting Tenderer an advantage or information that might be useful to all Tenderers. If the Contracting Authority is of the opinion that it must provide the answer to a request for information to all Tenderers, the Contracting Authority shall notify the requesting Tenderer. The Tenderer then will be entitled to withdraw its request. If the Tenderer does not do so within the stipulated period, the Contracting Authority will publish the answer in the form of a clarification visible to all Tenderers.
2 Tender instructions

Interested parties submitting tenders are obliged to do so in accordance with the instructions detailed below.

2.1 Form of tenders

This tender invitation also serves as tender form. This means that this tender invitation/form filled in with the required information from the tender and contain the following appendices, forms a complete tender.

- Appendix 1: Requirements filled in with required information and possible appendices asked for in Requirements.

All tender documents must be uploaded in TendSign

SMA prefers that

- Submitted electronic files are readable in PDF or Microsoft Office.
- Documents are provided unlocked, for example text search should be enabled in PDFs.
- Submitted electronic files have clear and logical file names.
- Your tender is structured in a logical way, if cross-referencing please provide clear references.

It is a fundamental principle for procurements carried out in accordance with the Public Procurement Act that all Tenderers must be treated equally. As a consequence the possibility to elucidate or amend the information already submitted in an tender is very limited. Thus please make sure that your tender is complete and contains answers to all requested information and that all tickboxes are marked. Unclarities in your application may be interpreted to your disadvantage. If the tender is incomplete, lacking in information or does not comply with the provisions of this Invitation to tender the tender may be rejected.

2.2 Signing of the tender

The signing of the tender is made on the last page of this tender invitation/form. When submitting the tender the last page must be printed, signed, scanned and uploaded in TendSign.

| The last page of this tender invitation/form is signed and uploaded in TendSign? | Yes [ ] |

2.3 Tenderer information

<table>
<thead>
<tr>
<th>Name of the company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organisation-number or equal</td>
</tr>
<tr>
<td>Address</td>
</tr>
<tr>
<td>Postcode and city</td>
</tr>
<tr>
<td>Name of point of contact (POC)</td>
</tr>
<tr>
<td>Phone-number to POC</td>
</tr>
</tbody>
</table>
2.4 Language

Requirement: The tender shall be written in English or in Swedish.

Formal certificates and information leaflets etc. may be supplied in other languages only if accompanied by a translation. SMA may by its own verify the translation.

2.5 Submission of tenders

Requirement: Complete tenders shall have been registered electronically on TendSign no later than 23:59 the 26th of June 2016.

The Tenderer is responsible for the tender arriving in time. Tenders received too late will not be considered.

A submitted tender may be modified up until and including the last day for submission of tenders. Please note that tenders submitted by post, fax or e-mail will not be accepted.

2.6 Tender validity

Requirement: The Tenderer must accept the following – the tender shall be binding and valid for 120 days after the tender submission deadline. If the procurement is subject to court proceedings the tender validity shall be extended until a contract can be signed after the court proceedings, however not for more than an additional 120 days.

The tender validity is accepted. Yes [ ]

2.7 Commercial conditions

The commercial conditions for the framework agreement are attached as Appendix 2 – Main Contract. The Tenderer must accept these commercial conditions in their entirety without reservations.

If a Tenderer find any commercial conditions and/or any requirements cost-driving or unreasonable it is important to notify SMA as early as possible during the tendering period using the Q/A-function in TendSign

2.8 Remuneration for submitting tenders

SMA will not accept any costs or expenses incurred by the Tenderers in connection with the tendering process, for example for preparation or submission or in the evaluation of the tender.

2.9 Opening of tenders

Tenders will be opened electronically on the next weekday after the last day for submission of tenders.
3 Examination and evaluation of tenders

3.1 Examination
Based on submitted tenders, SMA will examine whether all Shall-requirements are fulfilled. Tenders that do not fulfil all Shall-requirements will be excluded from contract award.

3.2 Tender price

3.2.1 Maximum price
Since all Tenderers will be awarded contracts SMA has set a maximum tender-price. This is to prevent a situation where a high priced tender could be awarded thus decreasing the number of the systems deployed.

The maximum price for a ship system will be 6 000 Euro. Any tender with a higher price will be disqualified.

3.2.2 Tender sum

<table>
<thead>
<tr>
<th>Item</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation and configuration of STM ship system. All costs shall be included</td>
<td>per ship system exclusive VAT (Maximum price accepted is 6 000 Euro)</td>
</tr>
<tr>
<td>Hourly rate for development, adjustment to the System or other needs. Only applies to projects separately ordered by the Purchaser.</td>
<td>per hour exclusive VAT</td>
</tr>
<tr>
<td>Optional cost for the purchase of an additional amount of transmission data</td>
<td>per MB exclusive VAT</td>
</tr>
<tr>
<td>Currency (Euro or SEK)</td>
<td></td>
</tr>
</tbody>
</table>

3.2.3 Currency
Prices may be offered in Euro or in SEK.
To be able to compare prices with regard to the principle of equal treatment the exchange rates at the last day of submission of tenders will be used. The following web-site will be used:
http://www.nordea.se/foretag/utland/valutahantering/valutakurser.html#tab=Betalningskurs
On the website the selling exchange rate (Säljkurs) will be used.

Please observe that the above procedure will only be used for evaluation purposes. Actual payments during the project is not affected by the above.

3.3 Evaluation

The evaluation is carried out on the principle “financially most advantageous” which means that both price and should-requirements are considered, as described in the following sections.

The evaluation will be performed according to a Value of Quality (VoQ) model (the value of fulfilled should-requirements), as per below:
Tender sum – (minus) deductions for VoQ = Comparative value

The Tender sum is a monetary sum as described below, consisting of costs related to the system. Tenders receive deductions for VoQ by fulfilling should-requirements, also described below.

Please note that the tender sum as well as deductions for VoQ constitute a fictive model for awarding the contract, they do not influence the prices or scope of the awarded contract.

The evaluation will be made in SEK using the web-site as described.

3.3.1 VoQ
In the below chart the should-requirements for VoQ are listed.

Please note that if a tender fulfils a should-requirement and the tender is given an additional value in the evaluation, the Tenderer is bound to fulfil the should-requirement when delivering.

Please note that the quantities of hourly rate and additional amount of transmission data that will be evaluated are only fictional quantities for the evaluation process.

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity that will be evaluated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deployment of the abilities for one ship according to the scope in section 1.4. All costs shall be included</td>
<td>1 ship system</td>
</tr>
<tr>
<td>Hourly rate for development, adjustment to the System or other needs. Only applies to changes/amendments separately ordered by the Purchaser.(^1)</td>
<td>1 hour</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Criteria</th>
<th>VoQ if fulfilled (Euro)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-2.1:12</td>
<td>270</td>
</tr>
<tr>
<td>R-3.2:4</td>
<td>210</td>
</tr>
<tr>
<td>R-3.2:5</td>
<td>180</td>
</tr>
<tr>
<td>R-3.2:6</td>
<td>210</td>
</tr>
<tr>
<td>R-3.4:5, R-3.4:6 and R-3.6:2(^2)</td>
<td>240</td>
</tr>
<tr>
<td>R-3.4:16</td>
<td>240</td>
</tr>
<tr>
<td>R-3.5:2</td>
<td>180</td>
</tr>
<tr>
<td>R-3.5:5</td>
<td>240</td>
</tr>
<tr>
<td><strong>Maximum VoQ</strong></td>
<td><strong>1 770 Euro</strong></td>
</tr>
</tbody>
</table>

\(^1\) See change request as described in chapter 18 in Main contract

\(^2\) All 3 requirements must be fulfilled to give VoQ
3.3.2 Example of evaluation
To illustrate how the evaluation will be carried out an fictitious example is shown below.
A tendererer has given a price per ship of 37 500 SEK and an hourly rate of 1050 SEK.
Using the web-site (Nordea) gives an exchange rate of 9.2777 SEK/Euro (the example is made 2016-05-11)
The comparative price will then be 4042 Euro for the ship-system and the hourly rate will be 113 Euro.

<table>
<thead>
<tr>
<th>Prices</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Price per ship system</td>
<td>4042 Euro</td>
</tr>
<tr>
<td>Price per hour</td>
<td>113 Euro</td>
</tr>
<tr>
<td>Total price</td>
<td>4 155 Euro</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Fulfilled</th>
<th>VoQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-2.1:12</td>
<td>yes</td>
<td>270</td>
</tr>
<tr>
<td>R-3.2:4</td>
<td>no</td>
<td>0</td>
</tr>
<tr>
<td>R-3.2:5</td>
<td>no</td>
<td>0</td>
</tr>
<tr>
<td>R-3.2:6</td>
<td>yes</td>
<td>210</td>
</tr>
<tr>
<td>R-3.4:5, R-3.4:6 and R-3.6:2</td>
<td>yes</td>
<td>240</td>
</tr>
<tr>
<td>R-3.4:16</td>
<td>yes</td>
<td>240</td>
</tr>
<tr>
<td>R-3.5:2</td>
<td>no</td>
<td>0</td>
</tr>
<tr>
<td>R-3.5:5</td>
<td>yes</td>
<td>240</td>
</tr>
<tr>
<td>Total given VoQ</td>
<td></td>
<td>1 200 Euro</td>
</tr>
</tbody>
</table>

Comparative value | 2955 Euro |

The Tenderer who receives the lowest comparative value has offered the financially most advantageous tender and will be given first place in the procurement.

3.4 Contract award distribution key
Contracts will be awarded to all Tenders that fulfil all Shall-requirements. Tenders that receive a lower Comparative value will be prioritised when allocating the number of ships

The number of ships will be allocated using the distribution key shown below.

<table>
<thead>
<tr>
<th>Number of tenderers</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>2</td>
<td>60%</td>
<td>40%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
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</table>
All tenderers shall in the Tender Form state the maximum number of systems a tenderer has capacity to deploy. As an example, if a Tenderer has the capacity of deploying 30 ships but could be awarded 60 ships if the tenderer had sufficient capacity, the 30 excess ships will be distributed to the other Tenderers.

Please note that the Tenderer must deploy the same number of ship systems under the contract as the maximum number of ship systems stated in the Tender Form.

Please note that the Comparative value and the VoQ are only fictive values used for evaluation purposes, and does not affect the Suppliers prices in the Agreement.

3.5 Decision
A decision regarding the procurement will be made by SMA – a tendering award - and will be communicated in writing to all Tenderers prior to the procurement Agreement being signed. Agreements may be signed at the earliest 10 days after the decision has been made known (Stand Still period).

4 Confidentiality
Details provided in procurement matters are considered confidential in accordance with the Swedish Public Access and Secrecy Act (2009:400) until such time as a decision is made and the procurement is made public, or the procurement is terminated. This means that details provided in procurement matters are only released to those requiring such information for the completion of work due to the procurement. At such time as the procurement is made public, it is standard practice for all details to be considered official and open documentation.

4.1 Commercial confidentiality
Details may, in certain cases, continue to be considered confidential even after the procurement is made public. Tenderers may claim commercial confidentiality for information pertaining to business or operational matters, and where there is particular reason to assume that disclosure of such information could damage the Tenderer.

In those cases where Tenderers consider that the details provided in the procurement process satisfy that which is required for commercial confidentiality, the Tenderer may submit a request for such. Such a request must contain a specification of which details are being referred to, as well as the damage that aforementioned details could incur in the event of disclosure. Please note however that information supplied for the purposes of tender evaluation can only be granted commercial confidentiality in exceptional circumstances. In those cases where Tenderers choose to request commercial confidentiality regarding parts of their tender, the below form must be used.

Do the Tenderer request part of the information in the tender to be granted commercial confidentiality?
Yes [ ] No [ ]

If Yes, which part or parts are requested to be granted commercial confidentiality?

Motivation to the request (Describe the damage which could occur if the information is revealed)
5 Signing of Tender

By signing of this tender form all requirements and conditions in the tender invitation including all appendices are accepted.

Please observe that this page must be printed, signed and uploaded together with all other required tender document in Tendsign!

Place and date

________________________________________
Signature:

Printed name

_________________________________
Document No: Appendix 1
Title: STM Ship system technical specification and tendering form
Date: 2016-05-16
### DOCUMENT STATUS

#### Authors

<table>
<thead>
<tr>
<th>Name</th>
<th>Organisation</th>
</tr>
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<tbody>
<tr>
<td>Björn Andreasson</td>
<td>Swedish Maritime Authority</td>
</tr>
<tr>
<td>Håkan Heurlin</td>
<td>Swedish Maritime Authority</td>
</tr>
<tr>
<td>Per Setterberg</td>
<td>Swedish Maritime Authority</td>
</tr>
<tr>
<td>Torbjörn Grape</td>
<td>Swedish Maritime Authority</td>
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<td>Per Löfbom</td>
<td>SMA</td>
</tr>
<tr>
<td>Per DeFlon</td>
<td>SMA</td>
</tr>
<tr>
<td>Mikael Olofsson</td>
<td>Combitech AB</td>
</tr>
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</table>

#### Approval

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The sole responsibility of this publication lies with the author. The European Union is not responsible for any use that may be made of the information contained therein.
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1 Summary

1.1 General

This document contains the technical requirement for the procurement of STM ship system within the scope of the STM Validation Project. The document describes the scope of the required functional and technical characteristics of the systems. The technical specifications, APIs and xml-codes are anticipated to be accurate but some are yet to be prototyped. This means that minor updates might be necessary. Latest updates to the specifications will be presented at the latest before the negotiation phase of the tender is commenced in order to tenderers to take updates into consideration in their final bid.

1.2 Definitions

1.2.1 Terminology for denoting a requirement

The following requirement is valid throughout this document:

- A mandatory requirement is denoted with the word “shall” and must be fulfilled.
- A criteria is denoted with the word “should” and gives added value in the evaluation if fulfilled.

All requirements are labeled with R-X.Y:Z, where X.Y is the current chapter number and Z is a consecutive numbering to separate each requirement within the chapter. There can be several “shall” or “should” in one numbered requirement, which means that all must be fulfilled in order for the requirement to be fulfilled. Descriptive text occurs throughout the document but is not labeled.

1.2.2 Select, turn-on, set etc.

All functions that are said to be selectable, turned-on, set, etc. will implicitly also be said to be the reverse, i.e. de-selected, turned-off, de-set, etc. unless specified explicitly to something else.
In this chapter the requirements that cannot be categorized into one or more of the 5 different components of the STM ship system as depicted in Figure 1 below, is stated.

R-2.1:1 The Tenderer shall supply SMA with a system description that describes the configuration and functionalities of the whole STM ship system (including communication with the online access point) the system description shall be based on the use cases provided in the procurement documentation

<table>
<thead>
<tr>
<th>Is above &quot;shall&quot; requirement fulfilled?</th>
<th>Yes ☐</th>
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<tr>
<td>How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):</td>
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</table>

R-2.1:2 The System Design Review (SDR) of the STM ship system at Milestone 1 Shall be based on the use cases provided in the procurement documentation

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<thead>
<tr>
<th>Is above &quot;shall&quot; requirement fulfilled?</th>
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<tr>
<td>How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):</td>
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</tbody>
</table>
The Tenderer of STM ship system **shall** at milestone 2 prove that the ship system can exchange .rtz, port call message (pcm), text- and area message with the Voyage Information Service (VIS) instance run by SMA, according to the use cases which the FAT procedure handbook **shall** be based on.

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<tr>
<th>Requirement</th>
<th>Fulfillment</th>
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<td>Is above “shall” requirement fulfilled?</td>
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The Tenderer **shall** be fully responsible of recruiting ships for system installation.

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<th>Requirement</th>
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<td>How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):</td>
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</table>

The Tenderer **shall** provide a list of ships that are appropriate test ships for STM validation project (see R-2.1:12 for details).

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<th>Requirement</th>
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<td>How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):</td>
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**R-2.1:6**

The Tenderer **shall** at Milestone 1 have a demonstration plan from each shipping company that are listed in the list above, the demonstration plan should include which STM services the company intend to use.

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<th>Is above “shall” requirement fulfilled?</th>
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How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):

**R-2.1:7**

The Tenderer **shall** provide a Draft Project Management Plan (with dates) including development, SDR, FAT, SAT and installation.

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<th>Is above “shall” requirement fulfilled?</th>
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How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):

**R-2.1:8**

The Tenderer **shall** be fully responsible for the installation of the STM ship systems on the ships.

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How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):
R-2.1:9

The installed STM ship systems **shall** have an operational and functional availability, end-to-end, of at least 328 days in a 365 days period (90%), this availability requirement is calculated as an average on all the recruited ships by one tenderer.

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R-2.1:10

*Tenderer shall* be responsible for decommissioning and removal of the STM ship systems (only if deemed necessary by ship owner or tenderer)

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R-2.1:11

*The Tenderer shall* conduct appropriate training and provide documentation (manual) for onboard equipment users.

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</table>
The ships recruited by the Tenderer **should** operate at regular intervals within the area of the STM validation project testbed regions (Mediterranean and/or Nordic (Baltic, Skagerrak, Kattegat and Norwegian coast)). If ships are sold or shift to a trading area outside the testbed regions, there will be no further requirements from SMA on recruiting replacement ships.

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3 Functional/Technical Requirements

3.1 STM Ship system overall description

At least one ECDIS workstation on the ship’s bridge shall be able to interact with the STM Module. The main functions are; to receive voyage plan (VP) for further processing until used for navigation, to send the VP used for navigation to the STM Module, to send ETA to the STM Module.

Communication between the ECDIS and the STM Module will ensure that the maximum possible degree of consistency in upheld between information held in the ECDIS and the STM Module. If information consistency decreases due to the status of communication link between the ECDIS and the STM Module the communication status and the age of information shall be known by both ends.

The STM Module is a set of software functions on some hardware located on the ship’s bridge. The STM Module may be integrated in the ECDIS, if certification allows, it may be integrated into an existing planning station or it may be running on a dedicated device which is supplied by the supplier.

Communication between the STM Module and Online access point will ensure that the maximum possible degree of consistency in upheld between information held in the STM Module and at the Online access point, depending on the online status of the ship. If information consistency decreases due to the status of communication links with the ship, the communication status and the age of information shall be known by both ends. If the ship is online but the bandwidth does not allow transfer of payloads, the receiving end shall be aware of that new information is stored in the sending end.

The online access point is constantly and stably connected to the internet and represents the ship towards other actors and services. The main functions in the online access point are the VIS, Port Information Service and the SeaSWIM Connector Service (SSCS). The Online access point may be implemented onboard the ship or at another location. Each VIS is attached to one (1) SSCS and each ship has one (1) VIS instance.
3.2 ECDIS functionality

R-3.2:1

The STM ship systems shall be able to send and receive route segment ship to ship via AIS, ASM message (8), according to appendix: Route message format version 1.0. The STM ship system shall be able to present route segment accordingly in ECDIS.

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How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):

R-3.2:2

In the STM ship system it shall be possible to make a default choice that the route segments will be shared or not, with other STM-ships.

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How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):

R-3.2:3

The STM ship system shall be able to present, via ASM message (8), according to appendix: Route message format (version1.0), info/flag on AIS targets that participates in STM test beds.

| Is above "shall" requirement fulfilled? | Yes ☐ |
STM ship systems **should** be able to calculate CPA and intersection points between own/other-ships route segments (including leg speed), even if the routes are not crossing each other.

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How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):

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**R-3.2:5**

If a ship is deviating from its intended route (exceeding pre-set limits, geographically and in time, set by own ship), that **should** somehow be presented on own ships STM ship system.

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How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):

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**R-3.2:6**

*It **Should** be possible to do some kind of “Trial Manoeuvre” including own and other ships routes (including leg speed)*

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The ECDIS shall be able to upload and download VP to and from the STM Module

Is above "shall" requirement fulfilled?  Yes

How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):
3.3 Communication between STM Module and ECDIS

R-3.3:1

The communication between the STM Module and ECDIS Shall have Information consistency (e.g. ship receives a VP in the STM module, accepts it, then the operator shall be able to choose it for monitoring in ECDIS, it shall then be identical to the one in the STM module).

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How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):
### 3.4 STM Module

**R-3.4:1**  
*STM module shall be able to send, receive and show text messages to/from other STM actor according to “STM text format”, in SeaSWIM technical specification appendix (e.g. Text body, Message subject, receiver id (actor id), sender id (actor id), reference to information object ID (e.g. UVID))*

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How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):

**R-3.4:2**  
The **STM module shall include the functionality to communicate the following (but not limited to) to and from VIS**

- Publish VP to VIS
- Retrieve VP proposals from VIS
- Send and receive VP, Area- and text messages to other STM services through VIS

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<th>Is above &quot;shall&quot; requirement fulfilled?</th>
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How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):
The STM module **shall** include the functionality to show, create, edit and save VP. **It shall** be possible to graphically clearly distinguish received VP updates, e.g. route suggestions.

Is above “shall” requirement fulfilled? | Yes ☑️
---|---
How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):

R-3.4:3

The STM module **shall** be able to set VP status (by operator) according to .rtz format in SeaSWIM technical specification appendix.

Is above “shall” requirement fulfilled? | Yes ☑️
---|---
How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):

R-3.4:4

STM module **should** be able to communicate states with Port Information Service (PIS)

Is above “should” requirement fulfilled? | Yes ☑️
---|---
How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):
The STM module **should** include the functionality to retrieve and display the following states according to PCM format in SeaSWIM technical specification:

- Planned time of arrival (PTA), Estimated time of arrival (ETA) to PIS
- Recommended time of arrival (RTA) retrieved from PIS

Interface according to PIS specification, Appendix-7

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<th>Is above &quot;should&quot; requirement fulfilled?</th>
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</table>

**R-3.4.7**

*OOO shall be made aware of relevant events such as incoming messages (VP updates, text messages new RTA etc.)*

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**R-3.4.8**

*Events in the system shall be stored and logged for later evaluation. Events could include, but are not limited to: system downtime (excluding communication), operator actions such as: Number of STM Module - VIS/PIS exchanges.*

| Is above “shall” requirement fulfilled? | Yes ☑ |
How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):

R-3.4:9

*The STM Module shall be able to upload and download VP to/from the ships ECDIS*

<table>
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<tr>
<th>Is above “shall” requirement fulfilled?</th>
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</table>

How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):

R-3.4:10

*Operator shall be able to search for services in STM module acc. to VIS spec. Based on attributes available in service registry*

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<tr>
<th>Is above &quot;shall&quot; requirement fulfilled?</th>
<th>Yes ✓</th>
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How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):

R-3.4:11

*STM module shall be able to store lists of services (for offline purposes)*

| Is above "shall" requirement fulfilled? | Yes ✓ |
How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):

R-3.4:12

Operator shall be able to give access to actors in STM module acc. to identity in service registry. Based on attributes available in service registry. See VIS specification

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<th>Is above “shall” requirement fulfilled?</th>
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How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):

R-3.4:13

Operator shall on the STM module be able to assign/remove access rights on VP to actors according to VIS specification

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<th>Is above “shall” requirement fulfilled?</th>
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How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):

R-3.4:14

STM module shall be able to inform operator of which actors that have been given access rights to VP
There **shall** be a functionality in the STM Module to correlate transaction sequences irrespective payload format e.g. a text message shall be correlated to a VP

The **STM ship systems should** handle real time calculation (including schedule) of ETA and or STG (Speed To Go to reach a WP at a given time) to one or more selected WP(s) (e.g. arrival traffic area or Pilot Boarding Position) along the route, a Flow Point (FP), not necessarily the last waypoint in the route.
### 3.5 Communications between the STM Module and Online access point

**R-3.5:1**  
The STM ship system **shall** be able to log outgoing and incoming “STM data traffic” (Bytes). See STM Data Communication Annex-A in this document

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<th>Is above &quot;shall&quot; requirement fulfilled?</th>
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<td>How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):</td>
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**R-3.5:2**  
The STM ship system **should** log availability to online access point (the time when it’s possible to communicate)

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<tr>
<th>Is above &quot;should&quot; requirement fulfilled?</th>
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<td>How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):</td>
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</table>

**R-3.5:3**  
Each recruited ship **shall** be equipped with a data link to the access point. This can either be an existing data link which is allowed to use for the tests, or a dedicated link installed by the supplier. The Tenderer shall include 200MB of data traffic in the tender price.
Each recruited ship **shall** have data link connectivity between the STM Module and the Online access point. The connectivity has the ability to be continuous with adequate capacity according the following: Communication between the STM Module and Online access point ensures that the maximum possible degree of consistency is upheld between information held in the STM Module and at the Online access point, depending on the online connectivity status of the ship.

Further, the communication link supports, but not limited to, all use cases in Appendix 5 – STM Voyage Management use cases and is able to handle all data transfers in minimum near real-time. All communication has security measures, in order to protect the information from unauthorized access. The connectivity is functional within, but not limited to, coastal waters of the ship’s normal area of operation.

Each recruited ship **should** have data link connectivity between the STM Module and the Online access point additional to the requirement [R-3.5:4] the following: The connectivity is functional within coverage of the ship’s entire normal area of operation with the most cost effective means of communications, i.e. terrestrial and satellite communication.
<table>
<thead>
<tr>
<th>Is above “should” requirement fulfilled?</th>
<th>Yes □</th>
</tr>
</thead>
<tbody>
<tr>
<td>How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):</td>
<td></td>
</tr>
</tbody>
</table>
3.6 Online access point (VIS/PIS including SSCS)

R-3.6:1  *Online access point shall* hold a VIS instance that is the internet connected representation of the ship, the VIS shall represent the ships VP towards other actors via a SSCS

<table>
<thead>
<tr>
<th>Is above &quot;shall&quot; requirement fulfilled?</th>
<th>Yes ☐</th>
</tr>
</thead>
<tbody>
<tr>
<td>How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):</td>
<td></td>
</tr>
</tbody>
</table>

R-3.6:2 *Online access point should* hold a PIS instance that is the internet connected representation of the ship, the PIS shall represent the ship in port-call synchronization interactions towards other actors via a SSCS

<table>
<thead>
<tr>
<th>Is above &quot;shall&quot; requirement fulfilled?</th>
<th>Yes ☐</th>
</tr>
</thead>
<tbody>
<tr>
<td>How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):</td>
<td></td>
</tr>
</tbody>
</table>

R-3.6:3 *Online access point shall be able to expose and consume* (to other STM actors) rtz-format, PCM-format, S124-format and text format using VIS/PIS, see appendices (3 and 4)

| Is above "shall" requirement fulfilled? | Yes ☐ |
The STM ship system **shall** be able to give the VP an Unique Voyage ID (UVID) using the maritime resource name (mrn) structure, e.g. "urn:mrnx:stm:voymgt:uvid:"<uvispid>:"<localid>" as described in SeaSWIM Specification and VIS Specification. The functionality to create UVID based on a localid will be included in the project-common VIS provided by SMA but may also be integrated into any component provided by tenderer. (If solution where VIS adds the UVID prefix the requirement on the STM module is to establish localid only according to specification)

<table>
<thead>
<tr>
<th>Is above “shall” requirement fulfilled?</th>
<th>Yes ✅</th>
</tr>
</thead>
</table>

How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):

---

**R-3.6:5**

*Online access point shall be permanent internet connected*

<table>
<thead>
<tr>
<th>Is above &quot;shall&quot; requirement fulfilled?</th>
<th>Yes ✅</th>
</tr>
</thead>
</table>

How is above requirement fulfilled, if needed, refer to System description or other documentation (Page and Bullet):
# Annex-A

## STM data communication estimates

<table>
<thead>
<tr>
<th>Actual price level (2015)</th>
<th>Comment</th>
<th>Kb</th>
<th>Freq/day</th>
<th>Total</th>
<th>F77</th>
<th>BB 150/250/300</th>
<th>VSAT</th>
<th>Thuraya</th>
<th>Iridium</th>
<th>Global Star</th>
<th>COST per Kb €</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Payload</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voyage Plan (rtz)</td>
<td>3 route updates per day (incl cross-check, optimization and change of ETA). More seldom on open sea, more frequent last 24 hours.</td>
<td>5</td>
<td>3</td>
<td>15</td>
<td>0,26</td>
<td>0,26</td>
<td>0</td>
<td>0,08</td>
<td>0,18</td>
<td>0,13</td>
<td></td>
</tr>
<tr>
<td>Port call format (PCMF)</td>
<td>Number of interactions is up to ships decision. More seldom on open sea, more frequent last 24 hours. Only applicable on calls to PortCDM ports in the test beds. The frequency is an estimated average taking this into consideration</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>0,07</td>
<td>0,07</td>
<td>0</td>
<td>0,02</td>
<td>0,05</td>
<td>0,03</td>
<td></td>
</tr>
<tr>
<td>STM text message format</td>
<td></td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>0,04</td>
<td>0,04</td>
<td>0</td>
<td>0,01</td>
<td>0,02</td>
<td>0,02</td>
<td></td>
</tr>
<tr>
<td>Area exchange format</td>
<td>Not expected to be used frequently.</td>
<td>2</td>
<td>0,5</td>
<td>1</td>
<td>0,02</td>
<td>0,02</td>
<td>0</td>
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<td>0,01</td>
<td>0,01</td>
<td></td>
</tr>
<tr>
<td>Cost per day/Ship</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost per year/Ship</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0,878</td>
</tr>
</tbody>
</table>

Viscon notes:
Sources: VISCON, Cordland Marine, Internet.
Retrospective analysis over the last 15 years shows that prices are in the same level, but usage of data have increased in average with shipping companies.
1) F77 End of service 2017.
39 partners from 13 countries
containerising maritime information

Demonstrating the function and business value of the
Sea Traffic Management concept and its services.
Seaing is believing!

SAFETY - ENVIRONMENT - EFFICIENCY

Swedish Maritime Administration ◦ SSPA ◦ Viktoria Swedish ICT ◦ Transas ◦ Chalmers University of Technology ◦ The Swedish Meteorological and Hydrological Institute ◦ Danish Maritime Authority ◦ Navicon ◦ Novia University of Applied Sciences ◦ Fraunhofer ◦ Jeppesen ◦ Carnival Corp. ◦ Italian Ministry of Transport ◦ SASEMAR ◦ Valencia Port Authority ◦ Valencia Port Foundation ◦ CIMNE ◦ University of Catalonia ◦ Norwegian Coastal Administration ◦ GS1 ◦ Cyprys University of Technology ◦ Port of Barcelona ◦ Costa Crociere ◦ Svitzer ◦ OFFIS ◦ Finnish Transport Agency ◦ Southampton Solent University ◦ Frequentis ◦ SAM Electronics ◦ University of Flensburg ◦ Signalis ◦ Maritiem Instituut Willem Barentsz ◦ SAAB TransponderTech AB ◦ University of Oldenburg ◦ Magellan ◦ Furuno Finland ◦ Rörvik ◦ University of Southampton ◦ HiQ

www.stmvalidation.eu

Co-financed by the European Union
Connecting Europe Facility
Main Contract

between

the Swedish Maritime Administration

and

[Leverantörsnamn]

for

Installations of Sea Traffic Management (STM) Ship System prototypes for the STM Validation Project.
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<td>13.1</td>
<td>Term</td>
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<td>13.2</td>
<td>Termination for default</td>
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<tr>
<td>14</td>
<td>Force majeure</td>
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<td>15</td>
<td>Notices and requests</td>
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<tr>
<td>16</td>
<td>Modifications and improvements</td>
</tr>
<tr>
<td>17</td>
<td>Amendments, changes and additions</td>
</tr>
<tr>
<td>18</td>
<td>Applicable law</td>
</tr>
<tr>
<td>18.1</td>
<td>Applicable law</td>
</tr>
<tr>
<td>18.2</td>
<td>Dispute</td>
</tr>
<tr>
<td>18.3</td>
<td>Assignment</td>
</tr>
<tr>
<td>19</td>
<td>Signing</td>
</tr>
</tbody>
</table>
Main Contract

1 Whereas

The Swedish Maritime Administration (SMA) is a governmental agency and enterprise within the transport sector and is responsible for maritime safety and availability. This means a collective responsibility for achieving the government’s transport and economic policy goals in the field of shipping. The goals of the transport policy, guiding our operations, are to attain an accessible transport system, a high level of transport quality, secure shipping, a favourable environment, positive regional development and an equitable transport system.

SMA’s services include, for example:

- Pilotage
- Fairway Service
- Maritime Traffic Information
- Icebreaking
- Hydrography
- Maritime and Aeronautical Search and Rescue
- Seamen’s Service

Our activities focus primarily on merchant shipping, but also take the pleasure boating and fishing interests into account.

1.1 Background

Based on MONALISA (2010-EU-21109-S) and MONALISA 2.0 (2012-EU-21007-S), see www.stmvalidation.eu, significant steps have been taken in bringing advancements in technology and innovation into the maritime sector. Both projects have defined and tested core STM components and shown very promising results.

The STM concept sets a focus upon enabling safe, sustainable, and efficient sea transports. STM is a response to the need to increase efficiency in operations within and between ports. The concept takes a holistic approach to services putting the berth-to-berth voyage in focus and uses that as a core element for process optimisation, stakeholder interaction and information sharing. An enhanced sharing of information ship-to-ship, ship-to-shore, and shore-to-shore is also an important enabler for increased situational awareness and safety during sea transports. STM has already shown that substantial savings of bunker costs could be earned and that high utilization of resources of the facilities in ports can be reached while the degree of safety is increased.

The information sharing principles in STM leads to improvements in

- Predictability of arrivals and departures enabling better planning for all parties
- Just in time operations by better predictability and information sharing in and between ports and ships
- New innovative services that are non-vendor dependent, interoperable and with low cost
- Situational awareness – knowing others intentions optimises resource utilisation and reduces number of accidents
The next step in this development, Fig. 1, is to validate the STM Target Concept. This is mainly done in the STM Validation Project, running from 2015 to 2018, by establishing large-scale test beds in order to test and validate different STM concepts. The output will be a validated target concept for STM and additional quantitative and qualitative support for the broader development of STM.

Fig. 1 The Development, Validation, and Deployment of STM

1.2 STM Validation Project

The STM Validation Project, see project information brochure, co-financed by the EU (Connecting Europe Facility/Motorways of the Sea) shall demonstrate and validate STM by using the European Maritime Simulator Network and by establishing large-scale test beds in both the Nordic and Mediterranean Seas, encompassing 300 ships and 13 ports. Key strategic services of STM will be tested and validated. The project encompasses:

- **Validation of Voyage Management** in two test beds. In the Nordic region, the application of STM for more efficient winter navigation will be tested and validated. In the Mediterranean Sea, the application of STM for crisis management (i.e., Search and Rescue) will be tested and validated.

- **Validation of Flow Management** utilizing the European Maritime Simulator Network and the test beds for Voyage Management. This simulator network was developed within the MONALISA 2.0 project and will be used both to simulate different traffic conditions and further test and validate other parts of STM, which are not possible to test and validate in real life at this stage, such as area management.

- **Validation of Port Collaborative Decision Making** (Port CDM) by expanding the network of ports and Port CDM services developed in MONALISA 2.0 in the Nordic and Mediterranean regions. The contextual differences between different port approaches will be gathered and analyzed, together with other information that will serve as a basis for the concept’s refinement. The test beds will also constitute a first step towards inviting both commercial and public service developers/distributors to further develop Port CDM Services.

- **Validation of System Wide Information Management** (SeaSWIM) using the Maritime Cloud as the infrastructure for information exchange in the validation test beds.

Extensive Analysis and Evaluation will be carried out and the different perspectives used in MONALISA 2.0: business, socio-economic, risk, technological, legal and institutional will be incorporated. Competencies and training requirements for STM implementation will also be considered within this activity.

The results from testbeds, which involve rigorous, transparent and replicable testing of, for example, route
exchange, route optimization, scientific theories, computational tools and new technologies. As there are linkages between STM and IMO’s e-navigation Strategy Implementation Plan (SIP), these test beds would allow for early detection of new system functionality, operational usability, areas of enhancement and identification of weakness. The results will be submitted to IMO in accordance with the format outlined in MSC.1/Circ.1494 on Guidelines on Harmonization of Testbed Reporting. The results of the project will thus also form the basis for policy making, further research and development of STM services and concepts and pre-deployment of STM services and concepts.

This Agreement is a part of the STM Validation Project. The project includes fulfillment of the terms of the Grant Agreement (GA) ([https://ec.europa.eu/inea/sites/inea/files/model_grant_agreement_en.pdf](https://ec.europa.eu/inea/sites/inea/files/model_grant_agreement_en.pdf)) whereby the European Commission has decided to award a grant for the STM Validation Project. The following parts of the GA should therefore also apply to this Agreement.

II.3 – LIABILITY FOR DAMAGES
II.4 – CONFLICT OF INTERESTS
II.5 – CONFIDENTIALITY
II.8 – PRE-EXISTING RIGHTS AND OWNERSHIP AND USE OF THE RESULTS (INCLUDING INTELLECTUAL AND INDUSTRIAL PROPERTY RIGHTS)

2 Parties

This contract (the “Main Contract”) is made on the xx of xx 2016 (the “Effective Date”) between:

Sjöfartsverket – the Swedish Maritime Administration, with organization number 202100-0654, a central administrative authority organized under the laws of Sweden, having its principal office at Östra Promenaden 7, 602 78 Norrköping, Sweden (hereinafter referred to as “SMA”);

And

[Leverantörsnamn], with organization number XXXXX, having its principal office at [Leverantörens fullständiga adress] (hereinafter referred to as “the Supplier”).

SMA and the Supplier are hereinafter sometimes individually referred to as “Party” or collectively as “Parties”.

3 Contract documents

3.1 Precedence

This Contract consists of the Main Contract (this document) and its appendices, which are, by this reference, hereby incorporated into this Contract, all as amended from time to time as provided herein. In case of a conflict the Main Contract shall take precedence over its appendices.

3.2 Appendices

Should information in appendices be contradictory, the appendices shall apply in the order in which they are numbered and listed below:

1. The SMA’s tendering documentation, including amendments and clarifications both to the tendering documentation and to the Suppliers offer as persub-appendices:
   a. Questions and Answers
   b. Amendments to procurement documentation
2. The Suppliers Tender
3. The Suppliers Application documents

4 Suppliers undertakings and system responsibility

4.1 Suppliers undertakings

The Supplier undertakes to design, develop, and install the Sea Traffic Management (STM) ship system prototypes for the STM Validation Project, fully compliant with Appendix 1, The SMA’s tendering documentation, and to maintain those systems operational throughout the test period which runs until 31
December 2018.

The undertaking includes all undertaking described in Requirements appendix.

The Supplier is also responsible for managing any required implementation activities, training and giving advice in how the system should be used to reach the best quality and efficiency. The contract should include required licenses as well as support and maintenance.

The Supplier is fully responsible for a fully setup System ready for deployment, and fully responsible for deploying the System. The delivery includes all components, software, and licenses for the System. The Supplier is also fully responsible for support during the test period.

4.2 System responsibility

The Supplier shall have responsibility for the fully satisfactory function of the complete System throughout the test period. The Supplier shall have full responsibility for design even if design proposals are put forward by SMA. SMA’s approval of drawings, designs or products and services does not constitute a discharge of the Supplier from his design and system responsibility.

4.3 Specifications

The Supplier shall deliver the System in accordance with this Contract.

4.4 Delivery requirements

The Supplier will manage and coordinate all parties involved in the Implementation project as well as the interface to SMA.

The implementation project will be executed in close cooperation with SMA to assure that the high quality in the System and deployment is achieved.

4.5 Subcontractors

The engagement by the Supplier of any subcontractor shall not relieve the Supplier from any liabilities or obligations under this Contract and the Supplier shall be responsible for any acts or omissions of any subcontractor as if they were acts or omissions of the Supplier.

The Supplier shall ensure that the terms and conditions of this Contract are reflected in all subcontracts, if any, to the extent necessary to enable the Supplier to fully meet his obligations to SMA. Such terms and conditions include, but are not limited to, technical, functional and operational requirements and technical specifications; time of delivery; warranty terms; and quality control.

4.6 Subcontractors substitution

The Supplier may not substitute the subcontractors identified in scope of delivery without informing SMA in advance of such substitution and receiving SMA’s written approval. Such approval shall not be unreasonably withheld.

5 SMA’s undertaking and responsibilities

SMA is responsible for the following undertakings:

- SeaSWIM central services
  - Service Registry, including registration of service instances in the Service Registry
  - Identity Registry, including registration of organizations in the Identity Registry and provide credentials for an administrative login in the Identity Registry (after registration each organization will be able to create and maintain own entities).
• SeaSWIM connector service\(^1\), Voyage information service and Port Information Service
  
  These three services will be provided as three different alternatives
  
  o SSCS implementation run by SMA (to facilitate the test bed)
  o SSCS open source code for tenders own implementation
  o SSCS specification for tenders own implementation

• Issuing of identity name spaces according to Unique Identification chapter in SeaSWIM specification

6  Project overview

6.1  Scope

The implementation project includes all activities to reach final acceptance. It includes project management, product training and solving problems identified during acceptance tests.

6.2  Contractual milestones

Milestone 1: System Design Review

The Supplier shall perform a System Design Review (SDR) and produce and deliver the documentation specified below as part of its undertakings. The purpose of the System Design Review is for SMA and the Supplier to jointly agree on the scope of the delivery and the fundamental technical design of the STM Ship Systems.

The System Design Review, including documentation, shall be approved by SMA before the Supplier may proceed towards the next Contractual Milestone. SMA shall approve or reject the System Design Review, including documentation.

Documentation to be, but not limited to, included in the SDR delivery:

• Updated Project Management Plan (PMP)
• Updated System solution description
• List and installation plan of recruited test ships
• Factory Acceptance Test (FAT) procedure book
• Site Acceptance Test (SAT) procedure book
• Installation test protocol
• Demonstration of progress within hardware and software development

Milestone 2 and 3: Acceptance Tests

The Supplier shall carry out the inspection and Acceptance Tests of the STM Ship System as a Factory Acceptance Test (FAT) (Milestone 2) and a Site Acceptance Test (SAT) (Milestone 3).

Milestone Acceptance shall be issued by SMA without undue delay upon successful execution of an Acceptance Test.

Each Party shall be responsible for any and all costs incurred by its representatives in attending the inspection and Acceptance Tests.

An Acceptance Test cannot be completed successfully if it results in a defect or in a deficiency. A defect prevents SMA from using the STM Ship System for its intended purpose and thereby the normal operation of the STM Ship System. A defect must be corrected before the Acceptance Test is re-started or continues.

\(^1\) Cimne maintains the Intellectual property on the SSCS code based on the openSource GPL Rules. This means that any use or improvements of the code must be referenced to Cimne.
A deficiency will not prevent SMA from using the STM Ship System for its intended purpose or the normal operation of the STM Ship System and the Acceptance Test continues.

In addition to the inspection and Acceptance Tests specified above, SMA shall have the possibility of free-testing for the benefit of both SMA and the Supplier.

**Factory Acceptance Test (FAT)**

The FAT shall verify that the Requirement Specification is fulfilled. The FAT shall be carried out in an adequate environment, such as the Suppliers factory or simulator facility.

Should problems materialize during the FAT or should the FAT test results be deemed unsatisfactory by SMA, the problems shall be corrected and the status shall be mutually verified and agreed. The Supplier shall take the full responsibility for any required rectification and re-testing program.

**Site Acceptance Test (SAT)**

The SAT shall verify that the STM Ship Systems fulfills the intended purpose and normal operation in a live environment. The SAT shall be carried out on two (2) of the recruited ships, approved by SMA. Should problems materialize during the SAT or should the SAT test results be deemed unsatisfactory by SMA, the problems shall be corrected and the status shall be mutually verified and agreed. The Supplier shall take the full responsibility for any required rectification and re-testing program.

**Milestone 4, 5 and 6: Assigned Systems Installed**

The Supplier shall carry out the installation on the recruited ships accordingly to the partition assigned to each milestone. After completion of each tested and verified installation, the Installation Test Protocol shall be sent to SMA for approval.

**Milestone 7: Final Acceptance**

Upon the Supplier’s successful completion of all the contractual obligations, including the Supplier’s operational and functional availability and support obligations, SMA will issue a Final Acceptance for the STM Ship Systems to the Supplier.

**Delivery and Payment Schedule**

The Supplier shall deliver the STM Ship Systems in accordance with the Delivery Schedule as specified below.

After successfully achieving the Contractual Milestones, the Supplier shall receive payment as specified below.

<table>
<thead>
<tr>
<th>Contractual Milestones</th>
<th>Description</th>
<th>Acceptance date (calendar months)</th>
<th>Percentage of Contract Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milestone 1</td>
<td>System Design Review</td>
<td>$T_0 + 3$</td>
<td>5 %</td>
</tr>
<tr>
<td>Milestone 2</td>
<td>FAT - system functions demonstrated and validated</td>
<td>$T_0 + 7$</td>
<td>5 %</td>
</tr>
<tr>
<td>Milestone 3</td>
<td>SAT - two (2) systems installed, tested and approved</td>
<td>$T_0 + 9$</td>
<td>20 %</td>
</tr>
<tr>
<td>Milestone 4</td>
<td>30% of assigned systems installed</td>
<td>$T_0 + 12$</td>
<td>20 %</td>
</tr>
<tr>
<td>Milestone 5</td>
<td>60% of assigned systems installed</td>
<td>$T_0 + 15$</td>
<td>20 %</td>
</tr>
<tr>
<td>Milestone 6</td>
<td>100% of assigned systems installed</td>
<td>$T_0 + 18$</td>
<td>20 %</td>
</tr>
<tr>
<td>Milestone 7</td>
<td>Final Acceptance</td>
<td>$T_0 + 27$</td>
<td>10 %</td>
</tr>
</tbody>
</table>

$T_0 = \text{Effective Date of Main Contract}$
6.3 **Actual acceptance date**

Provided that SMA does not reject the System or part thereof, the Actual Acceptance Date shall be deemed to be the day the System or part thereof (as the case may be) is accepted by SMA. SMA’s issuance of a written acceptance will serve as evidence of SMA’s acceptance.

6.4 **Ownership after acceptance**

After final acceptance the ownership of the System will remain with the Supplier.

6.5 **Delay**

If the Supplier does not keep a milestone agreed upon, no payment will be made from SMA until the Supplier has fulfilled the delivery stipulated in the milestone.

7 **Licenses**

The Supplier shall supply all required software licenses if needed for full functionality to meet the requirements in this document and specified in this Contract.

All licenses for the development, test, and training will be included in the delivery. The licensing also includes any third party software if needed for the System.

8 **Price**

Prices are given in the Tender from the supplier.

All local taxes and duties, if any, are included in the prices as listed in the Contract. VAT is excluded.

9 **Invoicing and terms of payment**

9.1 **Invoicing**

Payment shall be made in Swedish Kronor (SEK) or Euro (EUR) upon invoicing as stipulated in the Contract, payment in accordance with the payment schedule in this contract. Unless provided otherwise in the Contract or otherwise agreed in each instance, the Supplier shall not present invoices to SMA and SMA shall have no liability to make payment under the Contract.

Invoices from the Supplier shall be accompanied by relevant and detailed specifications clearly identifying on an item-by-item basis the purpose and scope of the delivery including the description, delivered quantity, agreed price and delivery time of each product and service.

Invoices shall always specify SMA’s Contract reference number.

Terms unilaterally included in invoices by the Supplier are not binding on SMA.

9.2 **Invoicing address**

Invoices in SEK shall be sent to:

Sjöfartsverket
Box 344
737 26 Fagersta, Sweden

Invoices in EUR shall be sent to:

Sjöfartsverket
601 78 Norrköping, Sweden
9.3 Payment schedule
After successfully achieving the Contractual Milestones and other acceptance requirements stipulated in the contract, the Supplier shall receive payment according to the payment schedules specified above in *contractual milestones*.

9.4 Payment terms and amendments, changes and additions
Interest on arrears in accordance with the Interest Act is accepted if the Swedish Maritime Administration is in arrears without objective cause. Collection measures shall, however, be preceded by a payment-reminder in order to be accepted. In delays of payment caused by insufficient invoicing, the Swedish Maritime Administration will dispute all demands concerning the delay.

The Swedish Maritime Administration does not accept any service or invoicing charges.

Payment for amendments to the Contract that may be viewed as independent of the System may be subject to negotiation between the Parties and a separate payment schedule.

9.5 Payment period
The Supplier is entitled to receive payment within thirty (30) days of receipt by SMA, provided that the Supplier has invoiced in accordance with the provisions of this Clause.

9.6 Delayed payment
For late payments the Supplier shall be entitled to charge default interest at a rate applicable in accordance with the Interest Act of Sweden.

10 Project organization

10.1 Project management
Each Party shall appoint a primary contact person whose responsibilities and obligations during the Term of the Contract are defined in this contract.

