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Service Specification for [Digital] VTS Traffic Clearance Service

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**Kuvaotsikkoluettelon hakusanoja ei löytynyt.**

# Introduction

This document was produced as part of the work of IALA joint VTS-ENAV task group on development of technical service specifications for VTS. The document is structured according to the IALA Guideline G1128: THE SPECIFICATION OF e-NAVIGATION TECHNICAL SERVICES. The design of the service interfaces was adapted from the standard for Secure communication between ship and shore IEC 63173-2:2022.

## Purpose of the Document

The purpose of this service specification document is to provide a holistic overview of digital VTS Traffic Clearance 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 VTS Traffic Clearance 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

## 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 VTS Traffic Clearance Service.

Furthermore, this service specification is intended to be read by enterprise architects, service architects, information architects, system engineers and developers in pursuing architecting, designing and development activities of other related services.

## Inputs from Other Sources

*This section provides an overview of activities, which are dealing with similar topics and lists already finished ones that provided inputs to this activity.*

To be added short references to IEC 63173-2:2022 -SECOM, S-211 as well as S-421 and S-210

# 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.

|  |  |
| --- | --- |
| Name | VTS Traffic Clearance Service |
| ID | urn:mrn:iala:techsvc:vts:tcs  [not official designation, for example only] |
| Version | 0.2 |
| Description | The VTS Traffic Clearance Service specification describes a standardized service implementing the Vessel Traffic Service traffic clearances communication between ship and shore |
| Keywords | VTS, MS1, Traffic Clearance, Ship Traffic Management, S-211, S-421 |
| Architect(s) |  |
| Status | Provisional |

# Operational Context

According to IMO resolution A.1158(32) Guidelines for Vessel Traffic Services one of the purposes of a VTS is to monitor and manage ship traffic to ensure the safety and efficiency of ship movements.

IALA Guideline G1089 Provision of a VTS states that the monitoring and management may include among other things forward planning and prioritization of ship movements to prevent congestion or dangerous situations and improve overall efficiency, establishing a system of traffic clearances and organizing space allocation.

The initial Maritime Service description for MS1 Vessel Traffic Services describes user needs for digital information services for the exchange of VTS information by electronic means between a VTS and ships. Vessels using MS1 can receive information related to the management of ship traffic in a digital format that can be displayed in the navigational equipment on board. Digital information exchange may apply to elements of ship traffic management that is not time critical.

## Present Day Operational Context

One of the main tasks for VTS is to monitor and manage ship traffic, including establishing a system for traffic clearances. Traffic clearances may be required in situations when a vessel is:

* entering or prior to entering a VTS area.
* departing from a berth or an anchorage within a VTS area.
* entering or prior to a fairway within a VTS area.
* prior to commencing a manoeuvre that may be detrimental to safe navigation.

Today VTS communication and interaction with ships and Allied services is currently almost exclusively undertaken by traditional VHF voice communications. System interfaces for digital exchange of information related to ship traffic management are not standardized.

## Envisioned Operational Context

This digital VTS traffic clearance service is a simplified service that is limited to exchange of a vessel’s estimated time of arrival (ETA) or its estimated time of departure (ETD) and acknowledgements or responses to these.

The service is based on standardized structured data format, that will enable the exchange of information related to traffic clearances in the VTS area. The service is based on S-211 standard for Port Call Messages. The service can be used by the exchange of timestamps providing ETA/ETD information.

The following general use cases provide examples for the digital information exchange between VTS and vessels using traffic clearance service:

Use Case 1 - Departing vessels, using timestamp-based service

1. Vessel wants to leave berth
2. The mariner sends ETD through vessel system to the service and requests permission to leave berth.
3. VTS sends response which may include conditions on when vessel can leave the berth
4. Service delivers response to ECDIS/ECS or other ship system
5. The mariner acknowledges revised ETD in ECDIS/ECS/ship system and send response to the VTS.