At signing here of the primary contact persons will

be: For SMA: XXXX
For the Supplier: XXXXX

11 Title, right of use, personal data, etc.

11.1 Title
All technical data of whatever kind, including all software and source codes with documentation necessary for operation, correction, modification and expansion produced by the Supplier or its subcontractor during the performance of this Contract shall be the property of the Supplier unless otherwise stipulated in the Grant Agreement...

11.2 Non-Disclosure
If not stipulated otherwise in the Grant Agreement all Data and information relating to a Party's business and activities that is disclosed by one Party to the other Party under this Contract shall be treated as confidential and proprietary by the other Party. Neither Party shall disclose such Data or information to any subcontractor, consultant or other third party unless such subcontractor, consultant or other third party has executed a confidentiality agreement with the Party for the direct benefit of the other Party protecting such Data and information.
The foregoing shall not apply to any information

- in the public domain; or
- which has been legally acquired from sources other than the other Party without confidentiality restrictions; or
- which is required to be disclosed under applicable mandatory law, final and legally enforceable order of any competent court or regulatory body or similar provisions.

11.3 Infringement of intellectual property rights

If not stipulated otherwise in the Grant Agreement the Supplier shall indemnify and hold SMA harmless in respect of any damages, costs and other expenses, which may arise for SMA as a result of any claim due to any alleged infringement of intellectual property rights as a consequence of manufacture or use of the System.

The Supplier shall not be liable for infringement pursuant to the preceding paragraph to the extent that such infringement is directly attributable to materiel supplied by SMA or to solutions or procedures prescribed by SMA contrary to the Supplier’s written objection.

The Supplier and SMA shall keep each other informed of claims arising from intellectual property rights.

If infringement occurs, the Supplier shall, in addition to what is stated in the first paragraph, at its own expense either modify the System so that infringement no longer occurs, or reach an agreement with the holder of the infringed upon intellectual property rights.

If the System is modified, the Supplier shall be responsible for ensuring that its agreed function, performance and utility remains unaffected and that there will be no cost increase for its future use.

If a claim is made against SMA in respect of an alleged infringement of any third party’s intellectual property rights, the Supplier shall at its own expense participate in any court proceedings where an action is brought against SMA and for such purpose, as well as otherwise, assist SMA to the best of its ability in the case of alleged infringement of any intellectual property rights.

12 Liability

Unless otherwise provided by other paragraphs in this contract, each Party shall be liable for loss or damage to its property, injury to or death of any of its employees or other person for whom the Party is responsible.

Each Party shall be liable for direct damage to property of third parties or personal injury, including death, in accordance with the applicable law, if caused by the Party, its personnel and/or its subcontractor(s) engaged in carrying out this Contract and shall indemnify and hold harmless the other Party accordingly.

If claim for damages pursuant to this Clause is made by a third party against either of the parties, said party shall immediately so notify the other party in writing.

Neither Party shall be liable to pay any compensation to the other Party either for loss of profit, production drop-out or any other consequential or indirect loss.

13 Insurance

The Supplier shall hold adequate liability insurance for its operations throughout the agreement.

14 Term and termination

14.1 Term

The Term of this Contract and all agreements (Appendix 1-6) shall commence on the date hereof and shall continue in force until Milestone 7 Final acceptance is reached and achieved, unless earlier terminated pursuant to the terms of this Contract.
14.2 Termination for default

SMA shall be entitled to terminate all or part of this Contract with immediate effect if:

a) The acceptance of the Milestones occurs later than the agreed dates and the delay for an individual Contractual Milestone has lasted more than three (3) months or the aggregate delay has lasted more than six (6) months and this is not due to Force Majeure, SMA or circumstances for which SMA is responsible and if such delay is attributable to the Supplier, or.

b) enforcement by a legal authority of a judgement or an enforceable decision of any other kind has shown the Supplier to be lacking the means of making full payment of a claim which is the subject of the judgement or decision, has suspended payments, an application has been made to a court or a public authority for corporation restructuring regarding the Supplier pursuant to a legislation act or the Supplier has been declared bankrupt, or

c) the Supplier fails to comply with any other obligation of this Contract and this may be regarded as constituting a substantial breach of Contract.

In case of termination for default, SMA shall be entitled to claim damage compensation in accordance with this contract and to a refund of payments made prior to the termination for default.

The Supplier may terminate this Contract in whole or in part if SMA substantially fails to perform its obligations under the Contract. Any Supplier termination for default shall become effective 90 (ninety) days following written notice of the event, unless the event has been cured within such notice period.

In case of termination for default, the Supplier shall be entitled to claim damage compensation in accordance with this Contract.

Any Party claiming breach of Contract shall take all measures necessary to limit the loss or damage arising insofar as this is possible without incurring unreasonable expense and inconvenience.

15 Force majeure

The following circumstances shall be deemed to constitute grounds for discharge from performing the Supplier’s obligations under this Contract if they occur after the Contract has been entered into and the due performance of the Contract is thereby prevented and it may not be considered that the Supplier ought to have taken such circumstances into account at the time of entering into the Contract and whose consequences could not reasonably have been avoided or circumvented by the Supplier: general labour conflict and any other circumstances, such as fire, war, mobilization or unforeseen military call-up of corresponding extent, requisition, seizure, insurrection and riot, general shortage of qualified labour, general scarcity of means of transport, general shortage of goods, general and enduring restrictions on the supply of motive power, as well as delay in deliveries from Subcontractors as a consequence of circumstances falling within the scope of this Clause, where the Supplier or subcontractor has not caused or contributed to such obstacle.

The aforesaid shall also apply in respect of undertakings, which it is SMA’s duty to perform.

In the event that a Force Majeure event described above prevents a Party from performing its obligations under this Contract for a period exceeding three (3) months, each Party shall be entitled to terminate the Contract and the following shall apply: SMA shall pay to the Supplier the Contract price for work completed as well as the costs of material and labour used for work uncompleted at the time of such termination, less any payments received for such work; and the Contract or shall deliver to SMA upon request any work so paid for.

16 Notices and requests

Notices required to be given by one Party to another shall be in the English language unless expressly agreed otherwise and shall be deemed properly given if reduced to writing and personally delivered or sent by registered or certified post to the address below, postage prepaid, or by fax or e-mail with confirmation of receipt in the same manner and shall be effective upon receipt.

Unless specified elsewhere in the Contract, all notices and requests shall be addressed as follows:
To SMA:

<table>
<thead>
<tr>
<th>Address:</th>
<th>POC:</th>
<th>Phone:</th>
<th>E-mail:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sjöfartsverket</td>
<td>Björn Andreasson</td>
<td>+46 104784630</td>
<td><a href="mailto:Bjorn.Andreasson@sjofartsverket.se">Bjorn.Andreasson@sjofartsverket.se</a></td>
</tr>
<tr>
<td>601 78 Norrköping</td>
<td>Häkan Heurlin</td>
<td>+46 104785273</td>
<td><a href="mailto:Hakan.Heurlin@sjofartsverket.se">Hakan.Heurlin@sjofartsverket.se</a></td>
</tr>
<tr>
<td>Sweden</td>
<td></td>
<td></td>
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</table>

To the Supplier:

<table>
<thead>
<tr>
<th>Address:</th>
<th>POC:</th>
<th>Phone:</th>
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</tr>
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<tbody>
<tr>
<td>xxx</td>
<td>xxx</td>
<td>xxx</td>
<td>xxx</td>
</tr>
</tbody>
</table>

17 Modifications and improvements

If during the Contract period or later on the Supplier becomes aware of special conditions or develops modifications or improvements that affect or might affect the operation, performance, maintenance, or training of the System delivered under this Contract, the Supplier shall without delay inform SMA thereof.

Notifications of improvements and modifications and the proposals for changes resulting from such improvements and modifications shall be made by the Supplier in writing.

The Supplier undertakes to notify SMA of modifications proposed to other customers and to offer these to SMA in accordance with the procedure described in this Clause.

18 Amendments, changes and additions

No amendments, changes, additions, revisions or discharges of the Contract shall have any effect unless set forth in writing and duly signed by the authorized representatives of SMA and the Supplier.

Either Party shall be entitled to propose changes and additions to the System (a “Change Request”). A Change Request shall be made in writing to the other Party.

During the development there might be a need to make corrections and alterations (change request). Change requests will be communicated with the entire group of vendors and an amount of hours, according to hourly rate for development will be agreed. The logic behind this is to treat all vendors equal.

If SMA makes a Change Request, the Supplier shall within 15 working days from the receipt of the Change Request notify SMA of the following:

a) the time needed to make the change or addition;
b) any effect on the System, such as altered performance, in relation to what is stated in the Requirement Specification;
c) any effect on the Delivery Schedule;
d) any reasons to modify the Acceptance Tests;
e) the way in which the change will affect the possibility of upgrading the System in the future, if any; and
f) the price asked by the Supplier, if any, to carry out the change.

If the Supplier makes a Change Request, the same information as above shall be provided by the
Supplier to SMA not later than 15 working days after the Change Request was received by SMA. On the basis of what has been stated in the Change Request and following negotiations between the Parties, SMA shall make a decision, within 15 working days from the receipt of the information as above, about whether the Change Request shall be accepted or not and inform the Supplier in writing. Through SMA’s written confirmation, the Contract shall be regarded as having been amended accordingly.

The Supplier shall use its reasonable commercial endeavors to ensure that the impact on costs and time-schedules is as favorable as possible for SMA.

19 Applicable law

19.1 Applicable law

This Contract shall be governed by and interpreted in accordance with the laws of Sweden.

19.2 Dispute

Any dispute, controversy or claim arising out of or in connection with this Contract shall be settled by a Swedish court of law in accordance with the laws of Sweden.

19.3 Assignment

Neither Party shall be entitled without the other Party’s written consent to put another party in its place, with the proviso, however, that SMA shall be entitled to assign all or part of the Contract to its legal successor(s) or an authority, agency, state enterprise or company wholly or partly owned by the Swedish State.

20 Signing

This Contract is executed in two (2) originals, whereof each Party shall keep one.

Norrköping, 2016-_____ - _____

For and on behalf of
Swedish Maritime Administration

xxxx

For and on behalf of

xxxx

xxxx
Document No: Appendix 3
Title: SeaSWIM Specification
Date: 2016-05-13
# DOCUMENT STATUS

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<th>Organisation</th>
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<tbody>
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<td>CIMNE</td>
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## Review

<table>
<thead>
<tr>
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<tr>
<td>Björn Andreasson</td>
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<td>Per Setterberg</td>
<td>Swedish Maritime Administration</td>
</tr>
</tbody>
</table>

## Approval

<table>
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<tr>
<th>Name</th>
<th>Organisation</th>
<th>Signature</th>
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## Document History

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1. Introduction

This appendix document is intended to provide information on what is required to integrate with the STM maritime digital infrastructure “Sea System Wide Information Management” (SeaSWIM). This document is solely focused on the STM Activity 2 testbed implementation of SeaSWIM, which represents a limited set of functionality of the core components in the maritime digital infrastructure.

The document provides two perspectives; one for interacting with SeaSWIM through a support interface, which aim to hide the full complexity of the different support service (Section 2), and one for building and integrating SeaSWIM compliant services inhouse (Section 3). General prerequisites and standards that have to be adhered to is described in Section 4 and the Data Model Appendix.

1.1 SeaSWIM Objectives and Scope

The fundamental objective for SeaSWIM is to provide and maintain a harmonized way of communicating within the maritime industry. This implies that open and accessible standards are promoted. Unifying the way maritime stakeholders communicate enable common understanding and a new level of potential interaction and integration.

Once communication standards are defined, the consecutive objective of SeaSWIM is to facilitate the flow of data and information. This means providing solutions to promote trust and lower the barriers of entry for potential data and information providers and consumers.

To accomplish this goal, SeaSWIM is envisioned to provide a reference for all common functionality needed by the ecosystem of stakeholders. However, during the STM Activity 2 testbeds the provided support services will be limited to the core functionality described in this document. For example, both access management and a publish-subscribe functionality are recognized as common needs that should be supported as SeaSWIM support services. However, the specific requirements and potential implementation alternatives for these support services are currently unclear and will not be provided as part of the STM Activity 2 testbed. Instead each application service can implement their own solution.

1.2 Sea System Wide Information Management (SeaSWIM)

SeaSWIM consists of specific support services that will ensure interoperability of the STM application services by facilitating data sharing in a common information environment and structure. The specification of SeaSWIM is developed to adhere to some important STM principles:

1. Only authenticated actors can provide and consume STM services.
2. The owner of data is the actor responsible for the original creation and provision. The owner has full control over the access management for this data.
3. STM strives after a service oriented and highly decentralized architecture.
4. Usage of open and widely accepted industry standards wherever these exist.

Extraction of the actor specific data or information and translation to the appropriate STM format is performed by the various maritime actors. To simplify the connection with STM, a standardized interface to the support service called the SeaSWIM Connector (SSC) will be provided (cf. Figure 1). The SSC is developed as a reference service that handles the interaction with all the SeaSWIM support services according to the SeaSWIM specification. The connector is hosted by the Application Service, both at the provider side and the consumer side. This way the SSC support communication according to the STM principles with minimal development and implementation efforts.

![SeaSWIM Connector (SSC) as a standardized interface to the services](image)

**Figure 1: SeaSWIM Connector (SSC) as a standardized interface to the services**

Behind the connector, SeaSWIM consists of two central components; the **Identity Registry** and the **Service Registry** (cf. Figure 2). The Identity Registry enables identity management and authentication mechanisms, while the Service Registry provides functionality to publish and find services, their functionality and endpoints. Both services will be further detailed in sections 2 and 3.

All services also depend on **unique identifiers** that define specific users, services and transferred data objects¹ to avoid conflicts and provide unambiguous references.

¹ Data objects can be a variable, a data structure, or a function, and as such, is a location in memory having a value and possibly referenced by an identifier. (Wikipedia)
There exists two potential ways to incorporate the SeaSWIM connector. The first option is to host the reference service as is and use its interface to reach STM and its connected actors and services. The second option is to integrate the libraries and methods contained in the SeaSWIM connector service to replicate its functionality. All function calls to the core SeaSWIM support services (Identity Registry and Service Registry) will be accepted as long as they adhere to the same standard as the SeaSWIM reference connector. It should be noted that only very limited support can be given if a vendor chooses to build their own SeaSWIM connector functionality. Both options will be described in the Section 2 (Using the SeaSWIM Connector) and Section 3 (Building the SeaSWIM Connector).

### 1.3 Interacting with SeaSWIM

This section will give an overview of the interaction with the SeaSWIM Support Services; the SeaSWIM Connector, the Identity Registry and the Service Registry. To understand how the SeaSWIM registers will interact with the connector a generic scenario
description is provided. More details and descriptions about the technical interfaces and standards will be provided in the following main chapters in this document.

1.3.1 Setup and Discovery

To provide a service the data provider register with the STM identity registry, which is shown as Step 1 (Figure 3) and explained more in depth in Section 4.1. The identity registry ensures unique identities that can be authenticated. Without a valid STM user identity, a user will not be able to provide or consume data within STM.

![Figure 3: Setup a service specification and deployment description in the service registry](image)

With a STM user identity the service provider can be authenticated as such and register a service in the service registry, shown in Step 2 (Figure 3). Registering a service entails publishing metadata of a service specification and then registering deployed instances of that service (Step 3 in Figure 3). This registration process can be done by separate parties and one service specification can have several deployed instances registered. The service specification and deployment description can subsequently be used by other STM users to interact with the service. It is important to note that published services can be simple data provision services, aggregated information services that consist of several sources of data or data consumer endpoints where data can be sent for processing.

Registering to become a STM member is also required to search and consume services, which is shown in Step 1 (Figure 4). With a STM identity the user can be authenticated by the service registry and search the published service specifications and/or deployed instances (Step 2 in Figure 4).

---

2 Data provider/consumer is taken to mean both data and service provider/consumer
The initial search in Step 2 is regularly done by humans to find appropriate functionality in relevant deployed instances. When a match has been found and an appropriate service has been built to interact with the specified service it is only relevant to search within its deployed instances. Step 3 (Figure 4) shows how the connector will support this specific search to list and choose between deployed service instances. The service registry responds to the request with a list of deployed instances that matches the service deployment attributes (e.g. closest in proximity or current licence).

1.3.2 Interaction
The user locates the service, its description and how to make use of it. For example, this could be a link to a graphical user interface that can be opened in a web browser or it could be a specification of the API that can be used to request a data point, machine to machine without user interaction. In any case, the consumer uses the metadata to establish a connection to the service producer directly.

The interaction requires that STM identities are used and valid. By uploading the user credentials to the SeaSWIM connector, it provides support to ensure that tokens and certificates can be authenticated (Step 1 in Figure 5).
Based on the service description and the found deployed instance the service endpoint can then be called. The connector compiles the request with the user identity and credentials and sends it to the receiving connector. The Producer SeaSWIM connector authenticates the request and “works” on it (e.g. checks authorization, performs optimization) and responds as shown in Step 2 (Figure 5). Depending on the service and the completeness of the request this response could be the requested payload, a notification callback or an error message.

2. Using the SeaSWIM Connector

This section describes the reference implementation of the SeaSWIM connector that links the internal system to the STM registers and provides general support services. The SeaSWIM reference connector is developed as a stand alone service that should be hosted by the service provider and service consumer. It provides a unified interface and ensures compliancy. The internal functionality of the SeaSWIM reference connector will be described in Section 3 to provide the option to develop SeaSWIM compliant services without using a reference instance.
2.1 SeaSWIM Setup, Deployment and Configuration

A general overview of the connector interfaces will be described below. A final version of the technical specification and a reference SSC will be available at the latest before contract signing.

Architecture

The picture below depict the Application Service and the SeaSWIM Connector (SSC) architecture.

![SSC Architecture Diagram](image)

*Figure 6: General architectural description of outgoing and incoming calls through the SSC*

- The SSC service component will forward all the outcoming connections requested by the Application Service (labeled SERVICE in the Figures 6 and 7).
- The SSC service will intercept the incoming call, check and forward to web service API exposed by the service
- ServiceSSC middleware module will be in charge of the communication with the SSC.
- A web service API will be exposed by the service receive the incoming call.

Deployment and configuration

The SSC will be developed as a service instance running on the same private network of the service application.
Figure 7: Single private network setup of Application Service and SSC

The SSC service exposes a set of private functions running on the private network (for example 192.168.0.1).
The SSC service will run a server on the WAN network on a public IP described in the application service description.
The SSC can be deployed in a single server instance or on separated servers, as pictured in Figure 7 and 8.

Figure 8: Multiple server deployment of Application Service and SSC

In the separated server deployment the SSC will expose a private interface on the private network in order to be used by the application service running in another server in the safe private network.
In the single server deployment there will be an instance of the SSC listening on the public ip of the server to intercept the incoming call. The public ip must be the same as defined the endpoint in the service registry.

2.2 Identity Management, Authentication and Encryption

Establishing connections with a SeaSWIM connector will be based on either digital certificates based on the global X.509 standard, or ‘single sign on’ to a web service based on the OpenID Connect standard, which is based on OAuth2.

Service providers or other actors, that need the ability to be authenticated in the testbed of the STM project, will be registered in the Identity Registry. The actors participating in the testbed can contact the Swedish Maritime Administration, who will assist in completing the registration in the Portal for the Identity and Service registries, for the STM testbed. Please consult Section 4 of this document.

The SeaSWIM connector will assist its parent service or consumer application in establishing secure and authenticated connections, allowing only interactions with actors who are registered users or service providers with an identity that can be authenticated. The connector will only allow outbound connections to endpoints at services with a valid certificate. Inbound connections will be accepted from other SeaSWIM connectors, that also hold a valid certificate, or where logon can be authenticated based on a trusted identity provider.

If the SeaSWIM connector is a service provider on land, a certificate for a ‘device’ can be issued. For a SeaSWIM connector to represent a particular vessel, that ship must have a certificate issued. This certificate will contain information such as the ships name, flag state, MMSI and IMO number packaged in an X.509 certificate, and the validity of this certificate can be verified using the root certificate supplied for the project.
The SeaSWIM connector will be able to provide the parent application or service with the attributes associated with the actor involved in an external connection, based on the content of the certificate or the attributes stored for a user in the Identity Registry, such as name, organizational belonging, etc. For more detail, consult Section 3.1.2.

Once the ‘owner’ of the SeaSWIM connector has downloaded the digital certificate and the private key, they must be stored in a predestined place in the installation of the SeaSWIM connector, together with the root certificate(s) of the certificate provider(s) that the SeaSWIM connector should trust.

Once the certificate is securely stored the SeaSWIM connector will use it whenever it attempts to securely connect to remote hosts, or present it to any remote host trying to connect to the SeaSWIM connector. It could also be used for digitally signing documents and messages being transferred to other SeaSWIM compliant actors, using a SeaSWIM compliant connector.

### 2.3 Service Management and Utilization

The SeaSWIM Connector interface with the application service is implemented using SOAP protocols. The methods interfaces described all contains a parameters object that will be specified in detail in the “SeaSWIM Reference Connector - Technical Specification” document by the 15th of September 2016. The method object parameter contains the information need by the method to interact with the SeaSWIM.

**Seaswim connector interfaces**

The below figure outlines interfaces to the SeaSWIM connector with a proposed information service. The service could be for instance a Voyage Information Service abstracting an application onboard a vessel like the STM Module. Respective interfaces are described in the following figure.

![Figure 10: Overview of server and client interfaces to the SSC](image)

---

14
**Call a service**

Facilitates STM Module initiation request for a specific service e.g. route optimization. The sequence involves request through VIS and the SeaSwim connector (SSC) interface call_service (acting as a proxy client) and forwards the call to the receiving service endpoint.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>call_service</td>
<td>call_service(callServiceObj)</td>
</tr>
<tr>
<td>Method description</td>
<td>This method it will be used by the service application to use methods of others seaswim services</td>
</tr>
<tr>
<td>Method parameter:</td>
<td>callServiceObj</td>
</tr>
<tr>
<td></td>
<td>This object contain the parameters need by the method like: endPoint and specifics parameters depending of the service application intent to use</td>
</tr>
<tr>
<td>Method return:</td>
<td>responseObject</td>
</tr>
<tr>
<td></td>
<td>responseObject contain the response to the specific external service.</td>
</tr>
</tbody>
</table>

**Set SSC configuration**

The set_configuration interface is used to store user credentials, certificate path and other settings in the SeaSWIM connector at deployment of a VIS instance in the SeaSWIM service registry. Expected response is a result successful/ unsuccessful with possible reasons.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>set_configuration</td>
<td>set_configuration(setConfigurationObj)</td>
</tr>
<tr>
<td>Method description</td>
<td>This method set the SSC configuration.</td>
</tr>
<tr>
<td>Method parameter:</td>
<td>setConfigurationObj</td>
</tr>
<tr>
<td></td>
<td>This object contain information like: certificate path, seaswim credentials and other settings.</td>
</tr>
<tr>
<td>Method return:</td>
<td>configurationResponseObj</td>
</tr>
<tr>
<td></td>
<td>configurationResponseObj contain the setting configuration state like: ok or notOk with additional useful information for error debugging.</td>
</tr>
</tbody>
</table>

**Find Services**

This interface is invoked from VIS when a search for services is initiated by the STM Module. Thus facilitating service discovery in the central SeaSWIM service registry using query service parameters like service type, service category, location, service id etc. The response typically includes a list of endpoints and corresponding service descriptions.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>find_services</td>
<td>find_services(findServicesObj)</td>
</tr>
<tr>
<td>Method description</td>
<td>This method is used to discover the services</td>
</tr>
</tbody>
</table>
registered in the seaswim.

Method parameter: findServicesObj
This object contains a set of attributes to filter the service discovery result.

Method return: servicesDescriptionObj
This object contains the list of service object discovered by the function.

Check authentication
The check_authentication method is invoked in the SSC after receiving a request from an unknown service. Thus authenticating the requesting actor ID (in STM) against the SeaSWIM identity registry.

<table>
<thead>
<tr>
<th>Name</th>
<th>check_authentication(checkAuthenticationObj)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method description</td>
<td>This method validate the authentication against the identity registry of the checkAuthenticationObj. For example can be used to validate other user identities</td>
</tr>
<tr>
<td>Method parameter:</td>
<td>checkAuthenticationObj</td>
</tr>
<tr>
<td></td>
<td>This object contain the authentication information that is wanted to be validated</td>
</tr>
<tr>
<td>Method return:</td>
<td>checkAuthenticationResponseObj</td>
</tr>
<tr>
<td></td>
<td>This object contain the result of the validation.</td>
</tr>
</tbody>
</table>

Find identities
When searching for identities using the STM Module to explore services provided, the SSC find_identities interface is called via the VIS, expected response is a list of identities from the SeaSWIM identity registry with associated attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>find_identities(findIdentitiesObj)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method description</td>
<td>This method is used to get a list of identities from the identity registry</td>
</tr>
<tr>
<td>Method parameter:</td>
<td>findIdentitiesObj</td>
</tr>
<tr>
<td></td>
<td>This object contains a list of attributes used to filter the result</td>
</tr>
<tr>
<td>Method return:</td>
<td>identitiesDescriptionObj</td>
</tr>
<tr>
<td></td>
<td>This object contains a list of identities and the associated identities attributes.</td>
</tr>
</tbody>
</table>
Seaswim connector general interactions patterns

General synchronous request
The picture below depict a general synchronous interaction between a service1 and service2. In this example is omitted the connector business logic used to initialize the encrypted safe connection.

Configure the SSC
The picture below depict a general setting config interaction with the connector

The setConfigurationObject will contain information about:
The public interface address of the SSC (x.x.x.x:ppppp)
- The private interface address of the Application Webservices
- Certificate location path
- User/Password credentials

**Find a service and call a service endPoint**
The picture below depict a general interaction pattern example to discovery a service and interact with a service.

![Diagram](image)

*Figure 13: Finding a service endpoint (top diagram) and the endpoint interaction (bottom diagram)*

### 3. Building a SeaSWIM Connector

The reference SeaSWIM Connector (SSC) presented in Section 2 is intended to hide the complexity of interacting and complying with the STM support services. This section, instead, provides the detail how the central registers and common support services function. The purpose is to provide transparency and to enable potential integration of SeaSWIM support services with the application services. A final version of the technical specification and a reference SSC will be available at the latest before contract signing.
3.1 Identity Registry Integration

In SeaSWIM, the Resource Provider does not need to implement its own workflow to support identification of Clients. It can be assumed that Clients are registered via the Identity Registry, and that a PKI (Public Key Infrastructure) infrastructure supporting certificate validation or that the Authentication request can be facilitated by a trusted Identity Manager via the Maritime Clouds Identity Registry.

Registration in the Identity Registry and issuing of certificates in the STM testbed is conducted through a workflow that does not involve the SeaSWIM connector.

When deciding to construct a SeaSWIM connector, those of the functions described in section 2.2. that are relevant to the parent service or application must be considered. The technical details on implementing interactions between the SeaSWIM connector and another SeaSWIM connector or the central functions related to Identity management and authentication are described below.

An instance of the Identity Registry can be expected to be online for testing during implementation, from July 2016.

3.1.1 Conceptual Description

Once the ‘owner’ of the SeaSWIM connector has downloaded the digital certificate and the private key they must be stored in a predestined place in the installation of the SeaSWIM connector. For added security the SeaSWIM connector should store them accordingly to the PKCS#8 standard or using a hardware security module (HSM).

The main interaction with the Identity Registry are related to validation of certificates and lookup of public keys of other actors based on the global X.509 standard or execution of an online authentication process based on OpenID Connect.

3.1.2 Technical Description

The authentication mechanism in the Maritime Cloud is based on open and proven standards, and their usages will be described below.

**X.509 Certificates - Machine to Machine**

For the machine-to-machine (M2M) communication primarily used in the STM setup the Maritime Cloud provides the ability to issue X.509 certificates for entities (users, vessels and devices). These certificates will enable entities to authenticate within the Public Key Infrastructure (PKI) provided by the Maritime Cloud. For services to be a part of this PKI they will need to be registred in the Maritime Cloud and obtain a certificate.

If an entity connects to a SeaSWIM service (via a SeaSWIM Connector) using a X.509 Certificate, the standard protocol for secure connection creation, automatically
authenticates the entity, and therefore validates the information embedded in the certificate.

Besides authentication the X.509 certificates can be used for encrypting the communication between SeaSWIM Connectors, using standard SSL/TLS.

The X.509 certificate that is issued will contain basic information about the entity it is issued to. Each entity belongs to an Organization which is identified by an Organization Id, also sometimes referred to as "shortname" of the organization, since it is a maximum 10 character name for the organization. Examples of an organization's shortname could be "DMA" (for the Danish Maritime Authority), "DMI" (for the Danish Meteorological Institute) or "MAERSK" (for Maersk Line).

The standard information that we currently envision to be included in the X.509 certificates for each entity category can be seen in the table below. **Note that the list of attributes and their content will be finalized mid June 2016.**

<table>
<thead>
<tr>
<th>Field</th>
<th>User</th>
<th>Vessel</th>
<th>Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>CN (CommonName)</td>
<td>Full name</td>
<td>Vessel name</td>
<td>Device name</td>
</tr>
<tr>
<td>O (Organization)</td>
<td>Organization Id and Organization Name, separated by semicolon</td>
<td>Organization Id and Organization Name, separated by semicolon</td>
<td>Organization Id and Organization Name, separated by semicolon</td>
</tr>
<tr>
<td>OU (Organizational Unit)</td>
<td>&quot;user&quot;</td>
<td>&quot;vessel&quot;</td>
<td>&quot;device&quot;</td>
</tr>
<tr>
<td>C (Country)</td>
<td>Organization country code</td>
<td>Organization country code</td>
<td>Organization country code</td>
</tr>
<tr>
<td>E (Email)</td>
<td>User email</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

An example of the fields for a vessel could look like this:
C=DK, O=DMA;Danish Maritime Authority, OU=vessel, CN=JENS SØRENSEN

Besides the information stored in the standard X.509 attributes listed above, the X509v3 extension SubjectAlternativeName (SAN) extension is used to store extra information. There already exists some predefined fields for the SAN extension, but they do not match the need we have for maritime related fields. Therefore the "otherName" field is used, which allows for using a Object Identifier (OID) to define custom fields. The OIDs currently used are not registered at ITU, but is randomly generated using a tool provided by ITU (see [http://www.itu.int/en/ITU-T/asn1/Pages/UUID/uuids.aspx](http://www.itu.int/en/ITU-T/asn1/Pages/UUID/uuids.aspx)). See the table below for the fields currently defined, the OID of the fields and which kind of entity that
uses the fields. **Note that the list of attributes and their content will be finalized mid June 2016.**

<table>
<thead>
<tr>
<th>Name</th>
<th>OID</th>
<th>Used by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flagstate</td>
<td>2.25.323100633285601570573910217875371967771</td>
<td>Vessels</td>
</tr>
<tr>
<td>Callsign</td>
<td>2.25.208070283325144527098121348946972755227</td>
<td>Vessels</td>
</tr>
<tr>
<td>IMO number</td>
<td>2.25.291283622413876360871493815653100799259</td>
<td>Vessels</td>
</tr>
<tr>
<td>MMSI number</td>
<td>2.25.328433707816814908768060331477217690907</td>
<td>Vessels</td>
</tr>
<tr>
<td>AIS shiptype</td>
<td>2.25.107857171638679641902842130101018412315</td>
<td>Vessels</td>
</tr>
<tr>
<td>MRN</td>
<td>2.25.271477598449775373676560215839310464283</td>
<td>Vessels, users, devices</td>
</tr>
<tr>
<td>Permissions</td>
<td>2.25.174437629172304915481663724171734402331</td>
<td>Vessels, users, devices</td>
</tr>
</tbody>
</table>

The first 5 fields mentioned in the table are all vessel specific, and should be self explanatory in the maritime context, but the last 2 are specific to the Maritime Cloud domain:

- "permissions": A comma separated list of permissions or roles assigned to the entity by the organization it belongs to. Also see the section on Authorization below.
- "mrn": A comma separated lists of Maritime Resource Names of the entity, in prioritized order, the highest priority first.

The Maritime Resource Name (MRN) is a unique identifier for users, vessels, etc. in the maritime domain (see [https://imo.amsa.gov.au/iala-aism/e-nav/enav17/9-14.pdf](https://imo.amsa.gov.au/iala-aism/e-nav/enav17/9-14.pdf) for more information). In the Maritime Cloud during the test phase a MRN will look like below, but it is expected to change when/if the MRN gets approved as an official sub-space of urn, and when the Maritime Cloud goes into production. For now the "mrnx" subspace is used, where "x" means "eXperimental".

```
urn:mrnx:mcl:identity:<entity type>:<Organization Id>:<entity id>
```

**Examples could be:**

```
urn:mrnx:mcl:identity:user:DMA:tgc
urn:mrnx:mcl:identity:vessel:DMA:JENS_SOERENSEN
```

See Chapter 5 for more information regarding the Maritime Resource Name.

**OpenID Connect - browser based**

For browser based authentication the Maritime Cloud Identity Registry offers an OpenID Connect based solution with federated identity management. A central Maritime Cloud Identity Broker will point to organizations registered as Identity Providers in the Maritime
Cloud. For the STM testbed a special STM Identity Provider will be set up to administrate STM testbed users.

When using OpenID Connect authentication the user is identified by a JWT ID token that contains various attributes that describes the users. The current attributes used in the Maritime Cloud are listed in the table below. **Note that the list of attributes and their content will be finalized mid June 2016.**

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>email</td>
<td>The email of the user.</td>
</tr>
<tr>
<td>family_name</td>
<td>Lastname of the user.</td>
</tr>
<tr>
<td>given_name</td>
<td>Firstname of the user.</td>
</tr>
<tr>
<td>mrn</td>
<td>The Maritime Resource Name of the user.</td>
</tr>
<tr>
<td>name</td>
<td>Full name of the user.</td>
</tr>
<tr>
<td>org</td>
<td>Id of the organization the user is a member of.</td>
</tr>
<tr>
<td>permissions</td>
<td>List of permissions for this user assigned by the organization the user is a member of.</td>
</tr>
<tr>
<td>preferred_username</td>
<td>The users username in the parent organization.</td>
</tr>
</tbody>
</table>

See the section on Certificates above for a description for the “mrn”, “org” and “permissions” attributes.

**Interface for the Identity Registry**
Besides a browser based interface, where entities can be managed, the Maritime Cloud Identity Registry will also offer a web based API that will make it possible for the SeaSWIM Connector to:

- Create/update/delete entities.
- Issue X.509 certificates for entities.
- Revoke entity certificates.
- Check for revoked certificates.

**A swagger-specification of the API will be finalized mid June 2016.**

3.2 Service Registry Integration

3.2.1 Conceptual Description
This chapter below describes a sample implementation of a service registry. It is a resource that aims to provide controlled access to data necessary for governance of
SOA (service-oriented architecture) projects, like the Maritime Cloud development. In effect, it is a constantly evolving catalogue of information about the available services in a SOA implementation (for the moment only some basic means to search for services are included in this chapter; it is intended to complement this list considering the needs of the services implementers later on). A service registry allows businesses to efficiently discover and communicate with each other using certain services. The ultimate goal is to allow fast and reliable communication and interoperability among diverse applications with minimal human oversight.

Services themselves and the service-based economy are a central part of the Maritime Cloud and SeaSWIM. In the context of service-oriented architecture, a service usually refers to a set of related software functionalities that can be reused for different purposes, together with policies that governs and controls its usage.

The service registry will contain service specifications according to an envisioned Service Specification Standard and provisioned service instances implemented according to these service specifications (at the time of writing, the service specification standard is still being developed and therefore not fully mature; it shall be delivered by latest end of October 2016). The service registry aims at improving the visibility and accessibility of available maritime information and services. This enables service providers, consumers, and regulatory authorities to share a common view on service standards and provisioned services. The service registry does not provide actual maritime information, but a specification of various services, the information they carry, and the technical means to obtain it. The service registry also provides the mechanisms to manage the lifecycle of service specifications and service instances.

As depicted below, the service registry enables the “provider” to “publish” information related to its service instances so that the “consumer” is able to “discover” them and obtain everything (e.g. interface information) required to ultimately use these services.
Figure 14: General architecture of the service registry

<table>
<thead>
<tr>
<th>Role</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Service Consumers</strong></td>
<td>Consumer uses service instances provided by service providers.</td>
</tr>
<tr>
<td></td>
<td>All users within the maritime domain can be service customers, e.g., ships and their crew, authorities, VTS stations, organizations (e.g., meteorological), commercial service providers, etc.</td>
</tr>
<tr>
<td><strong>Service Providers</strong></td>
<td>Provides instances of services according to a service specification, e.g. deploys the service to the Service Registry.</td>
</tr>
<tr>
<td></td>
<td>All users within the maritime domain can be service providers, e.g., ships and their crew, authorities, VTS stations, organizations (e.g., meteorological), commercial service providers, etc.</td>
</tr>
<tr>
<td><strong>Service Specification Implementers</strong></td>
<td>Implementers of services from the service provider side and/or the service consumer side.</td>
</tr>
<tr>
<td></td>
<td>Everybody can be a service implementer but mainly this will be commercial companies implementing solutions for shore and ship.</td>
</tr>
<tr>
<td><strong>Service Specification Producers</strong></td>
<td>Producers of service specifications in accordance with STM Governance procedures.</td>
</tr>
</tbody>
</table>
The service registry is intended to facilitate or implement the Maritime Service Portfolio (MSP) concept by providing a repository for the specification of operational and technical services and provisioned service instances. The service registry is intended to comprise all maritime services, not only digital services, thereby making it a single reference point for provisioning and discovery.

When specifying services it has to be distinguished between service specification, service technical design and service implementation (see figure below).

![Figure 15: Distinction between Service Specification, Service Technical Design and Service Instance](image)

The Service Specification describes one dedicated service at logical level in a technology-agnostic manner. On the other hand, the Service Technical Design describes the details about the actual realisation of a specific service with a dedicated technology.

It is possible to provide different technical designs (by using same or different technologies), all being compliant with the same service specification. It is also possible to provide one technical design that conforms to several service specifications, for example, to allow backward compatibility to older versions of a certain specification.

A service implementation (implemented according to a given technical design) may be deployed at different locations by different service providers.

For further details about the process to be followed for describing services in a standardized way, please refer to E2_Deliverable-D3.4-Service-Documentation-Guidelines.
3.2.1 Technical Description

This section describes the operations for interacting with the runtime part of the Service Registry. The technical interface to the registry is based on the IETF RFC 5222 titled “LoST: A Location-to-Service Translation Protocol” (https://tools.ietf.org/html/rfc5222), which describes a means to map the endpoint URI for a service (or services) within a given geographic region.

The standard above, that serves as baseline for the technical interface specification, has been developed for the public safety domain where a correlation of the availability of services to certain locations is essential and therefore this (temporary) mapping is reflected in the interface definition. Nevertheless, it is not mandatory to use this functionality and one (a service designer/implementer) can define services, which are not restricted to a certain region. From that perspective, the registry responds to queries with the required means to access one or more active services matching the query and operating in the specified region or at the specified position. This geographic mapping of services to locations is subject to timed expiration so as to reflect updates of service activity due to time of life cycle considerations.

A query may return one or more such mappings, if multiple services of the same type operate in overlapping regions. It is possible to define a default mapping which is returned in case specific service was found for a given point or area.

The queries are implemented as REST API calls via HTTP. The ability of a client to query the registry may be subject to authentication.

Core Operations

LoST defines several operations\(^3\), two of which are of particular relevance

<table>
<thead>
<tr>
<th>LoST Client Request</th>
<th>LoST Server Response</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>findService</td>
<td>findServiceResponse</td>
<td>Returns a service (endpoint URI, additional info) for a given geographic region</td>
</tr>
<tr>
<td>listServicesByLocation</td>
<td>listServicesByLocationResponse</td>
<td>Lists services available for a given geographic region</td>
</tr>
</tbody>
</table>

\(^3\) The requests and responses are further specified in RFC5222
Core Attributes for findService

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>GML (Point/Polygon/Circle/Ellipse/ArcBand)</td>
</tr>
<tr>
<td>Service URN</td>
<td>String</td>
</tr>
</tbody>
</table>

Example findService XML

```xml
<?xml version="1.0" encoding="UTF-8"?>
<findService
    xmlns="urn:ietf:params:xml:ns:lost1"
    xmlns:p2="http://www.opengis.net/gml"
    serviceBoundary="value"
    recursive="false">
    <location id="6020688f1ce1896d" profile="geodetic-2d">
        <p2:Point id="point1" srsName="urn:ogc:def:crs:EPSG::4326">
            <p2:pos>37.775 -122.422</p2:pos>
        </p2:Point>
    </location>
    <service>urn:service:sos.coastguard</service>
</findService>
```

Core Attributes of a mapping for findServiceResponse (extract from RFC5222 - not all attributes are listed)

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Name</td>
<td>String</td>
</tr>
<tr>
<td>Service Boundary</td>
<td>GML (Point/Polygon/Circle/Ellipse/ArcBand)</td>
</tr>
<tr>
<td>Service URI (1..n)</td>
<td>String</td>
</tr>
<tr>
<td>Mapping expiration</td>
<td>Date</td>
</tr>
<tr>
<td>Mapping Last Update Time</td>
<td>Date</td>
</tr>
<tr>
<td>Mapping information source</td>
<td>String</td>
</tr>
</tbody>
</table>

Example findServiceResponse XML

```xml
<?xml version="1.0" encoding="UTF-8"?>
```
<findServiceResponse xmlns="urn:ietf:params:xml:ns:lost1"
xmlns:p2="http://www.opengis.net/gml">
<mapping
  expires="2007-01-01T01:44:33Z"
  lastUpdated="2006-11-01T01:00:00Z"
  source="authoritative.example"
  sourceId="7e3f40b098c711dbb6060800200c9a66">
  <displayName xml:lang="en">
    Forsvaret Coast Guard
  </displayName>
  <service>urn:service:sos.coastguard</service>
  <serviceBoundary profile="geodetic-2d">
    <p2:Polygon srsName="urn:ogc:def::crs:EPSG::4326">
      <p2:exterior>
        <p2:LinearRing>
          <p2:pos>37.775 -122.4194</p2:pos>
          <p2:pos>37.555 -122.4194</p2:pos>
          <p2:pos>37.555 -122.4264</p2:pos>
          <p2:pos>37.775 -122.4264</p2:pos>
          <p2:pos>37.775 -122.4194</p2:pos>
        </p2:LinearRing>
      </p2:exterior>
    </p2:Polygon>
  </serviceBoundary>
</mapping>
</findServiceResponse>

Core Attributes for listServicesByLocation

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>GML (Point/Polygon/Circle/Ellipse/ArcBand)</td>
</tr>
<tr>
<td>Service URN</td>
<td>String</td>
</tr>
</tbody>
</table>

Example listServicesByLocation XML

```xml
<?xml version="1.0" encoding="UTF-8"?>
<listServicesByLocation
```
Core Attributes for listServicesByLocationResponse

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service List</td>
<td>String</td>
</tr>
</tbody>
</table>

Example findServiceResponse XML

```xml
<?xml version="1.0" encoding="UTF-8"?>
<listServicesByLocationResponse xmlns="urn:ietf:params:xml:ns:lost1">
  <serviceList>
    urn:service:sos.gmdss
    urn:service:sos.coastguard
  </serviceList>
  <locationUsed id="3e19dfb3b9828c3"/>
</listServicesByLocationResponse>
```

4. STM Registration Processes

4.1 Registering Users With the Identity Registry

In the STM testbed the registration of entities (users, vessels and devices) will be done using a browser based interface for Identity Registry. This interface is also called the "Maritime Cloud Portal".

Organizations can be registered in the Identity Registry by contacting the STM administrator at SMA, who will register the organization and provide credentials for an administrative login in the Identity Registry.
Once an organization is created, the organization will be able to create and maintain entities and create the X.509 certificates needed for authenticating using the SeaSWIM Connector.

It will also be provided as a REST based API that will make it possible to maintain entities and do bulk updates of users and vessels.

4.2 Registering Services with the Service Registry

In the STM testbed the registration of service instances in the Service Registry is done by the STM administrator at SMA.

5. Unique Identification

This section describes how unique identifiers are constructed for the STM validation project.

The syntax described in this section can be expected to be applied to identification of ships voyages (UVID – Unique Voyage ID) and Port Calls (UPCID – Unique Port Call ID), as well as Actor and Service instances in STM.

It is based on the project document ‘Unique Voyage Identifier in MONALISA 2.0 (by A. Rizvanolli and P.E. Holmberg) and a draft guideline on Unique Identifiers for Maritime Resources being developed by the International Association for marine aids to navigation and Lighthouse Authorities (IALA) based on the concept of a ‘Maritime Resource Name’, building on the Uniform Resource Name defined by RFC 2141.

Unique Voyage Identifier

The MONALISA 2.0 project identified the unique voyage identifier (UVID) as necessary for an efficient and STM compliant information exchange among the different actors and the ship during a given voyage.
Figure 16: Current situation of information exchange during a voyage

Unique Port Call Identifier

The concept of Port Collaborative Decision Making (PortCDM) has identified that the synchronization of a Port Call requires a unique identification of the a particular Port Call, i.e. the sequence of events that needs to be coordinated, when a particular Vessel arrive at the port, visit the port, and departs from the port.
Figure 17: A port call also consists of many stakeholder interactions.

The maritime actors involved in a ship voyage (some of them are shown in Figure 3) or a Port Call (some are shown in Figure 4) need to commit their changes to the voyage or Port Call and get informed about the changes made by others, based on the authorization they have.

The unique identifiers identifying a voyage – or a port call – during its lifetime should satisfy following requirements:

1. It should serve as a unique identifier for binding related informations being exchanged in STM. Each information object\(^4\) exchanged in STM that related to a Voyage or Port Call should contain the relevant identifier as reference.
2. Actors or systems who/which create or hold a Voyage or Port Call information object, should be able to decentrally generate a unique ID without requiring online access to a central function.
3. Life cycle or time dependency of the id’s uniqueness should be clear and unambiguous.

\(^4\) Data model, data object or payload format
4. The syntax of the ID should not reveal actor specific information if they don’t approve. The syntax may however provide reference to where actors can seek specific information about a Voyage or Port Call, if authorized to access the information.

**The syntax of identifiers using ‘Maritime Resource Name’**

The (draft) IALA guideline on ‘Unique Identifiers for Maritime Resources’ currently underway defines the syntax for Maritime Resource Names like this:

*Uniform Resource Names (URNs) as defined by the IETF (Internet Engineering Task Force) are intended to serve as persistent, location-independent, resource identifiers and are designed to make it easy to map other namespaces (which share the properties of URNs) into URN-space. Therefore, the URN syntax provides a mean to encode character data in a form that can be sent in existing protocols (like ASCII), transcribed on most keyboards, etc.*

The URN syntax provides a mechanism to ensure the uniqueness of the name of a resource, which is already widely used in different domains such as supply chain management, unique identification of books or laws.

The Syntax of a Maritime Resource Name (MRN) is based on [RFC 2141](https://tools.ietf.org/html/rfc2141) published by the Internet Engineering Task Force (IETF). The basic syntax of a MRN identifier is a string with a hierarchical structure as follows:

```
"urn:mrn":<NSS>
```

The “urn” identifies this to be a special case of a Universal Resource Name (URN), while the “mrn” identify a unique namespace within the URN. Efforts to register the "urn:mrn:" namespace with the [Internet Assigned Numbers Authority (IANA)](https://www.iana.org) are ongoing. <NSS> is the Namespace Specific String composed as follows:

```
<NSS>::=<governing-organization>"":"<type>"":"<type-specific-part>
```

**Delegation of authority**

The Maritime Resource Name is intended to be an extendable mechanism allowing delegation of authority to issue unique identifiers, yet making sure that these identifiers are unique right across the maritime domain, simply by adding a structured prefix to a unique identifier inside any system.

In other words – if two different ports use simple serial numbers to identify port calls in their own system, then putting a prefix that identifies the port in front of the serial number when referencing a particular port call outside the context of the port’s own system, will ensure that the identifier of any port call becomes globally unique.
The Experimental namespace “mrnx”

Development of good quality software frequently requires testing and validation of new functions or features in a realistic environment by real users, to prove a concept and take into account user feedback, before the technical details – such as data models, encoding formats or communication protocols are frozen and published as standards, recommendations or guidelines. The STM validation project is a window of opportunity to do exactly this.