Use Case 2 - Arriving vessels, using timestamp-based service

1. The vessel enters VTS area
2. The ECDIS/ECS requests permission to proceed to the predefined area from the service
3. Vessel's planned ETA is suitable. VTS sends new recommended ETA to ECDIS/ECS of the vessel through the service
4. The mariner acknowledges to reach the ETA in ECDIS/ECS/ship system and sends response to the service.
5. New ETA is confirmed by the VTS

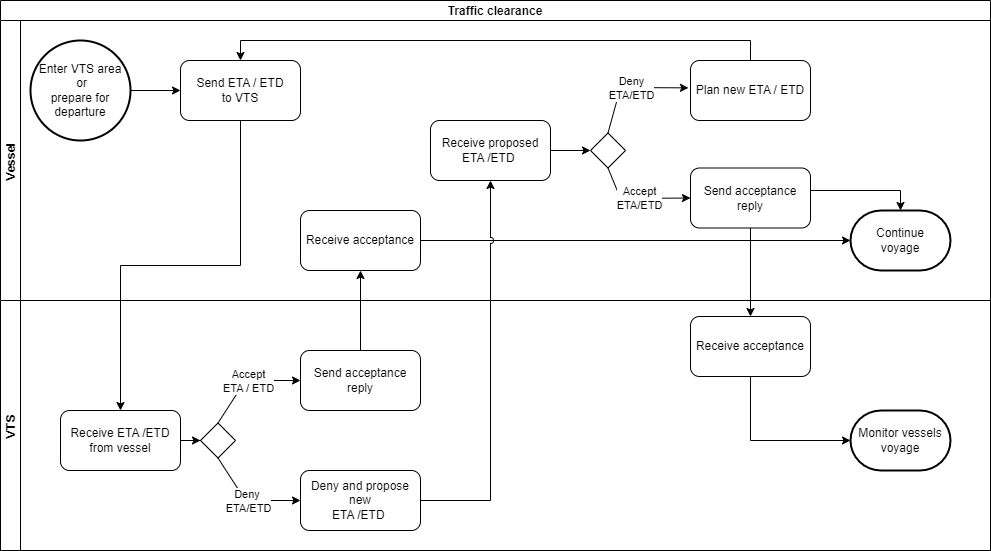


Figure 1: Traffic clearance dataflow

## Functional and Non-functional Requirements

*This section lists all (functional and non-functional) requirements applicable to the service being described. A tabular list of requirements shall be added here. If external requirements documents are available, then the tables shall refer to these requirements, otherwise the requirements shall be documented here.*

*The service must be linked to at least one requirement. At least one of the following tables shall be presented in this section. The first table lists references to requirements available from external documents. Make sure you document the sources from where the requirements are coming from. The second table lists new requirements defined for the first time in this service specification document.*

The table below lists applicable existing requirements for the Traffic Clearance service.

Table X: Requirements Tracing

|  |  |  |  |
| --- | --- | --- | --- |
| Requirement Id | Requirement Name | Requirement Text | References |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

Functional requirements

|  |  |
| --- | --- |
| Requirement Id | TCSF001 |
| **Requirement Name** | Receive ETA from vessel |
| **Requirement Text** | A vessel must be able to send its estimated time of arrival (ETA) to the service. The service must have the ability to forward the received ETA to the VTS System. |
| **Rationale** | Sending the ETA of the vessel to the service is a core requirement of the service. In most cases the ETA sent will be the ETA to port, but it could be any ETA that is needed to communicate between the vessel and VTS. |
| **Author** |  |

|  |  |
| --- | --- |
| Requirement Id | TCSF002 |
| **Requirement Name** | Receive ETD from vessel |
| **Requirement Text** | A vessel must be able to send its estimated time of departure (ETD) to the service. The service must have the ability to forward the received ETD to the VTS System. |
| **Rationale** | Sending the ETD of the vessel to the service is a core requirement of the service. In most cases the ETD sent will be the ETD from port, but it could be any ETD that is needed to communicate between the vessel and VTS. |
| **Author** |  |

|  |  |
| --- | --- |
| Requirement Id | TCSF003 |
| **Requirement Name** | Send ETA proposal to vessel from VTS |
| **Requirement Text** | The service must facilitate the sending of an ETA proposal from VTSs to the vessel. The proposal may be a part of a rejection of an ETA request from a vessel or standalone. If the proposal is a part of a rejection, the rejection message must be identified. |
| **Rationale** | When VTS personnel are either reviewing a sent ETD from a vessel or trying to organize traffic and need to suggest an ETD to a vessel the service must be able to send an ETD proposal to the vessel. |
| **Author** |  |

|  |  |
| --- | --- |
| Requirement Id | TCSF004 |
| **Requirement Name** | Send ETD proposal to vessel from VTS |
| **Requirement Text** | The service must facilitate the sending of an ETD proposal from VTSs to the vessel. The proposal may be a part of a rejection of an ETD request from a vessel or standalone. If the proposal is a part of a rejection, the rejection message must be identified. |
| **Rationale** | When VTS personnel are either reviewing a sent ETD from a vessel or trying to organize traffic and need to suggest an ETD to a vessel the service must be able to send an ETD proposal to the vessel. |
| **Author** |  |

|  |  |
| --- | --- |
| Requirement Id | TCSF005 |
| **Requirement Name** | Approve ETA/ETD from vessel |
| **Requirement Text** | The service must facilitate the sending of the acceptance of the ETA/ETD from the vessel without the need to negotiate the time. The approval may also include a new or changed location to which the ETA/ETD is defined. |
| **Rationale** |  |
| **Author** |  |

|  |  |
| --- | --- |
| Requirement Id | TCSF006 |
| **Requirement Name** | Send ETA / ETD proposal from VTS to vessel |
| **Requirement Text** | It will be possible for VTSO to send new proposed estimated time of arrival (ETA) and/or estimated time of departure (ETD) to the vessel |
| **Rationale** | Even before the vessel communicates its ETA or ETD, there must be the ability to communicate a proposal from VTS to a vessel. |
| **Author** |  |

|  |  |
| --- | --- |
| Requirement Id | TCSF007 |
| **Requirement Name** | Send acknowledgement from vessel to VTS |
| **Requirement Text** | After receiving a suggested ETA/ETD from VTS to the vessel the mariner must be able to either accept the proposal and thus send an immediate acknowledgement to VTS or propose a new ETA/ETD to VTS. |
| **Rationale** | The negotiation process for a new proposed ETA/ETD may include several phases of proposed times and new counterproposals. However a final acknowledgement must also be a part of the process so that VTS knows when vessel has approved the suggested ETA/ETD. |
| **Author** |  |

|  |  |
| --- | --- |
| Requirement Id | TCSF008 |
| **Requirement Name** | Service integration with VTS System (vessel traffic management information system) |
| **Requirement Text** | The service must integrate with the VTS System so that the information received from vessels can be utilized by the VTS System. |
| **Rationale** | The exact details of how this requirement are fulfilled are left to each implementor as they depend on the functionalities of the VTS System itself. In some cases, it may be better for the VTS System to poll the service, in other cases an event may be triggered, or a simple API call on the VTS System may be used. From the perspective of this specification the implementation details of how the service integrates with the VTS System can be left open. |
| **Author** |  |

|  |  |
| --- | --- |
| Requirement Id | TCSF009 |
| **Requirement Name** | Service must support event based communication |
| **Requirement Text** | For best possible compatibility with planned platforms service must be compatible with event driven. |
| **Rationale** | The event driven approach mimics the approach of MMS. MMS with its agents and edge routers abstracts much of the complexity of the challenges faced with ship to shore communication. An event driven approach is also architecturally different from a push/pull API-based approach. By supporting both approaches the services are as future proof as can be at the current stage. |
| **Author** |  |

|  |  |
| --- | --- |
| Requirement Id | TCSF010 |
| **Requirement Name** | Service must support API based communication |
| **Requirement Text** | Service should offer APIs for direct communication for SECOM style push/pull communication. |
| **Rationale** | Direct API communication enables many ways of interaction with the service. The interfaces defined for the API communication do not require SECOM-style implementations, but the design of the APIs is based on the requirements of SECOM. |
| **Author** |  |

|  |  |
| --- | --- |
| Requirement Id | TCSF011 |
| **Requirement Name** | Messages should be signed |
| **Requirement Text** | The service provider and consumer should sign all messages to better enable verification of the communicating parties. |
| **Rationale** | While both approaches typically allow both signed and unsigned communication, preferring signed communication enables easier verification and makes it harder to spoof sources of communication. |
| **Author** |  |