In order to support the STM validation project, an ‘experimental’ namespace is associated with the MRN namespace. This namespace will provide the basis for validating the voyage and port call identifiers, and subsequently converge smoothly into a standard that fulfills the requirements of “the real life”. It is defined as:

"urn:mrnx:"<NSS>

However the ‘x’ in “mrnx” identifies this namespace to be of an experimental nature – in other words, an unstable version which has not yet reached the maturity of a published standard or recommendation. The intention is to provide a namespace, where concepts can be matured fairly freely in the STM validation project, before it is published in a standard. The <NSS> is the Namespace Specific String of same composition as for the “urn:mrn” namespace:

<NSS>::=<governing-organization>":"<type>":"<type-specific-part>

The "urn:mrnx:" namespace may further be utilized to identify test datasets which conforms to published standards, but where the data content is intended for testing purposes only, and may not be used in an operational context.

During the STM validation project, we are considering an early stage technical implementation for validation purposes, and the software should therefore be prepared for a transition from an experimental stage to a standardized stage, by constructing testbed software to be able to apply exactly the same logic to information objects identified by ‘mrn’ or ‘mrnx’ prefixes – or to some other prefix by configuration, should the <governing-organization> change during the process of standardization. Taking testbed validated software to a production environment will thus be an easy transition. Yet, a simple differentiation between data that belong to a test (‘mrnx’) environment to a production environment using a formally standardized prefix is enabled – and methods to disallow test data in a production environment can easily be applied in the future.

Purpose and construction of identifiers

The primary purpose of ‘identifiers’ is to (uniquely) identify something. Sometimes identifiers are constructed in a way, which embeds information directly into the identifier. For instance, a phone number, 72196000 may represents the main phone number of the
Danish Maritime Authority, when used in a Danish context, but the number may be identical to the phone number of another organization or individual in another country. Internationally it is represented using an international dialing code in front of the national number (+45 72196000), to ensure universal uniqueness. This international dialing code constitutes an embedded piece of information, revealing the (national) belonging of the (national) identifier. Exceptions to the rule may apply, as for instance when buying a satellite phone: the ‘international dialing code’ will identify the satellite system, rather than a national telephone exchange. Similarly, it may be possible to derive certain information from an IP address or web address in the internet domain. Embedding information into the construction of a unique identifier, may serve two purposes:

A. It may achieve a simple way to delegate authority to issue identifiers that only need to be unique within your own domain (like national telephone numbers), providing a way to represent your identifier in a globally unique way
B. It may enable transfer of information needed to discover or route information to the ‘owner’ of the entity, which the identifier is intended to identify.

For option B to be useful, it requires the ability to decipher the information embedded in the identifier, which in turn requires a stable (standardized) definition of the identifier structure (a well defined way to decode the international dialing code). Otherwise it would be more safe, to embed the information to be transferred, in the payloads being exchanged between identities, rather than the identifier.

The STM validation project will apply a prefix structure for issuing identifiers, that separates responsibility of defining and utilizing identifiers in a project centric way (option A above), but also apply option B to embed information that promotes discoverability of the origin of an identifier, and thus validate the appropriateness of these approaches as part of the project.

Use of 'Maritime Resource Name’ in STM
The STM validation project will apply the Maritime Resource Name methodology to validate the concepts of Unique Voyage ID and Unique Port Call ID in the maritime context, before bringing them to relevant standardization bodies. The project has requested IALA to be registered as <governing-organization> for an experimental namespace:

“urn:mrnx:stm:“

The intention is to subdivide this namespace into four categories:

ID’s related to PortCDM (STM Activity 1)
urn:mrnx:stm:portcdm:<someID_type Relating_to_PortCDM>

ID’s related to Voyage Management (STM Activity 2)
urn:mrnx:stm:voymgt:<someID_type_Relating_to_Voyage_Management>
ID’s related to Actor Identity Management and Service Management (STM Activity 4) will use a similar syntax:

urn:mrnx:stm:actor:<someID_type_relating_to_Actor_Identity_Management>
and

urn:mrnx:stm:service:<someID_type_relating_to_Service_Management>

(or a similar URN construction with a different prefix, noting that the actor and service identity concepts are being developed in collaboration with other projects, but ultimately based on the same URN based syntax.)

Unique Voyage_ID (UVID)

The update of IEC 61174 test standard for ECDIS in 2015, introduced a standardized data format for representation of a ship’s voyage plan (the RTZ format).

This format includes an identifier field, which can be used to uniquely identify an instance of a ship’s planned voyage, during the lifecycle of the voyage from strategic planning, through the dynamic updates underway, until completion. For unique identification of this instance of the voyage, when communicating updates between any group of stakeholders, a globally unique identifier is needed, and methods to manage the version history of changes applied.

The STM project will establish the concept of a ‘Voyage Information Service’ as the point of contact to enable authorized parties (authorized collaborators such as agents, pilots, ports, VTSs etc.) to interact electronically with information related to a ship’s voyage. The definition of the UVID is closely related to the definition of the Voyage Information Service by Activity 2 of the STM project, and thus Activity 2 ‘owns’ this definition.

It has been observed that centralized methods for issuing unique identifiers (such as Global Unique Flight Identifiers in the aviation industry) demand connectivity at the time of creation. This is seen as an undesirable requirement and possible point of failure. Instead a delegated approach is desired, where each registered provider of a Voyage Information Service is delegates the ability to issue their own identifiers is desired.

The following definition of the UVID has been proposed, and is provided for explanation of the syntax. The final definition of the UVID is part of the documentation of the Voyage Information Service:

“urn:mrnx:stm:voymgt:uvid”<uvid>”:<localid>”[<version>]"
Where “urn:mrnx:stm:voymgt:uvid:” is the prefix, that identifies a UVID in the Voyage Management activity of the STM validation project.

<uvispid> denotes a Voyage Information Service Provider ID, and it’s purpose is to help discover the service endpoint (the address of the technical interface) of the Voyage Information Service were information related to this UVID can be found, via the Service Registry.

<localid> is a locally generated ID (syntax: a string of alphanumeric values (a-z, A-Z, 0-9), possibly characters '-' or '_', but no space or other special characters). It could be a serial number, UUID or something else. It is generated by the provider of the Voyage Information Service, and must be unique within the context of this particular instance of a Voyage Information Service.

<version> is an optional extension.

Example
This is provided as an explanatory example, not stating additional requirements.

Shipping company A (operating Ship A) has internally established their own Voyage Information Service to manage its voyages, and it is registered in the Service Registry as Voyage Information Service “urn:mrnx:stm:voymgt:uvid:imo-453345”.


The example above may also apply if shipping company A employs a third-party service to host its Voyage Information Service instance, since the naming of the unique identifier is rather a contractual matter between the parties than a consequence of the technical implementation.

Shipping Company B and C (operating Ships B and C) have both made a deal with Service Provider D to take care of representing their voyages electronically. Service Provider D operate the “urn:mrnx:stm:voymgt:uvispid:stm-d” Voyage Information Service.

“urn:mrnx:stm:voymgt:uvid:stm-d:346:4.12” may denote the voyage number “346” of ship B (version “4.12”) held at Voyage Information Service Provider “stm-d”. Similarly “urn:mrnx:stm:voymgt:uvid:stm-d:134” may denote the latest version of voyage number “134” (could be ship B or C), but you don’t know the ship involved, unless you ask the
Voyage Information Service – and you must be nominated as a collaborator of this voyage – or request nomination - to retrieve any information about this voyage.

Holding the authority over the “urn:mrnx:stm:voymgt:uvid:stm-d” namespace allows the service provider, if so decided in the agreement with the client, to sub-divide the namespace into client-specific namespaces, which allows the clients to manage the issuing of UVIDs under the sub-namespace on their own.

The examples above illustrate how the precise usage of the “urn:mrnx:stm:voymgt:uvid” namespace is flexible and allow for different technical and contractual arrangements between shipping companies and service providers.

**Unique Port Call ID (UPCID)**

Issuing unique identifiers to identify a Port Call is very similar to issuing identifiers for a Voyage. The Port Call ID is owned by Activity 1 of the STM Validation project and described in the documentation of the Port Information Service. The following is provided to explain the similar syntax:

“urn:x-mrn:stm:portcdm:port_call”:“<portCode>”:“<portspecificId>”

Please note that the “urn:mrnx” has been switched with “urn:x-mrn” in legacy work already committed in the project. This is an example of the evolving harmonization, pointing towards the need for preparing implementations to accept additional ID prefixes to represent certain identifier types as a result of ongoing standardization efforts. This should be possible by configuration, rather than hardcoding.

Thus, the software developed for the STM testbeds, should accept both the prefix “urn:x-mrn” and “urn:mrnx” as equivalent prefixes of testbed data. The prefix of future production data is to be determined depending on standardization, however the syntax of the URN notation will apply.

<portCode> denotes a Port Information Service of a particular port, identified through the UNLOCODE of a particular port – or another unique identification of the provider of a Port CDM service (syntax: a string of alphanumeric values (a-z, A-Z, 0-9), possibly characters ‘-‘ or ‘_‘, but no space or other special characters).

<portspecificid> is a locally generated ID (syntax: a string of alphanumeric values (a-z, A-Z, 0-9), possibly characters ‘-‘ or ‘_‘, but no space or other special characters). It could be a serial number, UUID or something else. It is generated by the Port system and must be unique within the context of this particular instance of a Voyage Information Service.

**Example**
“urn:x-mm:stm:portcdm:port_call:SEGOT:b44928d8-0e93-46be-baf9-b824e0fdbe90” will denote a port call in the Port of Gothenburg (UNLOCODE: SEGOT) with a UUDI as a local reference.

Post project considerations for utilization of the UVID and UPCID identifiers

Assuming that the STM validation project successfully validates this way of handling UVIDs, UPCIDs - and associated Actor and Service Provider IDs, the construction of these identifiers will be brought forward as a proposal for a standard to be published by some relevant standardization organization.

Regardless of which standardization organization is identified as the relevant host of such a standard, the intention is to replace the prefix of the identifier construction (“urn:mmx:stm:”) with another prefix, identifying the relevant host organization. Possible results could be:

- “urn:mmx:stm:” if the STM project ends up establishing a STM specific governing organization publishing the standards
- “urn:gs1:” if the STM project ends up proposing the STM services to become GS1 standards
- Either way, the technical implementations of STM Services in the testbeds may be prepared through configuration to accept the “urn:mmx:stm:” or “urn:x-mm:stm” prefixes for the testbeds, but another prefix (To Be Determined) should be anticipated as the ‘production’ prefix of STM services for STM related identifiers and type definitions in the future.
A. Data Models Appendix

This chapter provides references to the data formats and their data models currently supported in STM. The current listed STM standard formats are:

A.1. Port Call Message Format (PCMF)
A.2. Route Exchange Plan Format (RTZ)
A.3. Text Message
A.4. Area Exchange Format
A.1 Port Call Message Standard

– constituents, use cases, information model, and message format

by

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Executive summary
Standardized message formats are necessary if one wants to achieve synchronized operations among actors that act on behalf of themselves and on behalf of an ecosystem. In this document the port call message format is defined. This is to be used in the interaction between actors involved in a port call enabling well-coordinated operations. To reach well-coordinated operations a high degree of predictability is needed in which different actors share time-related information on when events are about to occur or has occurred, i.e. when events are commenced or completed. The scope is exchange of time-stamped data for ship-to-port interaction, port-actor interaction, and port-to-port interaction. It builds upon a nomenclature enabling the sharing of time related information on locations and services built upon a view of the port call process, as being constituted of three generic steps; the arrival, the port visit, and the departure. Each of these process steps is built up of sub processes capturing the different events of the port call. Each event is triggered by and results in state changes that need to be shared among the involved port call actors necessary for enabling well-coordinated port call operations performed by the different actors. Most often multiple actors are involved in the realization of the different events constituting the port call process. Given this viewpoint, different use cases building upon Port Collaborative Decision Making (PortCDM) for enhanced ship-to-port interaction, port-actor interaction, and port-to-port interaction are provided in this report. PortCDM provides situational awareness for actors’ decision-making on collaborative foundations enabled by sharing information on agreed timestamps. Founded in an information model that is provided in the report, an XML schema defines the message format.
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1. Introduction

Sea transport of today is strongly affected by its legacy, such as the 1609 mare Librium, charter parties, and operations driven by “first come, first served”. This legacy has encouraged a maritime ecosystem characterized by competitive autonomous actors. Due to this current situation, there is an unwillingness to share data and this creates a major challenge for collaboration. However, increased connectivity enabled by digitalization allowing different actors and objects to generate, distribute and access information about intentions and states has put pressure on the industry towards an increased degree of information transparency. This is of special concern for increasing safety, and efficiency, as well as reducing the environmental footprint.

Synchronized and coordinated port call operations build upon the principle that information objects are shared among different stakeholders. Founded in the MONALISA 2.0 project Port Collaborative Decision Making (PortCDM) has been introduced for the purpose of ensuring synchronized and optimized port visits (see figure 1).

PortCDM will be a platform enabling such support. The overall goal with PortCDM is to enable the sharing of intentions and actual state updates among involved actors to enable enhanced informed decisions concerning each actor’s coordination of upcoming operations to perform.

This synchronization effort does however build upon that messages can be transferred in a standardized way. This is of special concern due to the distributed nature of the industry where e.g. ships visits many ports and different ports in different nations that require different types of documentation. Initiatives have been taken, such as directive 65 (FOM 2010/65) reaching standardized administrative processes and reporting, but there are more steps that need to be taken arriving at a practice building on inter-operability allowing different systems to exist related to the practice of port operations. Many actors and system suppliers do operate in multiple ports and port actors in one port need to have

\[5\text{ This is also a clear demand from public bodies that have to control, inspect, and manage import and export.}\]
a standardized way of communicating. All this is a call for a standardized message format reflecting the needs in ship-to-port interactions, interactions among actors in a port, and in port-to-port interactions. Efforts in pursuing standardized message formats for enhanced collaboration is not new for the maritime sector. Several contemporary standards are being pursued, such as the time stamp standard (as proposed by Pronto, STM, BIMCO et al), Route Exchange Format (RTZ), S-100 product specification, the GS1 standard Electronic Product Code Information Services (EPCIS), and message formats related to the European efforts of National Single Windows. In this report the relationship between the port call message standard and these contemporary standardization efforts is provided to justify the need for a complementary standard for port call messages (PCM).

In this report a port call message format is described founded in the basic logic of how to enable well-coordinated port calls building upon each actor’s capabilities to plan and realize synchronized operations. This report does cover foundational logic for the constituents of time stamps, relationships between different port call messages, use cases, data model, and messaging format.

2. Constituents of the port call message standard

2.1 The Port Call Process conceived

A port call process is divided into three process steps; Arrival, Port Visit, and Departure. The Port Visit reflects the purpose of call. Each process step is to be conceived as existing of different sub processes and each sub process covers a number of events (see figure 2 below). Each event is triggered by state changes and leads to state changes.

6 http://s3-eu-west-1.amazonaws.com/stm-stmvalidation/uploads/20160420144429/ML2-D1.3.2-Voyage-Exchange-Format-RTZ.pdf
7 www.iho.int/iho_pubs/IHO_Download.htm
A port call is thus a process composed of process steps for arrival, port visit, and departure putting the operations associated with the turn-around process of the vessel at the core. The arrival process is divided into pre-arrival and port arrival processes. The port visit is composed by series of port manoeuvring, berth visit, and anchoring activities. As indicated in figure 2 the port visit might be constituted by multiple port manoeuvring, berth visit, and anchoring events. In this way berth shifting is possible to capture. The departure process captures the port departure and operations associated with post departure. Each sub process is composed of events and an event leads to state changes (see figure 3).

2.2 The constituents of time stamps

As states are results of events they could be: estimated of when they are expected to occur, targeted of when they are aimed, recommended to someone for its completion, and/or reported actual for when the they have occurred. These different time types, i.e. estimated, targeted, recommended and actual are different possible time types. As can be

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9 Within the ECDIS community (for navigational purposes), “planned time” is used for expressing the targeted time.
revealed in figure 3, one state could trigger several events and one event could be triggered by several states.

A state could concern the certain time a physical object has arrived at, or departed from a particular geographical spot (location state), such as the vessel is at berth (all fast), and the certain time a particular service is to be commenced or completed (service state), such as cargo operations are commenced. Commencing a service is normally preceded by sequences of communicative acts such as requested, request received, denied, confirmed etc regulated in the time sequence of the state (see section 2.2.2) below.

A unique combination of time type and state type constitute the time stamp (figure 4), as e.g. Estimated Time of Arrival Vessel at Pilot Boarding Area which is the specification of what is often referred to as ETA. This suggested level of granularity specifying what it concerns (reference object, see section 2.2.1 on location states) and to which location, decreasing the probability for misunderstanding.

2.2.1 Location states

A location state captures the location (such as traffic area, berth, tug zone, pilot boarding area, etc.) to which a reference object (such as vessel, pilot, tug, etc.) arrive to or depart from (figure 5). As for example, based on the nomenclature for a location state an arrival for a vessel to traffic area is expressed as Arrival_Vessel_Traffic_Area. A location state is thus defined by a unique combination of time sequence, reference object, and from_location/to_location.
For an arrival state the to_location is mandatory and the from_location is optional and for a departure state the from_location is mandatory and the to_location is optional. The following reference objects have so far been identified (extensible list):

- Vessel
- Pilot
- Pilot boat
- Tug
- Escort tug
- Ice Breaker

The following locations have been identified so far (extensible list):

- Anchoring Area
- Berth
- Etug zone
- Variable locations
- Next Port
- Pilot Boarding Area
- Previous Port
- Rendezvous Area
- Traffic Area
- Tug Zone
- Vessel

### 2.2.2 Service states

A service state expresses services (such as towage, pilotage etc.) requested by someone and to be supplied to someone (figure 6) and whether the message describes commencement or completion. Agreements between actors are patterns of interaction constructed of requests, reception of requests, denials and confirmations between actors, as for example, pilot requested and pilot confirmed. The time sequence characteristics possible to express associated to service states are; requested, request received, denied, confirmed, commenced, and completed. In combination with the time type, the first four states will most likely be an actual time, as e.g. actual time of pilotage requested. A service state is thus defined by a unique combination of service object and time sequence.

The location for where the service to be supplied is possible to specify, but optional. If the service implies a movement from one location to another, as in the case of pilotage and towage, it is possible to specify from which location (“from location”) and to which location (“to location”) the service is conducted. In the case of that it is relevant to specify where the service is to be/are being performed (not involving any movement) as in the case of mooring operations, the “at location” is possible to use for specifying where the service is realized.
The following service objects have so far been identified (extensible list):

- Anchorage
- Arrival Anchorage Operation
- Arrival Berth
- Berth Shifting
- Bunkering Operation
- Cargo Operation
- Departure Berth
- Departure Anchorage Operation
- Departure PortArea
- Departure VTSArea
- Escort Towage
- Garbage Operation
- LubeOil Operation
- Mooring Operation
- Provision Operation
- Sludge Operation
- Towage
- Water Operation

These different services are options dependent on the purpose of the call, the characteristics of the cargo, and particular port characteristics. As e.g. pre/port cargo operations survey is not applicable for all types of cargo. The list of possible service objects is thus dependent of the characteristics of the port call such as, type of vessel, and port characteristics.

**2.2.3 Different time types**

As indicated in figure 4, four time types are covered in the port call message standard. The four basic time types are defined as follows:

- **TT - Targeted Time:** The time when a particular actor committed to arrive at, or depart from, a certain location (location state) or initiate/complete a particular service (service state)\(^{10}\).

- **ET - Estimated Time:** The time for when a particular actor estimates to (based on calculations) arrive at, or depart from, a certain location (location state) or initiate/complete a particular service (service state). An estimated time is often made

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\(^{10}\) Within the ECDIS community (for navigational purposes), “planned time” (PTA) for arriving at a particular location (flowpoint) is used for expressing the targeted time. This means that PTA and TTA is used with the same meaning, but the TTA is used within the PortCDM community.
based on assumptions on forecasted circumstances (such as weather forecasts) and insights on other actors’ estimations.

- RT – Recommended Time: The time **recommended to another actor to** arrive at/depart from a certain location (location state) or initiate/complete a particular service (service state). Recommended times is used as a basis for changing targeted times.

- AT – Actual Time: The time **when an actor** arrived at/departed from a certain location (location state) or initiated/completed a particular service (service state). The actual time is used for evaluation based on the actual occurrence related to planned and/or estimated times. Actual times can also be used for billing, logbooks and/or statements of facts.

### 3. Constituents for coordinating Port Calls

#### 3.1 States as the coordination mechanism

To enable realization of the optimized port call, actions performed by different actors need to be synchronized, which means that actions need to be arranged in space and time in relation to each other. E.g. the vessel and the pilot need to be at the same place at the same time, in order to commence pilotage.

Due to its distributed nature, it is essential that actors continually share their intentions and report upon completion of a particular action, enabling others to position their plans in relation to other actors’ performances. Optimally, the different events of the port call process should be identified and planned for prior to the physical arrival of the vessel to the port.

In figure 7, a metro map is used as the metaphor for illustrating the complexity, and the need for collaboration between multiple actors, in staging a port call. The metro map expresses a positioned state catalogue in relation to the port call process and its actors on a generic level. The metro map is also a source for inspiration for different dashboards being used, adapted to each actor's needs, for providing situational awareness enabling informed decisions on collaborative foundations to be made by each actor. In figure 7, each metro line represents an actor and each metro station represents a state — such as a location state or service state — that is of importance for the coordination of the port call process. The metaphor illustrates a flow of states having a coordinating function in a port call, from the arrival of a vessel (left part of figure 7) to its departure (right part of figure 7). By including states related departure previous port and arrival next port the port visit at the focused port can be associated to a chain of port visits and thus enabling port-to-port collaboration.

As depicted in figure 7, there are several states that indicate a high degree of coordination and synchronized performances from several actors. The states that require two or more actors to be synchronized in time and/or space are referred to as coordination points. States prior to coordination points are as important for an optimal realization of a port calls but are more actor specific in their nature and are defined as actor specific milestones.
Figure 7: States and coordination points in the port call process - a generic state chart used for port specific adaptation of the PortCDM concept

The Port call message standard regulates how each message should be constituted, but as figure 7 indicates there are dependencies between different states. To support e.g. well-coordinated port calls such dependencies, possibly on application level, need to be elaborated on. Examples of such dependencies are:

- A confirmation of a service must be a response to a request.
- Different estimate times related to different states must be synchronized between different actor’s conceptions.
- Unreasonable state dependencies must be resolved, as e.g. unreasonable estimated times between different states (as e.g. time dependency between pilotage commenced and arrival vessel at berth).
- Missing information crucial for the coordination of the port call must be retrieved and shared among the actors.

States associated with the vessel’s turn-around process are also considered as the common object of interest among participating actors. Efficient resource allocation and port call execution require predictable state changes and would therefore benefit from improved communication and collaboration among participating actors. The following states are seen as crucial to share information about, and does thus constitute the common object of interest, to enable a well-coordinated turn around process:
### Process step: Pre-Arrival and Arrival

<table>
<thead>
<tr>
<th>PortVisit requested</th>
<th>Process step: PortVisit</th>
<th>Arrival Vessel TrafficArea OR Arrival Vessel PilotBoardingArea</th>
</tr>
</thead>
<tbody>
<tr>
<td>PortVisit confirmed</td>
<td>(if used) Pilotage Confirmed</td>
<td>(if used) Pilotage Confirmed</td>
</tr>
<tr>
<td>(if used) Towage Commenced</td>
<td>(if used) Towage Confirmed</td>
<td>(if used) Towage Confirmed</td>
</tr>
<tr>
<td>Cargo Operations Completed</td>
<td>ReadyToSail Completed</td>
<td>Departure Vessel Berth</td>
</tr>
<tr>
<td>(if used) Pilotage Confirmed</td>
<td>(if used) Pilotage Confirmed</td>
<td>(if used) Towage Confirmed</td>
</tr>
<tr>
<td>(if used) Towage Commenced</td>
<td>Departure Vessel TrafficArea OR Departure Vessel PilotBoardingArea</td>
<td></td>
</tr>
</tbody>
</table>

### Process step: Departure

<table>
<thead>
<tr>
<th>Departure Vessel TrafficArea OR Departure Vessel PilotBoardingArea</th>
</tr>
</thead>
<tbody>
<tr>
<td>(if used) Pilotage Confirmed</td>
</tr>
<tr>
<td>Cargo Operations Completed</td>
</tr>
<tr>
<td>(if used) Towage Confirmed</td>
</tr>
</tbody>
</table>

Other states are to be conceived as important for each actor to optimize their operations in relation to the common object of interest.

### 3.2 Different variants of port visits

As discussed in section 2.1 above a port call is composed of different events. In figure 8, a typical port call process is depicted.

As revealed in figure 8, the arrival is finalized by the vessel’s arrival to the traffic area. Information on timestamps related to the vessel’s arrival to the traffic area is important for the coordination of consequential actions in the port call process. The process step ’Arrival’ captures events and states related to the physical approach to the traffic area while the process step ’Departure’ captures events and states related to the physical movement of leaving the traffic area. All events occurring in between the arrival and departure are to be regarded as the port visit, i.e. the realization of the purpose of the call.

All port visits are not as straight forward as in the figure 8 above. For many ports it often happens that a vessel anchors outside the port waiting for clearance to enter the port area. In some cases a vessel might not even enter the port and choose to stay anchored outside. Anchoring outside might take advantage of complementary services such as bunkering or re-crewing before moving on. For the purposes of categorizing we will consider these actions as a part of the port visit (purpose of call). The process of going from the anchorage
area to berth is regarded as a shift of berth in this case. A berth shift can start when the vessel is heaving anchor, or is all-loose if it was moored and ends with the state where lines are all fast or at anchor again after having transited to the new berth/location. This means that a visit to the anchoring area is regarded is making berth. When shifting is applied, it always starts when it is ready to move from one location to another, and ends with that it is departed, i.e. ready to move to the next location. In the figure 9 this variant process is depicted.

![Figure 9: A port call process with anchoring on the way to berth](image)

The purpose with a berth shifting\(^\text{11}\) could also be to enable the vessel to perform the purpose of call e.g. cargo operations at different terminals. In figure 10, a variant process is depicted covering two berth shifts and where the vessel is anchoring on the way out from the port area.

![Figure 10: A port call with two berth shifts (with anchoring on the way out)](image)

A further more complex, yet common variant of a port visit, with the scenario above, is if the second terminal, the one which the vessel intends to visit, does not have an available slot, the vessel might choose to anchor at designated anchoring area and await the

\(^{11}\) If the captain does not have pilot exemption they need a pilot on berth shifting. Towage is used if regulations advise that.
availability of the second terminal. This scenario is common as the vessel might save a substantial amount in berthing fees.

### 3.3 States associated with the different events

Each event is built upon the different states that are reached by different actions performed by involved actors. The actions are associated with different events. A composition of states is thus used to define a particular event. In the figure 11, different states associated with typical events are captured.

In order to support the coordination, states in different events are to be related to each other, as e.g. the state *mooring_completed* in the event *arrival berth* is a pre-condition for the state *cargo_operations_commenced* in the event *cargo operations*.

![Event Diagram](image)

**Figure 11:** States associated with location and service based events
3.4 Summary – the constituents of the port call process

To summarize, the port call process is a complex sequence of activities, some optional and some mandatory, and some sets of sequences possibly repeated. Thus, it needs to be captured on different levels of granularity to provide complete operational support. A layered model has therefore informed the composition of a port call message standard. The basic unit of analysis is the time stamp as the basic foundation for a state. A combination of states characterizes an event and a sub-process is compound of one or several events. In figure 12, these layers (including instances) are captured.
### Event Layer

<table>
<thead>
<tr>
<th>Event</th>
<th>Process Steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Escort Tug</td>
<td>Pilotage</td>
</tr>
<tr>
<td>Ice Breaking Op.</td>
<td>Tugage</td>
</tr>
</tbody>
</table>

### State Layer

<table>
<thead>
<tr>
<th>State</th>
<th>Process Steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Departure, Tug, LOC</td>
<td>Departure, Tug, LOC</td>
</tr>
</tbody>
</table>

### Main Process

- **Arrival**
- **Port visit**
- **Departure**

### Sub Processes

- **Pre-arrival**
- **Port arrival**
- **Port maneuvering**
- **Berth visit**
- **Anchoring**
- **Port departure**
- **Post-departure**

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Connecting Europe Facility
To be noted is that there might be several different events (service objects) applicable for different purposes of the call. Examples of such events would be bunkering, quarantine, repairs, waste/garbage disposal, supplies/provision, sloop operations, sludge operations, water supply, as well as formalities (customs, immigration, health inspections etc.). The port call message standard allows for bringing in new service object adapted to different purposes of calls and to different port needs. Such service objects would then follow patterns of requested-request received-denied-confirmed-commenced-completed.

4. Use cases

4.1 Use cases for ship-to-port interaction

The optimized port call is to match the vessel reaching an agreed location with the readiness of the port to process the vessel’s port visit. The optimized port call is when the vessel reaches an agreed location at a specific time and all necessary facilities and services are ready to receive the vessel ensuring an optimal turn around in the port. One of the great challenges to overcome is that each port has its own preferred way of being informed and consequently to inform approaching vessels about the status in the port (see figure 13). By the introduction of a standardized way of informing about vessels needs and capacity of the port, this challenge is possible to overcome. Each port’s need for information would certainly vary, both which type of information is needed for the well-coordinated port call, and at what frequency. The port call message does however regulate the format and structure of the information that is being shared. In this section, two use cases are described depicting the use of the port call message for a ship-to-port interaction. In the figure 13 use cases related to the vessel’s desired capabilities is depicted and then further detailed in the following two sections.

4.1.1 Informing the port about TTA (= PTA), ATA and ETA

From a ship’s point of view, the foundation for setting up the port call can be established by informing other actors about its plans to reach a particular location, and its calculations of how well the plan can be achieved. This means that the planned time of arrival (PTA in
the navigational community but TTA according to the port call message standard) at a particular location is to be forwarded using the port call message standard. Continuously estimated time of arrival (ETA) as well as actual time of arrival (ATA) to certain waypoints also need to be forwarded from the ship or someone acting on behalf of the ship to the port (such as ECDIS suppliers land based infrastructure and/or fleet operating centers (FOC)). In the figure 14 this is expressed as three alternative ways for the ship / the shipping company to inform the port by using the port call message standard (PCM TTA, PCM ETA, and PCM ATA).

![Figure 14: Ships informing port about TTA, ATA and ETA using the Port Call Message (PCM) Standard](image)

The distribution of PTA (i.e. TTA) and Actual Time of Arrival (ATA) to the port is done whenever it is updated for/at the vessel. The recommendation is, but also taking the constraints of vessel connectivity in to consideration, that the distribution of estimated time of arrival (ETA) should follow the following frequency schema:

<table>
<thead>
<tr>
<th>Prior arrival to port</th>
<th>Minimum frequency in distribution of ETA</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 72 hours away</td>
<td>Every 6th hour</td>
</tr>
<tr>
<td>48 – 72 hours away</td>
<td>Every 3rd hour</td>
</tr>
<tr>
<td>&lt; 48 hours</td>
<td>Every 60th minute</td>
</tr>
</tbody>
</table>

Besides this, ETA should be also be distributed when there is a substantial deviation from the earlier reported ETA or when the PTA(= TTA) and ETA deviates substantially.

4.1.2 Port call synchronization

Another use case for the port call message standard in the interaction between the ship and the port is that the ship and port synchronize their efforts in enabling just-in-time operations. From the ship’s point of view this means a possibility to save fuel by green steaming\(^\text{12}\), in order to arrive just-in-time and enable just-in-time operations. This does however require that the port can communicate recommendations of when it is desired that the ship is at a certain location and that the ship can re-plan its schedule. These information exchanges, i.e. the ship informing about planned time of arrival (PTA in the navigational community but TTA according to the port call message standard) and the port making a recommended time of arrival (RTA), are depicted in figure 15. Based on the

\(^{12}\) Green steaming is often called slow steaming
recommendation from the port the ship might inform about a changed planned time of arrival (TTA), i.e. re-plan. The land-based infrastructure and fleet operating centre are both depicted in the upper part of the figure.

![Figure 15: Ports recommending arrival time and ships informing about target times the Port Call Message (PCM) Standard](image)

### 4.2 Use cases for port actor interaction and port-to-port interaction

As claimed above, optimized port calls builds upon different actors providing information about their intentions, and sharing time-based related information on actual outcomes, in order to reach a higher degree of predictability. A PortCDM compliant information service platform would facilitate a standardized way of sharing such information without being dependent on which systems are used in the port enabling optimized port calls. In this section, four use cases are described depicting the use of the port call message for port actor interaction and port-to-port interaction. In figure 16, use cases related to the port actors desired capabilities are depicted and then further detailed in the following four sections.

![Figure 16: Use cases from the port point of view](image)

#### 4.2.1 Planning the port call

At the time that the port of destination becomes aware of an upcoming port visit, the port call process is instantiated. This could be done by subscription services associated to the Sea Traffic Management service ecosystem but it is not restricted to whether the
approaching ship is STM compliant. It could also be e.g. the agent, or the arrival notification, that triggers the instantiation of the port call. In planning the port call there is a need for multiple operators to plan their operations in relation to the purpose and needs of the port visit.

When the port call is planned for, each of the involved actors is informed about which actors have set up plans (by having that information provided as situational awareness). In many cases the first initiative is taken by the terminal and the port authority, and by automatic connectors, information from different actors is replicated in interfaces using PortCDM information services. Prior to the vessel’s arrival at the port, involved actors will provide timestamps that are estimates (of location states and service states). The provision of those time stamps is through automatic connectors distributed over different systems using the port call message standard as a payload format (see figure 17) for sharing time stamp information between the systems. This means that PortCDM is not a new planning system it is rather a platform facilitating information exchange, between different existing systems operated by different actors, in a standardized way (see figure 17).

Agreements, as results of requests and confirmations, are important to enable optimal port calls. By visualizing such time stamp related data exchanges it both informs the involved port actors of which agreements that are requested and which consequential agreements need to be done. Providing information about when the port actor’s own operations would be required as e.g. the pilotage is going to end at a certain time, this provides information to the linesmen organization of when their services would be required.

There might be reasons for not being able to realize the port visit according to the original plan, as e.g. the ship is coming earlier/later, some other ships/operations are not performed in time. By sharing times that would affect consequential operations in real-
time and as soon as new information is received it enables other actors to re-plan and re-submit refined time stamps (see figure 16 on INFORM own TIMESTAMPS).

4.2.2 Re-planning during realization

As soon as the ship is physically in the port area, it is possible to inform others of actual time of arrival (ATA). This concerns both the ships progress and other actors’ progress in the port call process. Information about actual times supports involved port actors to fine-tune their planning and coordinate their efforts in relation to other port call actor’s operations.

4.2.3 Evaluating port call performance

Evaluation can be conducted during and after the realization of the port calls. By using the available timestamp information, different services for intermediate and post evaluation could be consumed by the different actors involved in the port call. Within PortCDM there are 5 key performance indicators (KPI’s) for measuring the ability to coordinate timestamp information communicated via the PortCall Message Standard. These are:

- Predictability
- Punctuality
- Waiting times / anchoring times
- Berth productivity
- Resource utilization

All of these KPIs, based upon specified time horizon, are possible to calculate using the current stream or the historical record of port call messages. Access to different actors’ estimates for related states enables actors to calculate a forecast for KPI’s. These forecasts enable actors to counter-act prior or during a specific port visit, based on the identified divergence in the desired value of a specific KPI and the value that the forecast indicates. An example is a prediction of berth productivity for a particular port call based on estimates of when cargo operations is intended to be commenced and completed, and estimates on when the ship is intended to arrive at and depart from berth. Given these estimates the forecast of the berth productivity for this port call might not meet the target value, this sends indications to involved port actors that there is a need to re-plan the port visit.

4.2.4 Use cases for port-to-port interaction

States for positioning Departure_previous port and Arrival_next port is also included in the port call message standard. This allows for short-sea-shipping solutions in which operation in a chain of port visits can be synchronized. This would mean that the port in focus would receive timestamp information on expected and actual time of departure from previous port as well as expected timestamp information on arrival to next port. This would also enable the port in focus to inform previous port on what a desired time of departure would be and inform the next port of destination of what an applicable time of arrival would be given the estimated and/or actual time of departure in the focused port given that there is a willingness from the two involved ports to collaborate.
5. Port call message in the context of SeaSWIM

In order to ensure secure, reliable and standardized communication and lower the threshold for joining PortCDM community by providing and using PortCDM services, exchange of port call messages (PCM) is conducted exclusively through the SeaSWIM connectors.

The fundamental objective for SeaSWIM is to provide and maintain a harmonized way of communicating within the maritime industry. This implies that open and accessible standards are promoted.

To lower the barriers of entry, SeaSWIM is envisioned to provide a reference for all common functionality needed by the ecosystem of stakeholders. For example, identity, service and access management are recognized as common needs that should be supported as SeaSWIM support services.

SeaSWIM consists of specific support services that will ensure interoperability of the STM application services by facilitating data sharing in a common information environment and structure. The specification of SeaSWIM is developed to adhere to some important STM principles:

- Only authenticated actors can provide and consume STM services.
- The owner of data is the actor responsible for the original creation and provision. The owner has full control over the access management for this data.
- STM strives after a service oriented and highly decentralized architecture.
- Usage of open and widely accepted industry standards wherever these exist.

The various maritime actors perform extraction of the actor specific data or information and translation to the appropriate STM format. To simplify the connection with STM, a standardized interface to the support service called the **SeaSWIM Connector** (SSC) will be provided (cf. Figure 18). The SSC is developed as a reference service that handles the interaction with all the SeaSWIM support services according to the SeaSWIM specification. The connector is hosted by the Application Service, both at the provider side and the consumer side. This way the SSC support communication according to the STM principles with minimal development and implementation efforts.

![Figure 18: General overview of the SeaSWIM support services showing the Connector, the Service and Identity Registers along with the decentralized communication pattern between a data provider and a data consumer.](image-url)
Behind the connector, SeaSWIM consists of two central components; the **Identity Registry** and the **Service Registry** (cf. Figure 18). The Identity Registry enables identity management and authentication mechanisms, while the Service Registry provides functionality to publish and find services, their functionality and endpoints. All services also depend on **unique identifiers** that define specific users, services and transferred data objects to avoid conflicts and provide unambiguous references.

### 6. Port call information model

The main purpose of the port call information model is to establish a common Port Call vocabulary by defining central data objects and their relationships. Furthermore, the model shall be used in specifying types, content and structure of Port Call messages. It also facilitates the analysis of functional changes and future requirements. The model is independent of implementation patterns but it could be successfully used, along with other relevant material, as e.g. for requirements for PortCDM related IT development.

#### 6.1 Information model

**PortCall** is the central object in the port call information model (c.f. figure 19). A PortCall encapsulates the data related to one **Vessel**’s visit to one **Port** as part of one inbound **Voyage** and one (optional) outbound voyage dependent on if the voyage is concluded in the port call. This means that a voyage could refer any number of port calls and a port call could refer to one or two voyages. At the Destination PortCall of a Voyage, this Voyage is the inbound Voyage of the PortCall. This PortCall will become the departing PortCall of the outbound Voyage.

The Vessel, Port and Voyage entities are assumed to be part of, and defined in, the sea traffic management (STM) information domain (indicated by the $\text{<<STM>>}$ stereotype). The PortCall entity might also be part of the STM information domain, but shall at least have a unique STM identifier—port call messages, carrying data about a port call must provide the port call identifier as means of identifying the port call for which the data applies. It is further assumed that **Location** is part of the STM information domain, keeping a registry of all valid locations, including ports, and the relevant locations within a port (e.g. rendezvous point, anchoring areas, and quays).

Port call data are encapsulated in a number of abstractions. The top level abstraction is the **ProcessStep**, which represents overarching port call phases (referred to as process steps in section 2.1 above) currently envisioned to be: Arrival, Port visit and Departure. A ProcessStep is further subdivided into **SubProcess** entities, where a SubProcess represents a set of related events. An example of a SubProcess instance is port manoeuvring, i.e. taking the vessel from an anchoring zone to berth, or between quays. A SubProcess entity is subdivided into **Event** instances, where an Event represents a small and coherent unit of work. Examples of typical events are pilotage, towage, cargo operations, arrival berth, departure berth, arrival port area, and departure port area. An Event, in turn, comprises **State** instances. A State maps directly to a “station” in the metro map metaphor (Figure 7), and represents a progress (or state) of a specific operation. The progress of an operation is chosen carefully such that it carries important properties for synchronizing and evaluating overall port call progress, and for planning future
operations. Typical examples of State instances are: arrival vessel to traffic area (Arrival_Vessel_TrafficArea) (i.e. to the port area), cargo operations completed (CargoOp_Completed), and towage commenced (Towage_Comenced). Following the nomenclature discussed in section 2.2, concrete instances of a State can be either a \textbf{LocationState} or a \textbf{ServiceState} is depicted in the model.

A \textbf{LocationState} represents a reference object’s arrival to, or departure from (controlled by the type \textbf{LocationTimeSequence}), a specific location. The reference object corresponds to a line in the metro map metaphor (see figure 7), i.e. vessel, tugboat, or pilot etc.

A \textbf{ServiceState} represents the progress of a service object (controlled by the type \textbf{ServiceTimeSequence}), such as cargo operations commenced or towage completed. The abstract ServiceState is specialized into either \textbf{NauticalServiceState} or \textbf{StationaryServiceState} depending on whether the service concerns movement (from one location to another, e.g. towage) or is performed at a specified location (e.g. bunkering or cargo operations). Performing actor is also captured for service states.

Finally, a State may contain any number of \textbf{Statement} instances. Together with \textbf{LocationState} and \textbf{ServiceState}, \textbf{Statement} dictates content and structure of the Port Call Message format. A Statement represents a reported data point, and corresponds directly to exactly one message in the Port Call Messaging format. A Statement comprises a stated time (timeStatement) and a specification of the meaning of that time (controlled by the type TimeType). For instance, providing an estimated time for the State ‘arrival vessel to traffic area’ with the TimeType ESTIMATED would mean an estimation of when the vessel will arrive to the port. In addition, a Statement comprises statement meta-data (which \textbf{Actor} reported the data, and at which time) as well as a free text comment.
In addition to the information model described above, the StateDefinition entity represents a valid PortCDM state. While combining elements of the Port Call Message format may produce any number of possible States, only a subset of these is considered valid within PortCDM (an initial set is shown in the port call metro map metaphor). It is envisioned that a standardized State Catalogue defines the set of valid PortCDM states in
terms of StateDefinition instances. A StateDefinition shall comprise at least an identifier, a name/description together with the Port Call Message (PCM) format elements that define it. Example StateDefinition instances may be defined as:

<table>
<thead>
<tr>
<th>ID:</th>
<th>Arrival_Vessel_TrafficArea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name:</td>
<td>Vessel arrival to traffic area</td>
</tr>
<tr>
<td>PCM definition:</td>
<td>Type: LocationState, ReferenceObject=VESSEL, TimeSequence=ARRIVAL_TO, Location=TRAFFICAREA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ID:</th>
<th>CargoOp_Commenced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name:</td>
<td>Cargo operations Commenced</td>
</tr>
<tr>
<td>PCM definition:</td>
<td>Type: StationaryServiceState, ServiceObject=CARGO_OPERATION, TimeSequence=COMMENCED</td>
</tr>
</tbody>
</table>

### 6.2 Information object definitions

<table>
<thead>
<tr>
<th>Object name</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vessel</td>
<td>The Vessel class holds information about a vessel. This is assumed to be data managed by a standard STM service, as it is information that is shared among multiple ports, and also among other STM services</td>
</tr>
<tr>
<td>Voyage</td>
<td>The Voyage class represents one vessel's voyage, including information about the planned port visits</td>
</tr>
<tr>
<td>Actor</td>
<td>The Actor class represents an organization that is somehow relevant to STM and PortCDM. Identification of data provider, and access management are examples of uses of the Actor class</td>
</tr>
<tr>
<td>Location</td>
<td>Location is the abstract class representing a named point of interest. The position represents the GPS position (complying to WGS84 Decimal Degrees) of the Location instance. Currently, position is represented as the center point of the location (this will change to be represented as polygons in future updates of the port call message format)</td>
</tr>
<tr>
<td>Port</td>
<td>The Port class represents one port</td>
</tr>
<tr>
<td>PortLocation</td>
<td>The class represents a logical location in the port, for instance a berth, or an anchoring zone.</td>
</tr>
<tr>
<td>PortCall</td>
<td>The PortCall class is the top level representation encapsulating all relevant port call data</td>
</tr>
<tr>
<td>ProcessStep</td>
<td>The ProcessStep class represents high level port call phases</td>
</tr>
<tr>
<td>SubProcess</td>
<td>The SubProcess class encapsulates a set of related operations (Events)</td>
</tr>
<tr>
<td>Event</td>
<td>The Event class represents a small and coherent piece of work</td>
</tr>
<tr>
<td>State</td>
<td>The abstract State class represents an important milestone in the carrying out of an event.</td>
</tr>
<tr>
<td>LocationState</td>
<td>The LocationState is a concrete specialization of State and represents information of an objects arrival to or departure from a specific location</td>
</tr>
<tr>
<td>ServiceState</td>
<td>ServiceState is the abstract specialization of the State class, and represents the progress of an operation</td>
</tr>
<tr>
<td>Nautical ServiceState</td>
<td>The NauticalServiceState is a concrete specialization representing a service that has the purpose of facilitating a movement, and thus encapsulates a from and a to location</td>
</tr>
<tr>
<td>Stationary ServiceState</td>
<td>The StationaryServiceState is a concrete specialization representing a service that is performed at a specified location</td>
</tr>
<tr>
<td>Statement</td>
<td>The Statement class represents one reported time (ISO-8601 in UTC) for a specific state (Examples: Cargo operations at quay 511 estimated to commence at 2016-03-03T21:00Z; Towage commenced confirmed for 2016-03-03T19:00Z from pilot</td>
</tr>
</tbody>
</table>
station to quay 511; Vessel estimated to arrive at pilot station at 2016-03-03T18:45Z)

| State Definition | The StateDefinition class represents what is considered a valid state. Valid State instances are defined and maintained by the PortCDM council. In order to be PortCDM compliant, systems must be able to understand and manage the relevant StateDefinitions. The states represented as StateDefinition (in a published StateCatalogue) are chosen such that these carry generally important information for successful coordination of a port call |

6.3 XML Schema and schema definition

This section describes the technical implementation of a port call message, representing singular data points that systems can report to PortCDM. While port call messages are represented by the Statement class in the port call information model, parts of the message elements are held by the State class to which the Statement belongs; for instance: ReferenceObject, TimeSequence and Location. Such elements determine to which StateDefinition the implied Statement belongs. Thus, in relation to the Port Call information model, a port call message carry in addition to the reported time and related meta-data, certain information regarding which State the reported time concerns, and thereby implicitly also the type of event. Identification of the more abstract entities in the information model (as well as the individual State and Event instances) will require algorithmic solutions.

6.3.1 XML-schema

The technical implementation for Port Call Message Format is described as an XML Schema (see figure 20, and appendix III for the schema definition) to facilitate an unambiguous representation of the format that allows implementation in a range of different software environments in a consistent manner. A few additions and adaptations stemming from the nature of XML schemas and simple convenience of usage that are worth noting:

1. LocationState has no explicit element holding the time sequence. Instead, this is expressed as a choice between two similar elements, arrivalLocation and departureLocation. Any LocationState must contain exactly one element, either an arrivalLocation or a departureLocation. Designing it this way lets us impose a specific rule that makes “from” optional for an arrivalLocation and “to” optional for a departureLocation.  

```xml
<pcm:locationState>
  <pcm:arrivalLocation>
    <!Optional:-->
    <pcm:name>BERTH</pcm:name>
    <pcm:from>
      <pcm:name>ANCHORAGE_AREA</pcm:name>
    </pcm:from>
  </pcm:arrivalLocation>
  <pcm:departureLocation>
    <!Optional:-->
    <pcm:name>TUG_STATION</pcm:name>
    <pcm:to>
      <pcm:name>ANCHORAGE_AREA</pcm:name>
    </pcm:to>
  </pcm:departureLocation>
</pcm:locationState>
```

13 Example showing two LocationState elements, one for TimeSequence ARRIVAL and one for TimeSequence DEPARTURE. In both cases the optional element to and from, respectively, are included and commented as being optional.
2. **messageId** is based on UUID in URN format, in accordance with RFC 4122. This allows us to assign messageIds in a distributed manner with no centralised id management and still be guaranteed that all messageIds are globally unique. As a result, any message that is sent has an Id.

3. **groupWith** is a messageId pointing to another, previously sent message that holds information that refers to a related data point. This facilitates good algorithmical identification of related messages, pertaining to, for instance, the same berth shifting event. The field is optional.