Non-functional requirements

|  |  |
| --- | --- |
| Requirement Id | TCSNF001 |
| **Requirement Name** | Authenticity |
| **Requirement Text** | The recipient of information must be able to verify the authenticity of the received datasets. The IDSec tools and identity registry specified in MCP must be used to facilitate this. |
| **Rationale** |  |
| **Author** |  |

|  |  |
| --- | --- |
| Requirement Id | TCSNF002 |
| **Requirement Name** | Integrity |
| **Requirement Text** | It must be clear to both service provider and consumer whether changes have been made to the information after the dataset was created. All messages must be signed with the correct certificates so that the contents of a message can be validated. |
| **Rationale** |  |
| **Author** |  |

|  |  |
| --- | --- |
| Requirement Id | TCSNF003 |
| **Requirement Name** | Availability |
| **Requirement Text** | The service must always be available with the ability defined by Owner of the service the to deliver traffic clearance information to its consumers. |
| **Rationale** | The service must be available based on the VTS Service hours and service levels. |
| **Author** |  |

|  |  |
| --- | --- |
| Requirement Id | TCSNF004 |
| **Requirement Name** | Performance – timeliness |
| **Requirement Text** | The service must provide a response to an incoming request instantly. This response is by necessity a technical delivery acknowledgement and not a business process response. This applies both to requests coming from vessels and VTS System. |
| **Rationale** | Especially from a vessel’s point of view it is important to get an acknowledgement that the service has received a request so that the vessel’s system does not need to try resending the request. |
| **Author** |  |

|  |  |
| --- | --- |
| Requirement Id | TCSNF005 |
| **Requirement Name** | Reliability |
| **Requirement Text** | The service must provide a retry mechanism to ensure that messages are delivered to the vessel or VTS System even if the first request fails. |
| **Rationale** | As the service is effectively a proxy between the VTS System and vessel’s systems it is vital that message delivery to the real consumer is ensured by retrying sending the message.  This is of increased importance when the vessel is behind an unreliable network connection or the actual data carrier changes during messaging. |
| **Author** |  |

## Other Constraints

### Relevant Industrial Standards

*To be added a table of applicable industrial standards*

### Operational Nodes

The following tables describe the operational nodes of the service.

Table x: Operational Nodes providing the Traffic Clearance service

|  |  |
| --- | --- |
| Operational Node | Remarks |
| **Vessel** | Vessels sailing in a service coverage area. |
| **VTS centres** | VTS centres responsible for a service coverage area. |

### Operational Activities

*Optional. If an operational model exists and provides sufficient details about operational activities, then this section shall include a mapping of the service to the relevant operational activities.*

Table x: Operational Activities supported by the *XYZ* service

|  |  |
| --- | --- |
| Operational Activity | Remarks |
|  |  |

# Service Overview

## Service Interfaces

Communication between ship and service is done either via APIs or an event-based approach. Both approaches must be supported in complying implementations.

And event-based service is based on an event (or message) driven architecture. All calls are assumed to be asynchronous with only a response receipt given from shore to ship or ship to shore.

In the API based approach the service provider is the ship itself because communication is primarily initiated by the ship and the ship is the primary source of the pushed messages. The consumer in this case is the VTS system.

### Event-based approach

*TODO Define interfaces needed in service to facilitate messaging service usage in communication.*

### API based approach

In an API based approach with a SECOM-style communication pattern the ship must act as the service provider that pushes information to VTS. In this case much of the subscription pattern is unnecessary. The fact that the ship is the source of the push communication in most cases is key for the role reversal to typical scenarios.

The challenge in this approach is that the service registry must now hold the ship as service provider, but the VTS system being the consumer is not found. For that reason the SECOM pattern is extended in this case to require the capability-interface on the consumer side as well.

A traffic clearance service that follows this specification must also register itself to a service registry to provide ships with the information that it can consume traffic clearance messages.

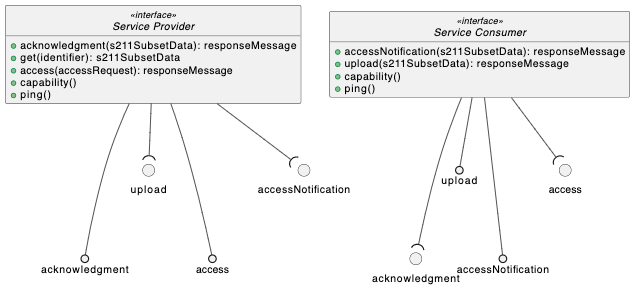


Figure 2 API based interfaces

|  |  |  |
| --- | --- | --- |
| ServiceInterface | ExchangePattern | Definition |
| upload | REQUEST\_CALLBACK | Interface for uploading (pushing) ETA/ETD to VTS system.  Must be implemented. |
| acknowledgement | ONE\_WAY or REQUEST\_CALLBACK | Interface for acknowledgement and response from VTS system to ship of proposed ETA/ETD.  Must be implemented. |
| get | REQUEST\_RESPONSE | Interface for VTS system to request information on a specific ETA/ETD and if it has been updated. |
| access | REQUEST\_CALLBACK | Interface for VTS system to request the ship to send a proposed ETA/ETD. |
| accessNotification | ONE\_WAY | Interface for ship to send proposed ETA/ETD to VTS system after it has been requested. |
| capability | REQUEST\_RESPONSE | Interface to ask for the interface capabilities.  Must be implemented. |
| ping | REQUEST\_RESPONSE | Interface check status of the service.  Must be implemented. |

# Service Data Model

The service must consume a data model that is a direct subset of S-211.

For complete and updated documentation of the S-211 data model refer to the latest S-211 Product Specification which can be found at IALA S-200 Data modelling web site <https://www.iala-aism.org/technical/data-modelling/iala-s-200-development-status/s-211/>

The data transfer between service and consumers MUST always conform to the model displayed below. Fields that are optional are identified with MAY and SHOULD in the descriptions below.

This data model does not define the envelops in which the data is sent between the ship and VTS system or all of the interface parameters. This only defines the subset of S211 data that must be present in the s211SubsetData objects defined in the interfaces.

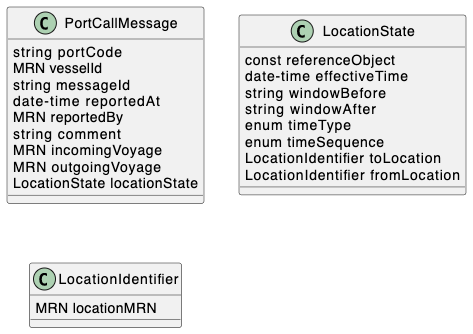


Figure ### Data model diagram

The description of the data model is as follows:

* portCode – UN/LOCODE as per standard
* vesselId – vessel MRN, IMO SHOULD be preferred, but MMSI MAY also be used.
* messageId – MRN + UUID to uniquely identify the message across systems.
* reportedAt – SHOULD be used as timestamp of message creation.
* reportedBy – SHOULD be used to identify the MRN or other identity of the person sending the message, for audit trails etc
* comment – MAY be used to pass additional information as part of the message for human consumption.
* incomingVoyage / outgoingVoyage – SHOULD be used to identify route the is shared or to ensure that all communication on a single arrival / departure is easily connected to a specific journey.
* locationState
  + referenceObject – MUST be Vessel.
  + effectiveTime – timestamp of the ETA/ETD being communicated.
  + windowBefore / windowAfter – MAY be used to give relative offset of the window requested / given. In hh:mm format.
  + timeType – MUST be one of Estimated, Planned, Recommended or Required
  + timeSequence ­– MUST be one of “Arrival To” or “Departure From”
  + toLocation / fromLocation
    - locationMRN – MRN specifying the point of arrival or departure. This may be changed by VTS / port operator to indicate e.g., a change of berth or assignment of berth.

# 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 (behaviour) is described in chapter 7.

The interfaces of both approaches are described here at an equal level.

## Upload interface

The purpose of this interface is to upload (push) the proposed ETA/ETD information from the ship to the VTS system.

### Operation

This operation is typically the starting point of the communication regarding an ETA/ETD between the ship and VTS. It is used to upload the initial ETA/ETD and subsequent responses to the changes required by VTS.

After an upload the VTS system (consumer) must provide an acknowledgment response in a separate call.

The upload must contain any necessary envelop data and the ETA/ETD data that conforms to the subset of S-211 defined above.

### Operation Functionality

The operation shall be used for uploading (push) ETA/ETD information to the VTS system.

### Operation Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameters (in)** | **Encoding** | **Mult.** | **Description** |
| s211SubsetData | See technical design | 1 | ETA/ETD data in subset of S-211 |

|  |  |  |  |
| --- | --- | --- | --- |
| **ReturnType (out)** | **Encoding** | **Mult.** | **Description** |
| responseMessage | See technical design | 1 | Technical response. Does not inculde a response from VTS on the actual content of the message. |

### Dependency

ConsumerInterface

* Must consume the acknowledgement service interface.