**Location**, the type that holds information about the actual locations for **LocationStates** have three identifying fields:

1. **name**, which is a logical location, in the sense that it identifies a location as being a quay, pilot station or anchoring area. This is the only mandatory field.

2. **identity** points to a specific instance of a logical location. This can be a quay number, the name of a specific anchoring area or similar.

3. **Position** is the geographical position of the location. Mainly intended for locations that are not geographically fixed over time, such as a specific rendezvous point between vessel and pilot.

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14 [www.ietf.org/rfc/rfc4122.txt](http://www.ietf.org/rfc/rfc4122.txt)
Figure 20: XML-schema
7. The Port Call Message in context

Several contemporary approaches are pursuing efforts in standardized messaging for the maritime sector. In this section the relationship to some relevant approaches is explored providing arguments to how these would be complemented and/or are not enough for the purpose of the port call message. The initiative taken by introducing a port call message format building on the practice of optimized port call operations are also to be seen as an input for those developing other standards providing possible insights for including the necessary parameters in these message standards for enabling optimized port calls.

7.1 The relationship to the timestamp standard proposed by Pronto, STM, BIMCO, and IHMA

One contemporary application in which the time stamp standard is being used is the Pronto application. Pronto is a social business communication platform for the port community. It invites all parties to share and receive information regarding the planning of all services related to the vessel. This is claimed to lead to optimization of the port call. The ambition is that the solution must work for every trade, for every port, from port to port and end to end (factory to warehouse or customer). That’s why:

1. Definitions of events are as much as possible in line with the existing IMO FAL, BIMCO contracts and Logbook entries
2. Exchange of events as much as possible in line with existing GS1 standards

Based on business cases of shipping the priority 1 and 2 events are Cargo Completion time and Pilot On Board time. The timestamp standard used in Pronto is founded in the same nomenclature that the port call message format builds upon. This time stamp standard has been introduced to IMO FAL (Fal 40/Action item 17) via an information paper and is planned to be a proposal in April 2017.

7.2 The relationship to Route Exchange Format (RTZ)

Empowered by the MONALISA projects, the Route Exchange Format (RTZ) has been standardized (IEC 61174:2015, annex S). The purpose with this format is to have a standardized format in exchanging voyage plans, especially ship-to-shore. This standard covers, among other attributes, waypoints and times of arrival (estimated or planned) to the different waypoints which constitute a route. In the revision of the RTZ, the standard is planned to also covers the different statuses of a route (planned, confirmed etc.). Until today the RTZ format is not put fully inter-lined with the port call message format due to its different purposes. The final waypoint of a route carried by the RTZ format does not need to have a direct relationship to a physical area related to the port.

In order to enable a good coupling between RTZ and the Port Call Message Format, the forthcoming version of RTZ is planned to also include the following attributes:
Port Call IDs for Departure and Destination Ports
Departure and Arrival ports using UNLOCODE
Waypoint for the Start of the Sea Voyage
Waypoint for the End of the Sea Voyage

Such enhancement would enable that port call synchronization and voyage optimization would be facilitated by the use of the two formats. This would however require that a particular a waypoint in the RTZ format could be mapped to a logical area defined in PortCDM. This would be a typical distributed PortCDM service. Another possible option would be that ships’ officers use PortCDM attributes in their voyage planning, e.g. use arrival to traffic area as a waypoint and use the correct PortCDM attribute as name of the waypoint. This would however require acceptance from all participating ships and also leave room for human errors since it is reliant on manual input and is considered as an inconvenient solution.

7.3 The relationship to Port Community Systems

To begin, it is important to point out that Port Community Systems can differ wildly from port to port so discussing their relationship to PortCDM can only be done in generalisations.

A Port Community System (PCS) is defined as a neutral and open electronic platform that optimises, manages and automates smooth port and logistics processes through a single submission of data, enabling intelligent and secure exchange of information between public and private stakeholders.

Two key characteristics of a Port Community System are:

- It is a neutral and open electronic platform enabling intelligent and secure exchange of information between public and private stakeholders in order to improve the competitive position of the sea and air ports communities; and
- It optimises, manages and automates port and efficient logistics processes through a single submission of data and connecting transport and logistics chains.

Essentially, PCS’s are a response to the need to maximise physical infrastructure utilisation and manage the efficiency of port operations as a whole. It is normally linked to a single port, therefore geographically constrained, and primarily seeks to serve the interests of the various companies and entities linked to the port activities.

From this definition it is easy to draw a common goal between a PCS and PortCDM as both are interested in information exchange however generally the former is focused on administrative data while the latter is interested in operational, real-time time stamp data. Some PCS’s have explored expanding into real-time data gathering but are limited to a single port and multiple standards. In this sense PortCDM is focused on providing time stamp basis for enabling actors to pursue efficient coordination of the port call while Port

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15 http://www.epcsa.eu/pcs
16 The vast majority of PCS’s operating in an international context are port specific. To the best of our knowledge only two countries developed National PCSs, that is India and South Africa. On the other hand there are numerous examples of PCSs covering two or more ports. This is the case of PortBase (ports of Rotterdam and Amsterdam) or valenciaportpcs.net (ports of Valencia, Sagunto and Gandia).
Community Systems has a much wider coverage and therefore is used for multiple purposes.

The scope of a PCS is much larger internally in a port as they deal with a wider range of issues while PortCDM is focused on specifically receiving and distributing live information in real-time extending beyond the single port and voyage management empowered by Sea Traffic Management. PortCDM can be seen as a natural extension to a working PCS as the goals and aims of PortCDM are aligned with each other.

This extension could provide a useful live view of port operations and potentially estimates on future operations in a standardized way. Port operators are already communicating PCS systems and an argument could be made that this information is already being submitting for invoicing purposes, however the key feature of the PortCDM concept is the live data. Operators are required to submit invoice data however this is done hours even days after the operations are completed.

Since PortCDM is a standardized platform of communication it is not limited to a single port and its open source availability facilitates small ports as well as large to deploy it. This can lead to a network of PortCDMs that are capable of communicating between each other in regards to time of arrive of vessels with a known target port and hence real-time port to port communication.

The information could flow in two ways between the two systems, a PCS can feed information about port call ETA’s, custom information, prearrival paperwork etc. while the PortCDM can feed timestamps abot operations back in order to have another source of information to assist billing and invoices etc.

7.4 The port call message standard as S-100 product compliant
(to be included in forthcoming versions)

7.5 The relationship to standard messaging in National Single Window
(to be included in forthcoming versions)

7.6 The relationship to EPCIS
(to be included in forthcoming versions)

8. The story of the emergence of the port call message

The Port Call Message standard presented in this report is a result of several efforts starting summer of 2014 within the MONALISA 2.0 project when the first sketches were made of PortCDM as an integration platform in a port system environment. The first PortCDM demonstrator was built for, and implemented during the fall of 2015 in, Port of Gothenburg and then replicated in Port of Valencia. The PortCDM concept has been
presented in numerous conferences and in scientific papers and became a part of the Sea Traffic Management concept – closing the loop of Sea Traffic Management.

An embryo to the port call message standard was presented at *COMPIT 2015 - Conference on Computer Applications and Information Technology in the Maritime Industries, 11-13 May 2015* and *WCTRS-SIG2, The Port and Maritime Sector: Key Developments and Changes, University of Antwerp, 11-12 May, 2015*. The Port Call Message Standard also build upon joint efforts proposed by Port of Rotterdam, BIMCO, Swedish Maritime Administration, and Viktoria Swedish ICT.

The efforts in validating the PortCDM concept in 13 ports in two test beds within the STM validation project has created a need to bring forward standardized solutions where the port call message standard is one of those. It is expected that a PortCDM council, which will support the future dissemination of PortCDM compliant solutions, will maintain the standard. Building on the results from MONALISA 2.0, the further development of the standard and the documentation of the standard captured in this report have been pursued within activity 1, STM validation project.

### 9. Final words - coming steps and usage of the Port Call Message Format

This version of the standard has gotten a lot of feedback from different stakeholder groups that have an interest to support the standardization of a port call message as a driver for exchanging time-based information within ports, between ships and ports, and between ports. So far different versions of the document has been sent to review to the following people (more to be announced):

<table>
<thead>
<tr>
<th>Name</th>
<th>Company/Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aron Frank Sörensen</td>
<td>BIMCO</td>
</tr>
<tr>
<td>Michael Bergman</td>
<td>Jeppesen</td>
</tr>
<tr>
<td>Björn Andreasson</td>
<td>Swedish Maritime Administration</td>
</tr>
<tr>
<td>Niels-Bjørn Andersen</td>
<td>Copenhagen Business School / Viktoria Swedish ICT</td>
</tr>
<tr>
<td>Richard T. Watson</td>
<td>University of Georgia / Viktoria Swedish ICT</td>
</tr>
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<td>Håkan Heurlin</td>
<td>Swedish Maritime Administration</td>
</tr>
<tr>
<td>Jens Kristian Jensen</td>
<td>Danish Maritima Authority</td>
</tr>
<tr>
<td>Per Setterberg</td>
<td>Swedish Maritime Administration</td>
</tr>
<tr>
<td>Mikael Hägg</td>
<td>Chalmers / Swedish Maritime Administration</td>
</tr>
<tr>
<td>Fredrik Karlsson</td>
<td>Swedish Maritime Administration</td>
</tr>
<tr>
<td>Åsa Kronaas et al</td>
<td>HiQ</td>
</tr>
<tr>
<td>Jarle Hauge</td>
<td>Norwegian Coastal Administration</td>
</tr>
<tr>
<td>Anders Rydlinger</td>
<td>Transas and CI RM</td>
</tr>
<tr>
<td>Mikael Renz</td>
<td>Swedish Maritime Administration</td>
</tr>
<tr>
<td>Jörgen Sjöholm</td>
<td>Swedish Maritime Administration</td>
</tr>
<tr>
<td>Björn Schröder</td>
<td>Raykkel</td>
</tr>
<tr>
<td>Christoph Becker</td>
<td>Raykkel</td>
</tr>
<tr>
<td>Konstantin Ivanov</td>
<td>Transas</td>
</tr>
<tr>
<td>Mikhail Andrianov</td>
<td>Transas</td>
</tr>
<tr>
<td>Tord Svanqvist</td>
<td>InPort</td>
</tr>
<tr>
<td>Jaco Voorspuij</td>
<td>GSI</td>
</tr>
<tr>
<td></td>
<td>Partners in activity 1 (Port CDM test beds) in the STM validation project</td>
</tr>
<tr>
<td></td>
<td>Partners in activity 2 (Voyage management testbeds) in the STM validation project</td>
</tr>
</tbody>
</table>
Partners in activity 4 (Maritime Service Infrastructure) in the STM validation project

<table>
<thead>
<tr>
<th>Name</th>
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<tbody>
<tr>
<td>Gurpreet Singhota</td>
<td>Swedish Maritime Administration</td>
</tr>
<tr>
<td>Edward Hosken</td>
<td>UKHO</td>
</tr>
<tr>
<td>Frank Koldijk</td>
<td>IBM</td>
</tr>
<tr>
<td>Norbert W. Kouwenhoven</td>
<td>IBM</td>
</tr>
<tr>
<td>Douglas Watson</td>
<td>Ericsson</td>
</tr>
<tr>
<td>Mike Collier</td>
<td>Carnival Cruises</td>
</tr>
<tr>
<td>Jaco Voorspuij</td>
<td>GS1</td>
</tr>
<tr>
<td>Douglas Hill</td>
<td>GS1</td>
</tr>
<tr>
<td>Ben van Scherpenzeel</td>
<td>Port of Rotterdam</td>
</tr>
<tr>
<td>Henrik Holm</td>
<td>SSPA</td>
</tr>
<tr>
<td>Thomas Jensen</td>
<td>Copenhagen Business School / Maersk</td>
</tr>
<tr>
<td>Michael Rosemann</td>
<td>Queensland University of Technology / Viktoria Swedish ICT</td>
</tr>
<tr>
<td>Peter Berljung</td>
<td>SAAB Transpondertech</td>
</tr>
<tr>
<td>Lind Modéer Näs</td>
<td>Carmenta</td>
</tr>
<tr>
<td>Johan Holmqvist</td>
<td></td>
</tr>
<tr>
<td>Mika Semann</td>
<td>Signalis</td>
</tr>
</tbody>
</table>

This version, 0.42, of the standard will be further developed based on insights received from the application of it in different settings, as e.g. by the use in PortCDM as part of the validation of the concept, in the STM validation project and in other contemporary efforts. The standard will also serve as an input for the PortCDM council who also will be the governance body for maintaining and updating the standard.
### Appendix I: Definitions of key concepts

<table>
<thead>
<tr>
<th>Concept</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>All fast</td>
<td>The vessel has connected all its lines to the shore</td>
</tr>
<tr>
<td>Anchoring Activities</td>
<td>Activities performed at anchoring area</td>
</tr>
<tr>
<td>Anchoring Area</td>
<td>An area within defined limits where anchoring is recommended</td>
</tr>
<tr>
<td>API</td>
<td>Application Programming Interface</td>
</tr>
<tr>
<td>Arrival Berth</td>
<td>When a vessel arrives to berth</td>
</tr>
<tr>
<td>ATA</td>
<td>Actual Time of Arrival</td>
</tr>
<tr>
<td>Berth</td>
<td>A location ashore where vessels can moore and perform different operations</td>
</tr>
<tr>
<td>Berth Shifting</td>
<td>When a vessel is maneuvering from one berth to another berth</td>
</tr>
<tr>
<td>Berth Visit</td>
<td>The time a vessel is at berth until it departures</td>
</tr>
<tr>
<td>Bunkering Operation</td>
<td>Operations where a vessel receives fuel</td>
</tr>
<tr>
<td>Cargo Operation</td>
<td>Loading or discharging cargo</td>
</tr>
<tr>
<td>Connector</td>
<td>An electronic connection between two data systems enabling interoperability and automatic exchange of information in a particular payload format</td>
</tr>
<tr>
<td>Departure Berth</td>
<td>When a vessel is leaving a berth</td>
</tr>
<tr>
<td>Departure Port Area</td>
<td>When a vessel is leaving the port limits</td>
</tr>
<tr>
<td>Departure VTS Area</td>
<td>When a vessel is leaving a VTS area</td>
</tr>
<tr>
<td>Escort Towage</td>
<td>An activity performed by one or several tug boats</td>
</tr>
<tr>
<td>Escort Tug</td>
<td>An Escort tug is a tug boat that escorts vessels in order to increase safety when vessels are maneuvering in narrow waters</td>
</tr>
<tr>
<td>ETA</td>
<td>Estimated Time of Arrival</td>
</tr>
<tr>
<td>Event</td>
<td>The Event class represents a small and coherent piece of work</td>
</tr>
<tr>
<td>Garbage Operation</td>
<td>Discharging of garbage</td>
</tr>
<tr>
<td>Ice Breaker</td>
<td>An icebreaker is a special-purpose ship or boat designed to move and navigate through ice-covered waters, and provides safe waterways for other boats and ships.</td>
</tr>
<tr>
<td>LocationState</td>
<td>The LocationState is a concrete specialization of State and represents information of an objects arrival to or departure from a specific location</td>
</tr>
<tr>
<td>Lube Oil Operation</td>
<td>Operations where a vessel receives Lube oil</td>
</tr>
<tr>
<td>Maneuvering</td>
<td>When a vessel is not at berth nor at anchor</td>
</tr>
<tr>
<td>Mooring Operation</td>
<td>The Operations when a vessel is connected to a berth or when disconnected from a berth</td>
</tr>
<tr>
<td>NauticalServiceState</td>
<td>The NauticalServiceState is a concrete specialization representing a service that has the purpose of facilitating a movement, and thus encapsulates a from and a to location</td>
</tr>
<tr>
<td>PCM</td>
<td>Port Call Message</td>
</tr>
<tr>
<td>Pilot</td>
<td>A pilot is a mariner who maneuvers ships through dangerous or congested waters, such as harbors or river mouths, and completes the berthing / unberthing operation of the ships by controlling the ship's maneuverability directly and the tugs and shore linesmen through a radio. Pilots are expert ship handlers who possess detailed knowledge of local waterways.</td>
</tr>
<tr>
<td>Pilot Boarding Area</td>
<td>An area at sea where the pilot embark to/disembark from the vessel. Sometimes referred to as Pilot Station</td>
</tr>
<tr>
<td>Pilot Boat</td>
<td>A pilot boat is a type of boat used to transport maritime pilots between land and the inbound or outbound ships that they are piloting.</td>
</tr>
<tr>
<td>Pilotage</td>
<td>The operations performed by the pilot</td>
</tr>
<tr>
<td>Port Call</td>
<td>A vessels visit to a specific port realizing the purpose of call</td>
</tr>
<tr>
<td>Port Call Process</td>
<td>The vessels turn-around process contains arrival, port visit and departure</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>--------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Port Visit</td>
<td>A Port-Visit includes is all the activities between arrival Traffic Area and departure Traffic Area</td>
</tr>
<tr>
<td>PortCDM</td>
<td>Port Collaborative Decision Making</td>
</tr>
<tr>
<td>Post Cargo Survey</td>
<td>A survey (E.g. Sampling when a cargo has been loaded to check if cargo is OK) after cargo operations is completed</td>
</tr>
<tr>
<td>Pre Cargo Survey</td>
<td>A survey (E.g. Sampling before discharging of cargo to check that cargo if cargo is OK) before cargo operation is commenced</td>
</tr>
<tr>
<td>Provision Operation</td>
<td>When vessels are receiving provisions (e.g. food delivery)</td>
</tr>
<tr>
<td>Rendezvous Area</td>
<td>A Rendezvous Area represents an important physical area within a port.</td>
</tr>
<tr>
<td>RTA</td>
<td>Recommended Time of Arrival</td>
</tr>
<tr>
<td>SeaSWIM</td>
<td>SWIM consists of standards, ICT infrastructure and governance enabling the management of STM information, its reuse and exchange between qualified parties via interoperable services.</td>
</tr>
<tr>
<td>ServiceState</td>
<td>ServiceState is the abstract specialization of the State class, and represents the progress of an operation</td>
</tr>
<tr>
<td>Sludge</td>
<td>Sludge is a semi-solid slurry and can be produced as sewage sludge from wastewater</td>
</tr>
<tr>
<td>Sludge Operation</td>
<td>When a vessel is discharging sludge.</td>
</tr>
<tr>
<td>State</td>
<td>The abstract State class represents an important milestone in the carrying out of an event.</td>
</tr>
<tr>
<td>Statement</td>
<td>The Statement class represents one reported time for a specific state</td>
</tr>
<tr>
<td>SubProcess</td>
<td>The SubProcess class encapsulates a set of related operations (Events)</td>
</tr>
<tr>
<td>Towage</td>
<td>An activity performed by one or several Escort tug boats</td>
</tr>
<tr>
<td>Traffic Area</td>
<td>A Geographical Area where certain Governmental or Port related regulations that applies to shipping</td>
</tr>
<tr>
<td>TTA</td>
<td>Target Time of Arrival</td>
</tr>
<tr>
<td>Tug</td>
<td>A tug (tugboat) is a boat or ship that maneuvers vessels by pushing or towing them to and from berth.</td>
</tr>
<tr>
<td>Tug Zone</td>
<td>The area where towage performed</td>
</tr>
<tr>
<td>Turn-Around Process</td>
<td>In PortCDM the vessels turn-around process is the time it takes from when a vessel arrives Traffic area to when the vessel departure from Traffic area</td>
</tr>
<tr>
<td>URN format</td>
<td>In computing, a Uniform Resource Name (URN) is the historical name for a Uniform Resource Identifier</td>
</tr>
<tr>
<td>UUID</td>
<td>A universally unique identifier (UUID) is an identifier standard used in software construction.</td>
</tr>
<tr>
<td>Water Operation</td>
<td>Bunkering of water</td>
</tr>
</tbody>
</table>
## Appendix II: State catalogue

<table>
<thead>
<tr>
<th>StateId</th>
<th>Time/Sequence</th>
<th>Reference/Object</th>
<th>Location</th>
<th>Type</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arrival Escort Tug ETugZone</td>
<td>ARIVAL.TO</td>
<td>ESCORT.TUG</td>
<td>ETUG.ZONE</td>
<td>Arrival Escort Tug ETug Zone</td>
<td></td>
</tr>
<tr>
<td>Arrival Escort Tug Zone</td>
<td>ARIVAL.TO</td>
<td>ESCORT.TUG</td>
<td>TUG.ZONE</td>
<td>Arrival Escort Tug Zone</td>
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</tr>
<tr>
<td>Arrival Icebreaker LOC</td>
<td>ARIVAL.TO</td>
<td>ICEBREAKER</td>
<td>LOC</td>
<td>Arrival Icebreaker LOC</td>
<td></td>
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<tr>
<td>Arrival Icebreaker Rendezvous Area</td>
<td>ARIVAL.TO</td>
<td>ICEBREAKER</td>
<td>RENDEZV_AREA</td>
<td>Arrival Icebreaker Rendezvous Area</td>
<td></td>
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<tr>
<td>Arrival Pilot Berth</td>
<td>ARIVAL.TO</td>
<td>PILOT</td>
<td>BERTH</td>
<td>Arrival Pilot Berth</td>
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<tr>
<td>Arrival Pilot PilotBA</td>
<td>ARIVAL.TO</td>
<td>PILOT</td>
<td>PILOT_BOARDING_AREA</td>
<td>Arrival Pilot PilotBA</td>
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<td>Arrival Pilot Tug Zone</td>
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<td>PILOT</td>
<td>TUG.ZONE</td>
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<td>Arrival Pilot Vessel</td>
<td>ARIVAL.TO</td>
<td>PILOT</td>
<td>VESSEL</td>
<td>Arrival Pilot Vessel</td>
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<td>Arrival Tug Berth</td>
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<td>BERTH</td>
<td>Arrival Tug Berth</td>
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<td>TUG.ZONE</td>
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<td>Arrival Vessel Anchorage Area</td>
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<td>VESSEL</td>
<td>BERTH</td>
<td>Arrival Vessel Berth</td>
<td></td>
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<td>Arrival Vessel ETug Zone</td>
<td>ARIVAL.TO</td>
<td>VESSEL</td>
<td>ETUG.ZONE</td>
<td>Arrival Pilot Tug Zone</td>
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<td>Arrival Vessel LOC</td>
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<td>VESSEL</td>
<td>LOC</td>
<td>Arrival Vessel LOC</td>
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<td>Arrival Vessel Next Port</td>
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<td>VESSEL</td>
<td>NEXT_PORT</td>
<td>Arrival Vessel Next Port</td>
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<td>ARIVAL.TO</td>
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<td>Arrival Vessel Traffic Area</td>
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<td>TRAFFIC_AREA</td>
<td>Arrival Vessel Traffic Area</td>
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<td>Departure Escort Tug LOC</td>
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<td>ESCORT.TUG</td>
<td>LOC</td>
<td>Departure Escort Tug LOC</td>
<td></td>
</tr>
<tr>
<td>Departure Escort Tug Vessel</td>
<td>DEPARTURE.FROM</td>
<td>ESCORT.TUG</td>
<td>VESSEL</td>
<td>Departure Escort Tug Vessel</td>
<td></td>
</tr>
<tr>
<td>Departure Icebreaker LOC</td>
<td>DEPARTURE.FROM</td>
<td>ICEBREAKER</td>
<td>LOC</td>
<td>Departure Icebreaker LOC</td>
<td></td>
</tr>
<tr>
<td>Departure Icebreaker Rendezvous Area</td>
<td>DEPARTURE.FROM</td>
<td>ICEBREAKER</td>
<td>RENDEZV_AREA</td>
<td>Departure Icebreaker Rendezvous Area</td>
<td></td>
</tr>
<tr>
<td>Departure Pilot Vessel</td>
<td>DEPARTURE.FROM</td>
<td>PILOT</td>
<td>VESSEL</td>
<td>Departure Pilot Vessel</td>
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</tr>
<tr>
<td>Departure Pilot Vessel</td>
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<td>PILOT</td>
<td>TUG</td>
<td>Departure Pilot Vessel</td>
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</tr>
<tr>
<td>Departure Tug LOC</td>
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<td>TUG</td>
<td>LOC</td>
<td>Departure Tug LOC</td>
<td></td>
</tr>
<tr>
<td>Departure Tug Tug Zone</td>
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<td>TUG</td>
<td>TUG.ZONE</td>
<td>Departure Tug Tug Zone</td>
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</tr>
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<td>ANCHORING_AREA</td>
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<td></td>
</tr>
<tr>
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<td>VESSEL</td>
<td>BERTH</td>
<td>Departure Vessel Berth</td>
<td></td>
</tr>
<tr>
<td>Departure Vessel ETug Zone</td>
<td>DEPARTURE.FROM</td>
<td>VESSEL</td>
<td>ETUG.ZONE</td>
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</tr>
<tr>
<td>Departure Vessel LOC</td>
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<td>LOC</td>
<td>Departure Vessel LOC</td>
<td></td>
</tr>
<tr>
<td>Departure Vessel PilotBA</td>
<td>DEPARTURE.FROM</td>
<td>VESSEL</td>
<td>PILOT_BOARDING_AREA</td>
<td>Departure Vessel PilotBA</td>
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<tr>
<td>Departure Vessel Previous Port</td>
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<td>VESSEL</td>
<td>PREVIDUS_PORT</td>
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<tr>
<td>Departure Vessel Rendezvous Area</td>
<td>DEPARTURE.FROM</td>
<td>VESSEL</td>
<td>RENDEZV_AREA</td>
<td>Departure Vessel Rendezvous Area</td>
<td></td>
</tr>
<tr>
<td>Departure Vessel Traffic Area</td>
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<td>VESSEL</td>
<td>TRAFFIC_AREA</td>
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</tr>
<tr>
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<td>DEPARTURE.FROM</td>
<td>VESSEL</td>
<td>TUG.ZONE</td>
<td>Departure Vessel Tug Zone</td>
<td></td>
</tr>
</tbody>
</table>

Figure 21: Definition of location states
<table>
<thead>
<tr>
<th>State/#</th>
<th>Service\ Type</th>
<th>Service\ Object</th>
<th>Time/Sequence</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anchoring_Commenced</td>
<td>STATIONARY</td>
<td>ANCHORING</td>
<td>COMMENDED</td>
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</tr>
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<td>ANCHORING</td>
<td>COMPLETED</td>
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</tr>
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<td>COMMENDED</td>
<td>Arrival_Anchoring_Operation_Commenced</td>
</tr>
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<td>ARRIVAL ANCHORING OPERATION</td>
<td>COMPLETED</td>
<td>Arrival_Anchoring_Operation_Completed</td>
</tr>
<tr>
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<td>DENIED</td>
<td>Departure_Vessel_Berth_Request_Denied</td>
</tr>
<tr>
<td>Berth_Departure_Req_Received</td>
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<td>DEPARTURE BERTH</td>
<td>REQUEST_RECEIVED</td>
<td>Departure_Vessel_Berth_Request_Received</td>
</tr>
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<td>BERTH SHIFTING</td>
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<td>COMPLETED</td>
<td>Berth_Shift_Completed</td>
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<tr>
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<td>DENIED</td>
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<tr>
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<td>DENIED</td>
<td>Arrival_Vessel_Berth_Request_Denied</td>
</tr>
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<td>COMMENDED</td>
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<td>Cargo_Operations_Completed</td>
</tr>
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<td>CARGO OPERATION</td>
<td>REQUEST_RECEIVED</td>
<td>Cargo_Operations_Request_Received</td>
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<td>Departure_Anchoring_Operation_Completed</td>
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<td>REQUEST_RECEIVED</td>
<td>Escort_Towage_Request_Received</td>
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<td>Garbage_Operation_Commenced</td>
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</tr>
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<td>Garbage_Operation_Request_Denied</td>
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<tr>
<td>Garbage_Op_Req_Received</td>
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<td>GARBAGE OPERATION</td>
<td>REQUEST_RECEIVED</td>
<td>Garbage_Operation_Request_Received</td>
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<td>GARBAGE OPERATION</td>
<td>REQUEST_RECEIVED</td>
<td>Garbage_Operation_Request_Received</td>
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<td>Ice_Breaker_Assistance_Commenced</td>
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<td>ICEBREAKING OPERATION</td>
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<td>Ice_Breaker_Assistance_Request_Denied</td>
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<td>ICEBREAKING OPERATION</td>
<td>REQUEST_RECEIVED</td>
<td>Ice_Breaker_Assistance_Request_Received</td>
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<td>REQUEST_RECEIVED</td>
<td>Ice_Breaker_Assistance_Request_Received</td>
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<td>Lube_Oil_Operation_Request_Denied</td>
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<td>REQUEST_RECEIVED</td>
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<td>LUBE OIL OPERATION</td>
<td>REQUEST_RECEIVED</td>
<td>Lube_Oil_Operation_Request_Received</td>
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<td>MOORING OPERATION</td>
<td>REQUEST_RECEIVED</td>
<td>Mooring_Operation_Request_Received</td>
</tr>
</tbody>
</table>

*Figure 22: Definition of service states - part 1*
MooringOp_Requested STATIONARY MOORING_OPERATION REQUESTED MooringOperationRequested
Pilotage_Commanded NAUTICAL PILOTAGE COMMENDED PilotageCommanded
Pilotage_Completed NAUTICAL PILOTAGE COMPLETED PilotageCompleted
Pilotage_Confirmed NAUTICAL PILOTAGE CONFIRMED PilotageConfirmed
Pilotage_Denied NAUTICAL PILOTAGE DENIED PilotageDenied
Pilotage_Requested NAUTICAL PILOTAGE REQUESTED PilotageRequested
PortDeparture_Confirmed STATIONARY DEPARTURE_PORTAREA CONFIRMED PortDepartureConfirmed
PortDeparture_Denied STATIONARY DEPARTURE_PORTAREA DENIED PortDepartureDenied
PortDeparture_Requested STATIONARY DEPARTURE_PORTAREA REQUESTED PortDepartureRequested
PortVisit_Confirmed STATIONARY ARRIVAL_PORTAREA CONFIRMED PortVisitConfirmed
PortVisit_Denied STATIONARY ARRIVAL_PORTAREA DENIED PortVisitDenied
PreCargoSurvey_Commanded STATIONARY PRECARGO SURVEY COMMENDED PreCargoSurveyCommanded
PreCargoSurvey_Completed STATIONARY PRECARGO SURVEY COMPLETED PreCargoSurveyCompleted
PreCargoSurvey_Confirmed STATIONARY PRECARGO SURVEY CONFIRMED PreCargoSurveyConfirmed
PreCargoSurvey_Requested STATIONARY PRECARGO SURVEY REQUESTED PreCargoSurveyRequested
PreProvision_Requested STATIONARY PROVISION_OPERATION REQUESTED ProvisionRequested
Provision_Confirmed STATIONARY PROVISION_OPERATION CONFIRMED ProvisionConfirmed
Provision_Denied STATIONARY PROVISION_OPERATION DENIED ProvisionDenied
Provision_Requested STATIONARY PROVISION_OPERATION REQUESTED ProvisionRequested
ReadyToSailOp_Commanded STATIONARY DEPARTURE BERTH COMMENDED ReadyToSailOpRequested
ReadyToSailOp_Completed STATIONARY DEPARTURE BERTH COMPLETED ReadyToSailOpCompleted
SlopOp_Commanded STATIONARY SLOP_OPERATION COMMENDED SlopOperationRequested
SlopOp_Completed STATIONARY SLOP_OPERATION COMPLETED SlopOperationCompleted
SlopOp_Confirmed STATIONARY SLOP_OPERATION CONFIRMED SlopOperationConfirmed
SlopOp_Denied STATIONARY SLOP_OPERATION DENIED SlopOperationDenied
SludgeOp_Commanded STATIONARY SLUDGE_OPERATION COMMENDED SludgeOperationRequested
SludgeOp_Completed STATIONARY SLUDGE_OPERATION COMPLETED SludgeOperationCompleted
SludgeOp_Confirmed STATIONARY SLUDGE_OPERATION CONFIRMED SludgeOperationConfirmed
SludgeOp_Denied STATIONARY SLUDGE_OPERATION DENIED SludgeOperationDenied
WaterOp_Requested STATIONARY WATER_OPERATION REQUESTED WaterOperationRequested
WaterOp_Commanded STATIONARY WATER_OPERATION COMMENDED WaterOperationCommanded
WaterOp_Completed STATIONARY WATER_OPERATION COMPLETED WaterOperationCompleted
WaterOp_Confirmed STATIONARY WATER_OPERATION CONFIRMED WaterOperationConfirmed
WaterOp_Denied STATIONARY WATER_OPERATION DENIED WaterOperationDenied
WaterOp_Requested STATIONARY WATER_OPERATION REQUESTED WaterOperationRequested

Figure 23: Definition of service states - part 2
Appendix III: Schema definition

<?xml version="1.0" encoding="utf-8" ?>
<!-- changelog
Version: 0.0.12
Revision date: 2016-05-06
- changed regex for PortCallIdentifier to allow upper case characters inURN
Version: 0.0.11
Revision date: 2016-04-26
- enumeration updates
  + ServiceTimeSequence
    - REQUEST -> REQUESTED
    - CONFIRM -> CONFIRMED
    - new REQUEST_RECEIVED
    - new DENIED

+ServiceObject
- ARRIVAL_ANCHORAGEAREA -> ARRIVAL_ANCHORING_OPERATION
- DEPARTURE_ANCHORAGEAREA -> DEPARTURE_ANCHORING_OPERATION
- new ANCHORING
- new ARRIVAL_VTSAREA
- new BERTH_SHIFTING
- new DEPARTURE_VTSAREA

+ LocationReferenceObject
- ICE_BREAKER -> ICEBREAKER

+LogicalLocation
- ANCHORAGE_AREA -> ANCHORING_AREA
- PILOT_STATION -> PILOT_BOARDING_AREA
- TUG_STATION -> TUG_ZONE
- new ETUG_ZONE
- new LOC
- new NEXT_PORT
- new PREVIOUS_PORT
- new RENDEZV_AREA
- new VESSEL

Version: 0.0.9
Revision date: 2016-04-19
- renamed ServiceReferenceObject to follow concept standard
- updated ServiceObject with new list of constants

Version: 0.0.8
Revision date: 2016-04-15
- field length for PortCallMessageIdentifier changed from 67 to 66, to match the actual pattern

Version: 0.0.7
Revision date: 2016-04-06
- Made reportedBy and reportedAt optional, since they should be determined by the receiving service
Version: 0.0.6
Revision date: 2016-04-01
- Added PORT to LogicalLocation

Version: 0.0.5
Revision date: 2016-03-31
- Moved REQUEST and CONFIRM from TimeType to ServiceTimeSequence

Version: 0.0.4
Revision date: 2016-03-16
- Renamed LatLong type Position
- Added coordinate system to documentation for Position
- Added type MRN
- Added MRN based identifiers for port call and message

Version: 0.0.3
Revision date: 2016-02-19
- Made groupWith optional

Version: 0.0.2
Revision date: 2016-02-19
- Added missing element portCallId to root node
- Added performingActor to type ServiceState
- Added messageId
- Added groupWith

-->
<xs:schema attributeFormDefault="unqualified"
    elementFormDefault="qualified"
    xmlns:xs="http://www.w3.org/2001/XMLSchema"
    xmlns:pcm="http://www.portcdm.eu/PortCallMessage"
    targetNamespace="http://www.portcdm.eu/PortCallMessage">
  <xs:annotation>
    <xs:appinfo>
      version = 0.0.11
      revisionDate = 2016-04-26
    </xs:appinfo>
    <xs:documentation>
      Schema for PortCDM PortCall Message Format
      The root element is a Port Call Message, containing some metadata about when and by whom this message was sent, followed by a time type and either a location state or a service state.
    </xs:documentation>
  </xs:annotation>
</xs:schema>
<dd>UUID-based so that no central identity management is necessary</dd>
<dt>groupWith</dt>
<dd>messageId of another message that this message should be grouped with. This is to facilitate repeated events like berth shifting by improving the ability to group data</dd>

There is also an optional comment element. All time values are in ISO-8601 format as per the dateTime type, in UTC, as denoted by the Z suffix.

LocationState is a representation for LOCATION STATE in the specification. It describes a time related data point for an arrival to or departure from a specified location. Time sequence is expressed implicitly by the choice of element arrivalLocation or departureLocation.

This is to avoid the redundancy of having to add a fixed element in each of the respective elements (ARRIVAL for arrivalLocation and DEPARTURE for departureLocation. Using this design allows us to dictate in the messaging format itself that "to" is mandatory, and "from" optional if time sequence is ARRIVAL and the reversed for time sequence DEPARTURE.
<xs:element name="arrivalLocation">
  <xs:complexType>
    <xs:sequence>
      <xs:element type="pcm:Location" name="from" minOccurs="0"/>
      <xs:element type="pcm:Location" name="to"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="departureLocation">
  <xs:complexType>
    <xs:sequence>
      <xs:element type="pcm:Location" name="from"/>
      <xs:element type="pcm:Location" name="to" minOccurs="0"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:choice>
  <xs:element name="referenceObject" type="pcm:LocationReferenceObject"/>
</xs:choice>

<xs:complexType name="ServiceState">
  <xs:annotation>
    <xs:documentation>
      ServiceState is a representation for SERVICE STATE in the specification. It describes a time related data point for a service. The service can be either stationary (sludge, bunkering, cargo operations) in which case the "at" elements hold its location or navigational (towage, escort towage or piloting) which requires to and from locations.
    </xs:documentation>
  </xs:annotation>
  <xs:sequence>
    <xs:element name="serviceObject" type="pcm:ServiceObject"/>
    <xs:element name="performingActor" type="pcm:Actor"/>
    <xs:element name="timeSequence" type="pcm:ServiceTimeSequence"/>
    <xs:choice>
      <xs:element name="at" type="pcm:Location"/>
      <xs:element name="between">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="to" type="pcm:Location"/>
            <xs:element name="from" type="pcm:Location"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:choice>
  </xs:sequence>
</xs:complexType>
<xs:complexType name="Location">
  <xs:sequence>
    <xs:choice>
      <xs:sequence>
        <xs:complexType name="ServiceObject">
          <xs:restriction base="xs:string">
            <xs:enumeration value="ANCHORING"/>
            <xs:enumeration value="ARRIVAL_ANCHORING_OPERATION"/>
            <xs:enumeration value="ARRIVAL_BERTH"/>
            <xs:enumeration value="ARRIVAL_PORTAREA"/>
            <xs:enumeration value="ARRIVAL_VTSAREA"/>
            <xs:enumeration value="BERTH_SHIFTING"/>
            <xs:enumeration value="BUNKERING_OPERATION"/>
            <xs:enumeration value="CARGO_OPERATION"/>
            <xs:enumeration value="DEPARTURE_ANCHORING_OPERATION"/>
            <xs:enumeration value="DEPARTURE_BERTH"/>
            <xs:enumeration value="DEPARTURE_PORTAREA"/>
            <xs:enumeration value="DEPARTURE_VTSAREA"/>
            <xs:enumeration value="ESCORT_TOWAGE"/>
            <xs:enumeration value="GARBAGE_OPERATION"/>
            <xs:enumeration value="ICEBREAKING_OPERATION"/>
            <xs:enumeration value="LUBEOIL_OPERATION"/>
            <xs:enumeration value="MOORING_OPERATION"/>
            <xs:enumeration value="PILOTAGE"/>
            <xs:enumeration value="POSTCARGOSURVEY"/>
            <xs:enumeration value="PRECARGOSURVEY"/>
            <xs:enumeration value="PROVISION_OPERATION"/>
            <xs:enumeration value="SLOP_OPERATION"/>
            <xs:enumeration value="SLUDGE_OPERATION"/>
            <xs:enumeration value="TOWAGE"/>
            <xs:enumeration value="WATER_OPERATION"/>
          </xs:restriction>
        </xs:complexType>
      </xs:sequence>
    </xs:choice>
    <xs:complexType name="TimeType">
      <xs:restriction base="xs:string">
        <xs:enumeration value="ESTIMATED"/>
        <xs:enumeration value="ACTUAL"/>
        <xs:enumeration value="TARGET"/>
        <xs:enumeration value="RECOMMENDED"/>
      </xs:restriction>
    </xs:complexType>
  </xs:sequence>
</xs:complexType>
<xs:element name="locationType" type="pcm:LogicalLocation"/>
<!-- Geographical position, for dynamically defined locations like TUG_STATION -->
<xs:element name="position" type="pcm:Position" minOccurs="0"/>
<!-- Location name such as specific quay number or anchoring area name -->
<xs:element name="name" type="xs:string" minOccurs="0"/>
</xs:sequence>
</xs:complexType>

<xs:simpleType name="ServiceTimeSequence">
  <xs:restriction base="xs:string">
    <xs:enumeration value="COMMENCED"/>
    <xs:enumeration value="COMPLETED"/>
    <xs:enumeration value="CONFIRMED"/>
    <xs:enumeration value="DENIED"/>
    <xs:enumeration value="REQUESTED"/>
    <xs:enumeration value="REQUEST_RECEIVED"/>
  </xs:restriction>
</xs:simpleType>

<xs:simpleType name="LocationReferenceObject">
  <xs:restriction base="xs:string">
    <xs:enumeration value="VESSEL"/>
    <xs:enumeration value="TUG"/>
    <xs:enumeration value="ESCORT_TUG"/>
    <xs:enumeration value="PILOT"/>
    <xs:enumeration value="PILOT_BOAT"/>
    <xs:enumeration value="ICEBREAKER"/>
  </xs:restriction>
</xs:simpleType>

<xs:simpleType name="LogicalLocation">
  <xs:restriction base="xs:string">
    <xs:enumeration value="ANCHORING_AREA"/>
    <xs:enumeration value="BERTH"/>
    <xs:enumeration value="ETUG_ZONE"/>
    <xs:enumeration value="LOC"/>
    <xs:enumeration value="NEXT_PORT"/>
    <xs:enumeration value="PILOT_BOARDING_AREA"/>
    <xs:enumeration value="PREVIOUS_PORT"/>
    <xs:enumeration value="RENDEZV_AREA"/>
    <xs:enumeration value="TRAFFIC_AREA"/>
    <xs:enumeration value="TUG_ZONE"/>
    <xs:enumeration value="VESSEL"/>
  </xs:restriction>
</xs:simpleType>
<xs:complexType name="Position">
  <xs:annotation>
    <xs:documentation>
      To allow us to include physical, geographical position for locations that aren't predefined at a fixed geographical position i.e. the rendezvous point for vessel and tug boat. Coordinate system is WGS84 Decimal Degrees. Format is decimal degrees notation as described in ISO 6709.
    </xs:documentation>
  </xs:annotation>
  <xs:all>
    <xs:element name="latitude">
      <xs:annotation>
        <xs:documentation>
          Latitude in decimal degrees notation as described in ISO 6709. Northern latitudes are denoted by positive numbers, southern latitudes by negative.
        </xs:documentation>
      </xs:annotation>
      <xs:simpleType>
        <xs:restriction base="xs:double">
          <xs:minInclusive value="-90"/>
          <xs:maxInclusive value="90"/>
        </xs:restriction>
      </xs:simpleType>
    </xs:element>
    <xs:element name="longitude">
      <xs:annotation>
        <xs:documentation>
          Longitude in decimal degrees notation as described in ISO 6709. Eastern longitudes are denoted by positive numbers, western longitudes by negative.
        </xs:documentation>
      </xs:annotation>
      <xs:simpleType>
        <xs:restriction base="xs:double">
          <xs:minInclusive value="-180"/>
          <xs:maxInclusive value="180"/>
        </xs:restriction>
      </xs:simpleType>
    </xs:element>
  </xs:all>
</xs:complexType>

<xs:complexType name="Actor">
  ...
<xs:element name="id" type="xs:string"/>
<xs:element name="name" type="xs:string"/>
</xs:sequence>
</xs:complexType>

<xs:simpleType name="UUID">
    <xs:restriction base="xs:string">
        <xs:length value="36" fixed="true" />
        <xs:pattern value="[0-9a-fA-F]{8}-[0-9a-fA-F]{4}-[0-9a-fA-F]{3}-[8-9a-bA-B][0-9a-fA-F]{3}-[0-9a-fA-F]{12}"/>
    </xs:restriction>
</xs:simpleType>

<xs:simpleType name="MRN">
    <xs:annotation>
        <xs:documentation>Marine Resource Name identifier, based on URN. Note that the NID, including the mrn: prefix can be no more than 31 characters long</xs:documentation>
    </xs:annotation>
    <xs:restriction base="xs:string">
        <xs:pattern value="urn:mrn:[a-z0-9]+(0,27):[a-z0-9]+,\.:\@\$!*%/?#]+"/>
    </xs:restriction>
</xs:simpleType>

<xs:simpleType name="PortCallIdentifier">
    <xs:annotation>
        <xs:documentation>Port call identifier, based on MRN</xs:documentation>
    </xs:annotation>
    <xs:restriction base="xs:string">
        <xs:pattern value="urn:x-mrn:stm:portcdm:port_call:[A-Za-z]{5}:\[A-Za-z0-9()+,\.:\@\$!*%/?#]+"/>
    </xs:restriction>
</xs:simpleType>

<xs:simpleType name="PortCallMessageIdentifier">
    <xs:annotation>
        <xs:documentation>Port call message identifier, based on MRN and UUID</xs:documentation>
    </xs:annotation>
    <xs:restriction base="xs:string">
        <xs:length value="66" fixed="true" />
        <xs:pattern value="urn:x-mrn:stm:portcdm:message:[0-9a-fA-F]{8}-[0-9a-fA-F]{4}-[0-9a-fA-F]{3}-[8-9a-bA-B][0-9a-fA-F]{3}-[0-9a-fA-F]{12}"/>
    </xs:restriction>
</xs:simpleType>

</xs:schema>
<table>
<thead>
<tr>
<th>Element</th>
<th>Attribute</th>
<th>Description</th>
<th>Type</th>
<th>Status</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>portCallMessage</td>
<td>portCallId</td>
<td>Globally unique identifier for the port call</td>
<td>string</td>
<td>Mandatory</td>
<td>Uses the proposed MRN standard</td>
</tr>
<tr>
<td>portCallMessage</td>
<td>messageId</td>
<td>Globally unique identifier for this port call message</td>
<td>string</td>
<td>Mandatory</td>
<td>Uses the proposed MRN standard</td>
</tr>
<tr>
<td>portCallMessage</td>
<td>groupWith</td>
<td>Message id of port call message this message should be grouped with</td>
<td>string</td>
<td>Optional</td>
<td>Same format as messageId</td>
</tr>
<tr>
<td>portCallMessage</td>
<td>reportedAt</td>
<td>Time and date for when the update in this message was reported</td>
<td>dateTime</td>
<td>Optional</td>
<td>ISO8601 date time string in UTC eg “2016-07-03T11:37:05Z”. Normally set by the first receiving system</td>
</tr>
<tr>
<td>portCallMessage</td>
<td>reportedBy</td>
<td>Identity of the reporting organisation</td>
<td>string</td>
<td>Optional</td>
<td>Normally set by the first receiving system</td>
</tr>
<tr>
<td>portCallMessage</td>
<td>timeType</td>
<td>Semantic type of this message</td>
<td>TimeType</td>
<td>Mandatory</td>
<td>One of ESTIMATED, ACTUAL, TARGET or RECOMMENDED</td>
</tr>
<tr>
<td>portCallMessage</td>
<td>time</td>
<td>Reported time</td>
<td>dateTime</td>
<td>Mandatory</td>
<td>ISO8601 date time string in UTC eg “2016-07-03T11:37:05Z”.</td>
</tr>
<tr>
<td>portCallMessage</td>
<td>comment</td>
<td>Free form comment</td>
<td>string</td>
<td>Optional</td>
<td></td>
</tr>
<tr>
<td>portCallMessage</td>
<td>locationState</td>
<td>Location state of this message</td>
<td>LocationState</td>
<td>Optional</td>
<td>Exactly one of locationState and serviceState must be set</td>
</tr>
<tr>
<td>portCallMessage</td>
<td>serviceState</td>
<td>Service state of this message</td>
<td>ServiceState</td>
<td>Optional</td>
<td>Exactly one of locationState and serviceState must be set</td>
</tr>
<tr>
<td>locationState</td>
<td>arrivalLocation</td>
<td>Arrival location of this LocationState</td>
<td>ComplexType</td>
<td>Optional</td>
<td>Exactly one of arrivalLocation and departureLocation must be set.</td>
</tr>
<tr>
<td>arrivalLocation</td>
<td>to</td>
<td>The referred location for an arrival</td>
<td>Location</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>arrivalLocation</td>
<td>from</td>
<td>Location the arrival is from</td>
<td>Location</td>
<td>Optional</td>
<td>Mainly used to help with relations between states in the port call</td>
</tr>
<tr>
<td>departureLocation</td>
<td>from</td>
<td>The referred location for a departure</td>
<td>Location</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>departureLocation</td>
<td>to</td>
<td>Location the departure is to</td>
<td>Location</td>
<td>Optional</td>
<td>Mainly used to help with relations between states in the port call</td>
</tr>
<tr>
<td>serviceState</td>
<td>serviceObject</td>
<td>The service to be delivered or performed</td>
<td>ServiceObject</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>serviceState</td>
<td>performingActor</td>
<td>The actor performing the service</td>
<td>Actor</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>----------------</td>
<td>---------------------------------</td>
<td>-------</td>
<td>-----------</td>
<td></td>
</tr>
<tr>
<td>serviceState</td>
<td>timeSequence</td>
<td>The time sequence of this message, within the service instance</td>
<td>ServiceTimeSequence</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>serviceState</td>
<td>at</td>
<td>Location where this service is to be performed</td>
<td>Location</td>
<td>Optional</td>
<td></td>
</tr>
<tr>
<td>serviceState</td>
<td>between</td>
<td>Start and end locations</td>
<td>Location</td>
<td>Optional</td>
<td></td>
</tr>
</tbody>
</table>

- **at**: Location where this service is to be performed. Optional. Set for stationary services. Exactly one of at and between must be set.
- **between**: Start and end locations. Optional. Set for nautical services. Contains a from and to location. Exactly one of at and between must be set.
A.2 Route Plan Exchange Format (RTZ)

Route Exchange Format (rtz) in STM Validation Project test bed
This chapter describes the usage and necessary attributes and extensions in the Route Exchange Format (RTZ) that is needed for the STM Validation project test bed. Pay attention – some attributes that has status OPTIONAL in the original standard IEC 61174:2015 Annex S are changed to MANDATORY to meet project needs. The official version of IEC 61174 is to be found at https://webstore.iec.ch/publication/23127.
As the new rtz-format allows manufacturer or any other organization to add new attributes as extensions it has been agreed between CIRM representing majority of manufacture and IEC that CIRM will publish new updated versions of the standard http://cirm.org/rtz/index.html.
An updated version that includes changes and amendments as described in this document is expected to be published in June 2016.
Notification of new versions will be provided to the qualified vendors taking part in STM by SMA.