ExchangePattern

* REQUEST\_CALLBACK

## Acknowledgement interface

Interface provided for ship to receive responses from VTS on proposed ETA/ETD.

### Operation

After the ship initiates ETA/ETD communication through the upload interface, VTS will respond in due course with their reply on the proposed ETA/ETD. Due to the need for human decision making and responses, the upload / acknowledgement sequence must be asynchronous.

The upload must contain any necessary envelop data and the ETA/ETD data that conforms to the subset of S-211 defined above.

### Operation Functionality

The operation shall be used for replying with the VTS response to the proposed ETA/ETD from the ship.

### Operation Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameters (in)** | **Encoding** | **Mult.** | **Description** |
| s211SubsetData | See technical design | 1 | The VTS response to the proposed ETA/ETD in subset of S-211 |

|  |  |  |  |
| --- | --- | --- | --- |
| **ReturnType (out)** | **Encoding** | **Mult.** | **Description** |
| responseMessage | see technical design | 1 | Technical response. Does not inculde a response from VTS on the actual content of the message. |

### Dependency

ConsumerInterface

* No dependency.

ExchangePattern

* ONE\_WAY or REQUEST\_CALLBACK depending on business case.

TODO further interfaces still need to be written out.

# Service Dynamic Behaviour

This section describes the interactive behaviour between service interfaces and service consumers.

Before the exchange of information is initiated, the service consumer retrieves the identity of the service provider from the service infrastructure and performs authentication procedure. If not authenticated, the service request is rejected. The specific authentication procedure is out of scope of the service specification and is described in the technical designs of this service.

## UPLOAD Interface

Usage of upload interface is shown for use cases (perspectives) below;

* Upload message initiated from service provider to service consumer

The service producer may request acknowledgement, which is sent by the service consumer when the uploaded message was delivered successfully. The acknowledgement contains reference to the identity of the message given in the upload request.

The service provider also indicates whether the uploaded message is within a subscription, or if it is a one-time upload of data, hence no updates can be expected if not within a subscription.

Figure 5: Upload message initiated by service provider with acknowledgement.

## ACKNOWLEDGEMENT interface

Usage of ACKNOWLEDGEMENT interface is shown for use cases (perspectives) below;

* Acknowledging the retrieval of a message sent by the service provider

The Acknowledgement interface is used for confirming the retrieval of uploaded data using the UPLOAD interface.

## CAPABILITY interface

Usage of CAPABILITY interface is shown for use cases (perspectives) below;

* The service consumer retrieves all capabilities of the services provider related to VTS Traffic Clearance S-211 information exchange.

## DESCRIPTION interface

Usage of DESCRIPTION interface is shown for use cases (perspectives) below;

* The service consumer retrieves the operational/user description of the specific service instance. This involves information about the services ability to exchange Traffic Clearance information objects and semantic conditions.

# References

| Nr. | Version | Reference |
| --- | --- | --- |
| 1. Service Documentation Guidelines | 01.00 | SG\_Annex\_A\_Service\_Documentation\_Guidelines |
| 1. Document ID | xx.yy | Deliverable abc |
| 1. Maritime Resource Names | ED 1.0 | IALA R1023 MARITIME RESOURCE NAMES |
| 1. S-100 Universal Hydrographic Data Model | 2.0.0 | S-100 –  UNIVERSAL HYDROGRAPHIC DATA MODEL  <http://www.iho.int/iho_pubs/standard/S-100/S-100_Ed_2/S_100_V2.0.0_June-2015.pdf> |
| 1. IEC 63173-2 ED1 | 1.0 | Maritime navigation and radiocommunication equipment and systems –  Data interfaces –  Part 2: Secure communication between ship and shore (SECOM) |
| 1. IALA Guideline G1128 |  | THE SPECIFICATION OF e-NAVIGATION TECHNICAL SERVICES |
| 1. S-211 Port Call Message | 1.0 | IALA Port Call Message Product Specification |
| 1. MMS |  |  |
|  |  |  |
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|  |  |  |
|  |  |  |
|  |  |  |