RouteInfo node description

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
<th>Format</th>
<th>Status</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>routeName</td>
<td>name of the route</td>
<td>String</td>
<td>Mandatory</td>
<td></td>
</tr>
<tr>
<td>routeAuthor</td>
<td>Author of route</td>
<td>String</td>
<td>Option</td>
<td></td>
</tr>
<tr>
<td>routeStatus</td>
<td>Status of route</td>
<td>String</td>
<td>Option</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mandatory</td>
<td>Status should be one (1) digit with values from 1-8</td>
<td></td>
</tr>
<tr>
<td>validityPeriodStart</td>
<td>Start of validity period</td>
<td>ISO 8601</td>
<td>Option</td>
<td></td>
</tr>
<tr>
<td>validityPeriodStop</td>
<td>Stop of validity period</td>
<td>ISO 8601</td>
<td>Option</td>
<td></td>
</tr>
<tr>
<td>vesselName</td>
<td>Ship's name</td>
<td>String</td>
<td>Option</td>
<td></td>
</tr>
<tr>
<td>vesselMMSI</td>
<td>Ship's MMSI</td>
<td>XXXXXXXX</td>
<td>Option</td>
<td></td>
</tr>
<tr>
<td>vesselIMO</td>
<td>Ship's IMO number</td>
<td>XXXXXXXX</td>
<td>Option</td>
<td></td>
</tr>
<tr>
<td>vesselVoyage</td>
<td>Number of the voyage</td>
<td>String</td>
<td>Option</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mandatory</td>
<td></td>
<td>Format according to Unique Voyage Identifier (UVID) description in VIS- and SeaSWIM Specification</td>
<td></td>
</tr>
<tr>
<td>vesselDisplacement</td>
<td>Ship's displacement</td>
<td>Integer</td>
<td>Option</td>
<td></td>
</tr>
<tr>
<td>vesselCargo</td>
<td>Ship's cargo</td>
<td>Integer</td>
<td>Option</td>
<td>Unit: tons</td>
</tr>
<tr>
<td>vesselGM</td>
<td>Metacentric height</td>
<td>XX.XX</td>
<td>Option</td>
<td>Metacentric height of the ship for intended voyage. Unit: metres</td>
</tr>
<tr>
<td>optimizationMethod</td>
<td>Route is optimized to meet KPI</td>
<td>String</td>
<td>Option</td>
<td>Could be fixed speed, Lowest Fuel Consumption, Fixed ETA</td>
</tr>
</tbody>
</table>
Route status description

The routeStatus field should be used to inform about the status of the route in order to support the various STM test bed scenarios, e.g. route optimization and cross-checking. The different statuses to be used in the test bed are shown in Table 1 and the voyage planning process in figure 1 (see appendix 8 for better resolution). Note that there is no requirement to use all of these statuses during voyage planning but as a must the route must have a status. The intention with status 8, inactive, is to be able to inform subscribers to a voyage plan that the voyage has been completed or cancelled, e.g. if a voyage is cancelled possible previous subscribers need to be made aware about this whether or not they are given access rights to the voyage that “replaces” cancelled one.

<table>
<thead>
<tr>
<th>Route Status</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Original</td>
<td>Template or basic voyage planned and received from shore</td>
</tr>
<tr>
<td>2</td>
<td>Planned for voyage</td>
<td>Route and schedule prepared by crew</td>
</tr>
<tr>
<td>3</td>
<td>Optimized</td>
<td>Route and scheduled optimized by 3rd party service provider</td>
</tr>
<tr>
<td>4</td>
<td>Cross Checked</td>
<td>Route verified by 3rd party</td>
</tr>
<tr>
<td>5</td>
<td>Safety Checked</td>
<td>Safety check by ECDIS/crew</td>
</tr>
<tr>
<td>6</td>
<td>Approved</td>
<td>Approved by master</td>
</tr>
<tr>
<td>7</td>
<td>Used for monitoring</td>
<td>Loaded in ECDIS for monitoring</td>
</tr>
<tr>
<td>8</td>
<td>Inactive</td>
<td>Voyage completed or cancelled</td>
</tr>
</tbody>
</table>

Table 1, route statuses

In addition to the changes of the status and vesselVoyage field also the following attributes are to be implemented to support the STM Validation project needs.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
<th>Format</th>
<th>Status</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>depPort</td>
<td>Departure Port</td>
<td>String</td>
<td>Optional</td>
<td>UN/LOCODE</td>
</tr>
<tr>
<td>Attribute</td>
<td>Description</td>
<td>Format</td>
<td>Status</td>
<td>Comment</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------------------------------------</td>
<td>---------</td>
<td>--------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>arrPort</td>
<td>Arrival Port</td>
<td>String</td>
<td>Optional</td>
<td>UN/LOCODE</td>
</tr>
<tr>
<td>depPortCallId</td>
<td>Port Call Identifier for Departure Port</td>
<td>String</td>
<td>Optional</td>
<td>Format according to Unique Port Call Identifier (UPCID) in SeaSWIM Specification</td>
</tr>
<tr>
<td>arrPortCallId</td>
<td>Port Call Identifier for Arrival Port</td>
<td>String</td>
<td>Optional</td>
<td>Format according to Unique Port Call Identifier (UPCID) in SeaSWIM Specification</td>
</tr>
<tr>
<td>startSeaPassage</td>
<td>WP Where Sea passage start</td>
<td>String</td>
<td>Optional</td>
<td></td>
</tr>
<tr>
<td>endSeaPassage</td>
<td>WP where Sea passage ends</td>
<td>string</td>
<td>Optional</td>
<td></td>
</tr>
<tr>
<td>lastUpdateTime</td>
<td>When the route was last updated/modified and saved</td>
<td>dateTime</td>
<td>Mandatory</td>
<td>UTC</td>
</tr>
</tbody>
</table>
Figure 1 Route planning process flowchart (see appendix 8 for better resolution)
A.3 Text Message

<table>
<thead>
<tr>
<th>Type Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>textMessage</td>
<td>A STM Text message type schema to be used for exchanging free text messages</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Element Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>textMessageId</td>
<td>string</td>
<td>Identifier of the text message, mandatory</td>
</tr>
<tr>
<td>informationObjectReferenceld</td>
<td>string</td>
<td>A reference to an information object (such as a Unique Voyage ID), optional</td>
</tr>
<tr>
<td>author</td>
<td>string</td>
<td>The message author, mandatory</td>
</tr>
<tr>
<td>from</td>
<td>string</td>
<td>The sending actor, mandatory</td>
</tr>
<tr>
<td>serviceType</td>
<td>string</td>
<td>The service type of the sender, optional</td>
</tr>
<tr>
<td>createdAt</td>
<td>dateTime</td>
<td>The message creation dateTime, mandatory</td>
</tr>
<tr>
<td>position</td>
<td>GM_Point</td>
<td>A geographical location (point) related to the text message, optional</td>
</tr>
<tr>
<td>subject</td>
<td>string</td>
<td>The message subject, mandatory</td>
</tr>
<tr>
<td>body</td>
<td>string</td>
<td>The message body (the actual text message), mandatory</td>
</tr>
</tbody>
</table>
<?xml version="1.0" encoding="utf-8"?>
<xs:schema id="TextFormat"
    targetNamespace="http://tempuri.org/TextFormat.xsd"
    elementFormDefault="qualified"
    xmlns="http://tempuri.org/TextFormat.xsd"
    xmlns:mstns="http://tempuri.org/TextFormat.xsd"
    xmlns:xs="http://www.w3.org/2001/XMLSchema">
    <xs:annotation>
        <xs:documentation>A STM Text message type schema</xs:documentation>
    </xs:annotation>
    <xs:element name="textMessage">
        <xs:complexType>
            <xs:sequence>
                <xs:element name="textMessageId" type="xs:string" minOccurs="1" maxOccurs="1">
                    <xs:annotation>
                        <xs:documentation>Identifier of the text message, mandatory.</xs:documentation>
                    </xs:annotation>
                </xs:element>
                <xs:element name="informationObjectReferenceId" type="xs:string" minOccurs="0" maxOccurs="1">
                    <xs:annotation>
                        <xs:documentation>A reference to an information object, optional.</xs:documentation>
                    </xs:annotation>
                </xs:element>
                <xs:element name="author" type="xs:string" maxOccurs="1">
                    <xs:annotation>
                        <xs:documentation>The message author, mandatory.</xs:documentation>
                    </xs:annotation>
                </xs:element>
                <xs:element name="from" type="xs:string" maxOccurs="1">
                    <xs:annotation>
                        <xs:documentation>The sending actor, mandatory.</xs:documentation>
                    </xs:annotation>
                </xs:element>
                <xs:element name="serviceType" type="xs:string" minOccurs="0" maxOccurs="1">
                    <xs:annotation>
                        <xs:documentation></xs:documentation>
                    </xs:annotation>
                </xs:element>
            </xs:sequence>
        </xs:complexType>
    </xs:element>
</xs:schema>
The service type of the sender, optional.

The message creation date time, mandatory.

The message subject, mandatory.

The message body, mandatory.

Geographic point, optional.

Latitude in degrees.

Longitude in degrees.
<xs:simpleType name="LatitudeType">
    <xs:annotation>
        <xs:documentation>
The latitude of the point. Decimal degrees, WGS84 datum.
        </xs:documentation>
    </xs:annotation>
    <xs:restriction base="xs:decimal">
        <xs:minInclusive value="-90.0" />
        <xs:maxInclusive value="90.0" />
    </xs:restriction>
</xs:simpleType>

<xs:simpleType name="LongitudeType">
    <xs:annotation>
        <xs:documentation>
The longitude of the point. Decimal degrees, WGS84 datum.
        </xs:documentation>
    </xs:annotation>
    <xs:restriction base="xs:decimal">
        <xs:minInclusive value="-180.0" />
        <xs:maxInclusive value="180.0" />
    </xs:restriction>
</xs:simpleType>
A.4 Area Exchange Format
DOCUMENT STATUS

Authors

<table>
<thead>
<tr>
<th>Name</th>
<th>Organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denis Fokin</td>
<td>Transas</td>
</tr>
<tr>
<td>Konstantin Ivanov</td>
<td>Transas</td>
</tr>
</tbody>
</table>

Review

<table>
<thead>
<tr>
<th>Name</th>
<th>Organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Björn Andreasson</td>
<td>SMA</td>
</tr>
<tr>
<td>Håkan Heurlin</td>
<td>SMA</td>
</tr>
</tbody>
</table>

Approval

<table>
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<th>Name</th>
<th>Organisation</th>
<th>Signature</th>
<th>Date</th>
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</thead>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Document History

<table>
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<tr>
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<th>Date</th>
<th>Status</th>
<th>Initials</th>
<th>Description</th>
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<tr>
<td>1.0</td>
<td>2016-05-10</td>
<td></td>
<td></td>
<td>Used in tendering documentation</td>
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<tr>
<td>1.01</td>
<td>2016-06-07</td>
<td></td>
<td></td>
<td>Updated with xsd-scheme</td>
</tr>
<tr>
<td>1.02</td>
<td>2016-06-27</td>
<td></td>
<td></td>
<td>With minor updates in xsd-scheme</td>
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1 Background

This document describes an interchange format for transmitting specific areas from shore centres to ships.
The Area transmission is used to notify specific polygons allowing vessels take attention on received marine safety information and thus to plan corresponding actions.
The use of this message requires that both the receiving and transmitting side have the appropriate communication equipment as well as presentation and navigation systems.
2 Objectives

An area exchange format shall be developed, which supports all processes in the Sea Traffic Management (STM) where the area can be used:

- On board for safe navigation (ECDIS etc.)
- By Pilots
- Ashore for Sea Traffic Management services

The area format should be open and in compliance with S-1XX standards.
3 The area exchange format

3.1 General

An area exchange format between ship and shore is intended to be used both to inform the ship about the area nearby of his route and to direct the ship in required area (for example SAR-area).

File information must include the following main fields: header information, references on using of defined application schemas (S-1xx standards), geofeatures/ information types with attributes, associations. Data structure must correspond to the applied application schemas.

For example, if Sail Race event or SAR areas take place then S-124 (Navigational warning) standard (the conforming application schemas) will be applied. If Marine Protected area takes place then S-122 (MPA) standard with the conforming application schemas will be applied.

All directories in the S-1xx standards are extensible. New values can be added to them at any time.

The area exchange format is a file containing the GML coded version of the area description.

3.2 High-level description of the Area format

The logical design of an area consists of three units:

- A block with general information about the area
- A block with area geometry information, which consists of blocks interior and exterior areas, which described of set of points with geographical coordinates
- A block that contains set of information types which are linked with geofeature objects by associations

3.3 Detailed Area format description

3.3.1. File components

The area file consists of:

- The mandatory XML processing instruction, which allows the specification of the encoding of string data
- A root to the applied namespace, which described data structure, as well as the area format namespace
- The version attribute in the format “Major.Minor”
3.3.2. Feature type description
This is the root element of the Area format
The feature object consists of a sequence of the following elements:
- Geofeature object (Navigational warnings, Notice to Mariners) that contains main
  semantic information about area including geometry information
- Information object (References, Information Notices) that contains data source
  information or is linked to other geofeature
- Association that defines the relationship between geofeatures and information
  objects.

3.3.3. Geofeature description
The geofeature (Navigational warnings or Notice to Mariners) contains data related to
the geometry of the area. It also contains semantic information, for example: category of
area, textual information etc.
Information is stored in the following attributes:

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
<th>Format</th>
<th>Status</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>TypeOfNotice</td>
<td>type of Notice</td>
<td>enumeration</td>
<td>mandatory</td>
<td>Navigational warnings and Port Marine Notice only</td>
</tr>
<tr>
<td>NavigationalArea</td>
<td>Navigational area</td>
<td>text</td>
<td>option</td>
<td>Navigational warnings and Port Marine Notice only</td>
</tr>
<tr>
<td>SourceDate</td>
<td>Date of publication</td>
<td>date</td>
<td>mandatory</td>
<td></td>
</tr>
<tr>
<td>GeneralArea</td>
<td>general area</td>
<td>text</td>
<td>mandatory</td>
<td></td>
</tr>
<tr>
<td>Locality</td>
<td>local area</td>
<td>text</td>
<td>mandatory</td>
<td></td>
</tr>
<tr>
<td>Restriction</td>
<td>type of restriction</td>
<td>enumeration</td>
<td>mandatory</td>
<td></td>
</tr>
<tr>
<td>HorizontalDatum</td>
<td>used Datum</td>
<td>enumeration</td>
<td>option</td>
<td>default - WGS84</td>
</tr>
<tr>
<td>keySubject</td>
<td></td>
<td>text</td>
<td>option</td>
<td></td>
</tr>
<tr>
<td>generalCategory</td>
<td>category type for area</td>
<td>enumeration</td>
<td>option</td>
<td></td>
</tr>
<tr>
<td>ListOfLightNumber</td>
<td>list of light number</td>
<td>text</td>
<td>option</td>
<td></td>
</tr>
<tr>
<td>Graphic</td>
<td>references on the pictures</td>
<td>complex</td>
<td>option</td>
<td></td>
</tr>
<tr>
<td>Notice Identifier</td>
<td>identifier of notice</td>
<td>complex</td>
<td>mandatory</td>
<td></td>
</tr>
<tr>
<td>referenceUUID</td>
<td>reference to an unique voyage UVID</td>
<td>text</td>
<td>option</td>
<td>e.g. reference on unique voyage ID (UVID)</td>
</tr>
<tr>
<td>Information</td>
<td>Information</td>
<td>complex</td>
<td>mandatory</td>
<td></td>
</tr>
<tr>
<td>Fixed Date Range</td>
<td>period of validity</td>
<td>complex</td>
<td>option</td>
<td></td>
</tr>
<tr>
<td>Periodic date range</td>
<td>periodic date range</td>
<td>complex</td>
<td>option</td>
<td></td>
</tr>
<tr>
<td>Affected Charts</td>
<td>references on the charts</td>
<td>complex</td>
<td>option</td>
<td></td>
</tr>
<tr>
<td>BerthName</td>
<td>name of berth</td>
<td>text</td>
<td>option</td>
<td>Port Marine Notice only</td>
</tr>
<tr>
<td>TypeOfNoticeToMariners</td>
<td>type of NM</td>
<td>enumeration</td>
<td>mandatory</td>
<td>Notice to Mariners only</td>
</tr>
<tr>
<td>OriginalInformation</td>
<td>original information</td>
<td>boolean</td>
<td>mandatory</td>
<td>Notice to Mariners only</td>
</tr>
</tbody>
</table>
New attribute reference UVID is added in the Geofeature Type to reference to other object as specific voyage (unique voyage ID)

3.3.4. Information object description

The Information type provides a place to store information related to data source information. Also it provides the reference to other MSI that are important or to link a cancellation notice to existing MSI which may not have an expiry date via the complex attribute fixedDateRange

Information is stored in the following attributes:

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
<th>Format</th>
<th>Status</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>ReferenceType</td>
<td>type of Reference</td>
<td>enumeration</td>
<td>mandatory</td>
<td></td>
</tr>
<tr>
<td>NoticeIdentifier</td>
<td>existing Notice identifier</td>
<td>complex</td>
<td>option</td>
<td></td>
</tr>
<tr>
<td>SourceIndication</td>
<td>source of indication</td>
<td>complex</td>
<td>option</td>
<td></td>
</tr>
</tbody>
</table>

3.4 Basic Area example

Here example of GML-file (Sale Race event):

```xml
<?xml version="1.0" encoding="UTF-8"?>
<MSI:DataSet xmlns:MSI="file:///C:/S124/gml/1.0"
xsi:schemaLocation="file:///C:/S124/gml/1.0/../../schemas/0.5/S124.xsd"
xlns:xsi=http://www.w3.org/2001/XMLSchema-instance
xmlns:gml=http://www.opengis.net/gml/3.2
xmlns:S100=http://www.iho.int/s100gml/1.0
xmlns:xlink="http://www.w3.org/1999/xlink" gml:id="EX001">
<!--characteristics of dataset as ID, bounds, coordinate system-->
<gml:boundedBy><gml:Envelope srsName="EPSG:4326">
  <gml:lowerCorner>55.0000 20.0000</gml:lowerCorner>
  <gml:upperCorner>85.0000 60.0000</gml:upperCorner>
</gml:Envelope></gml:boundedBy>
<!— elements, list of feature types (Geofeatures and InformationTypes)—>
<member>
  <MSI:NoticesToMariners gml:id="AAARE0001"/>
  <!—Geofeature: Notices to Mariners—>
  <S100:informationAssociation gml:id="AAia00001" xlink:href="#AAREF0001" xlink:role="http://www.iho.int/S-124/gml/1.0/roles/noticeReference"/>
  <!—reference on the InformationType:References—>
  <typeOfNoticeToMariners>temporary</typeOfNoticeToMariners>
  <sourceDate>2016-07-15</sourceDate>
  <generalArea>BalticSea</generalArea>
  <locality>gulfOfFinland</locality>
  <generalCategory>SailRaceEvent</generalCategory>
  <!—New value "Sail Race event" should be added in the enumeration—>
  <noticeIdentifier>
```
```
Annual Sail Race is held on the 16th of July near Helsinki.

Fixed Date Range:
- Start: 1200, 16th of July, 2016
- End: 1700, 16th of July, 2016

Geometry:
- S100:surfaceProperty
- gml:Surface gml:id="AAs00001"
srsName="EPSG:4326"
  - gml:PolygonPatch
    - gml:exterior
      - LinearRing

Information Type: References
3.5 Marine Safety Information – XSD scheme

```xml
<xs:schema xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:xs="http://www.w3.org/2001/XMLSchema"
  xmlns:gml="http://www.opengis.net/gml/3.2"
  targetNamespace="file://C:/S124/gml/1.0"
  version="0.5.0">
  <!-- S100 XML/GML Schema for S-124 (Marine Safety Information). -->
  <xs:import namespace="http://www.iho.int/s100gml/1.0" schemaLocation="s100gmlbase.xsd"/>
  <xs:import namespace="http://www.opengis.net/gml/3.2" schemaLocation="/S100_gmlProfile.xsd"/>
  <xs:import namespace="http://www.iho.int/S-100/profile/s100_gmlProfile" schemaLocation="S100_gmlProfileLevels.xsd"/>

  <xs:complexType name="S100_TruncatedDate">
    <xs:annotation>
      <xs:documentation>built in date types from W3C XML schema, implementing S-100 truncated date</xs:documentation>
    </xs:annotation>
    <xs:choice>
      <xs:element name="gDay" type="xs:gDay"/>
      <xs:element name="gMonth" type="xs:gMonth"/>
      <xs:element name="gYear" type="xs:gYear"/>
      <xs:element name="gMonthDay" type="xs:gMonthDay"/>
      <xs:element name="gYearMonth" type="xs:gYearMonth"/>
    </xs:choice>
  </xs:complexType>
</xs:schema>
```
<xs:element name="date" type="xs:date"/>
</xs:choice>
</xs:complexType>
<xs:simpleType name="ISO639-3">
  <xs:annotation>
    <xs:documentation>stub for ISO 639-3 language codes</xs:documentation>
  </xs:annotation>
  <xs:restriction base="xs:string">
    <xs:pattern value="\w{3}"/>
  </xs:restriction>
</xs:simpleType>
<xs:simpleType name="ISO639-2">
  <xs:annotation>
    <xs:documentation>stub for ISO 639-2 language codes</xs:documentation>
  </xs:annotation>
  <xs:restriction base="xs:string">
    <xs:pattern value="\w{3}"/>
  </xs:restriction>
</xs:simpleType>
<xs:simpleType name="ISO3166-alpha2">
  <xs:annotation>
    <xs:documentation>stub for ISO 3166 alpha2 country codes</xs:documentation>
  </xs:annotation>
  <xs:restriction base="xs:string">
    <xs:pattern value="\w{2}"/>
  </xs:restriction>
</xs:simpleType>
<!-- spatial property convenience types -->
<!-- ----------------------------------------------- -->
<xs:complexType name="PointOrSurface">
  <xs:choice>
    <xs:element ref="S100:pointProperty"/>
    <xs:element ref="S100:surfaceProperty"/>
  </xs:choice>
</xs:complexType>
<xs:complexType name="CurveOrSurface">
  <xs:choice>
    <xs:element ref="S100:curveProperty"/>
    <xs:element ref="S100:surfaceProperty"/>
  </xs:choice>
</xs:complexType>
<xs:complexType name="PointCurveSurface">
  <xs:choice>
    <xs:element ref="S100:pointProperty"/>
    <xs:element ref="S100:curveProperty"/>
    <xs:element ref="S100:surfaceProperty"/>
  </xs:choice>
</xs:complexType>
<xs:complexType name="PointOrCurve">
  <xs:choice>
    <xs:element ref="S100:curveProperty"/>
    <xs:element ref="S100:surfaceProperty"/>
  </xs:choice>
</xs:complexType>
<xs:complexType name="GM_Point">
    <xs:choice>
        <xs:element ref="S100:pointProperty"/>
    </xs:choice>
</xs:complexType>

<xs:complexType name="GM_Curve">
    <xs:choice>
        <xs:element ref="S100:curveProperty"/>
    </xs:choice>
</xs:complexType>

<xs:complexType name="GM_Surface">
    <xs:choice>
        <xs:element ref="S100:surfaceProperty"/>
    </xs:choice>
</xs:complexType>

<xs:complexType name="informationType_s101">
    <xs:annotation>
        <xs:appinfo>
            ?
        </xs:appinfo>
        <xs:documentation>
            Textual information about an object and the language in which it is written
        </xs:documentation>
    </xs:annotation>
    <xs:sequence>
        <xs:element name="text" type="xs:string">
            <xs:annotation>
                <xs:appinfo/>
                <xs:documentation/>
            </xs:annotation>
        </xs:element>
        <xs:element name="language" type="ISO639-3" minOccurs="0"/>
    </xs:sequence>
</xs:complexType>

<xs:complexType name="textualDescriptionType_s101">
    <xs:annotation>
        <xs:appinfo>
            ?
        </xs:appinfo>
        <xs:documentation/>
    </xs:annotation>
    <xs:sequence>
        <xs:element name="fileReference" type="xs:string">
            <xs:annotation>
                <xs:appinfo/>
                <xs:documentation>The name of a text file where more information can be found and the language in which it is written</xs:documentation>
            </xs:annotation>
        </xs:element>
        <xs:element name="language" type="ISO639-3" minOccurs="0"/>
    </xs:sequence>
</xs:complexType>
<xs:complexType name="graphicType">
    <xs:element name="pictorialRepresentation" type="xs:string" minOccurs="1" maxOccurs="1"/>
    <xs:element name="pictureCaption" type="xs:string" minOccurs="0" maxOccurs="1"/>
    <xs:annotation>
        <xs:documentation>Short description of the purpose of the image.</xs:documentation>
    </xs:annotation>
</xs:complexType>

<xs:complexType name="AbstractInformationNotice" abstract="true">
    <xs:annotation>
        <xs:documentation>xxx</xs:documentation>
    </xs:annotation>
    <xs:complexContent>
        <xs:extension base="InformationTypeType">
            <xs:sequence>
                <xs:element name="sourceDate" type="xs:date" minOccurs="1" maxOccurs="1"/>
                <xs:element name="generalArea" type="xs:string" minOccurs="1" maxOccurs="1"/>
                <xs:element name="locality" type="xs:string" minOccurs="1" maxOccurs="1"/>
                <xs:element name="keySubject" type="xs:string" minOccurs="0" maxOccurs="1"/>
                <xs:element name="graphic" type="graphicType" minOccurs="0" maxOccurs="unbounded"/>
                <xs:element name="noticeIdentifier" type="noticeIdentifierType" minOccurs="1" maxOccurs="1"/>
                <xs:element name="information" type="informationType" minOccurs="1" maxOccurs="unbounded"/>
                <xs:element name="fixedDateRange" type="fixedDateRangeType" minOccurs="0" maxOccurs="1"/>
                <xs:element name="periodicDateRange" type="periodicDateRangeType" minOccurs="0" maxOccurs="unbounded"/>
            </xs:sequence>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:element name="theInformationNotice" type="gml:ReferenceType" minOccurs="0" maxOccurs="unbounded"/>
</xs:sequence>
</xs:extension>
</xs:complexContent>
<xs:element name="FeatureType" type="FeatureType" abstract="true" substitutionGroup="gml:AbstractFeature"/>
<xs:complexType name="FeatureType" abstract="true">
<xs:annotation>
<xs:documentation>Generalized feature type which carry all the common attributes</xs:documentation>
<xs:complexContent>
<xs:extension base="S100:AbstractFeatureType">
<xs:sequence>
<xs:element name="sourceDate" type="xs:date" minOccurs="1" maxOccurs="1"/>
<xs:element name="generalArea" type="xs:string" minOccurs="1" maxOccurs="1"/>
<xs:element name="locality" type="xs:string" minOccurs="1" maxOccurs="1"/>
<xs:element name="restriction" type="restrictionType" minOccurs="0" maxOccurs="1"/>
<xs:element name="horizontalDatum" type="EPSGType" minOccurs="0" maxOccurs="1"/>
<xs:element name="keySubject" type="xs:string" minOccurs="0" maxOccurs="1"/>
<xs:element name="generalCategory" type="generalCategoryType" minOccurs="0" maxOccurs="1"/>
<xs:element name="listOfLightNumber" type="xs:string" minOccurs="0" maxOccurs="unbounded"/>
<xs:element name="graphic" type="graphicType" minOccurs="0" maxOccurs="unbounded"/>
<xs:element name="noticeIdentifier" type="noticeIdentifierType" minOccurs="1" maxOccurs="1"/>
<xs:element name="information" type="informationType" minOccurs="0" maxOccurs="unbounded"/>
<xs:element name="fixedDateRange" type="fixedDateRangeType" minOccurs="0" maxOccurs="1"/>
<xs:element name="periodicDateRange" type="periodicDateRangeType" minOccurs="0" maxOccurs="unbounded"/>
<xs:element name="affectedCharts" type="affectedChartsType" minOccurs="0" maxOccurs="unbounded"/>
<xs:element name="referenceUVID" type="xs:string" minOccurs="0" maxOccurs="1"/>
<xs:element name="noticeReference" type="gml:ReferenceType" minOccurs="0" maxOccurs="unbounded"/>
<xs:element name="permission" type="gml:ReferenceType" minOccurs="0" maxOccurs="unbounded"/>
<xs:element name="provides" type="gml:ReferenceType" minOccurs="0" maxOccurs="1"/>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="InformationType" type="InformationTypeType" abstract="true"/>
<xs:complexType name="InformationTypeType" abstract="true">
    <xs:annotation>
        <xs:documentation>
            Generalized information type which carry all the common attributes
        </xs:documentation>
    </xs:annotation>
    <xs:complexContent>
        <xs:extension base="S100:AbstractInformationType">
            <xs:sequence>
                <!--
                <xs:element name="fixedDateRange" type="fixedDateRangeType"
                minOccurs="0" maxOccurs="1"/>
                <xs:element name="periodicDateRange" type="periodicDateRangeType" minOccurs="0" maxOccurs="unbounded"/>
                <xs:element name="featureName" type="featureNameType" minOccurs="0" maxOccurs="unbounded"/>
                <xs:element name="sourceIndication" type="sourceIndicationType" minOccurs="0" maxOccurs="1"/>
                -->
                <xs:element name="provides" type="gml:ReferenceType" minOccurs="0" maxOccurs="1"/>
            </xs:sequence>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>

<xs:element name="NavigationalWarning" type="NavigationalWarningType" substitutionGroup="FeatureType"/>
<xs:complexType name="NavigationalWarningType">
    <xs:annotation>
        <xs:documentation>xxx</xs:documentation>
    </xs:annotation>
    <xs:complexContent>
        <xs:extension base="FeatureType">
            <xs:sequence>
                <xs:element name="typeOfNotice" type="typeOfNoticeType" minOccurs="1" maxOccurs="1">
                    <xs:annotation>
                        <xs:documentation>xxx</xs:documentation>
                    </xs:annotation>
                </xs:element>
                <xs:element name="navigationalArea" type="xs:string" minOccurs="0" maxOccurs="unbounded"/>
                <xs:element name="noticeReferences" type="gml:ReferenceType" minOccurs="0" maxOccurs="unbounded"/>
                <xs:element name="geometry" type="PointCurveSurface" minOccurs="0" maxOccurs="unbounded"/>
            </xs:sequence>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>

<xs:element name="PortMarineNotice" type="PortMarineNoticeType" substitutionGroup="FeatureType"/>
<xs:complexType name="PortMarineNoticeType">
    <xs:annotation>
        <xs:documentation>xxx</xs:documentation>
    </xs:annotation>
</xs:complexType>
<xs:complexType base="FeatureType">
  <xs:sequence>
    <xs:element name="typeOfNotice" type="typeOfNoticeType" minOccurs="1" maxOccurs="1"/>
    <xs:element name="navigationalArea" type="xs:string" minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="berthName" type="xs:string" minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="noticeReferences" type="gml:ReferenceType" minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="geometry" type="PointCurveSurface" minOccurs="0" maxOccurs="unbounded"/>
  </xs:sequence>
</xs:complexType>

<xs:element name="NoticesToMariners" type="NoticesToMarinersType" substitutionGroup="FeatureType"/>
<xs:complexType name="NoticesToMarinersType">
  <xs:annotation>
    <xs:documentation> xxx </xs:documentation>
  </xs:annotation>
  <xs:complexContent>
    <xs:extension base="FeatureType">
      <xs:sequence>
        <xs:element name="typeOfNoticeToMariners" type="typeOfNoticeToMarinersType" minOccurs="1" maxOccurs="1"/>
        <xs:element name="originalInformation" type="xs:boolean" minOccurs="0" maxOccurs="1"/>
        <xs:element name="noticeReferences" type="gml:ReferenceType" minOccurs="0" maxOccurs="unbounded"/>
        <xs:element name="geometry" type="PointCurveSurface" minOccurs="0" maxOccurs="unbounded"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:element>

<xs:element name="References" type="ReferencesType" substitutionGroup="InformationType"/>
<xs:complexType name="ReferencesType">
  <xs:annotation>
    <xs:documentation> xxx </xs:documentation>
  </xs:annotation>
  <xs:complexContent>
    <xs:extension base="InformationType">
      <xs:sequence>
        <xs:element name="referenceType" type="referenceTypeType" minOccurs="1" maxOccurs="1"/>
        <xs:element name="noticeIdentifier" type="noticeIdentifierType" minOccurs="0" maxOccurs="1"/>
        <xs:element name="sourceIndication" type="sourceIndicationType" minOccurs="0" maxOccurs="1"/>
        <xs:element name="theInformationNotice" type="gml:ReferenceType" minOccurs="0" maxOccurs="unbounded"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:element>
<xs:element name="InformationNotice" type="InformationNoticeType" substitutionGroup="InformationType"/>
<xs:complexType name="InformationNoticeType">
<xs:annotation>
  <xs:documentation>xxx</xs:documentation>
</xs:annotation>
<xs:complexContent>
  <xs:extension base="AbstractInformationNotice">
    <xs:element name="NAVAREA" type="xs:string" minOccurs="1" maxOccurs="1"/>
    <xs:element name="typeOfNotice" type="typeOfNoticeType" minOccurs="1" maxOccurs="1"/>
  </xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>

<xs:complexType name="featureNameType">
<xs:annotation>
  <xs:documentation>xxx</xs:documentation>
</xs:annotation>
<xs:sequence>
  <xs:element name="displayName" type="xs:boolean" minOccurs="0" maxOccurs="1">
    <xs:annotation>
      <xs:documentation>A statement expressing if a feature name is to be displayed in certain display settings or not. Indication: Boolean. A True value is an indication that the name is intended to be displayed. Remarks: Where it is allowable to encode multiple instances of feature name for a single feature instance, only one feature name instance can indicate that the name is to be displayed (display name set to True) </xs:documentation>
    </xs:annotation>
    <xs:element name="language" type="ISO639-3" minOccurs="0" maxOccurs="1">
      <xs:annotation>
        <xs:documentation>The language is encoded by a character code following ISO 639-3</xs:documentation>
      </xs:annotation>
      <xs:element name="name" type="xs:string" minOccurs="1" maxOccurs="1">
        <xs:annotation>
          <xs:documentation>The individual name of a feature.</xs:documentation>
        </xs:annotation>
      </xs:element>
    </xs:element>
  </xs:element>
</xs:sequence>
</xs:complexType>
<xs:complexType name="fixedDateRangeType">
  <xs:annotation>
    <xs:documentation>Describes a single fixed period, as the date range between its sub-attributes. Remarks: Sub-attributes date end and date start must have the calendar year encoded using 4 digits for the calendar year (CCYY). Month (MM) and day (DD) are optional. (This definition merges the planned S-100 temporal model with the current S-101 DCEG definition of fixed date range.)</xs:documentation>
  </xs:annotation>
  <xs:sequence>
    <xs:element name="timeStart" type="xs:time" minOccurs="0" maxOccurs="1"/>
    <xs:element name="timeEnd" type="xs:time" minOccurs="0" maxOccurs="1"/>
    <xs:element name="dateStart" type="S100_TruncatedDate" minOccurs="0" maxOccurs="1"/>
    <xs:element name="dateEnd" type="S100_TruncatedDate" minOccurs="0" maxOccurs="1"/>
  </xs:sequence>
</xs:complexType>
The end date or time of the interval.

The publication, document, or reference work from which information comes or is acquired.

Type of source

Treaty, convention, or international agreement; or European Union law

Publication issued by an international organisation

Publication issued by an international administration
legislation by a national government
publication issued by a national administration
local law or regulation
publication issued by local administration
law made by a national sub-division such as a state, province, or local government
publication issued by local administration, such as local government or port authority
Reported by mariner(s) and confirmed by another source
Reported by mariner(s) but not confirmed
industry publications and reports
shipping and other industry publication, including graphics, charts and web sites
information obtained from satellite images
photographs
information obtained from products issued by HO services
Hydrographic Offices
<xs:enumeration>
  <xs:enumeration value="news media">
    <xs:annotation>
      <xs:documentation>information obtained from news media</xs:documentation>
    </xs:annotation>
  </xs:enumeration>
  <xs:enumeration value="traffic data">
    <xs:annotation>
      <xs:documentation>information obtained from the analysis of traffic data</xs:documentation>
    </xs:annotation>
  </xs:enumeration>
</xs:restriction>
</xs:simpleType>

<xs:simpleType name="timeReferenceType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="UTC">
      <xs:annotation>
        <xs:documentation>Coordinated Universal Time</xs:documentation>
      </xs:annotation>
    </xs:enumeration>
    <xs:enumeration value="LT">
      <xs:annotation>
        <xs:documentation>Local time</xs:documentation>
      </xs:annotation>
    </xs:enumeration>
  </xs:restriction>
</xs:simpleType>

<xs:complexType name="informationType">
  <xs:annotation>
    <xs:documentation>Provides textual information that cannot be provided using other allowable attributes for the feature, in a defined language. The information may be provided as a string in sub-attribute text, or by encoding the file name of a single external text file that contains the text in sub-attribute file reference. Remarks:
    - The sub-attribute text should be used, for example, to hold the information that is shown on paper charts by cautionary and explanatory notes. No formatting of text is possible within the sub-attribute text. If formatted text is required then an associated text file referenced by the sub-attribute file reference must be used.
    - The sub-attribute file reference is generally used for long text strings or those that require formatting, however there is no restriction on the type of text (except for lexical level) that can be held in files referenced by sub-attribute file reference. </xs:documentation>
  </xs:annotation>
  <xs:sequence>
    <xs:element name="fileLocator" type="xs:string" minOccurs="0" maxOccurs="1">
      <xs:annotation>
        <xs:documentation>The string encodes the location of a fragment of text or other information in a support file. Remarks:</xs:documentation>
      </xs:annotation>
    </xs:element>
  </xs:sequence>
</xs:complexType>
Application schemas must describe how the associated file is identified. The associated file will commonly be named in a file reference co-attribute of the same complex attribute.

- Each DCEG must specify requirements for the format of the associated file and the semantics of file locator. For example, the value of file locator may be an HTML ID in an HTML file, line number in a text file) or a bookmark in a PDF file.

```xml
<xs:element name="fileReference" type="xs:string" minOccurs="0" maxOccurs="1">
  <xs:annotation>
    <xs:documentation>The string encodes the file name of a single external text file that contains the text. Remarks: The attribute file reference is generally used for long text strings or those that require formatting, however there is no restriction on the type of text (except for lexical level) that can be held in files referenced by sub-attribute file reference.</xs:documentation>
  </xs:annotation>
</xs:element>
```

```xml
<xs:element name="headline" type="xs:string" minOccurs="0" maxOccurs="1">
  <xs:annotation>
    <xs:documentation>Words set at the head of a passage or page to introduce or categorize</xs:documentation>
  </xs:annotation>
</xs:element>
```

```xml
<xs:element name="language" type="xs:string" minOccurs="0" maxOccurs="1">
  <xs:annotation>
    <xs:documentation>ISO 639-3 value</xs:documentation>
  </xs:annotation>
</xs:element>
```

```xml
<xs:element name="text" type="xs:string" minOccurs="0" maxOccurs="1">
  <xs:annotation>
    <xs:documentation>A non-formatted digital text string. Remarks: The attribute should be used, for example, to hold the information that is shown on paper charts by short cautionary and explanatory notes. Therefore text populated in text must not exceed 300 characters. Text may be in English or in a national language defined by the attribute language. No formatting of text is possible within the sub-attribute text. If formatted text, or text strings exceeding 300 characters, is required, then the attribute file reference must be used.</xs:documentation>
  </xs:annotation>
</xs:element>
```

```xml
<xs:complexType name="affectedChartsType">
  <xs:annotation>
    <xs:documentation>xxx</xs:documentation>
  </xs:annotation>
</xs:complexType>
```
<xs:element name="chartAffected" type="xs:string" minOccurs="0" maxOccurs="1"/>
<xs:element name="internationalChartAffected" type="xs:string" minOccurs="0" maxOccurs="1"/>
</xs:sequence>
</xs:complexType>

<xs:simpleType name="restrictionType">
<xs:restriction base="xs:string">
<xs:enumeration value="entry restricted"/>
<xs:enumeration value="entry prohibited"/>
<xs:enumeration value="area to be avoided"/>
<xs:enumeration value="stopping prohibited"/>
<xs:enumeration value="speed restricted"/>
</xs:restriction>
</xs:simpleType>

<xs:simpleType name="referenceTypeType">
<xs:restriction base="xs:string">
<xs:enumeration value="cancellation"/>
<xs:enumeration value="source reference"/>
<xs:enumeration value="repetition"/>
<xs:enumeration value="update"/>
</xs:restriction>
</xs:simpleType>

<xs:simpleType name="typeOfNoticeType">
<xs:restriction base="xs:string">
<xs:enumeration value="local"/>
<xs:enumeration value="coastal"/>
<xs:enumeration value="sub-area"/>
<xs:enumeration value="NAVAREA"/>
<xs:enumeration value="no warnings"/>
</xs:restriction>
</xs:simpleType>

<xs:simpleType name="sourceType">
<xs:restriction base="xs:string">
<xs:enumeration value="report"/>
<xs:enumeration value="graphic"/>
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="mainTypeType">
    <xs:restriction base="xs:string">
        <xs:enumeration value="nm"/>
        <xs:enumeration value="msi"/>
    </xs:restriction>
</xs:simpleType>

<xs:simpleType name="typeOfNoticeToMarinersType">
    <xs:restriction base="xs:string">
        <xs:enumeration value="permanent"/>
        <xs:enumeration value="temporary"/>
        <xs:enumeration value="preliminary"/>
        <xs:enumeration value="miscellaneous"/>
    </xs:restriction>
</xs:simpleType>

<xs:simpleType name="EPSGType">
    <xs:restriction base="xs:string">
        <xs:enumeration value="4326"/>
    </xs:restriction>
</xs:simpleType>

<xs:simpleType name="categoryOfAuthorityType">
    <xs:annotation>
        <xs:documentation>The type of person, government agency or organisation, corporation, or private or publicly owned company entrusted or invested with powers of managing or controlling access or activity in an area.</xs:documentation>
    </xs:annotation>
    <xs:restriction base="xs:string">
        <xs:enumeration value="customs">
            <xs:annotation>
                <xs:documentation>The agency or establishment for collecting duties, tolls. (Merriam-Websters online Dictionary 23rd February 2006, amended).</xs:documentation>
            </xs:annotation>
        </xs:enumeration>
        <xs:enumeration value="border control">
            <xs:annotation>
                <xs:documentation>The administration to prevent or detect and prosecute violations of rules and regulations at international boundaries (adapted from Merriam-Websters online Dictionary 23rd February 2006).</xs:documentation>
            </xs:annotation>
        </xs:enumeration>
        <xs:enumeration value="police">
            <xs:annotation>
                <xs:documentation>The department of government, or civil force, charged with maintaining public order. (Adapted from OED)</xs:documentation>
            </xs:annotation>
        </xs:enumeration>
    </xs:restriction>
</xs:simpleType>
Person or corporation, owners of, or entrusted with or invested with the power of managing a port. May be called a Harbour Board, Port Trust, Port Commission, Harbour Commission, Marine Department (NP 100 8th Edition 14 Oct 2004) 

The authority controlling people entering a country.

The authority with responsibility for checking the validity of the health declaration of a vessel and for declaring free pratique.

Organisation keeping watch on shipping and coastal waters according to governmental law; normally the authority with responsibility for search and rescue.

The authority with responsibility for preventing infection of the agriculture of a country and for the protection of the agricultural interests of a country.

A military authority which provides control of access to or approval for transit through designated areas or airspace.

A private or publicly owned company or commercial enterprise which exercises control of facilities, for example a callibration area.

A governmental or military force with jurisdiction in territorial waters. Examples could include Gendarmerie Maritime, Carabinerie, and Guardia Civil.
An authority with responsibility for the protection of the environment.

An authority with responsibility for the control of fisheries.

An authority with responsibility for the control and movement of money.

A national or regional authority charged with administration of maritime affairs.

Aids to navigation

Dangerous wreck

Unwieldy tow

Drifting hazard

SAR and anti pollution operations

Newly discovered dangers

Route alterations or suspensions

Underwater operations

Pipe or cable laying operations

Seismic surveys

Research or scientific operations

Offshore structures

Radio navigation services

Special operations
including ENC issues, security-related requirements, piracy, tsunamis and other natural phenomena, World Health Organization (WHO) health advisory information, SailRaceEvent.
<xs:element name="member" minOccurs="0" maxOccurs="unbounded" type="MemberType">
  <xs:annotation>
    <xs:documentation>intended for technical GML 3.2 requirement for making the dataset a "GML document" and clause 21.3 of the OGC GML standard</xs:documentation>
  </xs:annotation>
</xs:element>
</xs:choice>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>

<xs:complexType name="MemberType">

  <xs:annotation>
    <xs:documentation>dataset member</xs:documentation>
  </xs:annotation>
  
  <xs:complexContent>
    <xs:extension base="gml:AbstractFeatureMemberType">
      <xs:sequence>
        <xs:element ref="gml:AbstractFeature"/>
        <xs:sequence>
          <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
        </xs:sequence>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>

<xs:complexType name="IMemberType">

  <xs:annotation>
    <xs:documentation>dataset member S-100 infotmation types</xs:documentation>
  </xs:annotation>
  
  <xs:complexContent>
    <xs:extension base="gml:AbstractFeatureMemberType">
      <xs:sequence>
        <xs:element ref="InformationType"/>
        <xs:sequence>
          <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
        </xs:sequence>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>

<!-- treatment of S-100 Information types is provisional, because GML does not have the concept, and they must be modeled as AbstractGML -->
<xs:complexType name="IMemberType">

  <xs:annotation>
    <xs:documentation>dataset member S-100 infotmation types</xs:documentation>
  </xs:annotation>
  
  <xs:complexContent>
    <xs:extension base="gml:AbstractFeatureMemberType">
      <xs:sequence>
        <xs:element ref="gml:AbstractGML"/>
        <xs:sequence>
          <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>
        </xs:sequence>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
3.6 Feature Catalogue

There are three feature types (NavigationWarning, PortMarineNotice and NoticeToMariners) and two information types (InformationNotice and References) in the data model S-124 Standard.

Geo Features

Navigational warnings

<table>
<thead>
<tr>
<th>IHO Definition: MSI – Navigational warnings:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>S-124 Geo Feature: Navigational warning</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Primitives: Surface</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>S-124 Attribute</th>
<th>S-57 Acronym</th>
<th>Allowable Encoding Value</th>
<th>Type</th>
<th>Multiplicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>TypeOfNotice</td>
<td>Local Coastal Sub-area NAVAREA No warnings</td>
<td>EN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Navigational area</td>
<td></td>
<td>TEXT</td>
<td>0..*</td>
<td></td>
</tr>
<tr>
<td>SourceDate</td>
<td></td>
<td>DATE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GeneralArea</td>
<td>Enumeration</td>
<td>TEXT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Locality</td>
<td>Enumeration</td>
<td>TEXT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restriction</td>
<td>Entry restricted Entry prohibited Area to be avoided Stopping prohibited Speed restricted</td>
<td>EN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HorizontalDatum</td>
<td>EPSG</td>
<td>EN</td>
<td>0..1</td>
<td></td>
</tr>
<tr>
<td>keySubject</td>
<td></td>
<td>TEXT</td>
<td>0..1</td>
<td></td>
</tr>
<tr>
<td>generalCategory</td>
<td>+ aids to navigation +dangerous wreck +unwieldy tow +drifting hazard +SAR and anti-pollution operations</td>
<td>EN</td>
<td>0..1</td>
<td></td>
</tr>
<tr>
<td>ListOfLightNumber</td>
<td>TEXT</td>
<td>0..*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>referenceUVID</td>
<td>TEXT</td>
<td>0..*</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Complex Attributes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graphic</td>
<td>C</td>
<td>0..*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pictorial representation</td>
<td>(PICREP)</td>
<td>TEXT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Picture Caption</td>
<td>TEXT</td>
<td>0..1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source Date</td>
<td>$\text{DATE}$</td>
<td>0..1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Picture Information</td>
<td>TEXT</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Notice Identifier</td>
<td>C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notice Number</td>
<td>INT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td>INT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production Agency</td>
<td>TEXT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main Type</td>
<td>Nm (notices to mariners)</td>
<td>EN</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MSI (navigational warnings)</td>
<td>EN</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Information</strong></td>
<td>C</td>
<td>1..*</td>
<td></td>
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</tr>
<tr>
<td>File Locator</td>
<td>TEXT</td>
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<td>File Reference</td>
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</tr>
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<td>Headline</td>
<td>TEXT</td>
<td>0..1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Language</td>
<td>ISO 639-3</td>
<td>(S) TEXT</td>
<td>0..1</td>
<td></td>
</tr>
<tr>
<td>Text</td>
<td>(INFORM)</td>
<td>(S) TEXT</td>
<td>0..1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(NINFORM)</td>
<td>(S) TEXT</td>
<td>0..1</td>
<td></td>
</tr>
<tr>
<td>Fixed date range</td>
<td>C</td>
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<td></td>
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<tr>
<td>Time Start</td>
<td>TIME</td>
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<td></td>
</tr>
<tr>
<td>Time End</td>
<td>TIME</td>
<td>0..1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date start</td>
<td>$\text{S100_TruncatedDate}$</td>
<td>(S) DATE</td>
<td>0..1</td>
<td></td>
</tr>
<tr>
<td>Date end</td>
<td>$\text{S100_TruncatedDate}$</td>
<td>(S) DATE</td>
<td>0..1</td>
<td></td>
</tr>
<tr>
<td>Periodic date range</td>
<td>C</td>
<td>0..*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- newly discovered dangers
- route alterations or suspensions
- underwater operations
- pipe or cable laying operations
- seismic surveys
- research or scientific operations
- offshore structures
- radio navigation services
- special operations
- operating anomalies identified within ECDIS including ENC issues
- piracy
- tsunamis and other natural phenomena
- World Health Organization (WHO) health advisory information
- security-related requirements
- Sail Race event
<table>
<thead>
<tr>
<th>Date start</th>
<th>(PEREND)</th>
<th>S100_TruncatedDate</th>
<th>(S) DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date end</td>
<td>(PERSTA)</td>
<td>S100_TruncatedDate</td>
<td>(S) DATE</td>
</tr>
<tr>
<td>Affected Charts</td>
<td>C</td>
<td>0..*</td>
<td></td>
</tr>
<tr>
<td>Chart affected</td>
<td>TEXT</td>
<td>0..1</td>
<td></td>
</tr>
<tr>
<td>International Chart affected</td>
<td>TEXT</td>
<td>0..1</td>
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</table>

### Feature associations

<table>
<thead>
<tr>
<th>Role Type</th>
<th>Association Name</th>
<th>Role</th>
<th>Features</th>
<th>Multiplicity</th>
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</thead>
<tbody>
<tr>
<td>Association</td>
<td>noticeReferences</td>
<td>References</td>
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</tr>
</tbody>
</table>

**Remarks:**

- nil

### Port Marine Notice

**IHO Definition:** MSI – Port Marine Notice

**S-101 Geo Feature:** Port Marine Notice

**Primitives:** Surface

<table>
<thead>
<tr>
<th>S-124 Attribute</th>
<th>S-57 Acronym</th>
<th>Allowable Encoding Value</th>
<th>Type</th>
<th>Multiplicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>BerthName</td>
<td></td>
<td>New attribute for Port Marine Notice</td>
<td>TEXT</td>
<td>0..*</td>
</tr>
<tr>
<td>TypeOfNotice</td>
<td></td>
<td>Local</td>
<td>EN</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Coastal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sub-area</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>NAVAREA</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>No warnings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Navigational area</td>
<td></td>
<td>TEXT</td>
<td>0..*</td>
<td></td>
</tr>
<tr>
<td>SourceDate</td>
<td></td>
<td>DATE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GeneralArea</td>
<td></td>
<td>Enumeration</td>
<td>TEXT</td>
<td></td>
</tr>
<tr>
<td>Locality</td>
<td></td>
<td>Enumeration</td>
<td>EN</td>
<td></td>
</tr>
<tr>
<td>Restriction</td>
<td></td>
<td>Entry restricted</td>
<td>EN</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Entry prohibited</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Area to be avoided</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stopping prohibited</td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Speed restricted</td>
<td></td>
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<tr>
<td>HorizontalDatum</td>
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<td>EPSG</td>
<td>EN</td>
<td>0..1</td>
</tr>
<tr>
<td>keySubject</td>
<td></td>
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**Notice To Mariners**

**IHO Definition:** NM – Notice To Mariners:

**S-124 Geo Feature:** Notice To Mariners

**Primitives:** Surface

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+dangerous wreck
+ unwieldy tow
+ drifting hazard
+ SAR and anti pollution operations
+ newly discovered dangers
+ route alterations or suspensions
+ underwater operations
+ pipe or cable laying operations
+ seismic surveys
+ research or scientific operations
+ offshore structures
+ radio navigation services
+ special operations
+ operating anomalies identified within ECDIS including ENC issues
+ piracy
+ tsunamis and other natural phenomena
+ World Health Organization (WHO) health advisory information
+ security-related requirements
+ Sail Race event
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**Feature associations**

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**Information Types**

**Information Types derived from S-101**

**References**

**IHO Definition:** **References**: Reference to source information, other MSI that are important or to link a cancellation notice to existing MSI which may not have an expiry date via the complex attribute fixedDateRange

**S-101 Information Feature:** **References**

**Primitives:** None

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**INT 1 Reference:** nil

**Remarks:**

nil

### Information Type: Information Notice

**IHO Definition:** *Information Notice* is intended for important information which does not have specific spatial attribution, such as notices to a whole NAVAREA, a largely undefined region like North Sea, for making announcements about a service, etc. InformationNotice feature instances can be referenced to other InformationNotice or other information through the information type References, which can carry reference to source information, other InformationNotice that are important or to link a cancellation notice to existing InformationNotice which may not have an expiry date via the complex attribute fixedDateRange.

### S-101 Information Feature: Information Notice

**Primitives:** None

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keySubject | TEXT | 0..1
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Graphic | C | 0..*
Pictorial representation | TEXT |
Picture Caption | TEXT | 0..1
Source Date | S(DATE) | 0..1
Picture Information | TEXT | 0..1
Notice Identifier | C |
Notice Number | INT |
Year | INT |
Production Agency | TEXT |
Main Type | Nm (notices to mariners) MSI (navigational warnings) | EN |
Information | C | 1..*
File Locator | TEXT | 0..1
File Reference | TEXT | 0..1
Headline | TEXT | 0..1
Language | ISO 639-3 | (S) TEXT | 0..1
Text | (INFORM) (NINFORM) | (S) TEXT | 0..1
Fixed date range | C | 0..1
Time Start | TIME | 0..1
Time End | TIME | 0..1
Date start | (DATEND) S100_TruncatedDate | (S) DATE | 0..1
Date end | (DATSTA) S100_TruncatedDate | (S) DATE | 0..1
Periodic date range | C | 0..*
Date start | (PEREND) S100_TruncatedDate | (S) DATE |
Date end | (PERSTA) S100_TruncatedDate | (S) DATE |
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4 Use cases

4.1. General use case

General use case – Area (SAR areas, Sail Race areas, Marine Protected areas and others)

4.1.1. Event taking place in an Area.

Shore Center creates \ sends out the Area including attributes to ships

Information needs: It’s necessarily to define the kind of event in order to prepare conforming file in accordance with S-1xx standards

Information about events should include the following fields: positions, date/times (in force/expiry), the reason for the area

Data format: GML under S-1xx standards (depending on the kind of event)

4.1.2. Ship receives area

Process needed: Connection to Sea SWIM

4.1.3. Area to be displayed

Process needed: to display Area in ECDIS

Information needs: positions, date/times (in force/expiry), the reason for the area

Data format: GML under S-1xx standards (depending on the kind of event)

4.1.4. Area deleted

Process needed: Area should be deleted automatically when it’s obsolete

Information needs: date/times (in force/expiry)

4.2. Use case - Sail Race event or SAR areas

Sail Race event relates to NtM (Notices to Mariners) so data format must conform to the S-124 standards (Navigational warnings). SAR area event relates to NW (navigational warning) so data format must conform to the S-124 also.

In this case, file should include the following fields (in accordance with the S-124):

- Identifier (attribute – notice identifier)
- References: Each message can be assigned a list of references that is used to define the relationship to other messages. A reference consists of a series identifier of the referenced message and a reference type (attribute – associations)
- Time: Each message has a (possibly open-ended) date interval for which the hazard described by the message is valid (attribute – fixed date range)
Area: a hierarchical area tree (with each area having a localized name). A message must be assigned to one of these areas, and by implication, the parent areas of the selected area (attribute – general area).

Locations: Each message can be assigned to a list of geographical locations. A location may be either a point, a circle, a polyline or a polygon (attribute – locality).

Categories: A message can be assigned to a list of categories (attribute – general category).

Description (attribute – information)

Attachments (attribute – graphic)

Data preparation is carried out by Feature Catalogue (S-124). The full feature catalogue is below in the table of this document.

4.2.1. Sale race event

4.2.1.1. Sale Race taking place in an Area between two dates

4.2.1.2. Shore Centre send out the area including attributes to ships

ECDIS receives the file from Service-provider – Notices to Mariners as Sale Race event in GML-format.

• Data model allows to define locations for each message as either a point, a circle, a polyline or a polygon in accordance with OpenGIS Geography Markup Language (GML) Encoding Standard

• Data & Times are available «ComplexAttributeType» - fixedDateRange

• Reason: New value “Sail Race event” should be added in the enumeration “generalCategory”

4.2.1.3. Ship receives area

Area to be displayed

Software development is required to read\ display GML/JSON in ECDIS (after confirming of data model). The warnings could be sorted/filtered by time-based criteria, range-based criteria including area-based criteria along ship’s route.

4.2.1.4. Area deleted

ECDIS / STM Display may provide an extra warning about this even, if necessary.

Attribute “FixedDateRange” must be used for automatic deletion of messages-areas
4.2.2. **SAR – area event**

This case is the same as for Sail Race

4.2.2.1 Sale Race taking place in an Area between two dates

4.2.2.2 Shore Centre send out the area including attributes to ships

ECDIS receives the message from Service-provider – Navigational warnings as SAR-area event in GML-format.

*See the example of GML-file above (the same structure with assigning of conforming attributes for SAR-event)*

- Data model allows to define locations for each message as either a point, a circle, a polyline or a polygon in accordance with GML-specification
- Data & Times are available «ComplexAttributeType» - fixedDateRange
- Reason might be as SAR and anti pollution operations (from «S100_CodeList» generalCategory)

4.2.2.3 Ship receives area

Area to be displayed: Additional works will be required to read\display GML/JSON in ECDIS (after confirming of data model)

Supporting of relevance filtering of warnings by time-based criteria, range-based criteria including area-based criteria along ship’s route.

4.2.2.4 Area deleted

ECDIS / STM Display may provide an extra warning
Demonstrating the function and business value of the Sea Traffic Management concept and its services.

Seaing is believing!

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Document History

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Review

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1 Introduction

1.1 Purpose of the document
The purpose of this service specification document is to provide a holistic overview of the Voyage Information service and its building blocks in a technology-independent way, according to the guidelines given in [1]. It describes a well-defined baseline of the service by clearly identifying the service version.

The aim is to document the key aspects of the Voyage Information service at the logical level:

- the operational and business context of the service
  - requirements for the service (e.g., information exchange requirements)
  - involved nodes: which operational components provide/consume the service
  - operational activities supported by the service
  - relation of the service to other services

- the service description
  - service interface definitions
  - service interface operations
  - service payload definition
  - service dynamic behaviour description

- service provision and validation aspects

1.2 Intended readership
This service specification is intended to be read by service architects, system engineers and developers in charge of designing and developing an instance of the Voyage Information service.

Furthermore, this service specification is intended to be read by enterprise architects, service architects, information architects, system engineers and developers in pursuing architecting, design and development activities of other related services such as the STM Module, SeaSWIM Connector, central SeaSWIM services etc.

1.3 Inputs from other projects
This section provides an overview of projects, which are dealing with similar topics and lists already finished ones that provided inputs to this activity.

The division in Fel! Hittar inte referenskälla. is purely organizational. The overview shows two project specific areas: SeaSWIM (STM) and Core MC (E2). The bridge between the two projects is called Enhanced MC and signifies the development effort needed in the STM (Sea Traffic Management) project to adapt the Core MC solutions for the Maritime Digital Infrastructure instance needed to for the STM Validation.
1.3.1 Core Maritime Cloud

The Maritime Cloud, MC, is a key part of the EfficienSea2 project. E2 plans to lay the foundation for a widely used framework (Maritime Architecture Framework - MAF), facilitating interoperable solutions. In a first stage, it is a framework providing standardized protocol and functional support for identity and role management, authentication, encryption, authenticity validation, service discovery and bandwidth efficient messaging in a geographic context. This enables easy development of innovative solutions targeted at maritime end users in a context of global interoperability. The Maritime Cloud shall be regarded much like the Internet as the enabler of interoperable systems for email, VoIP, webpages, blogs, social networks, or online shopping sites.

The framework, MAF, constitutes the theoretical basis to support the development of maritime service infrastructures within the Maritime Cloud and SeaSWIM - System-wide Information Management as well as its corresponding technical services. It is used to support the architectural development of the Maritime Cloud within the two projects EfficienSea2 and STM to ensure the interoperability of services (developed throughout the STM project) and to facilitate data sharing using a common information environment and structure (e.g., the Maritime Cloud).

Components of the Maritime Cloud

Services themselves and the service based economy are a central part of the vision of the Maritime Cloud and explicitly include also services that do not solely rely on machine to machine communication such as services delivered over telephone calls (voice or fax), email, websites, Navtex and other "primitive" solutions.

The Service Registry is a central component of the MC and allows to:
• specify services according to an envisioned Service Specification Standard and provisioned service instances implemented according to these service specifications
• improve the visibility and accessibility of available maritime information and services
• share a common view on service standards and provisioned services between service providers, consumers, and regulatory authorities
• have a single reference point for provisioning and discovery by comprising all maritime services, not only digital services, the information they carry, and the technical means to obtain it
• manage the life cycle of service specifications and service instances
• implement the Maritime Service Portfolio (MSP) concept by providing a repository for the specification of operational and technical services and provisioned service instances.

Together with the concept of Identity Management, E2 envisions to enable service providers to deliver their services to customers with increased security and productivity while decreasing the cost and effort. Identity Management deals with identifying individuals such as users, devices, and computer systems and controlling their access to resources within some kind of organizational context, e.g. private company, country or a whole industry. To overcome the lack of a global digital identity for service users, vessels and systems and to require confidentiality and integrity the **Maritime Identity Registry** concept has been proposed that allows to:

• manage all organizations, users, devices, and systems that need to communicate with each other in some way, not necessarily via the MC services
• integrate with any form of external information carrier using standard security protocols
• manage human users with a single identity (password/certificate, later also fingerprints, mobiles, etc.) for authentication that can be used across all maritime systems
• digitally sign messages and documents by human users
• provide digital certificates and support authentication for user and systems in the MC to allow machine to machine communication
• integrate with companies’ existing identity management systems in order to “reuse” the identities already set up internally in a company (federated identity management)
• further provide (strict) guidelines how service providers should handle information about client’s shared information (e.g. a vessel's position)

### 1.3.2 Enhanced Maritime Cloud

The bridge between the two projects is called Enhanced MC [*Fel! Hittar inte referenskälla.*] and signifies the development effort needed in the STM project adapt the Core MC solutions for the Maritime Digital Infrastructure instance needed for the STM Validation.

For example, to prevent that each e.g. resource provider in SeaSWIM needs to implement support for a workflow for validated identification of clients or users accessing their resource, the STM project will provide an **Identity Registry** in collaboration with the EfficienSea 2 project, based on the ‘Maritime Cloud’ concept. This way, resource providers can instead focus on managing access control and the nomination of access to already validated user identities.
1.3.3 Sea System Wide Information Management (SeaSWIM)

SeaSWIM (System-wide Information Management) consists of various components which ensure interoperability of the STM services by facilitating data sharing in a common information environment and structure. Hereby, STM overcomes many of the challenges of communication and information sharing between stakeholders in the maritime transport industry. The STM Validation Project aims at providing a Maritime Service Infrastructure based on the SeaSWIM principles, defined in MONALISA 2.0 project, and will provide the basis for the test beds being realized in Activity 1 (PortCDM) and Activity 2 (Voyage Management) of the STM Validation Project. The Maritime Cloud is used as the infrastructure for information exchange/sharing in the STM test beds, i.e. for the validation of SeaSWIM.

As a user of STM I can for instance provide or use application services (e.g. enhanced monitoring, route optimization service, voyage information service) that rely on support services (e.g. a logging service). Yet, more than just the support services, the SeaSWIM infrastructure also consists of SeaSWIM rules, regulations, management services and governance structures. SeaSWIM is also developed to adhere to some important STM principles:

a. Only authenticated actors can provide and use STM services
b. Data creators are owners and have full control over the authorization process
c. STM strives after a service oriented and highly decentralized architecture
d. Usage of widely accepted industry standards wherever these exist

The Voyage Information Service, aka VIS, is an application service within SeaSWIM outlined in activity 2 of the STM Validation project.

Voyage Information Object

The Voyage Information Service is used to abstract access to a Voyage Information Object, VI.O. Voyage information consists of all the voyage related information available within the STM information system.

Further, the Voyage Information Object is to depict all information segments relevant for supporting the STM-services currently published in SeaSwim, with voyage related information. Common for all these information segments is that they can be identified with a Unique Voyage Identifier (UVID).

Even though all these segments have a common reference-key (UVID), they can still originate from different databases, systems and processes. On ship or on shore. In SeaSWIM they can be published by different service providers, all representing the information owner (ship or ship operator), which means that the information object can be distributed among different service providers.

Access to the Voyage information Object instance (UVID) is controlled by the owner of that information, in a way similar to the existing booking systems of the airlines today. You enter
information and share it with a trusted third party with which you are planning some sort of cooperation. The part of the information required by the other party to make collaboration possible is “Nominated” for him/her to see, understand and react upon.

![Diagram of Voyage Object](image)

**Figure 2: Populating and publicising the Voyage Object**

### 1.3.4 The Unique Voyage Identifier

The update of IEC 61174 test standard for ECDIS in 2015, introduced a standardized data format for representation of a ship’s voyage plan (the RTZ format).

This format includes an identifier field, which can be used to uniquely identify an instance of a ship’s planned voyage, during the lifecycle of the voyage from strategic planning, through the dynamic updates underway, until completion. For unique identification of this instance of the voyage, when communicating updates between groups of stakeholders, a globally unique identifier is needed, and methods to manage the version history of changes applied.

It has been observed that centralized methods for issuing unique identifiers (such as Global Unique Flight Identifiers in the aviation industry) demand connectivity at the time of creation. This is seen as an undesirable requirement and possible point of failure. Instead a delegated approach is desired, where each registered provider of a Voyage Information Service has the ability to issue their own identifiers as desired.
The following definition of the UVID has been proposed, and is provided for explanation of the syntax.

“urn:mrnx:stm:voymgt:uvid:”<uvispid>”:<localid>”[:<version>]

where

“urn:mrnx:stm:voymgt:uvid:” is the prefix, that identifies a UVID in the Voyage Management activity of the STM validation project. For an in-depth explanation of this prefix see Appendix 3 SeaSWIM Specification.

<uvispid> denotes a Voyage Information Service Provider ID, and its purpose is to help discover the service endpoint (the address of the technical interface) of the Voyage Information Service where information related to this UVID can be found, via the Service Registry (a part of the SeaSWIM central infrastructure).

<localid> is a locally generated ID (syntax: a string of alphanumeric values (a-z, A-Z, 0-9), possibly characters ‘-’ or '_', but no space or other special characters). It could be a serial number, UUID or something else. It is generated by the provider of the Voyage Information Service, and must be unique within the context of this particular instance of a Voyage Information Service.

<version> is an optional extension.

Example
This is provided as an explanatory example, not stating additional requirements:

Shipping company A (operating Ship A) has internally established their own Voyage Information Service to manage its voyages, and it is registered in the Service Registry as Voyage Information Service “urn:mrnx:stm:voymgt:uvid:imo-453345”.


The example above may also apply if shipping company A employs a third-party service to host its Voyage Information Service instance, since the naming of the unique identifier is rather a contractual matter between the parties than a consequence of the technical implementation.

Shipping Company B and C (operating Ships B and C) have both made a deal with Service Provider D to take care of representing their voyages electronically. Service Provider D operate the “urn:mrnx:stm:voymgt:uvispid:stm-d” Voyage Information Service.

“urn:mrnx:stm:voymgt:uvid:stm-d:346:4.12” may denote the voyage number “346” of ship B (version “4.12”) held at Voyage Information Service Provider “stm-d”. Similarly “urn:mrnx:stm:uvid:stm-d:134” may denote the latest version of voyage number “134” (could be ship B or C), but you don’t know the ship involved, unless you ask the Voyage Information Service – and you must be nominated as a collaborator of this voyage – or request nomination - to retrieve any information about this voyage.

Holding the authority over the “urn:mrnx:stm:uvid:stm-d” namespace allows the service provider, if so decided in the agreement with the client, to sub-divide the namespace into
client-specific namespaces, which allows the clients to manage the issuing of UVIDs under the sub-namespace on their own.

The examples above illustrate how the precise usage of the “urn:mrnx:stm:uvid” namespace is flexible and allow for different technical and contractual arrangements between shipping companies and service providers.
## 2 Service identification

The purpose of this chapter is to provide a unique identification of the service and describe where the service is in terms of the engineering lifecycle.

<table>
<thead>
<tr>
<th>Name</th>
<th>Voyage Information Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>urn:mrnx:stm:voymgt:uvid:imo-453345</td>
</tr>
<tr>
<td>Version</td>
<td>1.0</td>
</tr>
<tr>
<td>Description</td>
<td>The service supports exchange of voyage plans and text messages between a Vessel or a shore based representation of the Vessel, and other voyage stakeholders.</td>
</tr>
<tr>
<td>Keywords</td>
<td>voymgt;uvid, Voyage Information Service, STM</td>
</tr>
<tr>
<td>Architect(s)</td>
<td>nn</td>
</tr>
<tr>
<td>Status</td>
<td>Specified</td>
</tr>
</tbody>
</table>
3 Operational context
This section describes the context of the service from an operational perspective.

3.1 STM Target Concept requirements on VIS
The STM Target Concept is designed to meet requirements the vessel has for sharing information, instructions or facts. These requirements are constantly changing as the reporting demand on shipping constantly increases. It’s therefore important that the definition of the VIO and corresponding VIS will be evolutionary and that SeaSwim governance framework will cater for the possibility to revise those standards along time.

Currently the following reporting needs exist (refer to document: “Information management-Voyage information object” for further reading).

- Arrival notification reporting (FAL – Facilitation of international Maritime Traffic)
- Port call information requirements
- Master-Pilot Exchange (MPEX)
- Cargo operation information requirements
- Customs and clearance information
- Noon reporting (Voyager reporting, Ship reporting)
- Navigational information

3.2 Functional and Non-functional Requirements
In designing the Voyage Information Service (VIS) for the STM Validation project and subsequent test-beds a reduced scope will be implemented as compared with what will be catered for according to the STM Target Concept. Initially for the test-beds we have decided upon supporting described operational requirements and use cases below (from Appendix 5 - STM Voyage Management use cases’)

The table below lists applicable existing requirements for the Voyage Information service.

Table 1: Requirements tracing

<table>
<thead>
<tr>
<th>Requirement Id</th>
<th>Requirement Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sharing of Voyage Plan</td>
<td>As part of the Voyage Information Object the Voyage Plan (VP) can be shared among the different parties participating in a ships voyage. The ship/shipping company is the information owner of the VP and as such chooses which actors that should be granted access to the voyage plan.</td>
</tr>
<tr>
<td>Route Cross-check</td>
<td>The intended voyage plan is sent to a shore based service provider for cross-checking. The purpose is to include updated regional area information that could affect ships voyage plan. The cross-checking can be done before the vessels departure or before arrival at a certain geographical area. The cross-check can include, but is not limited to, Under Keel Clearance (UKC), air draught, no violation of no-go areas, MSI and compliance with mandatory routeing. No optimization service as such is included in the route validation.</td>
</tr>
</tbody>
</table>
Enhanced Monitoring

Enhanced monitoring will be supported by adding route information and a monitoring service can be provided in previously unmonitored areas. SC will be able to detect if planned schedule is not kept or if ship deviates from planned route. Thus SC can monitor that ships are following their planned route and also foresee possible dangerous situations and suggest route modifications (geographic and/or speed) due to traffic or other impeding conditions. These tools can also enhance current VTS services.

Route optimization

The route optimization tools will be different in nature with a common purpose to provide more information for the navigator on board. The STM concept will provide the means to get the ships route optimised from different service providers in a standardised way. The service providers has different focus including best route regarding; the weather forecast, surface currents, fuel consumption, no-go areas regarding draft, areas with sensitive nature, conflicts with other ships routes etc.

The table below defines additional requirements for the Voyage Information service.

*Table 2: Additional requirements definition*

<table>
<thead>
<tr>
<th>Requirement Id</th>
<th>VIS001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirement Name</td>
<td>Handling of area format using the Area exchange format</td>
</tr>
<tr>
<td>Requirement Text</td>
<td>The area exchange format is one of the payload formats that needs to be handled by the VIS. The area exchange is included in the use cases.</td>
</tr>
<tr>
<td>Rationale</td>
<td>Introducing area exchange format into the maritime domain will give a more graphic overview on areas where ships are not allowed to pass due to e.g. whale nursery areas, military exercises or other MSI areas. Sending of areas can also support SAR operations e.g. sending of search areas to SAR units.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Requirement Id</th>
<th>VIS002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirement Name</td>
<td>Handling of exchange of text messages</td>
</tr>
<tr>
<td>Requirement Text</td>
<td>Possibility to send and receive text messages. Text messages should support other exchanges, e.g. voyage plans, but also be possible to use as a “stand alone” message. The text message is included in the use cases.</td>
</tr>
<tr>
<td>Rationale</td>
<td>Text messages instead of verbal communication has in earlier studies proved to be an effective mean to reduce misunderstandings and to exchange information between ship and shore.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Requirement Id</th>
<th>VIS003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirement Name</td>
<td>Message transaction sequence</td>
</tr>
<tr>
<td>Requirement Text</td>
<td>Handling of transaction sequence of correlated messages to enable consistency between VIS and the STM Module.</td>
</tr>
<tr>
<td>------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Rationale</td>
<td>Messages in STM, irrespectively of payload format, needs to be possible to correlate to each other to make it clear to operators which previous message a new message is related to.</td>
</tr>
<tr>
<td><strong>Requirement Id</strong></td>
<td>VIS004</td>
</tr>
<tr>
<td>Requirement Name</td>
<td>Message transfer status</td>
</tr>
<tr>
<td>Requirement Text</td>
<td>Handling of message statuses sent to be able to support messages transferred ok.</td>
</tr>
<tr>
<td>Rationale</td>
<td>The rationale behind message transfer status is to get (automatic) acknowledgement when messages is available at the recipient which is extra important in the maritime domain since ships are not always connected. The rationale is to give add trust in the system by knowing for sure that the message has reached the end system/operator.</td>
</tr>
<tr>
<td><strong>Requirement Id</strong></td>
<td>VIS005</td>
</tr>
<tr>
<td>Requirement Name</td>
<td>Save timestamp for sent and received messages</td>
</tr>
<tr>
<td>Requirement Text</td>
<td>The communication status and the age of information has to be known by VIS</td>
</tr>
<tr>
<td>Rationale</td>
<td>As in Requirement Id VIS004 it is important that other actors know the connectivity status of the ship to know how recently the STM module has been connected to the VIS.</td>
</tr>
</tbody>
</table>

### 3.3 Other Constraints

#### 3.3.1 Relevant Industrial Standards

The VIS model needs to cater for the IEC 61174 standard for RTZ and the standard [S-101] for Polygon message.

#### 3.3.2 Operational Nodes

In designing VIS for STM Validation Project Test-Beds the below picture visualizes the scope including actors and proposed VIS Use-Cases.
Figure 3: Voyage Information Service context including actors

Table 3: Operational Nodes providing the Voyage Information service

<table>
<thead>
<tr>
<th>Operational Node</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vessels</td>
<td>For ships with a permanent internet connection like V-SAT the VIS instance can be provided from the vessel itself.</td>
</tr>
<tr>
<td>Shore based representation of Vessels</td>
<td>For ships without a permanent internet connection the VIS instance can be provided by a shore centre.</td>
</tr>
</tbody>
</table>

Table 4: Operational Nodes consuming the Voyage Information service

<table>
<thead>
<tr>
<th>Operational Node</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route Optimization entities</td>
<td>Organizations/ authorities offering route optimization services possible consumers of voyageplans provided by a vessel or a representation thereof. SMHI (Swedish Metrological &amp; Hydrological Institute) is one example.</td>
</tr>
<tr>
<td>Vessel Traffic Service, VTS</td>
<td>This refers to entities offering services such as route check and/ or enhanced monitoring.</td>
</tr>
<tr>
<td>Ships, websites and apps</td>
<td>All sorts of clients can be envisaged to consume the published VIS messages. Examples may be an ECDIS on a ship or any STM compliant application.</td>
</tr>
</tbody>
</table>
### 3.3.3 Operational Activities

Table 5: Operational Activities supported by the Voyage Information service

<table>
<thead>
<tr>
<th>Operational Activity</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Login to STM environment</td>
<td>The user logs in to STM by submitting credentials which are authenticated in the STM Identity registry. Refer to interface <code>setCredentials</code>.</td>
</tr>
<tr>
<td>Uploading a Voyage Plan to VIS</td>
<td>This is required to be able to share a Voyage Plan (VP) with other actors in STM, purpose being to publish new VP to subscribers. Refer to interface <code>publishMessage</code>.</td>
</tr>
<tr>
<td>Search the STM service registry</td>
<td>The user needs to identify possible services to use like a Route Optimization service. Refer to interface <code>findService</code>.</td>
</tr>
<tr>
<td>Search the STM identity registry</td>
<td>The user need to search for identities providing a specific service. Refer to interface <code>findIdentities</code>.</td>
</tr>
<tr>
<td>Authorize access for identities</td>
<td>By authorizing identities the owner of the Voyage Plan can control which users in STM has access to the Voyage Plan. Refer to interface <code>authorizeIdentities</code>.</td>
</tr>
<tr>
<td>Request service</td>
<td>Facilitates the possibility to consume services exposed in the STM service registry, i.e. Route Check. Refer to interface <code>callService</code>.</td>
</tr>
<tr>
<td>Retrieve messages received in VIS</td>
<td>Typically this is needed when an optimized route has been received in VIS and the user in STM Module chooses to download the message from VIS. Refer to interface <code>getMessage</code>.</td>
</tr>
<tr>
<td>Receive notifications from VIS</td>
<td>When for instance an optimized route is received in VIS a notification is sent to the STM Module prior to sending the actual optimized route. It is expected that an email from VIS to the STM Module is sufficient. Refer to interface <code>notify</code>.</td>
</tr>
</tbody>
</table>
4 Service overview

4.1 Introduction

The Voyage Information Services (VIS) is a set of one or many sub-service(s). Each VIS actor holds its own VIS-instance. VIS connects with the onboard system through the STM module that maps messages to/from RTZ format from/to the onboard system’s internal formats. The main purpose for VIS existence is to handle the communication around the Voyage Plan (VP). VIS implements methods for exposing new and updated VP’s and to consume external VP’s. VIS also supports subscription with notification. Every message to and from VIS is sent through the SeaSWIM Connector, SSC.

Ship and VIS instance

4.2 Overall requirements

4.2.1 VIS requirements briefly

- VIS has a **storage** (for storing sent and received messages, XML schemas)
- VIS is an **information service registered** in SeaSWIM central Service Registry
- VIS has **Endpoints** for exposing **methods**
- VIS has **method for calling** other services (consume endpoints) through the SeaSWIM connector (i.e. Route Optimization)
- VIS has a **private Notification** function for sending notifications to backend application (in the testbed this is limited to smtp messages)
- VIS has a **function to validate** message payload according to the following predefined schemas (rtz, text, polygon, PCM)
• VIS stores **service descriptions** (WSDL, Swagger) to facilitate consumption of other service endpoints and required interaction patterns (pub/sub, request/response).

• **All communication** between VIS and SeaSWIM Central services and other information services is made using the SeaSWIM connector.

### 4.2.2 Assumptions

### 4.3 Service Interfaces

Below picture visualizes the interfaces needed for VIS.

**Voyage Information Service - interfaces**

![Figure 5: Voyage Information Service Interface Definition diagram](image)

Exposed VIS service endpoints are facilitated using the SeaSWIM connector, VIS consumes services using the SeaSWIM connector acting as a proxy. VIS exposes two groups of interfaces to the surrounding context, interfaces towards the STM Module and interfaces facing the SSC service.

<table>
<thead>
<tr>
<th>ServiceInterface</th>
<th>Role (from service provider point of view)</th>
<th>ServiceOperation</th>
</tr>
</thead>
<tbody>
<tr>
<td>publishMessage</td>
<td>Provided</td>
<td>POST internalURI/publishMessage/STMMessage</td>
</tr>
</tbody>
</table>
Table 7: Service Interfaces facing the SSC service

<table>
<thead>
<tr>
<th>ServiceInterface</th>
<th>Role (from service provider point of view)</th>
<th>ServiceOperation</th>
</tr>
</thead>
<tbody>
<tr>
<td>getVoyagePlan</td>
<td>Provided</td>
<td>GET URI/voyagePlan/{uvid}/{routeStatus}</td>
</tr>
<tr>
<td>uploadVoyagePlan</td>
<td>Provided</td>
<td>POST URI/voyagePlan/</td>
</tr>
<tr>
<td>uploadTextMessage</td>
<td>Provided</td>
<td>POST URI/textMessage/</td>
</tr>
<tr>
<td>subscribeToVoyagePlan</td>
<td>Provided</td>
<td>POST URI/subscribe/voyagePlan/{UVID}</td>
</tr>
<tr>
<td>removeVoyagePlanSubscription</td>
<td>Provided</td>
<td>DELETE URI/subscribe/voyagePlan/{UVID}</td>
</tr>
<tr>
<td>set_configuration</td>
<td>Consumed</td>
<td>set_configuration(setConfigurationObj)</td>
</tr>
<tr>
<td>find_identities</td>
<td>Consumed</td>
<td>find_identities(findIdentitiesObj)</td>
</tr>
<tr>
<td>find_services</td>
<td>Consumed</td>
<td>find_services(findServicesObj)</td>
</tr>
<tr>
<td>call_service</td>
<td>Consumed</td>
<td>call_service(callServiceObj)</td>
</tr>
</tbody>
</table>

getMessage  Provided  GET internalURI/getMessage/{dataID}
authorizeIdentities  Provided  POST internalURI/authorizeIdentities/{UVID,Identity}
findIdentities  Provided  POST internalURI/findIdentities/{findIdentityParameters}
findService  Provided  POST internalURI/findService/{findServiceParameters}
callService  Provided  POST internalURI/callService/{URI}/{STMMessage}
notify  Consumed  SMTP emailAddress/{dataId}
5 Service Data Model

For Service data models see Appendix 7-Port Information Service Specification, Appendix 3 - SeaSWIM Specification including SeaSWIM Connector (SSC), RTZ, textMessage, Area exchange format.

An XML schema for this data model is included in the formal service specification xml file attached in Appendix A.1.
6 Service interface specifications

This chapter describes the details of each service interface. One sub-chapter is provided for each Service Interface.

The Service Interface specification covers only the static design description while the dynamic design (behavior) is described in chapter 7.

6.1 Service Interface – callService

The callService is a private interface to the STM Module to enable consumption of other information services endpoints through the VIS and SSC. The sequence is described in the following figure. (Note in the diagram VIS is represented by the Generic Information Service)

![Sequence diagram callService private interface](image)

6.1.1 Purpose

Handles STM Module initiation request for a specific service e.g. route optimization. The method performs the request through VIS and the SeaSwim connector (acting as a proxy client) and pushes the data to the receiving service endpoint.

6.1.2 Example

The operator will select services from a presented list of possible services using the STM Module and use this list of endpoints together with the payload as input parameters to invoke the private interface callService in VIS. The payload is validated in VIS using the specified schema in accordance with the service description, previously downloaded from the SeaSWIM service registry. Furthermore the message is stored in VIS message database after which the SSC service endpoint is consumed for initiating a service request forwarded to a required information service (i.e. Route Optimization).

6.1.3 Interface Specification
CallService(URI, STMMessage)

Example
CallService([http://stm-d.com/service/RouteOptimization/POST], [RTZ])
In this example the STM Module invokes a service call via VIS and SSC to a RouteOptimization service with a STMMessage containing RTZ as payload.

Interaction pattern
Request – Response (with call-back)
POST internalURI/callService/{URI}/{STMMessage}

6.1.4 Operation callService
When a callService request is received in VIS the message payload is validated and subsequently stored in the VIS dB together with the endpoint of the called service. After which the interface exposed in the SSC for handling service calls, is invoked. The SSC then forwards the call to desired service in e.g. RouteOptimization passing along the payload and required parameters. In case the validation fails a message informing the caller of an invalid format is returned.

6.1.5 Operation Functionality
The callService operation includes the following functionality:

- validateSchema
  Validate received message according to referenced schema in the payload contained in STMMessage, could be one of the STM defined payload formats (RTZ, Polygon, textMessage, PCMF). Received payload in callService is validated against stored schemas in the VIS database. Successful validation returns true, otherwise false is returned, thus triggering an error message to the caller.

- storeMessageInCache
  A successfully received message is stored in VIS database and in VIS dB cache together with the dataId (UVID etc.). UVID is extracted from the payload i.e. RTZ. The cache database is used for temporary storage of messages, thus forming a queue for facilitating ordered delivery of messages.

- callService
  After storing the message a call is made to a privately exposed endpoint in SSC facing VIS including payload (RTZ) and the called service endpoint.

6.1.6 Operation Parameters
Table 2: Payload description of callService operation

<table>
<thead>
<tr>
<th>Parameter Name</th>
<th>Direction</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>endpoint</td>
<td>Input</td>
<td>String</td>
<td>The endpoint parameter specifies the address URL to the service instance endpoint to be consumed, i.e. RouteOptimization.</td>
</tr>
<tr>
<td>STMMessage</td>
<td>Input</td>
<td>XML</td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>---------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>&lt;none&gt;</td>
<td>Return</td>
<td>String</td>
<td></td>
</tr>
</tbody>
</table>

This parameter holds the payload to be sent when consuming a service. For consuming a RouteOptimization service this is the VoyagePlan in RTZ format.

The return value provides the http response either successful 200 or unsuccessful 40X.

### 6.2 Service interface – publishMessage

This private interface in VIS is used when an operator via the STM module uploads a voyage plan to be stored in VIS. A voyage plan which can be consumed in a subscription and/or sent in a service request.

![Sequence diagram publishMessage private interface](image)

**Figure 7: Sequence diagram publishMessage private interface**

#### 6.2.1 Purpose

Method used when data owner wants to share his information to subscribers of the same information or make the voyage plan available for request not tied to a subscription.

#### 6.2.2 Example

When the ship is ready for departure, there is a new Voyage Plan available for upload. By selecting a VoyagePlan in the STM Module for upload to VIS, the STM Module application consumes the exposed private endpoint, publishMessage in VIS. Furthermore the hereby invoked VIS method, storeMessage, will save the VP in its data storage in VIS and/or push it to the subscriber’s endpoints by using the SSC endpoint for publishing a message.
Interface Specification
publishMessage(STMMessage)

Example
publishMessage(RTZ)

Interaction pattern
POST

6.2.3 Operation publishMessage
When a publishMessage request is received in VIS the message payload is validated and subsequently stored in the VIS database. Publishing a message serve two purposes; store the latest VoyagePlan (in monitoring) and facilitate sending of the published VoyagePlan to subscribers. The latter case is only relevant if there are subscribers for Voyage Plans with the actual UVID. Endpoints for subscribers are read from the subscription table in VIS dB and the SSC exposed interface for consuming a service, call_Service is invoked. Hereby passing the relevant payload received in the STMMessage together with endpoint (URI) for the called service found in the subscription table. In case the schema validation fails a message informing the caller of an invalid format is returned.

6.2.4 Operation Functionality
The publishMessage operation includes the following functionality:

- validateSchema
  Validate received message according to referenced schema in the payload contained in STMMessage, could be one of the STM defined payload formats (RTZ, Polygon, textMessage, PCMF). Received payload in publishMessage is validated against stored schemas in the VIS database. Successful validation returns true, otherwise false is returned, thus triggering an error message to the caller.

- storeMessage
  A successfully received message is stored in VIS database together with the dataId (UVID etc.). UVID is extracted from the payload i.e. RTZ.

- callService
  After storing the message a call is made to a privately exposed endpoint in SSC facing VIS including payload and the found service endpoint in the subscription table of VIS dB.

6.2.5 Operation Parameters

<table>
<thead>
<tr>
<th>Parameter Name</th>
<th>Direction</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>STMMessage</td>
<td>Input</td>
<td>XML</td>
<td>This parameter holds the payload to be sent when consuming a service. For consuming a</td>
</tr>
</tbody>
</table>
RouteOptimization service this is the VoyagePlan in RTZ format.

| <none> | Return | String | The return value provides the http response either successful 200 or unsuccessful 40X. |

### 6.3 Service interface – getMessage

Private interface exposed in VIS enabling the STM module to retrieve a message (RTZ, textMessage, Polygon, PCM) from the VIS message database.

![Sequence diagram getMessage private interface](image)

**Figure 8: Sequence diagram getMessage private interface**

#### 6.3.1 Purpose

Purpose is to facilitate STM Module consumption of messages received in VIS following a notification message received from VIS.

#### 6.3.2 Example

VIS receives an optimized route from a Route Optimization service, the received message is validated and stored in VIS database. Normally this message consists of an optimized route (RTZ). A notification is sent to the STM Module by mail indicating an optimized route is ready for consumption for a specific UVID. The operator may choose to act on the received notification and initiate a function in the STM Module for fetching the message from VIS by consuming the getMessage endpoint exposed in VIS.

#### 6.3.3 Interface Specification

`getMessage(dataID)`
Example
GET internalURI/getMessage/{URN}
Response: RTZ

6.3.4 Interaction pattern
Request - Response
GET

6.3.5 Operation getMessage
When a getMessage request is received in VIS the message is read from VIS dB cache (incoming message queue) filtered by parameter dataID. The dataID consists of an URN to identify the sender of the message to be fetched. The messages are read from VIS dB cache in received order for the actual dataId. Note the dataID parameter is optional, should the operator choose not to specify a dataID, the messages in VIS cache dB will be read in received order and then returned to the STM Module.

6.3.6 Operation Functionality
The getMessage operation includes the following functionality:
- getMessageFromCache
  Fetch received message for a specific URN from VIS dB cache (incoming message queue). The oldest not yet processed message is selected and marked as sent.

6.3.7 Operation Parameters

<table>
<thead>
<tr>
<th>Parameter Name</th>
<th>Direction</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>dataID</td>
<td>Input</td>
<td>String</td>
<td>The dataID, URN, represents the originator of a received message in VIS to be sent to the STM Module. Note this is optional no parameter is passed the oldest message is returned.</td>
</tr>
<tr>
<td>message</td>
<td>Return</td>
<td>String</td>
<td>The matched message from VIS dB cache according to dataID above (RTZ, textMessage, PCMF, Polygon).</td>
</tr>
</tbody>
</table>

6.4 Service interface – findService
Private interface in VIS exposed for the STM Module to facilitate service discovery in the central SeaSWIM service registry using query service parameters like service type, service category, location, service id etc. The response is a list of endpoints and corresponding service descriptions.
6.4.1 Purpose
Private interface findService objective is to enable functions for discovery of services in the central SeaSWIM service registry.

6.4.2 Example
Ship operator needs to search for suitable optimisation services to get a list of service descriptions with endpoints.

6.4.3 Interface Specification
findService(findServiceParameters)

Example
GET internalURI/findService/{findServiceParameters}
Response: List of endpoints with corresponding service descriptions

6.4.4 Interaction pattern
Request - Response
GET

6.4.5 Operation findService
In the STM Module an operator performs a search for services with different attributes like service type, location or specific service ID etc. The user action initiates a request to VIS private interface findService. VIS in turn forwards the request to the SSC service endpoint find_service after which the request to SeaSWIM central service registry is made. Parameters supplied by the operator are used in querying the service registry, resulting in a list of service instances including endpoints and descriptions returned to VIS. Finally a list of
endpoints together with a brief description of each found service instance is returned to the STM Module.

6.4.6 Operation Functionality

The findService operation includes the following functionality:

- **storeServiceDescription**
  
  Received service instance descriptions are stored in VIS dB to facilitate consumption of services with reference to exposed endpoints and identity of service providers. The resulting list of endpoints, brief description, provider ID, provider Name etc. are compiled in the response message to the STM Module.

6.4.7 Operation Parameters

<table>
<thead>
<tr>
<th>Parameter Name</th>
<th>Direction</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>findServiceParameters</td>
<td>Input</td>
<td>String</td>
<td>Parameters are typically: Id (service instance id)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>keywords (i.e. service type)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>location (coordinates)</td>
</tr>
<tr>
<td>servicedescriptionList</td>
<td>Return</td>
<td>String</td>
<td>List of endpoints together with descriptions and provider ID and name.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ServiceInstance</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Id</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Description</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Name</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- URL (endpoint)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Provider</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Id</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Name</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- ContactInfo</td>
</tr>
</tbody>
</table>

6.5 Service interface – findIdentities

Private interface in VIS exposed for the STM Module to facilitate identity discovery in the central SeaSWIM identity registry using query identity parameters like name, location, provided service types etc. The response is a list of identities and associated identity attributes.
6.5.1 Purpose
Private interface findIdentities objective is to enable functions for discovery of identities in the central SeaSWIM identity registry.

6.5.2 Example
Ship operator needs to search for identities providing with specific attributes like provider of a service, location, by name etc. Resulting response includes the identity id and associated attributes.

6.5.3 Interface Specification
findIdentities(findIdentityParameters)

Example
GET internalURI/findIdentities/{Acme Route Optimization}
Response: List of identities with associated identity attributes

6.5.4 Interaction pattern
Request - Response
GET

6.5.5 Operation findIdentities
In the STM Module an operator performs a search for identities with different attributes like name, location, specific identity ID etc. The user action initiates a request to VIS private interface findIdentities. VIS in turn forwards the request to the SSC service endpoint find_identities after which the request to SeaSWIM central identity registry is made. Parameters supplied by the operator are used in querying the identity registry, resulting in a list of identities including name, contact details, which services are provide etc. returned to VIS. Finally a list of identities together with above attributes are forwarded to the STM Module.
6.5.6 Operation Functionality

The findIdentities operation includes the following functionality:

- **storeMessageInCache**

  Received identities and associated attributes are stored in VIS database and VIS dB cache. The cache database is used for temporary storage of messages, thus forming a queue for facilitating ordered delivery of messages to the STM Module. The resulting list of identities and other attributes are compiled in the response message to the STM Module.

6.5.7 Operation Parameters

Table 9: Payload description of findIdentities operation

<table>
<thead>
<tr>
<th>Parameter Name</th>
<th>Direction</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>findIdentitiesParameters</td>
<td>Input</td>
<td>String</td>
<td>Parameters are typically:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Id (service instance id)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• keywords (i.e. service type)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• name</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• contactinfo</td>
</tr>
<tr>
<td>IdentityDescriptionList</td>
<td>Return</td>
<td>String</td>
<td>List of identities together with associated attributes.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Identity</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Id</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Name</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• ContactInfo</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Keywords (services provided, user category)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Service</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Organization</td>
</tr>
</tbody>
</table>

6.6 Service interface – Notify

Notify is a method in VIS used for notifying the STM Module of events in VIS.
6.6.1 Purpose
Private method in VIS for sending a notification to the STM Module.

6.6.2 Example
The VIS instance need to notify the STM Module that there is new message received in VIS message database. Typically this occurs when an optimized route is received from an optimization service. By notifying the STM Module of a message received in VIS the operator on the vessel can choose to fetch the message or not hereby limiting the data traffic between ship and shore.

6.6.3 Interface Specification

Example
"Message received from optimization service" | mail -s "urn:mrnx:stm:voymgt:uvid:123456" -aFrom:RO\routeoptimizer@gmail.com > metallica@gmail.com

Interaction pattern
Fire and forget

6.6.4 Operation Notify
At receipt of a message in VIS a notification of the event is forwarded to the STM Module. In VIS dB the service description of the originating service is used to populate the notification email sent to the vessel.

6.6.5 Operation Functionality
The findService operation includes the following functionality:

• composeNotifyMessage
VIS composes the notify message by extracting information from the originating service instance description previously stored in the find service call. To and from e-mail address, (the vessel e-mail address) is fetched from the configuration of VIS. Subject is the dataID included in received message typically an UVID. The body part consists of service instance description and provider details.

- **sendNotification**
  The notification might utilize an existing mail server by setting up an smtp client and sending the notification message to the STM Module. By using a mail server located alongside VIS the notification messages are stored in the outbox of the e-mail server hereby managing the synchronization in case of a disrupted connection between the shore centre and the vessel.

### 6.6.6 Operation Parameters

**Table 10: Payload description of notify operation**

<table>
<thead>
<tr>
<th>Parameter Name</th>
<th>Direction</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>dataID</td>
<td>Input</td>
<td>String</td>
<td>The dataID is a pointer to the unique identity of the information object received in a message in VIS. Typically an UVID.</td>
</tr>
<tr>
<td>&lt;body&gt;</td>
<td>Input</td>
<td>String</td>
<td>The body part consists of service instance description and provider details.</td>
</tr>
<tr>
<td>&lt;none&gt;</td>
<td>Return</td>
<td>e-mail</td>
<td>In the case of a faulty e-mail address a return mail is sent back to the mail server, providing the details and reason for e-mail transport recipient failure. However this is not received in VIS instead this is handled in the adjacent e-mail client where VIS is installed.</td>
</tr>
</tbody>
</table>

### 6.7 Service Interface – authorizIdentities

The authorizIdentities is a **private interface** to the STM Module to set and change authorization of STM actors to a specific voyage plan.
6.7.1 Purpose

The purpose of the interface is to implement the STM design rule “The owner of data is the actor responsible for the original creation and provision. The owner has full control over the access management for this data. Before sharing a voyage plan to a consumer, the actor requesting the voyage plan shall be authorized by the data owner, in this case the STM Module represents the data owner of the voyage plan and shall authorize actors for each specific voyage plan identified by the UVID.

6.7.2 Example

When a new voyage plan has been created, given a UVID and shall be published, the operator will select STM Actors from a presented list and call VIS interface authorizeIdentities.

6.7.3 Interface Specification

authorizeIdentities (URN, actorList)

POST internalURI/authorizeIdentities/{UVID,Identity}

Interaction pattern

Request – Response

6.7.4 Operation authorizeIdentities

When authorizeIdentities request is received in VIS an Access Control List is defined for the UVID and stored in VIS for use by checkAuthorization.

6.7.5 Operation Functionality

The authorizeIdentities operation includes the following functionality:

- CreateACL
Create an Access Control List for the UVID and set given actorList as authorized to the information object (identified by UVID).

- If there already exists an Access Control List for the UVID, the ACL is emptied and re-created based on the new list of actors.
- Store ACL in VIS

### 6.7.6 Operation Parameters

**Table 11: Payload description of authorizeIdentities operation**

<table>
<thead>
<tr>
<th>Parameter Name</th>
<th>Direction</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>id</td>
<td>Input</td>
<td>String</td>
<td>The data object identification (UVID) in URN format.</td>
</tr>
<tr>
<td>actorList</td>
<td>Input</td>
<td>actorListObj</td>
<td>List of STM Actors in URN format in SeaSWIM that represents the actor authentication in SeaSWIM.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>See Appendix 3 SeaSWIM Specification for details regarding URN format.</td>
</tr>
<tr>
<td>&lt;none&gt;</td>
<td>Return</td>
<td>String</td>
<td>The return value provides the http response either successful 200 or unsuccessful 40X.</td>
</tr>
</tbody>
</table>

### 6.8 Service interface – getVoyagePlan

Publicly exposed endpoint in VIS to facilitate sharing of an information object i.e. voyage plan. The consumer can select to request the active voyage plan and/or a specific voyage plan.

![Sequence diagram getVoyagePlan public interface](image-url)
6.8.1 Purpose
The publicly exposed interface getVoyagePlan provides access to stored voyage plans in VIS for calling services.

6.8.2 Example
When performing a route optimization the interface getVoyagePlan is consumed to request a Voyage Plan for optimization. In VIS the request is received and the requester is authenticated by use of the SSC service. After a successful authentication and subsequent access check the latest Voyage Plan is read from VIS dB and returned to the calling service.

6.8.3 Interface Specification
- getVoyagePlan()
  - returns the active VoyagePlan
- getVoyagePlanByld({uvid})
  - returns a VoyagePlan filtered by VoyageID
- getVoyagePlanIdRouteStatus({uvid},{routeStatus})
  - returns a VoyagePlan filtered by VoyageID and Voyage Status

Example
GET URI/voyagePlan/{uvid}/{routeStatus}
Response: RTZ

6.8.4 Interaction pattern
Request – Response (with callback)

6.8.5 Operation getVoyagePlan
At receipt of request for a voyage plan in VIS, following the SSC service user authentication, the user is authorized using an Access Control List (ACL) stored in VIS dB. In case of successful authorization the latest voyage plan, stored in VIS dB, is fetched and returned to the calling service.

6.8.6 Operation Functionality
The getVoyagePlan operation includes the following functionality:
- checkAuthorization
  User identity is checked against the ACL issued for an UVID. Providing the user has at least read access the operation returns true and the next operation is called, below. In case of a false result, an error message is returned to the caller stating denied access to the UVID.
- getMessageFromCache
  In VIS dB all published messages are stored alongside the dataID, i.e. UVID. The received UVID is used to query the VIS dB to find the latest published UVID. Found message payload, voyage plan is returned to the caller in RTZ format.
6.8.7 Operation Parameters

Table 12: Payload description of getVoyagePlan operation

<table>
<thead>
<tr>
<th>Parameter Name</th>
<th>Direction</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>UVID</td>
<td>Input</td>
<td>String</td>
<td>Unique Identification of a voyage as defined.</td>
</tr>
<tr>
<td>&lt;none&gt;</td>
<td>Return</td>
<td>message</td>
<td>A voyage plan, RTZ, is returned as a reply to the above request for a specific voyage plan. In the case of failed authentication and/or authorization an error message is returned the calling service.</td>
</tr>
</tbody>
</table>

6.9 Service interface – uploadVoyagePlan

Publicly exposed endpoint in VIS to facilitate receipt of a STM Message i.e. voyage plan in VIS. The received message is stored in VIS database and forwarded to the STM Module.

![Sequence diagram uploadVoyagePlan public interface](image)

6.9.1 Purpose

The publicly exposed interface uploadVoyagePlan is used for receiving voyage plans from other services in STM.

6.9.2 Example

After receipt of a voyage plan from a route optimization service the originating user is authenticated in SSC service. Following a successful authentication the payload of the received message is validated against the schema stored in VIS dB (RTZ). A validated message is stored in VIS dB and VIS dB cache for further processing according to specific use cases. In return to the uploaded Voyage plan a message is sent with optional data like transactionId, this is to facilitate possible subsequent text messages received.
6.9.3 Interface Specification

- uploadVoyagePlan(STMMessage)
  - returns transactionId (to be used in the case a related textMessage is sent following this message)

**Example**

POST URI/voyagePlan/
Response: (transactionId )

**Interaction pattern**
Request – Response

6.9.4 Operation uploadVoyagePlan

After receipt of a voyage plan from a route optimization service the originating user is authenticated in SSC service. Following a successful authentication the payload of the received message is validated against the schema stored in VIS dB (RTZ). A. validated message is stored in VIS dB and VIS dB cache for further processing according to specific use cases. In return to the uploaded Voyage plan a message is sent with optional data like transactionId and/or routeStatus, this is to facilitate possible subsequent text messages received.

6.9.5 Operation Functionality

The uploadVoyagePlan operation includes the following functionality:

- **validateSchema**
  Validate received message according to referenced schema in the payload contained in STMMessage, could be one of the STM defined payload formats (RTZ, Polygon, textMessage, PCMF). Received payload in callService is validated against stored schemas in the VIS database. Successful validation returns true, otherwise false is returned, thus triggering an error message to the caller.

- **storeMessageInCache**
  A successfully received message is stored in VIS database and in VIS dB cache together with the dataId (UVID etc.). UVID is extracted from the payload i.e. RTZ. The cache database is used for temporary storage of messages, thus forming a queue for facilitating ordered delivery of messages.

6.9.6 Operation Parameters

<table>
<thead>
<tr>
<th>Parameter Name</th>
<th>Direction</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>UVID</td>
<td>Input</td>
<td>String</td>
<td>Unique Identification of a voyage as defined.</td>
</tr>
</tbody>
</table>
**6.10 Service interface – uploadTextMessage**

Publicly exposed endpoint in VIS to facilitate receipt of a STM Message i.e. text message in VIS. The received message is stored in VIS database and forwarded to the STM Module.

**6.10.1 Purpose**

The publicly exposed interface uploadTextMessage is used for receiving text messages from other services in STM typically as an information message when receiving a checked route.

**6.10.2 Example**

After receipt of a voyage plan from a route optimization service a related text message is sent describing the basis for optimization. The uploaded text message is stored in VIS dB and VIS dB cache after which a notification message is sent to the operator (STM Module). The uploadTextMessage response is returned to the caller with a transactionId to enable consecutive sending of related messages.

**6.10.3 Interface Specification**

- uploadTextMessage(textMessage, transactionId)
  - returns transactionId (to be used in the case a related textMessage is sent following this message)

**Example**

POST URI/textMessage/\{textMessage\}

Response: (transactionId )
**Interaction pattern**
Request – Response

**6.10.4 Operation uploadTextMessage**
Request to uploadTextMessage including parameters transactionId and payload, textMessage trigger SSC authentication check followed by validation of the payload against stored schemas in VIS dB. Finally the received text message is stored in VIS dB and VIS dB cache.

**6.10.5 Operation Functionality**
The uploadTextMessage operation includes the following functionality:

- **validateSchema**
  Validate received message according to referenced schema in the payload contained in STMMessage, could be one of the STM defined payload formats (RTZ, Polygon, textMessage, PCMF). Received payload in uploadTextMessage is validated against stored schemas in the VIS database. Successful validation returns true, otherwise false is returned, thus triggering an error message to the caller.

- **storeMessageInCache**
  A successfully received message is stored in VIS database and in VIS dB cache together with the datalId (UVID etc.). UVID is extracted from the payload i.e. textMessage. The cache database is used for temporary storage of messages, thus forming a queue for facilitating ordered delivery of messages.

**6.10.6 Operation Parameters**

<table>
<thead>
<tr>
<th>Parameter Name</th>
<th>Direction</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>transactionId</td>
<td>Input</td>
<td>String</td>
<td>The transactionId for received message.</td>
</tr>
<tr>
<td>payload</td>
<td>Input</td>
<td>XML</td>
<td>Text message in textMessage format.</td>
</tr>
<tr>
<td>transactionId</td>
<td>Return</td>
<td>string</td>
<td>The transactionId for received message.</td>
</tr>
</tbody>
</table>

**6.11 Service interface – subscribeToVoyagePlan**
Publicly exposed endpoint in VIS to facilitate subscription request of an information object i.e. voyage plan in VIS or the active VP. The received message is stored in VIS database and endpoint from calling party is stored in a subscription table in VIS database together with subscription parameters.
6.11.1 Purpose
Public endpoint to facilitate subscription of Voyage plans published in VIS.

6.11.2 Example
Typically this is used when enhanced monitoring commenced to enable subsequent sending of voyage plans for monitoring from the vessel.

6.11.3 Interface Specification
- `subscribeToVoyagePlan(endPoint)`
  - Implements a subscription for an active VoyagePlan
- `subscribeToVoyagePlanByUvid(endPoint,uvid,SubscriptionParameters)`
  - Implements a subscription for a specific VoyagePlan

Example
POST URI/subscribe/voyagePlan/{UVID}
Response: Subscription accepted

Interaction pattern
Publish – Subscribe

6.11.4 Operation `subscribeToVoyagePlan`
To be completed later.

6.11.5 Operation Functionality
The subscribeToVoyagePlan operation includes the following functionality:

To be completed later.

**6.11.6 Operation Parameters**

To be completed later.

*Table 15: Payload description of subscribeToVoyagePlan operation*

<table>
<thead>
<tr>
<th>Parameter Name</th>
<th>Direction</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**6.12 Service interface – removeVoyagePlanSubscription**

Publicly exposed endpoint in VIS to facilitate deletion of subscription requests for an information object i.e. voyage plan in VIS or all subscriptions. The received message is stored in VIS database and all/or a specific subscription is deleted from the subscription table in VIS database.

![Sequence diagram](image)

**6.12.1 Purpose**

Remove previously registered subscriptions for voyage plans.

**6.12.2 Example**

To be completed later.

**6.12.3 Interface Specification**

- removeAllVoyagePlanSubscription(endPoint)
Delete subscription for all VoyagePlans for a subscribing endpoint
- removeVoyagePlanSubscriptionByUvid(uvid,endPoint)

Delete subscription for specific VoyagePlan for a subscribing endpoint

Example
DELETE URI/subscribe/voyagePlan/{UVID}
Response: Removal ok

Interaction pattern
Request – Response

6.12.1 Operation removeVoyagePlanSubscription
To be completed.

6.12.2 Operation Functionality
The removeVoyagePlanSubscription operation includes the following functionality:
To be completed.

6.12.3 Operation Parameters
To be completed later.

Table 16: Payload description of removeVoyagePlanSubscription operation

<table>
<thead>
<tr>
<th>Parameter Name</th>
<th>Direction</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
7 Service dynamic behaviour

See corresponding sequence diagrams in chapter 6.
8 Service provisioning (optional)

This chapter should describe the way services are planned to be provided and consumed. It is labelled optional since one of the key aspects of service-orientation is to increase flexibility of the overall system by separating the definition of services from their implementation. This means that a service can be provided in several different contexts that are not necessarily known at the time, when the service is designed.

To be completed later.
9 References

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Version</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1]</td>
<td>Service Description Guidelines</td>
<td>01.00</td>
</tr>
</tbody>
</table>
10 Acronyms and Terminology

10.1 Acronyms

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>API</td>
<td>Application Programming Interface</td>
</tr>
<tr>
<td>MC</td>
<td>Maritime Cloud</td>
</tr>
<tr>
<td>MEP</td>
<td>Message Exchange Pattern</td>
</tr>
<tr>
<td>NAF</td>
<td>NATO Architectural Framework</td>
</tr>
<tr>
<td>REST</td>
<td>Representational State Transfer</td>
</tr>
<tr>
<td>SOAP</td>
<td>Simple Object Access Protocol</td>
</tr>
<tr>
<td>SSD</td>
<td>Service Specification Document</td>
</tr>
<tr>
<td>UML</td>
<td>Unified Modelling Language</td>
</tr>
<tr>
<td>URL</td>
<td>Uniform Resource Locator</td>
</tr>
<tr>
<td>VTS</td>
<td>Vessel Traffic Service</td>
</tr>
<tr>
<td>WSDL</td>
<td>Web Service Definition Language</td>
</tr>
<tr>
<td>XML</td>
<td>Extendible Mark-up Language</td>
</tr>
<tr>
<td>XSD</td>
<td>XML Schema Definition</td>
</tr>
</tbody>
</table>

10.2 Terminology

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>External Data Model</td>
<td>Describes the semantics of the “marine world” (or a significant part thereof) by defining data structures and their relations. This could be at logical level (e.g., in UML) or at physical level (e.g., in XSD schema definitions), as for example standard data models, or S-100 based data produce specifications.</td>
</tr>
<tr>
<td>Operational Activity</td>
<td>An activity performed by an operational node. Examples of operational activities in the maritime context are: Route Planning, Route Optimization, Logistics, Safety, Weather Forecast Provision, …</td>
</tr>
<tr>
<td>Operational Model</td>
<td>A structure of operational nodes and associated operational activities and their inter-relations in a process model.</td>
</tr>
<tr>
<td>Operational Node</td>
<td>A logical entity that performs activities. Note: nodes are specified independently of any physical realisation. Examples of operational nodes in the maritime context are: Maritime Control Center, Maritime Authority, Ship, Port, Weather Information Provider, …</td>
</tr>
<tr>
<td>Service</td>
<td>The contractual provision of something (a non-physical object), by one, for the use of one or more others. Services involve interactions between providers and consumers, which may be performed in a digital form (data exchanges) or</td>
</tr>
</tbody>
</table>
through voice communication or written processes and procedures.

| Service Consumer | A service consumer uses service instances provided by service providers. All users within the maritime domain can be service customers, e.g., ships and their crew, authorities, VTS stations, organizations (e.g., meteorological), commercial service providers, etc. |
| Service Data Model | Formal description of one dedicated service at logical level. The service data model is part of the service specification. If an external data model exists (e.g., a standard data model), then the service data model shall refer to it: each data item of the service data model shall be mapped to a data item defined in the external data model. |
| Service Implementer | Implementers of services from the service provider side and/or the service consumer side. Everybody can be a service implementer but mainly this will be commercial companies implementing solutions for shore and ship. |
| Service Interface | The mechanism by which a service communicates. |
| Service Instance | The implementation of a dedicated service in a dedicated technology. One service specification may result in several service instances, being implemented with different or same technologies. |
| Service Instance Description | Documents the details of a service instance (most likely documented by the service implementer). The service instance description includes (but is not limited to) a service instance model and describes the used technology, transport mechanism, quality of service, etc. |
| Service Instance Model | Describes the implementation of a dedicated service instance in a dedicated technology. This includes a detailed description of the data payload to be exchanged by this service instance. The actual format of the service instance model depends on the chosen technology. Examples may be WSDL and XSD files (e.g., for SOAP services) or swagger (Open API) specifications (e.g., for REST services). If an external data model exists (e.g., a standard data model), then the service instance model shall refer to it: each data item of the service instance model shall be mapped to a data item defined in the external data model. In order to prove correct implementation of the service specification, there shall exist a mapping between the service instance model and the service data model. This means, each data item used in the service instance model shall be mapped to a corresponding data item of the service data model. (In case of existing mappings to a common external (standard) data model from both the service data model and the service instance model, such a mapping is implicitly given.) |
Service Provider

Service
Specification

Service
Specification
Producer
Service Technology
Catalogue

A service provider provides instances of services according to
a service specification and service instance description. All
users within the maritime domain can be service providers,
e.g., authorities, VTS stations, organizations (e.g.,
meteorological), commercial service providers, etc.
Describes one dedicated service at logical level. The Service
Specification is technology-agnostic. The Service
Specification includes (but is not limited to) a description of
the Service Interfaces and Service Operations with their data
payload. The data payload description may be formally
defined by a Service Data Model.
Producers of service specifications in accordance with the
service description guidelines.
List and specifications of allowed technologies for service
implementations. Currently, SOAP and REST are envisaged
to be allowed service technologies. The service technology
catalogue shall describe in detail the allowed service profiles,
e.g., by listing communication standards, security standards,
stacks, bindings, etc.

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Appendix A Service Specification XML

This appendix contains the formal definition of the service specification.

A.1 Service datamodel
To be completed later.
Document No: Appendix 5
Title: STM Voyage Management use cases
Date: 2016-05-12
The sole responsibility of this publication lies with the author. The European Union is not responsible for any use that may be made of the information contained therein.
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<th>Title</th>
<th>Page</th>
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</thead>
<tbody>
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<td>Use case/functions to be supported</td>
<td>17</td>
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<td>9</td>
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<td>9.1.1</td>
<td>Description</td>
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<td>9.1.2</td>
<td>Test bed usage</td>
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<td>9.1.3</td>
<td>Information needs</td>
<td>19</td>
</tr>
<tr>
<td>9.1.4</td>
<td>Use case/functions to be supported</td>
<td>19</td>
</tr>
<tr>
<td>10</td>
<td>Appendix A Terminology</td>
<td>20</td>
</tr>
</tbody>
</table>
1 Route exchange ship-ship

Description
Introducing route exchange ship-ship, will give the intentions of other ships. Nothing in the current “navigational process” will be changed and the master is still responsible. The route exchange will solely introduce a new tool which helps the OOW to plan ahead, foresee possible dangerous situations and reduce route detours due to traffic conditions. The route exchange should be used to avoid collision situations and close quarter situations. When in close quarter situations COLREGs are always in force.

1.1.1 Test bed usage
Ships participating in the test beds should exchange routes (send and receive route segments) ship to ship via new route message (AIS ASM) developed within the project and display them on ECDIS. Routes should not be displayed unless activated/clicked by other ship. The number of waypoints, updating frequency etc. is further described in the route message format description. Route exchange should only be tested when it does not interfere with the safe navigation of participating ships which is up to OOW to decide.

1.1.2 Information needs/prerequisites
• New route message (AIS-ASM)
• Information from AIS (POS, Speed etc)

1.1.3 Use case/functions to be supported

<table>
<thead>
<tr>
<th>Event</th>
<th>Functionality needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1. Indication what ship is part of STM test bed to separate them from non STM ships</td>
<td>A graphical symbol (colour/text/flag/log) should mark STM ships on STM compatible onboard system</td>
</tr>
<tr>
<td>1.2. A choice is made to allow others (vessels and shore centres) to see new route</td>
<td>It should be possible to choose, made once as a default setting, to show or not to show own route message. The idea to have it as a default is to not add an extra work step that can be missed out unintentionally.</td>
</tr>
<tr>
<td>Message (AIS ASM)</td>
<td>Description</td>
</tr>
<tr>
<td>------------------</td>
<td>-------------</td>
</tr>
<tr>
<td><strong>1.3. Voyage is loaded for monitoring</strong></td>
<td>Standard ECDIS voyage planning procedure</td>
</tr>
<tr>
<td><strong>1.4. Ship broadcasts route message</strong></td>
<td>If 1.2 and 1.3 is yes route message is transmitted with defined updating frequency/when passing waypoint</td>
</tr>
<tr>
<td><strong>1.5. Own ship route message should be visualized on other ships ECDIS/STM module</strong></td>
<td>NA</td>
</tr>
<tr>
<td><strong>1.6. Other ship acquires own ships route and displays it on ECDIS/STM module</strong></td>
<td>It should be possible to select which ships routes to display and also to hide them again. The routes should not be showed automatically (If not triggered by certain events/limits e.g. CPA)</td>
</tr>
<tr>
<td><strong>1.7. Ship Passes a waypoint</strong></td>
<td>Updated route is broadcasted (i.e. one more waypoint is added in the end of the broadcasted route)</td>
</tr>
<tr>
<td><strong>1.8. Ship sailing between two waypoints (long distance between these waypoints)</strong></td>
<td>In order for ship “arriving” into AIS coverage area to receive own ships route it should be broadcasted according to updating frequency in route message format</td>
</tr>
<tr>
<td><strong>1.9. Other ship is deviating from its voyageplan (in time or geographically)</strong></td>
<td>Ownship’s ECDIS STM Module should be able to adjust settings that triggers “notification” about that another ship is not following it’s voyageplan (e.g other ships route changes color)</td>
</tr>
<tr>
<td><strong>1.10. Ship is entering VTS AIS coverage area</strong></td>
<td>VTS systems should support new route message</td>
</tr>
</tbody>
</table>
2 Sharing of Voyage Plan

2.1.1 Description.
Ships in test bed will share Voyage Plans (VP) with Shore Centres (SC), ports and service providers. The ship/shipping company is the information owner of the VP and as such chooses which actors that should be granted access to the voyage plan. This is part of the access mananagement functionality in SeaSWIM. Another prerequisite is that ships voyage plans can be identified and that the identification is unique, therefore the Unique Voyage ID (UVID) concept is a cornerstone in STM and the future usage is to act as a pointer to other information that is related to a voyage such as cargo, crew reporting information etc.

2.1.2 Test bed usage
See VIS and SeaSWIM technical specification.

2.1.3 Information needs
• Rtz.
• UVID
• ID registry
• VIS
• Access management functionality

2.1.4 Use case/functions to be supported

<table>
<thead>
<tr>
<th>Event</th>
<th>Functionality needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1. Ship prepare voyage plan i.e. Route and Schedule.</td>
<td>Sending the Route to onboard STM module. STM ship system should support route status (part of rtz)</td>
</tr>
<tr>
<td>2.2. Ship assigns access rights to VP</td>
<td>STM Module shall have a functionality for assign access rights to a VP</td>
</tr>
<tr>
<td>2.3. Voyage plan is made available for authorised stakeholders</td>
<td>Voyage Information Service (VIS) and SeaSWIM Connector Service (SSCS)</td>
</tr>
</tbody>
</table>
3 Route Cross-check

3.1.1 Description

The intended voyage plan is sent to a shore based service provider for cross-checking. The purpose is to include updated regional area information that could affect ships voyage plan. The cross-checking can be done before the vessels departure or before arrival at a certain geographical area. The cross-check can include, but is not limited to, Under Keel Clearance (UKC), air draught, no violation of no-go areas, MSI and compliance with mandatory routeing. No optimization service as such is included in the route validation.

3.1.2 Test bed usage

In the test beds SC will act as the service providers performing route cross-checking. The cross-checking will be limited to the SC area of responsibility. Operators in the SC can be supported by softwares for detection of unnormal routes.

3.1.3 Information needs

- Rtz.
- AIS

3.1.4 Use case/functions to be supported

Note. Event 2.1, 2.2 and 2.3 are general for all voyages.

<table>
<thead>
<tr>
<th>3. Route cross-check</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event</td>
</tr>
<tr>
<td>3.1. Voyage Plan is shared according to Sharing of VP (use-case 2)</td>
</tr>
<tr>
<td>3.2. Ship requests a route Cross-Check</td>
</tr>
</tbody>
</table>
| 3.3. SC checks the route and want to suggest a different route | SC should be able to confirm to the ship that the route is checked and is ok or have errors (alternatively send a route suggestion).
   SC should get (automatic) acknowledgement when the suggested VP is available at the STM Module |
| 3.4. Ship accepts or rejects suggested route | When/If the route suggestion is loaded for monitoring all actors with access rights shall be notified |
4 Flow Management

4.1.1 Description
A shore-based operator is performing flow optimization through advice to the ships within a defined sea area using an enhanced traffic image, consisting of AIS targets, radar targets and with the planned routes for the STM ships. As a part of the route schedule, the operator has access to the ship’s ETA to some key waypoint, denoted Flowpoint (FPT). Based on the above information, the operator is continually assessing the overall maritime traffic situation within his sector of responsibility. If a developing traffic situation is identified, the operator can recommend a new ETA for the FPT in order to resolve the situation at an early stage. In case of a MSI receipt, e.g. a fairway or traffic lane is closed; the operator can use both re-scheduling and suggested route/s, which is a proposed new route segment. In the case of a port approach the approach could be synchronized with the port call.

4.1.2 Test bed usage
The flow management concept for flow management of complete traffic situations will only be tested in the simulator network. Test plan to be elaborated but no other information/functions than stated in information needs is anticipated. Basic flow functionalities as Recommended Time of Arrival (RTA) to a given flowpoint will be included in the test beds, by using textmessage regarding RTA, this will not imply any additional requirements on the STM Module.

4.1.3 Information needs
- Rtz
- AIS
- Flow points

4.1.4 Use case/functions to be supported

<table>
<thead>
<tr>
<th>Event</th>
<th>Functionality needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1. Voyage Plan is shared according to Sharing of VP (use-case 2)</td>
<td></td>
</tr>
<tr>
<td>4.2. Necessary flow points along the VP to be inserted</td>
<td>Shore centers check route for FPT and send back confirmation or new proposal including FPT (Might include text message)</td>
</tr>
<tr>
<td>4.3. Ship enters SC monitored area and enhanced</td>
<td>When SC detects a STM ship (AIS symbol) on AIS it should be possible to automatically</td>
</tr>
<tr>
<td>Monitoring is commenced used for flow management</td>
<td>Connect AIS signal to ships .rtz route in order to conduct enhanced monitoring including ships FPT schedule</td>
</tr>
<tr>
<td>-------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>4.4. VTS/SC want to suggest a different route schedule using FPT</td>
<td>VTS/SC should be able to send a RTA to a FPT by means of a textmessage or a VP schedule</td>
</tr>
<tr>
<td>4.5. Ship accepts or rejects suggested route</td>
<td>When/If VP (with new FPT schedule) is loaded for monitoring all actors with access rights shall be notified</td>
</tr>
</tbody>
</table>

1 See chapter “Enhanced Monitoring”
5 Enhanced Monitoring

5.1.1 Description
Enhanced monitoring will be supported by adding route information and a monitoring service can be provided in previously unmonitored areas. SC will be able to detect if planned schedule is not kept or if ship deviates from planned route. Thus SC can monitor that ships are following their planned route and also foresee possible dangerous situations and suggest route modifications (geographic and/or speed) due to traffic or other impeding conditions. These tools can also enhance current VTS services.

5.1.2 Test bed usage
The SC should exchange routes with the ships (send and receive routes/route segments) ship to shore and display them on the VTS/STM shore centre system. All STM ships within predefined areas (AIS coverage limitation due to input of pos, course etc.), from SC will be monitored from SC. The SC operators will be supported by anomaly detection tools, described elsewhere, to be taken into operation in the project. TCP/IP based exchange of navigational data via new message format/extension to other format might be tested on some ships.

5.1.3 Information needs/prerequisites
- AIS
- rtz.
- Info on what ships are STM compatible
- Connection to SeaSWIM by means of SSCS

5.1.4 Use case/functions to be supported

### 5. Enhanced Monitoring

<table>
<thead>
<tr>
<th>Event</th>
<th>Functionality needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1. Voyage Plan is shared according to Sharing of VP (use-case 2)</td>
<td></td>
</tr>
<tr>
<td>5.2. Ship requests Enhanced monitoring</td>
<td>Enhanced monitoring functionality in the SC</td>
</tr>
</tbody>
</table>
| 5.3. SC receives access rights to voyage plan according to use case 2 | VP should be detected by all actors with access rights e.g. service providers and SC  
SC should be able to display, use and toggle on and off ship’s VP |
| 5.4. Ship enters SC monitored area and enhanced monitoring is commenced | When SC detects a STM ship (AIS symbol) on AIS it should be possible to automatically connect AIS signal to ships .rtz route in order to conduct enhanced monitoring |
| 5.5. Ship deviates from VP (time or geographical) | SC operator should be supported and alerted by existing alarm engines (schedule and geographical deviation from route) in SC software (after that it is SC SOP how to act) |
| 5.6. SC suggests a changed route by sending route proposal | SC should be able to send a route proposal where part of route geometry or schedule is changed  
SC should get (automatic) acknowledgement when the suggested VP is available at the STM Module |
| 5.7. Ship receives route proposal | The changed part of the route should be clearly marked/distinguished to make it clear what is the difference from currently monitored route |
| 5.8. Ship accepts or rejects suggested route | When/If the route suggestion is loaded for monitoring all actors with access rights shall be notified |
| 5.9. Ship leaves enhanced monitored area and/or enters another SC area | Enhanced monitoring of ship should be deactivated in SC software |
6 PortCDM

6.1.1 Description
Port Collaborative Decision Making (PortCDM) will provide a basis for collaboration between key actors within the port and towards its surroundings based on shared situational awareness enabling increased predictability. To enable just-in-time arrivals of ships, just-in-time operations and further on just-in-time integration with hinterland transportation leading to optimized turn-around processes; and to enable improved resource utilization for all involved port actors and optimized operations.

6.1.2 Test bed usage
Ports in the testbed should collaborate with participating ships exchanging information about arrival/departure times using standardized information (e.g. Port Call message format). This gives earlier information on port availability and is a prerequisite for ships to optimize arrival times (JIT arrivals, all port actors ready to perform operations).

6.1.3 Information needs
- Port Call message format
- AIS
- rtz

6.1.4 Use case/functions to be supported
See Port call message format in SeaSWIM Specification (Appendix 3)
7 Winter Navigation

7.1.1 Description
Information regarding best route, waiting positions, preparations for assistance, position in convoy, time for departures from port is important for the Icebreaking services. The information should preferably be transmitted directly to ships' navigation system. Introducing route exchange will give both Icebreaker services and assisted ships better information in more automated procedures reducing workload and risk for misunderstandings.

7.1.2 Test bed usage
ICEINFO, ships and Ice breakers participating in the test beds should exchange routes. Ice breakers and assisted ships should also exchange information by means of a text message function.

7.1.3 Information needs
• rtz.
• Text message

7.1.4 Use case/functions to be supported
Note. The ability to send and receive messages is related to serveral services but the use case and functionality for this is included in the winter navigation table.

<table>
<thead>
<tr>
<th>Event</th>
<th>Functionality needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.1. Voyage Plan is shared according to Sharing of VP (use-case 2)</td>
<td>See Use Case 2</td>
</tr>
<tr>
<td>7.2. Icebreaker (IB) need to get the ship about to be assisted to a certain position at a certain time</td>
<td>Send text message regarding arrival time to the ship to be assisted</td>
</tr>
<tr>
<td>7.3. Ship about to be assisted updates VP</td>
<td>Ship about to be assisted updates VP, all actors with access rights shall be notified</td>
</tr>
<tr>
<td>7.4. IB need to get the ship about to be assisted to follow a recommended route from the IB (e.g. Open waters acc. to latest Iceinformation that IB has)</td>
<td>IB to Send suggested VP to the ship about to be assisted</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>7.5. Ice-Breaker (IB) need to relay information to ship regarding IB-Assistance, such as Towing arrangement, convoy information</td>
<td>Text about such information should be possible to send to ship from Ice-Breaker and vice versa (Including automatic confirmation of that messages is received)</td>
</tr>
<tr>
<td>Ship and IceBreaker should be able to reply to incoming message, in a “communication-thread”</td>
<td></td>
</tr>
<tr>
<td>7.6. Ship being assisted by IB need to send Updated PTA to port (received via text from IB)</td>
<td>IB to send PTA via text to assisted ship</td>
</tr>
<tr>
<td>Ship to Update VP, all actors with access rights shall be notified</td>
<td></td>
</tr>
</tbody>
</table>
8 Area management

8.1.1 Description
Introducing area management tool into the maritime domain will give a more graphic overview on areas where ships are not allowed to pass due to e.g. whale nursery areas, military exercises or SAR operations. The areas should be attached with a date attribute so that they disappear when they are obsolete.

8.1.2 Test bed usage
Areas (e.g. Area to avoided and/or search area) should be sent by the SC to ships in the testbeds.

8.1.3 Information needs
New area exchange format.
- Date/time of enforcement
- Date/time of expiry
- Text Information regarding the area

8.1.4 Use case/functions to be supported

Note. Areas of interest is not limited to sail race. This is just an example given. Other areas of interest could be SAR Areas, MSI Areas, MSP Areas, Protected Areas. All of these areas could be used as clarification when SC needs to inform ships about situations/events that concerns safe passage in the area alternatively be a clarification to a proposal if SC chooses to send a route proposal to the ship..

<table>
<thead>
<tr>
<th>Event</th>
<th>Functionality needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.1. Sail Race taking place in an Area between 2 dates</td>
<td>NA</td>
</tr>
<tr>
<td>8.2. SC creates area</td>
<td>An area with attributes describing activity in area, geography and validity period should be possible to create and display</td>
</tr>
<tr>
<td>8.3. Shore Center</td>
<td>Send areas</td>
</tr>
</tbody>
</table>
**send out the Area including attributes to ships**

<table>
<thead>
<tr>
<th>8.4. Ship receives area</th>
<th>Automatic Confirmation from STM Module that Area is received</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.5. Area displayed onboard</td>
<td>Ship to be able to display area in STM Module</td>
</tr>
<tr>
<td>8.6. Area deleted</td>
<td>Area should be deleted automatically when it´s obsolete</td>
</tr>
</tbody>
</table>
9 Route optimisation

9.1.1 Description
The route optimisation tools will be different in nature with a common purpose to provide more information for the navigator on board. The STM concept will provide the means to get the ships route optimised from different service providers in a standardised way. The service providers has different focus including best route regarding; the weather forecast, surface currents, fuel consumption, no-go areas regarding draft, areas with sensitive nature, conflicts with other ships routes etc.

9.1.2 Test bed usage
Ships participating in the test beds will be offered to take part of the route optimisation services that are developed within the STM project.

9.1.3 Information needs
- Ships identification/UVID
- rtz
- Ship specific information, different attributes needed for different services. (No standard exists.)

9.1.4 Use case/functions to be supported

<table>
<thead>
<tr>
<th>9. Route optimization</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Event</strong></td>
</tr>
<tr>
<td>9.1. Voyage Plan is shared according to Sharing of VP (use-case 2)</td>
</tr>
<tr>
<td>9.2. Vessel request optimization (this can happen daily during long voyage)</td>
</tr>
<tr>
<td>9.3. Service provider receives VP to be optimised</td>
</tr>
<tr>
<td>9.4. Optimized voyage plan is returned to ship</td>
</tr>
<tr>
<td>9.5. If ship accepts voyage plan and it is set for monitoring.</td>
</tr>
</tbody>
</table>
# 10. Terminology

<table>
<thead>
<tr>
<th>Term</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.1. ETA</td>
<td>Estimated time of arrival to a location, (normally a waypoint along (FP) or in the end of a route) based on present Speed and the schedule attached to Voyage plan</td>
</tr>
<tr>
<td>10.2. PTA</td>
<td>Planned time of arrival to a location, based on Voyage plan</td>
</tr>
<tr>
<td>10.3. RTA</td>
<td>Requested time of arrival to a location, if ship’s PTA and ETA doesn’t match e.g. then ship should send a RTA to stakeholders e.g. Port, Pilot Station. RTA could also be used an actor wants to recommend/request a new arrival time to a ship.</td>
</tr>
<tr>
<td>10.4. ATA</td>
<td>Actual time of arrival to a location, when the location actually is geographically passed, or arrived at.</td>
</tr>
<tr>
<td>10.5. FP</td>
<td>Flowpoint a location, normally a waypoint along a route</td>
</tr>
<tr>
<td>10.6. ETD</td>
<td>Estimated Time of Departure</td>
</tr>
</tbody>
</table>
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Title: Route Message Format
Date: 2016-05-13
## DOCUMENT STATUS

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</tr>
</tbody>
</table>

### Document History

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Status</th>
<th>Initials</th>
<th>Description</th>
</tr>
</thead>
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<tr>
<td>1.0</td>
<td>2016-05-10</td>
<td>Reviewed</td>
<td></td>
<td>Used in procurement appendix</td>
</tr>
</tbody>
</table>

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1 Sharing and receiving Monitored Routes

This document describes a method for sharing route data between vessels, with an STM capable system using VDES or AIS equipment for communication. The Route Message Broadcast is used as a means to indicate intended navigation to nearby vessels, allowing vessels to avoid ending up in a close quarter where the involved ships have to use the regulations in COLREG. The current and a fixed number of coming route legs of the monitored route are shared with other vessels.

The use of this message requires that both the receiving and transmitting side have the appropriate communication equipment as well as presentation and navigation systems.
2 System components

2.1 HMI and operational equipment
The Route Message sharing system presentation and is done through an ECDIS or similar system. The ECDIS is also responsible for assembly, disassembly, and interpretation of Route Message data.

*Note: ECDIS in all parts of this document may also be INS or other systems with the STM functional module integrated.*

2.2 Communication Device
The ECDIS shall be connected to a VDES unit supporting both AIS and ASM-channel communication*. This communication device will function only as a modem in this system. The VDES unit shall employ a carrier sense technique to avoid VHF broadcast at the same time and channel as coastal VHF stations. The maximum length of one broadcast shall not exceed three AIS TDMA slots (<80 ms), to ensure compliance to AIS and VDES equipment standards.

*Note: Standalone AIS may be used where VDES is not available. Loss of route message data fidelity will occur (fewer legs and no leg XTD values).*

2.3 Interfaces
The ECDIS shall communicate with the Communication Device using IEC 61162-2 or IEC 61162-450 compliant interfaces.

2.3.1 Data formats
Incoming Data will be presented to the ECDIS using standard VDM messages as defined in above referenced interface standards.

Data sent from ECDIS to the communication device unit shall be using ABM and BBM messages, as defined in the same interface standards.
3 Route Messages

3.1 Onboard message flow
The ECDIS is responsible for initiating any Route Message broadcast to be transmitted by the Communication Device, as well as any Route Message interrogations. The ECDIS will compile the Route Message data payload, or interrogation message payload, as defined in section 4, and send a BBM or ABM message with the payload to the Communication Device.

The Communication Device will provide the ECDIS with VDM-message data as they are received on the VHF data links. VDM message payloads may be:

- Remote AIS target dynamic, static and voyage data (AIS Msg 1,2,3,5,9,18,19,24A,24B)
- Remote vessel route message data (AIS msg 8 or VDES ASM msgs)
- Route Message interrogation messages (AIS msg 6 or VDES ASM msgs)

3.2 Message broadcast trigger events
The message shall be broadcast so that vessels in receiving range has accurate information at a reasonable delay, without creating unnecessary load on the VHF datalinks.

A new Route Message broadcast shall be initiated by ECDIS when any of the below events occurs:

- Six minutes have passed since last Route Message broadcast
- A Route Message interrogation was received and over one minute has passed since last Route Message broadcast on that channel
- Any of the data in the last Route Message broadcast has been changed
- When passing a waypoint
- The Monitored Route has been deactivated
- A Monitored Route is activated

The Route Message broadcast shall be initiated by the ECDIS as soon as possible after any of the above broadcast triggers.

There shall be no autonomous Route Message broadcasts when there is no Monitored Route active in ECDIS, except for one additional Route Message transmission after stopping a Monitored Route. The system shall however respond to interrogations.

3.3 Route segmentation for AIS broadcasts
The Route Message-payload is defined such that the current leg as well as up to six additional legs can be shared. If any of the waypoints within the next four legs is over 200 NM from previous waypoint, this will be treated as the last WP in the currently shared monitored route segment.

3.4 Route segmentation for VDES ASM broadcasts
The Route Message-payload is defined such that the current leg as well as up to twelve additional legs can be shared, with Cross Track Distance (XTD) parameters for each leg.
4 Route Message structure

The Route Message structures are defined in the following tables.
When no Monitored Route is active, the Route Message shall have an empty payload.
Two Route Messages are defined, depending on the communication system used. VDES ASM channel communication allows for a higher bitrate, and more data within the three timeslot limit.
Leg parameters (planned speed, XTD, geometry) are for the leg ending at the waypoint following those parameters. Turn radius is for the next waypoint.

4.1 AIS Route Message

The first and last waypoints are fully qualified, while intermediate waypoints are defined as the difference from the previous waypoint in the route. This way of defining intermediate waypoints saves bits but limits the maximum length of those legs. In cases where representative length is insufficient, the total route segment reported in a message is cut short and the “intermediate” waypoint becomes the last waypoint in the message.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Bits</th>
<th>Description</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message ID</td>
<td>6</td>
<td>Identifier for Message 8; always 8</td>
<td></td>
</tr>
<tr>
<td>Repeat indicator</td>
<td>2</td>
<td>Used by the repeater to indicate how many times a message has been repeated.</td>
<td></td>
</tr>
<tr>
<td>Source ID</td>
<td>30</td>
<td>MMSI number of source station</td>
<td></td>
</tr>
<tr>
<td>Spare</td>
<td>2</td>
<td>Not used. Should be set to zero. Reserved for future use</td>
<td></td>
</tr>
<tr>
<td>DAC</td>
<td>10</td>
<td>TO BE DETERMINED WITHIN THE PROJECT</td>
<td></td>
</tr>
<tr>
<td>FI</td>
<td>6</td>
<td>TO BE DETERMINED WITHIN THE PROJECT</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>If no monitored route is available the message ends here</th>
</tr>
</thead>
<tbody>
<tr>
<td>First waypoint type</td>
</tr>
<tr>
<td>First waypoint longitude</td>
</tr>
<tr>
<td>First waypoint latitude</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intermediate legs (64)</th>
<th>Repeats 0 ... 6 times depending on total number of legs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leg geometry</td>
<td>1</td>
</tr>
<tr>
<td>Planned speed</td>
<td>10</td>
</tr>
<tr>
<td>Turn radius</td>
<td>9</td>
</tr>
<tr>
<td>Longitude delta</td>
<td>22</td>
</tr>
<tr>
<td>Latitude delta</td>
<td>22</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Final reported leg (66)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leg geometry</td>
</tr>
</tbody>
</table>
### Parameter Bits Description Comment

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Bits</th>
<th>Description</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planned speed</td>
<td>10</td>
<td>Planned speed over ground in 1/10 knot steps (0-102.2 knots) 1 023 = not available, 1 022 = 102.2 knots or higher</td>
<td>Standard AIS format</td>
</tr>
<tr>
<td>Last waypoint longitude</td>
<td>28</td>
<td>Longitude in 1/10 000 min (±180°, East = positive (as per 2's complement), West = negative (as per 2's complement). 181° = (6791AC0h) = not available = default)</td>
<td>Standard AIS format</td>
</tr>
<tr>
<td>Last waypoint latitude</td>
<td>27</td>
<td>Latitude in 1/10 000 min (±90°, North = positive (as per 2's complement), South = negative (as per 2's complement), 91° (3412140h) = not available = default)</td>
<td>Standard AIS format</td>
</tr>
<tr>
<td>Steering mode</td>
<td>2</td>
<td>0 = Manual (default) 1 = Heading control 2 = Track control 3 = Reserved for future use</td>
<td></td>
</tr>
<tr>
<td>Spare</td>
<td>4</td>
<td>Padding to bring total message length to a byte boundary. Always 0</td>
<td>Required for AIS</td>
</tr>
</tbody>
</table>

### 4.2 VDES ASM Route Message

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Bits</th>
<th>Description</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message ID</td>
<td>6</td>
<td>Identifier for Message 8; always 8</td>
<td>To be defined by VDES standard</td>
</tr>
<tr>
<td>Repeat indicator</td>
<td>2</td>
<td>Used by the repeater to indicate how many times a message has been repeated.</td>
<td></td>
</tr>
<tr>
<td>Source ID</td>
<td>30</td>
<td>MMSI number of source station</td>
<td></td>
</tr>
<tr>
<td>Spare</td>
<td>2</td>
<td>Not used. Should be set to zero. Reserved for future use</td>
<td></td>
</tr>
<tr>
<td>DAC</td>
<td>10</td>
<td>TO BE DETERMINED</td>
<td></td>
</tr>
<tr>
<td>FI</td>
<td>6</td>
<td>TO BE DETERMINED</td>
<td></td>
</tr>
</tbody>
</table>

If no monitored route is available the message ends here

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Bits</th>
<th>Description</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>First waypoint type</td>
<td>1</td>
<td>0 = First waypoint (below) is FROM waypoint 1 = Navigating towards first waypoint (start of route)</td>
<td></td>
</tr>
<tr>
<td>First waypoint longitude</td>
<td>28</td>
<td>Longitude in 1/10 000 min (±180°, East = positive (as per 2’s complement), West = negative (as per 2’s complement). 181° = (6791AC0h) = not available = default)</td>
<td>Standard AIS format</td>
</tr>
<tr>
<td>First waypoint latitude</td>
<td>27</td>
<td>Latitude in 1/10 000 min (±90°, North = positive (as per 2’s complement), South = negative (as per 2’s complement), 91° (3412140h) = not available = default)</td>
<td>Standard AIS format</td>
</tr>
</tbody>
</table>

Intermediate legs (97) Repeats 0 … 12 times depending on total number of legs

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Bits</th>
<th>Description</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>XTD port side</td>
<td>11</td>
<td>XTD port side in 1/1000 NM. 0 = not available</td>
<td>Max 2.047 NM</td>
</tr>
<tr>
<td>XTD starboard</td>
<td>11</td>
<td>XTD starboard in 1/1000 NM. 0 = not available</td>
<td>Max 2.047 NM</td>
</tr>
<tr>
<td>Leg geometry</td>
<td>1</td>
<td>0 = Loxodrome (Rhumb line) 1 = Orthodrome (Great circle)</td>
<td></td>
</tr>
<tr>
<td>Planned speed</td>
<td>10</td>
<td>Planned speed over ground in 1/10 knot steps (0-102.2 knots) 1 023 = not available, 1 022 = 102.2 knots or higher</td>
<td>Standard AIS format</td>
</tr>
<tr>
<td>Turn radius</td>
<td>9</td>
<td>Turn radius in 1/100 NM. 0 = not available</td>
<td>Max 5.11 NM</td>
</tr>
<tr>
<td>Waypoint longitude</td>
<td>28</td>
<td>Longitude in 1/10 000 min (±180°, East = positive (as per 2’s complement), West = negative (as per 2’s complement). 181° = (6791AC0h) = not available = default)</td>
<td>Standard AIS format</td>
</tr>
<tr>
<td>Waypoint latitude</td>
<td>27</td>
<td>Latitude in 1/10 000 min (±90°, North = positive (as per 2’s complement), South = negative (as per 2’s complement),</td>
<td>Standard AIS format</td>
</tr>
</tbody>
</table>
### Parameter Table

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Bits</th>
<th>Description</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final reported leg</td>
<td>(88)</td>
<td>91° (3412140h) = not available = default</td>
<td></td>
</tr>
<tr>
<td>XTD port side</td>
<td>11</td>
<td>XTD port side in 1/1000 NM. 0 = not available</td>
<td>Max 2.047 NM</td>
</tr>
<tr>
<td>XTD starboard</td>
<td>11</td>
<td>XTD starboard in 1/1000 NM. 0 = not available</td>
<td>Max 2.047 NM</td>
</tr>
<tr>
<td>Leg geometry</td>
<td>1</td>
<td>0 = Loxodrome (Rhumb line)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 = Orthodrome (Great circle)</td>
<td></td>
</tr>
<tr>
<td>Planned speed</td>
<td>10</td>
<td>Planned speed over ground in 1/10 knot steps (0-102.2 knots)</td>
<td>Standard AIS format</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.023 = not available, 1.022 = 102.2 knots or higher</td>
<td></td>
</tr>
<tr>
<td>Last waypoint longitude</td>
<td>28</td>
<td>Longitude in 1/10 000 min (±180°, East = positive (as per 2’s complement), West = negative (as per 2’s complement). 181° = (6791AC0h) = not available = default)</td>
<td>Standard AIS format</td>
</tr>
<tr>
<td>Last waypoint latitude</td>
<td>27</td>
<td>Latitude in 1/10 000 min (±90°, North = positive (as per 2’s complement), South = negative (as per 2’s complement). 91° (3412140h) = not available = default)</td>
<td>Standard AIS format</td>
</tr>
<tr>
<td>Steering mode</td>
<td>2</td>
<td>0 = Manual (default)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 = Heading control</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 = Track control</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 = Reserved for future use</td>
<td></td>
</tr>
<tr>
<td>Spare</td>
<td>0..7</td>
<td>Padding to bring total message length to a byte boundary. Always 0</td>
<td>For byte alignment</td>
</tr>
</tbody>
</table>

### 4.3 Interrogation

Standard AIS/VDES interrogation for a specific functional message shall be used to initiate a request of a Route Message from a remote vessel. The reply shall always be as defined above (broadcast), to allow all ships within range to receive the message. The reply should be sent with empty content when there is no monitored route in use.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Bits</th>
<th>Description</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Message ID</td>
<td>6</td>
<td>Identifier for Message 6; always 6</td>
<td></td>
</tr>
<tr>
<td>Repeat indicator</td>
<td>2</td>
<td>Used by the repeater to indicate how many times a message has been repeated.</td>
<td></td>
</tr>
<tr>
<td>Source ID</td>
<td>30</td>
<td>MMSI number of source station</td>
<td></td>
</tr>
<tr>
<td>Sequence number</td>
<td>2</td>
<td>0-3</td>
<td></td>
</tr>
<tr>
<td>Destination ID</td>
<td>30</td>
<td>MMSI number of destination station</td>
<td></td>
</tr>
<tr>
<td>Retransmit flag</td>
<td>1</td>
<td>Retransmit flag should be set upon retransmission: 0 = no retransmission = default; 1 = retransmitted</td>
<td></td>
</tr>
<tr>
<td>Spare</td>
<td>1</td>
<td>Not used. Should be zero</td>
<td></td>
</tr>
<tr>
<td>DAC</td>
<td>10</td>
<td>International DAC = 1₂ = 00000000001₂</td>
<td></td>
</tr>
<tr>
<td>FI</td>
<td>6</td>
<td>Function identifier = 2₃ = 000001₀</td>
<td></td>
</tr>
<tr>
<td>Requested DAC code</td>
<td>10</td>
<td>TO BE DETERMINED WITHIN PROJECT (same as in Route Message definition above)</td>
<td></td>
</tr>
<tr>
<td>Requested FI code</td>
<td>6</td>
<td>TO BE DETERMINED WITHIN PROJECT (same as in Route Message definition above)</td>
<td></td>
</tr>
<tr>
<td>Total length</td>
<td>104</td>
<td>The resulting Message 6 occupies 1 slot.</td>
<td></td>
</tr>
</tbody>
</table>
5 Use cases and operational aspects

See SMAs STM Voyage management use cases document.
39 partners from 13 countries containerising maritime information

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www.stmvalidation.eu
Port Information Service scope for Test beds

Document No: Appendix 7
Title: Appendix 7-Port Information Service Specification
Date: 2016-05-13
## Document status

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<th>Name</th>
<th>Organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mikael Olofsson</td>
<td>SMA</td>
</tr>
</tbody>
</table>

## Document History

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Initials</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>00.01</td>
<td>20160504</td>
<td>MOL</td>
<td>Initial version</td>
</tr>
<tr>
<td>00.02</td>
<td>20160513</td>
<td>MOL</td>
<td>Updates</td>
</tr>
</tbody>
</table>

## Review

<table>
<thead>
<tr>
<th>Name</th>
<th>Organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almir Zerem</td>
<td>Viktoria Swedish ICT</td>
</tr>
</tbody>
</table>
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1 Introduction

1.1 Purpose of the document
The purpose of this service specification document is to provide a holistic overview of the Port Information service and its building blocks in a technology-independent way, according to the guidelines given in [1].

The aim is to document the key aspects of the Port Information Service at the logical level:

- the operational and business context of the service
  - requirements for the service (e.g., information exchange requirements)
  - involved nodes: which operational components provide/consume the service
  - operational activities supported by the service
  - relation of the service to other services
- the service description
  - service interface definitions
  - service interface operations
  - service payload definition
  - service dynamic behaviour description
- service provision and validation aspects

1.2 Intended readership
This service specification is intended to be read by service architects, system engineers and developers in charge of designing and developing an instance of the Port Information Service.

Furthermore, this service specification is intended to be read by enterprise architects, service architects, information architects, system engineers and developers in pursuing architecting, design and development activities of other related services such as the STM Module, SeaSWIM Connector, central SeaSWIM services etc.

1.3 Inputs from other projects
2 Service identification

The purpose of this chapter is to provide a unique identification of the service and describe where the service is in terms of the engineering lifecycle.

<table>
<thead>
<tr>
<th>Name</th>
<th>Port Information Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>TBD</td>
</tr>
<tr>
<td>Version</td>
<td>0.1</td>
</tr>
<tr>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>Keywords</td>
<td></td>
</tr>
<tr>
<td>Architect(s)</td>
<td></td>
</tr>
<tr>
<td>Status</td>
<td>Proposed for testbed</td>
</tr>
</tbody>
</table>
3 Operational context

This section describes the context of the service from an operational perspective.
3.1 Functional and Non-functional Requirements

In designing the Port Information Service (PIS) for the STM Validation project and subsequent test-beds, a reduced scope will be implemented as compared with what will be catered for according to the STM Target Concept. Initially for the test-beds we have decided upon supporting described operational requirements and use cases below. (Refer to document: “STM Voyage Management operational requirements and use cases”)

The table below lists applicable existing requirements for the Port Information service.

**Table 1: Requirements Tracing**

<table>
<thead>
<tr>
<th>Requirement Id</th>
<th>Requirement Text</th>
<th>References</th>
</tr>
</thead>
</table>
| Initializing Port Call to PortCDM enabled port | The ship shall initialize the port call and be given a Port Call Identity in return. | Use-Case : Ship to port  
See ref [5] Port Call Message |
| Send state updates to PortCDM   | The ship shall send updated states to Port, such as Planned Time of Arrival (PTA), Estimated Time of Arrival (ETA). | Use-Case : Ship to port  
See ref [5] Port Call Message |
| Receive port recommendations from PortCDM | The ship shall receive recommendations from Port, such as Recommended Time of Arrival (RTA) | Use-Case : Ship to port  
See ref [5] Port Call Message |

The table below defines additional requirements for the Port Information service.

**Table 2: Requirements Definition**

<table>
<thead>
<tr>
<th>Requirement Id</th>
<th>Requirement Name</th>
<th>Requirement Text</th>
<th>Rationale</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.2 Other Constraints

3.2.1 Relevant Industrial Standards

3.2.2 Operational Activities

Table 3: Operational Activities supported by the Port Information service

<table>
<thead>
<tr>
<th>Operational Activity</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port Call Synchronization</td>
<td>Ship and port synchronize their efforts in enabling just-in-time operations. From the ship’s point of view this means a possibility to save fuel by green steaming, in order to arrive just-in-time and enable just-in-time operations.</td>
</tr>
</tbody>
</table>
4 Service overview

4.1 Introduction

The main purpose with the Port Information Service (PIS) is to support the ship or ship operator with Port Calls to a PortCDM enabled port. The Port Information Service is collocated with a Voyage Information Service and a SeaSWIM Connector and have a backend interface to the STM Module.

4.2 Scope and context of PIS

The Port Information Service (PIS) is intended to be located together with a Voyage Information Service (VIS) and a SeaSWIM Connector. The Port Information Service (PIS) has three main functionalities;

- Initialise Port Call
- Send state updates to Port
- Receive messages (recommendations) from Port

To enable dynamic initialisation of port calls, PIS is configured to become a subscriber on VIS, and each voyage plan without a Port Call ID (UPCID) is used as basis for initializing a port call. The initialisation of the port call returns a Port Call ID (UPCID) which is forwarded to the backend application (STM Module) via notification (could be e-mail in testbed).

To send a state update, the STM Module sends a Port Call Message to PIS (interface stateUpdate) containing planned/estimated time of arrival and the Port Call ID.

The port may send recommendation of time of arrival through a queue in port which is monitored by Port Information Service. When a message is located in the queue it is forwarded to the backend application (STM Module) through notification. In case the ship is...
offline, the message needs to be stored in Port Information Service until ship is online and can receive/get the message.
4.3 Overall requirements

4.3.1 PIS requirements briefly

- PIS shall receive Voyage Plans in RTZ format and initialize a Port Call to a PortCDM enabled port.
- PIS shall have a private method for sending state updates through the SeaSWIM connector to PortCDM service.
- PIS shall search for messages from PortCDM and send them to backend application (such as STM Module).
- PIS shall have a private notification function for sending notifications to backend application (such as STM Module).
- All communication between PIS and SeaSWIM Central services and other information services within SeaSWIM is made using the SeaSWIM Connector.

4.3.2 Assumptions

- The PortCDM services uses a SeaSWIM Connector (or similar functionality)
- The STM Module has a notification interface of some kind
- The STM Module handles the Port Call ID in relation to the voyage plan
- The STM Module uses the Port Call ID when sending port call state updates to PIS.
## 4.4 Service Interfaces

PIS provides and consumes the following interfaces.

### Provided interfaces by Port Information Service

<table>
<thead>
<tr>
<th>ServiceInterface</th>
<th>Role (from service provider point of view)</th>
<th>ServiceOperation</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIS\initiatePortCall (RTZ)</td>
<td>Provided</td>
<td>initiatePortCall</td>
</tr>
<tr>
<td>PIS\stateUpdate (stateUpdateObj)</td>
<td>Provided</td>
<td>stateUpdate</td>
</tr>
<tr>
<td>PIS\getMessage ()</td>
<td>Provided</td>
<td>getMessage</td>
</tr>
</tbody>
</table>

Table 4 Provided service interfaces towards backend application (STM Module)

### Consumed interfaces (PortCDM) on SeaSWIM

See Appendix B and ref [4] for further information on PortCDM services.

<table>
<thead>
<tr>
<th>ServiceInterface</th>
<th>Role (from service provider point of view)</th>
<th>ServiceOperation</th>
</tr>
</thead>
<tbody>
<tr>
<td>PortCDM Service\port_call_finder</td>
<td>Consumed</td>
<td>port_call_finder</td>
</tr>
<tr>
<td>PortCDM Service\state_update</td>
<td>Consumed</td>
<td>state_update</td>
</tr>
<tr>
<td>PortCDM Service\state_update_queues</td>
<td>Consumed</td>
<td>state_update_queues</td>
</tr>
</tbody>
</table>

Table 5 Consumed PortCDM interfaces on SeaSWIM

### Consumed interfaces (VIS)

See ref [3] for detailed description

<table>
<thead>
<tr>
<th>ServiceInterface</th>
<th>Role (from service provider point of view)</th>
<th>ServiceOperation</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIS\subscribeToVoyagePlan</td>
<td>Consumed</td>
<td>subscribeToVoyagePlan</td>
</tr>
</tbody>
</table>

Table 6 Consumed Voyage Information Service interfaces
### Provided interfaces on SeaSWIM

<table>
<thead>
<tr>
<th>ServiceInterface</th>
<th>Role (from service provider point of view)</th>
<th>ServiceOperation</th>
</tr>
</thead>
<tbody>
<tr>
<td>No interfaces provided on SeaSWIM</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 7 Provided service interfaces on SeaSWIM**

### Consumed interfaces in SeaSWIM Connector


<table>
<thead>
<tr>
<th>ServiceInterface</th>
<th>Role (from service provider point of view)</th>
<th>ServiceOperation</th>
</tr>
</thead>
<tbody>
<tr>
<td>callService</td>
<td>Consumed</td>
<td></td>
</tr>
<tr>
<td>findService</td>
<td>Consumed</td>
<td></td>
</tr>
</tbody>
</table>

**Table 8 Consumed service interfaces on SeaSWIM Connector**
5 Service Data Model

The data model for information exchange between the Port Information Service and PortCDM (PCM) is described in ref [5].

The data model for RTZ is described in ref [2] SeaSWIM Technical Specification.
6 Service interface specifications

This chapter describes the details of each service interface. The Service Interface specification covers only the static design description while the dynamic design (behavior) is described in chapter 7.

Figure 2 Sketch of a Port Information Service

6.1 Provided Service Interface – initiatePortCall

The initiatePortCall is an interface that take a voyage plan as input and initiates a Port Call if not done before (if no Port Call ID is set for arrival port). The initiating of a port call is done by locating a PortCDM service for the arrival port and calling a service to find a port call for the ship (IMO number). In return a Port Call ID is given by PortCDM to be used when updating states (times) to PortCDM.

The interface is provided as the callback endpoint when subscribing to voyage plans from the Voyage Information Service (VIS) or for receiving voyage plans by direct call.

The endpoint is not intended to be published in SeaSWIM for the testbed.

6.1.1 Interface Specification

initiatePortCall ( voyagePlan : RTZ ) : status
6.1.2 Operation initiatePortCall

The operation initialise a Port Call by calling PortCDM with ship identification and date. In return a Port Call Identity is given.

The input information shall be given in RTZ format from which IMO, port and date is extracted.

The output is a response with status. If a Port Call ID is provided by PortCDM, a notification will be sent to a backend application. In the testbed the backend application will be the STM Module. The notification will need to be configured in PIS to suit the STM Module.

6.1.3 Operation Functionality

The following functionality is expected:

- Extract relevant information from RTZ
  - IMO number
  - Arrival Port
  - Arrival Date on last waypoint
  - Port Call ID for arrival port (indicates that the initiation has been done to PortCDM)
- Check if initiation needs to be done, i.e. Port Call ID is missing for arrival port
- Find PortCDM service in arrival port. If no service can be found, return in status X in response
- Check that all information mandatory for initiation of port call is found in the RTZ, return error message if not.
- Build the call to PortCDM service “port_call_finder”, see ref
- Call the service “port_call_finder” through the SeaSWIM Connector and receive the UPCID or error message in response.
- The service call to PortCDM is done through a SeaSWIM Connector
- Notify UPCID to backend application (STM Module) together with UVID, Port and Date
- Initiate queue on PortCDM by calling state_update_queues
- Start poll the queue in search for messages (recommendations) from the Port.
### 6.1.4 Operation Parameters

<table>
<thead>
<tr>
<th>Parameter Name</th>
<th>Direction</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>voyagePlan</td>
<td>Input</td>
<td>RTZ</td>
<td>See ref [2] Where RTZ is expected to have at least the following fields set</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>{</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>IMO</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>arrivalPort</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TA (dateOfArrival) on last waypoint</td>
</tr>
<tr>
<td>status</td>
<td>Return</td>
<td>int</td>
<td>Status from initialisation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>To be further detailed</strong></td>
</tr>
</tbody>
</table>

Table 9 Payload description of initiatePortCall operation
6.2 Provided Service Interface – stateUpdate
The StateUpdate is a private interface to the STM Module to send a state update to a PortCDM enabled port.

6.2.1 Interface Specification
stateUpdate (stateObj : PCM) : response

6.2.2 Operation stateUpdate
The operation sends a state update by calling PortCDM service state_update.

6.2.3 Operation Functionality
The following functionality is expected:
- Forward the call to PortCDM service state_update
- The service call to PortCDM is done through a SeaSWIM Connector

6.2.4 Operation Parameters

<table>
<thead>
<tr>
<th>Parameter Name</th>
<th>Direction</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>stateObj</td>
<td>Input</td>
<td>Port Call Message</td>
<td>PCM format Containing: Port Call ID (UPCID) ArrPort timeType [TARGET</td>
</tr>
<tr>
<td>result</td>
<td>Return</td>
<td>int</td>
<td>Status code on service call See ref [5] PortCDM Specification</td>
</tr>
</tbody>
</table>

Table 10 Payload description of stateUpdate operation

1.1 Provided Service Interface – getMessage
The interface is intended to be called by the backend application (e.g. STM Module) when notified or to check whether there are messages from Port. If the STM Module has been offline the interface is recommended to be called when coming online to get all messages received during offline.

The endpoint is not intended to be published in SeaSWIM for the testbed.

1.1.1 Interface Specification
getMessage (message : STM_Message) : status
1.1.2 Operation getMessage
The operation is called by the STM Module either when notified or when coming online to check and/or get messages to the ship from the Port.

1.1.3 Operation Functionality
The following functionality is expected:
- Get message from internal queue (optional: check PortCDM queue)
- Return message

1.1.4 Operation Parameters

<table>
<thead>
<tr>
<th>Parameter Name</th>
<th>Direction</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>message</td>
<td>Return</td>
<td>STM_Message</td>
<td>Will be further described</td>
</tr>
</tbody>
</table>

Table 11 Payload description of getMessage operation

6.3 Consumed service interface – Notify
Notify is an interface in the STM Module that Port Information Service can use for notifying when message is received.

6.3.1 Purpose
Interface in STM Module for receiving notifications.

6.3.2 Example
The PIS instance need to notify the STM Module that there is new message received, either a Port Call ID or a recommendation from port. The notification might utilize an existing mail server by setting up a smtp client and sending the notification message to an address e.g. configured in the PIS web.config file.

6.3.3 Operation Parameters

STM_Notification format will be further specified.

<table>
<thead>
<tr>
<th>Parameter Name</th>
<th>Direction</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
</table>
| message        | Input     | STM_Notification, PortCallID| Notification to backend application (STM Module) when new Port Call ID is received from service call to port_call_finder with the following information:  
- UVID  
- Port  
- ArrivalDate  
- Port Call ID |
<table>
<thead>
<tr>
<th>message</th>
<th>STM_Notification</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Notification to backend application (STM Module) when a message from PortCDM is found in the PortCDM queue with the following information:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Port Call ID</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Port</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ServiceState</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- TimeType</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- DateTime</td>
</tr>
</tbody>
</table>
7 Service dynamic behaviour

7.1 Configuration of Port Information Service
7.2 Service Interface initiatePortCall
7.3 Service Interface stateUpdate
The STM Module sends state updates such as Planned/Target Time of Arrival (PTA/TTA) and Estimated Time of Arrival (ETA) on a specific location to PortCDM through Port Information Service.

7.1 Internal function [Timer] Poll PortCDM queue
This functionality is started in initiatePortCall and is triggered by a configurable timer. By calling the PortCDM service interface state_update_queues (queueId) messages (recommendations) shall be collected from queue and forwarded to STM Module through the notify interface.
### 7.2 Internal function SubscribeToVoyagePlan

This functionality is engaged at startup by configuration. The purpose is to activate a subscription on Voyage Information Service and listen to updated Voyage Plans from ship. Each Voyage Plan without a Port Call Identity (UPCID) for Arrival Port triggers a search for a Port Call ID if the Port is PortCDM enabled (i.e. there are published PortCDM services on SeaSWIM). If no Port Call ID exists in PortCDM for the ship, it’s created, returned and forwarded to STM Module for correlation with Voyage Plan.

### 7.3 STM Module interface – Notify
8 Service provisioning

The Port Information Service is used by the ship to access PortCDM services on SeaSWIM. Depending on the network connectivity, the Port Information Service may be hosted onboard or at a shorebased server site.

Figure 3 Operational context – PIS deployment
# 9 References

This chapter shall include all references used when designing the service. Specifically, the applicable steering and requirements documents shall be listed.

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Version</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1]</td>
<td>Service Description Guidelines</td>
<td>01.00</td>
</tr>
<tr>
<td>[5]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
10 Acronyms and Terminology

10.1 Acronyms

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>API</td>
<td>Application Programming Interface</td>
</tr>
<tr>
<td>MC</td>
<td>Maritime Cloud</td>
</tr>
<tr>
<td>MEP</td>
<td>Message Exchange Pattern</td>
</tr>
<tr>
<td>NAF</td>
<td>NATO Architectural Framework</td>
</tr>
<tr>
<td>REST</td>
<td>Representational State Transfer</td>
</tr>
<tr>
<td>SOAP</td>
<td>Simple Object Access Protocol</td>
</tr>
<tr>
<td>SSD</td>
<td>Service Specification Document</td>
</tr>
<tr>
<td>UML</td>
<td>Unified Modelling Language</td>
</tr>
<tr>
<td>URL</td>
<td>Uniform Resource Locator</td>
</tr>
<tr>
<td>VTS</td>
<td>Vessel Traffic Service</td>
</tr>
<tr>
<td>WSDL</td>
<td>Web Service Definition Language</td>
</tr>
<tr>
<td>XML</td>
<td>Extendible Mark-up Language</td>
</tr>
<tr>
<td>XSD</td>
<td>XML Schema Definition</td>
</tr>
</tbody>
</table>

10.2 Terminology

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>External Data Model</td>
<td>Describes the semantics of the “maritime world” (or a significant part thereof) by defining data structures and their relations. This could be at logical level (e.g., in UML) or at physical level (e.g., in XSD schema definitions), as for example standard data models, or S-100 based data produce specifications.</td>
</tr>
<tr>
<td>Operational Activity</td>
<td>An activity performed by an operational node. Examples of operational activities in the maritime context are: Route Planning, Route Optimization, Logistics, Safety, Weather Forecast Provision, …</td>
</tr>
<tr>
<td>Operational Model</td>
<td>A structure of operational nodes and associated operational activities and their inter-relations in a process model.</td>
</tr>
<tr>
<td>Operational Node</td>
<td>A logical entity that performs activities. Note: nodes are specified independently of any physical realisation. Examples of operational nodes in the maritime context are: Maritime Control Center, Maritime Authority, Ship, Port, Weather Information Provider, …</td>
</tr>
<tr>
<td>Service</td>
<td>The contractual provision of something (a non-physical object), by one, for the use of one or more others. Services involve interactions between providers and consumers, which may be performed in a digital form (data exchanges) or through voice communication or written processes and procedures.</td>
</tr>
<tr>
<td>Service Consumer</td>
<td>A service consumer uses service instances provided by service providers. All users within the maritime domain can be service customers, e.g., ships and their crew, authorities, VTS stations, organizations (e.g., meteorological), commercial service providers, etc.</td>
</tr>
</tbody>
</table>
**Service Data Model**
Formal description of one dedicated service at logical level. The service data model is part of the service specification. Is typically defined in UML and/or XSD. If an external data model exists (e.g., a standard data model), then the service data model shall refer to it: each data item of the service data model shall be mapped to a data item defined in the external data model.

**Service Implementer**
Implementers of services from the service provider side and/or the service consumer side. Everybody can be a service implementer but mainly this will be commercial companies implementing solutions for shore and ship.

**Service Instance**
The implementation of a dedicated service in a dedicated technology. One service specification may result in several service instances, being implemented with different or same technologies.

**Service Instance Description**
Documents the details of a service instance (most likely documented by the service implementer). The service instance description includes (but is not limited to) a service instance model and describes the used technology, transport mechanism, quality of service, etc.

**Service Instance Model**
Describes the implementation of a dedicated service instance in a dedicated technology. This includes a detailed description of the data payload to be exchanged by this service instance. The actual format of the service instance model depends on the chosen technology. Examples may be WSDL and XSD files (e.g., for SOAP services) or swagger (Open API) specifications (e.g., for REST services). If an external data model exists (e.g., a standard data model), then the service instance model shall refer to it: each data item of the service instance model shall be mapped to a data item defined in the external data model.

In order to prove correct implementation of the service specification, there shall exist a mapping between the service instance model and the service data model. This means, each data item used in the service instance model shall be mapped to a corresponding data item of the service data model. (In case of existing mappings to a common external (standard) data model from both the service data model and the service instance model, such a mapping is implicitly given.)

**Service Interface**
The mechanism by which a service communicates.

**Service Provider**
A service provider provides instances of services according to a service specification and service instance description. All users within the maritime domain can be service providers, e.g., authorities, VTS stations, organizations (e.g., meteorological), commercial service providers, etc.

**Service Specification**
Describes one dedicated service at logical level. The Service Specification is technology-agnostic. The Service Specification includes (but is not limited to) a description of the Service Interfaces and Service Operations with their data payload. The data payload description may be formally defined by a Service Data Model.

**Service Specification Producer**
Producers of service specifications in accordance with the service description guidelines.
List and specifications of allowed technologies for service implementations. Currently, SOAP and REST are envisaged to be allowed service technologies. The service technology catalogue shall describe in detail the allowed service profiles, e.g., by listing communication standards, security standards, stacks, bindings, etc.
Appendix B  PortCDM Services


swagger: '2.0'
info:
description: Port CDM Services with convenience interface delegating STM port call finder
version: 1.0-SNAPSHOT
title: Port CDM Services
contact:
  name: Eddie Olsson
  #url: 'http://dev.portcdm.net'
  email: eddie.olsson@viktoria.se
license:
  name: Apache 2.0
  url: 'http://www.apache.org/licenses/LICENSE-2.0.html'
basePath: /dmp
tags:
  - name: port_calls
  - name: state_definition_catalogue
  - name: port_call_finder
  - name: state_update
  - name: port_info
  - name: actor_catalogue
schemes:
  - http
  - https
paths:

# PORTCALL FINDER

'/port_call_finder/{imo}/{plannedArrival}':
  get:
    tags:
      - port_call_finder
    summary: Find a port call by vessel imo and planned arrival date
    description: The service finds the portcall identifier required when interacting with the other services in PortCDM. The service searches existing portcalls for the specified vessel, and returns the identifier of the portcall that is the best match based on the planned arrival date. If there are no portcalls registered for the vessel, or there is a bad match between the specified planned arrival date and the arrival dates of registered portcalls, a new portcall will be created. The service will therefore always return a valid portcall identifier.
operationId: findPortCall

produces:
  - text/plain

parameters:
  - name: X-PortCDM-UserId
description: The STM identifier for the caller
  in: header
required: false
type: string
default: "

- name: X-PortCDM-Password
description: The password matching STM identifier (X-PortCDM-UserId)
in: header
required: false
type: string
default: "

- name: X-PortCDM_ApiKey
description: A unique string identifying the application accessing PortCDM (contact the PortCDM demonstrator development team to acquire an API key)
in: header
required: false
type: string
default: "

- name: imo
description: The IMO string identifying the vessel that plans to visit the port
in: path
required: true
type: string

- name: plannedArrival
description: An approximate date and time eg 2016-08-23T14:53:12Z when the vessel plans to arrive at the port. This date will be used by PortCDM when identifying the best matching portcall if there are already portcalls registered for the vessel.
in: path
required: true
type: string

responses:
'200':
description: Successful operation returns a string identifying the best matching PortCDM portcall.
  If no match was found, a new portcall is created. The service will therefore always return a valid portcall identifier.
schema:
  type: string

'401':
description: Error code '401' is returned if authentication of the provided header parameters (X-PortCDM-UserId and X-PortCDM-Password) failed.

'403':
description: Error code '403' is returned if parameters are missing or of the wrong type.

'404':
description: Error code '404' is returned if the vessel with the specified IMO identifier is not found.
schema:
$ref: '#/definitions/PortCallIdentifier'

### STATE UPDATE

/state_update:
  post:
    tags:
      - state_update
    summary: Send a Port Call Message to PortCDM
    description: submits a statement for a portCMD state enclosed in a PortCallMessage xml data structure (see [REF PortCall Messaging standard])

    The message contains a time-related statement for valid a PortCDM state, for instance a vessel's arrival to a port or completing cargo operations.

    A message REQUIRES--
      * 'messageId' is a locally generated identifier that must be guaranteed to be unique within the reporting system. This identifier will remain stable in PortCDM, allowing tracability from the reporting system to the individual messages sent to PortCDM.
      * 'portcallId' identifying the portcall to which the message is posted (see portcall_finder_service),
      * 'locationState' OR serviceState, where exactly one is required and allowed.
      * 'time' the time which the message reports
      * 'timeType' identifying the type of statement

    The message may OPTIONALLY contain--
      * 'groupWith' The messageId of a previously submitted message concerning the same state. This provides PortCDM with a hint on how to structure the message within the portcall object. This can be provided, for instance, if it is known that the current message is an update for a previously submitted message (e.g. a new estimate)
      * 'comment' A free-text comment that can be used to provide further (human-readable) information about the message (e.g. the name of the tug boat sending the message)

    The message shall NOT contain--
      * 'reportedBy' This field is automatically assigned by PortCDM upon receiving the message (contents of the field is ignored by PortCDM)
operationId: sendMessage
consumes:
  - application/xml
parameters:
  - name: X-PortCDM-UserId
    description: The STM identifier for the actor submitting the message
    in: header
    required: false
    type: string
    default: 
  - name: X-PortCDM-Password
    description: The password matching STM identifier (X-PortCDM-UserId)
    in: header
    required: false
    type: string
    default: 
  - name: X-PortCDM-ApiKey
    description: A unique string identifying the application accessing PortCDM (contact the PortCDM demonstrator development team to acquire an API key)
    in: header
    required: false
    type: string
    default: 
  - in: body
    description: The portcall message to be submitted
    name: body
    required: false
    schema:
      $ref: '#/definitions/PortCallMessage'
responses:
  401:
    description: Error code '401' is returned if authentication of the provided header parameters (X-PortCDM-UserId and X-PortCDM-Password) failed.
  403:
    description: Error code '403' is returned if call parameters are missing or invalid
  404:
    description: Error code '404' is returned if the specified portcallId is not found
    default:
      description: Successful operation (no return value)
# MESSAGE QUEUES

/state_update/queues:
  post:
    tags:
      - state_update
    summary: Create a Port Call Message queue
    description: The method creates a message queue from which new accessible messages can be fetched, returning a queue token used when fetching messages.
    The queue may be removed by PortCDM if not accessed at a regular interval (typically in the order of days)
    operationId: createQueue
    produces:
      - application/json
    parameters:
      - name: X-PortCDM-UserId
        description: The STM identifier for the caller
        in: header
        required: false
        type: string
        default: ''
      - name: X-PortCDM-Password
        description: The password matching STM identifier (X-PortCDM-UserId)
        in: header
        required: false
        type: string
        default: ''
      - name: X-PortCDM-ApkKey
        description: A unique string identifying the application accessing PortCDM (contact the PortCDM demonstrator development team to acquire an API key)
        in: header
        required: false
        type: string
        default: ''
    responses:
      '200':
        description: Successful operation returns a string token identifying the newly created queue. This token is used when retrieving messages from the queue.
        schema:
          type: string
      '401':
        description: Error code '401' is returned if authentication of the provided header parameters (X-PortCDM-UserId and X-PortCDM-Password) failed.

/state_update/queues/{queueId}:
get:

tags:
  - state_update

summary: Retrieve new Port Call Messages from PortCDM

description: Returns all messages that have been submitted to PortCDM since the last time the queue was checked, or created if no previous checks have been made.

The messages includes only those that the actor has been granted access.

The call must be made with the same credentials as created the queue, otherwise an error is given.

operationId: getMessages

produces:
  - application/xml

parameters:
  - name: X-PortCDM-UserId
    description: The STM identifier for the caller
    in: header
    required: false
    type: string
    default: '
  - name: X-PortCDM-Password
    description: The password matching STM identifier (X-PortCDM-UserId)
    in: header
    required: false
    type: string
    default: '
  - name: X-PortCDM-ApKey
    description: A unique string identifying the application accessing PortCDM (contact the PortCDM demonstrator development team to acquire an API key)
    in: header
    required: false
    type: string
    default: '
  - name: queueId
    description: The string token acquired when the queue was created.
    in: path
    required: true
    type: string

responses:
  '200':
    description: Successful operation returns a (possibly) empty list containing new portcall messages since the queue was last checked.

    schema:
      type: array
      items:
        $ref: '#/definitions/PortCallMessage'
'401':
    description: Error code '401' is returned if authentication of the provided header parameters (X-PortCDM-UserId and X-PortCDM-Password) failed.

'403':
    description: Error code '403' is returned if service is called with credentials different to those that created the queue

'404':
    description: Error code '404' is returned if no queue with the specified queueId exists
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www.stmvalidation.eu

Co-financed by the European Union
Connecting Europe Facility
Procurement report

This report is a summary of the Swedish Maritime Administration’s (SMA) procurement of installations of Sea Traffic Management (STM) ship system prototypes for the STM Validation Project, with reference number 0307-15-03862.

1. Introduction

The scope of this procurement is to contract the supply of STM ship systems.

The system installations will be distributed among several different suppliers. All Tenderers, whose Tender fulfill the Shall-requirements and whose price does not exceed the maximum price, will be awarded contracts, according to the distribution key described in the tendering documents. The distribution key will give the Tenderer with the financially most advantageous tender the largest volume. The second best Tenderer will get the second largest volume and so on.

The reason why the delivery will be distributed among multiple Tenderers is that a spread of different technologies and proof of interoperability is needed to meet the goals of the project.

2. Procurement form

This procurement has been conducted in accordance with the Swedish Public Procurement Act (2007:1091) as a Negotiated Procedure with prior publication.

In addition, this procurement has been conducted in two-steps procedure, consisting of an application phase and tendering phase.

3. Procurement notice and publication

The procurement notice was made public through TendSign 25th of November 2015 and the latest date for submission of applications was 14th of January 2016.

4. Application submissions and examination of Applicants

The following companies submitted an application:

- Adveto Advanced Technology – 556267-7319
- Raytheon Anschuetz GmbH – 4086
- SAAB AB – 556036-0793
- Signalis GmbH – 25316
- Transas Marine Limited – 6380963
- Wärtsilä SAM Electronics GmbH – 89408
All applicants were successfully qualified to further themselves to the tendering phase. Before the tendering phase, Signalis Gmbh however informed SMA that they had decided not to submit a tender.

Subsequently, the invitation to tender was sent to the remaining above-mentioned applicants.

5. The Tendering Phase

The procurement notice was made public to the remaining qualified applicants through TendSign 13th of May 2016 and the last date of submission of tenders was 27th of June 2016.

6. Tender Submissions and examination of Tenderers

The following companies submitted a tender:

- Transas Marine Limited
- Adveto Advanced Technology
- Wärtsilä SAM Electronics GmbH

Two of the applicants, Raytheon Anschutz GmbH, and SAAB AB informed SMA during the tendering phase that they had decided not to submit a tender. However, the remaining tenderers proceeded to the next step for examination and evaluation for the offered tenders.

7. Examination and evaluation of tenders

Tenders were examined for fulfilment of mandatory shall requirements, both regarding requirements on the Supplier and on the scope of the deliveries.

Evaluation of tenders was performed according to the method “most economically advantageous”, i.e. both quality and price are considered, using the evaluation model described in the invitation to tender.

The evaluation would be performed according to a Value of Quality (VoQ) model (the value of fulfilled should-requirements), as per below:

8. Maximum price

The evaluation model was based on the maximum price for a ship system will be 6 000 Euro. Any tender with a higher price would be disqualified.

9. Tender sum

<table>
<thead>
<tr>
<th>Item</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation and configuration of STM ship system. All costs shall be included</td>
<td>per ship system exclusive VAT (Maximum price accepted is 6 000 Euro)</td>
</tr>
</tbody>
</table>
Hourly rate for development, adjustment to the System or other needs. Only applies to projects separately ordered by the Purchaser.  

<table>
<thead>
<tr>
<th>Currency (Euro or SEK)</th>
<th>per hour exclusive VAT</th>
</tr>
</thead>
</table>

Tender sum – (minus) deductions for VoQ = Comparative value

In the below chart the should-requirements for VoQ are listed.

Please note that if a tender fulfils a should-requirement and the tender was given an additional value in the evaluation, the Tenderer is bound to fulfil the should-requirement when delivering.

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity that was evaluated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deployment of the abilities for one ship according to the scope in section Fell Hittar inte referenskälla.. All costs shall be included</td>
<td>1 ship system</td>
</tr>
<tr>
<td>Hourly rate for development, adjustment to the System or other needs. Only applies to changes/amendments separately ordered by the Purchaser.</td>
<td>1 hour</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Criteria</th>
<th>VoQ if fulfilled (Euro)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-2.1:12</td>
<td>270</td>
</tr>
<tr>
<td>R-3.2:4</td>
<td>210</td>
</tr>
<tr>
<td>R-3.2:5</td>
<td>180</td>
</tr>
<tr>
<td>R-3.2:6</td>
<td>210</td>
</tr>
<tr>
<td>R-3.4:5, R-3.4:6 and R-3.6:2</td>
<td>240</td>
</tr>
<tr>
<td>R-3.4:16</td>
<td>240</td>
</tr>
<tr>
<td>R-3.5:2</td>
<td>180</td>
</tr>
<tr>
<td>R-3.5:5</td>
<td>240</td>
</tr>
<tr>
<td><strong>Maximum VoQ</strong></td>
<td><strong>1 770 Euro</strong></td>
</tr>
</tbody>
</table>

10. **Negotiations**

After the examination, SMA invited the tenderers to negotiations. The main objective of the negotiations was to ensure that both parties had the same view of the fulfilment of the requirements and to clarify any eventual outstanding issues.

- Transas Marine Limited was invited on the 22nd of August 2016
- Wärtsilä SAM Electronics GmbH was invited on the 23rd of August 2016
- Adveto Advanced Technology was invited on the 24th of August 2016

11. **Result of the evaluation**

---

1 All 3 requirements must be fulfilled to give VoQ
The result of the evaluation after the negotiations is as follows:

<table>
<thead>
<tr>
<th>Tenderer 1</th>
<th>Tenderer 2</th>
<th>Tenderer 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adveto</td>
<td>Transas</td>
<td>Wärtsilä</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Installation and configuration of STM ship system. (per ship system ex. VAT Max 6 000 Euro)</th>
<th>6 000 €</th>
<th>4 860 €</th>
<th>5 973 €</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hourly rate for development, adjustment to the system or other needs. Only applies to projects separately ordered by purchaser (per hour ex. VAT)</td>
<td>150 €</td>
<td>95 €</td>
<td>95 €</td>
</tr>
<tr>
<td><strong>Total price</strong></td>
<td>6 150 €</td>
<td>4 955 €</td>
<td>6 068 €</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>R-2.1:12</th>
<th>270 €</th>
<th>270 €</th>
<th>270 €</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-3.2:4</td>
<td>210 €</td>
<td>210 €</td>
<td>210 €</td>
</tr>
<tr>
<td>R-3.2:5</td>
<td>180 €</td>
<td>180 €</td>
<td>180 €</td>
</tr>
<tr>
<td>R-3.2:6</td>
<td>210 €</td>
<td>210 €</td>
<td>210 €</td>
</tr>
<tr>
<td>R-3.4:5, R-3.4:6, R-3.6:2</td>
<td>240 €</td>
<td>240 €</td>
<td>240 €</td>
</tr>
<tr>
<td>R-3.4:16</td>
<td>240 €</td>
<td>240 €</td>
<td>240 €</td>
</tr>
<tr>
<td>R-3.5:2</td>
<td>180 €</td>
<td>180 €</td>
<td>180 €</td>
</tr>
<tr>
<td>R-3.5:5</td>
<td>240 €</td>
<td>240 €</td>
<td>240 €</td>
</tr>
<tr>
<td><strong>Total given VoQ</strong></td>
<td>1 770 €</td>
<td>1 770 €</td>
<td>1 770 €</td>
</tr>
<tr>
<td><strong>Comparative value</strong></td>
<td>4 380 €</td>
<td>3 185 €</td>
<td>4 298 €</td>
</tr>
</tbody>
</table>

Please note that all Tenderers fulfilled all VOQ and therefore were given maximum VoQ.

12. **Ranking of Tenderers**

The evaluation gave the following ranking of the Tenderers

1. Transas Marine Limited
2. Wärtsilä SAM Electronics GmbH
3. Adveto Advanced Technology

13. **Contract Award**
Based on the examination of shall-requirements and the evaluation of above criterias, it is recommended that the contracts and final allocations among the tenderers on the numbers of system installations quantity are awarded to the following:

- Transas Marine Limited – 129 system installations
- Wärtsilä SAM Electronics GmbH - 63 system installations
- Adveto Advanced Technology - 33 system installations

Since the project budget is limited to 1 200 000 Euro in combination with the pricing from the tenderers the original objective of 300 systems could not be achieved. The above number of systems is what the present budget permits.

The final allocations are made according to the distribution key stated in the tender invitation. The distribution key should originally have given Adveto 40 system installations but their capacity was limited to 33 system installations. The excess number of systems is distributed to Transas and Wärtsilä according to the distribution key.

6th of September 2016

Per Kyhle
Letter of contract award regarding procurement of installations of Sea Traffic Management (STM) compliant ship system prototypes for the STM Validation Project

With this letter of contract award the SMA announces its intention to sign and allocate contracts with the following tenderers in ranking order:

1. Transas Marine Limited – 6380963
2. Wärtsilä SAM Electronics GmbH – 89408
3. Adveto Advanced Technology – 556267-7319

This decision has been reached based on qualification and evaluation of received tenders, as described in the SMA’s tendering documentation. The Tenderers fulfill all mandatory shall requirements and in the evaluation have been found to be the most economically advantageous.

Details of the evaluation may be found in the appended procurement report.

A contract with the Tenderers will be signed at the earliest after the standstill period, the length of which is given by the award notice (the Tendsign message). Please note that the contract award decision is not to be perceived as a legally binding contract.

The Swedish Maritime Administration (SMA) would like to thank you for your participation in the procurement,

For and on the behalf of The Swedish Maritime Administration (SMA),

6th of September 2016

Per Kyhle

Appendix 1:

Procurement report
Letter of interpretation regarding the Main Contract for the STM Validation project.

Objectives

This document aims at clarifying the scope of some clauses included in the Main Contract for Installations of Sea Traffic Management (STM) Ship System prototypes for the STM Validation Project earlier signed by both the Supplier and SMA.

Background

SMA has recognized that the clauses in the Main contract regarding 6.5 Delay and 12 Liability are not fully clear and leaves room for interpretation and could be regarded as potential risks for the Supplier.

Clarifications

To lower the risk for the Supplier the following clarifications are stated by SMA.

SMA hereby states in addition to the original clause in 6.5 Delay that the payment postponement shall be SMA’s only remedy for delay.

SMA hereby also states in addition to the original clause in 12 Liability that the Supplier’s maximum liability under the Main Contract shall be limited to the Contract Price.

Norrköping 2016-09-

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Ulf Holmgren
Three leading ECDIS-suppliers, Transas, Wärtsilä SAM Electronics and Adveto, will provide the first Sea Traffic Management-compatible on-board systems.

Test Manager Björn Andreasson of The Swedish Maritime Administration is content: “We are pleased to assign contracts to these market leaders and fore-running vendors, who together with the project can take a lead in the future development.” The decision was released on Thursday at the SMM in Hamburg.

“In Transas we strive to create and enable the connection of the dots in ship operations. Sea Traffic Management is in line with our vision as we want to show the industry how they can use technology to become more efficient” comments Frank Coles, CEO Transas.

“Wärtsilä is giving customers a competitive advantage by converting new technology into reliable solutions. Sea Traffic Management will change how maritime actors share information and Wärtsilä is an innovative power that supports the development of the industry.” says Maik Stoevhase, Director, Automation, Navigation and Communication, Wärtsilä Marine Solutions.

The detailed specification of the requirements and interfaces is a major step towards making the vision of the open standard connected ship real. The Sea Traffic Management test introduces an infrastructure supporting maritime actors in providing and consuming services as well as information machine-to-machine, with more automated procedures than can be achieved today. The development of Sea Traffic Management is open, and all interested parties are invited to join as associate partners and take part in the development of the future.

Supplied services during the test include route optimisation, monitoring, port call synchronisation, ship to ship route exchange and many more. Fuel can be saved, port call efficiency increased and accident risk reduced.

Which will be the first 225 ships in the world to test and validate Sea Traffic Management with updated systems free-of-charge? Maybe yours? Participation is simple. Your ECDIS-supplier does the installation, and we use existing on-board systems. Only minor software updates and – perhaps – marginal system modifications are needed.

For more information, please contact:
Ulf Siwe, STM Validation Communications Officer, Swedish Maritime Administration, +46 10 478 56 29
Björn Andreasson, Test Manager, Swedish Maritime Administration +46 10 478 46 30

*The Swedish Maritime Administration (SMA) offers modern and safe shipping routes with 24 hour service. We take responsibility for the future of shipping.*
38 partners from 13 countries -
Creating a safer more efficient and environmentally friendly maritime sector

Demonstrating the function and business value of the Sea Traffic Management concept and its services.

SAFETY - ENVIRONMENT - EFFICIENCY

Swedish Maritime Administration ◦ SSPA ◦ RISE Viktoria ◦ Transas/ Wärtsilä Voyage ◦ Chalmers University of Technology ◦ The Swedish Meteorological and Hydrological Institute ◦ Danish Maritime Authority ◦ Navicon ◦ Novia University of Applied Sciences ◦ Fraunhofer ◦ Carnival Corp. ◦ Italian Ministry of Transport ◦ SASEMAR ◦ Valencia Port Authority ◦ Valencia Port Foundation ◦ CIMNE ◦ University of Catalonia ◦ Norwegian Coastal Administration ◦ GS1 ◦ Cyprus University of Technology ◦ Port of Barcelona ◦ Costa Crociere ◦ Switzer ◦ OFFIS ◦ Finnish Transport Agency ◦ Southampton Solent University ◦ Frequentis ◦ Wärtsilä SAM Electronics ◦ University of Flensburg ◦ Airbus ◦ Maritiem Instituut Willem Barentsz ◦ SAAB TransponderTech AB ◦ University of Oldenburg ◦ Magellan ◦ Furuno Finland ◦ Rörvik ◦ University of Southampton ◦ HiQ

www.stmvalidation.eu

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