# Acronyms and Terminology

## Acronyms

|  |  |
| --- | --- |
| Term | Definition |
| API | Application Programming Interface |
| MC | Maritime Cloud |
| MEP | Message Exchange Pattern |
| MRN | Maritime Resource Name |
| NAF | NATO Architectural Framework |
| REST | Representational State Transfer |
| SOA | Service Oriented Architecture |
| SOAP | Simple Object Access Protocol |
| SSD | Service Specification Document |
| UML | Unified Modelling Language |
| URL | Uniform Resource Locator |
| VTS | Vessel Traffic Service |
| WSDL | Web Service Definition Language |
| XML | Extendible Mark-up Language |
| XSD | XML Schema Definition |

## Terminology

|  |  |
| --- | --- |
| Term | Definition |
| External Data Model | 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. |
| Message Exchange Pattern | Describes the principles how two different parts of a message passing system (in our case: the service provider and the service consumer) interact and communicate with each other. Examples:  In the Request/Response MEP, the service consumer sends a request to the service provider in order to obtain certain information; the service provider provides the requested information in a dedicated response.  In the Publish/Subscribe MEP, the service consumer establishes a subscription with the service provider in order to obtain certain information; the service provider publishes information (either in regular intervals or upon change) to all subscribed service consumers. |
| Operational Activity | 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, … |
| Operational Model | A structure of operational nodes and associated operational activities and their inter-relations in a process model. |
| Operational Node | 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, … |
| Service | The provision of something (a non-physical object), by one, for the use of one or more others, regulated by formal definitions and mutual agreements. 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. |
| 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. 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 Design Description | Documents the details of a service technical design (most likely documented by the service implementer). The service design description includes (but is not limited to) a service physical data model and describes the used technology, transport mechanism, quality of service, etc. |
| Service Implementation | The provider side implementation of a dedicated service technical design (i.e., implementation of a dedicated service in a dedicated technology). |
| Service Implementer | Implementers of services from the service provider side and/or the service consumer side. Anybody can be a service implementer but mainly this will be commercial companies implementing solutions for shore and ship. |
| Service Instance | One service implementation may be deployed at several places by same or different service providers; each such deployment represents a different service instance, being accessible via different URLs. |
| Service Instance Description | Documents the details of a service implementation (most likely documented by the service implementer) and deployment (most likely documented by the service provider). The service instance description includes (but is not limited to) service technical design reference, service provider reference, service access information, service coverage information, etc. |
| Service Interface | The communication mechanism of the service, i.e., interaction mechanism between service provider and service consumer. A service interface is characterised by a message exchange pattern and consists of service operations that are either allocated to the provider or the consumer of the service. |
| Service Operation | Functions or procedure which enables programmatic communication with a service via a service interface. |
| Service Physical Data Model | Describes the realisation of a dedicated service data model in a dedicated technology. This includes a detailed description of the data S-211 to be exchanged using the chosen technology. The actual format of the service physical data 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 physical data model shall refer to it: each data item of the service physical data 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 physical data model and the service data model. This means, each data item used in the service physical data 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 physical data model, such a mapping is implicitly given.) |
| 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 S-211. The data S-211 description may be formally defined by a Service Data Model. |
| Service Specification Producer | Producers of service specifications in accordance with the service documentation guidelines. |
| Service Technical Design | The technical design of a dedicated service in a dedicated technology. One service specification may result in several technical service designs, realising the service with different or same technologies. |
| Service Technology Catalogue | 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. |
| Spatial Exclusiveness | A service specification is characterised as “spatially exclusive”, if in any geographical region just one service instance of that specification is allowed to be registered per technology.  The decision, which service instance (out of a number of available spatially exclusive services) shall be registered for a certain geographical region, is a governance issue. |

1. Service Specification XML

This appendix contains the formal definition of the service specification.

To be done.

1. Service JSON schema

As previously noted, this schema is directly mappable to S-211. The root element of PortCallMessage in S-211 has been left out as an unnecessary level of objects in this use case. MRN validation has also been relaxed from S-211 v1.1.0 requirement to allow generic MRNs better allowing reuse of any valid MRN.

{

"$schema": " https://json-schema.org/draft/2020-12/schema",

"$id": "https://docs.maritimeconnectivity.net/schema/1.0.0/vts-tcs/schema.json",

"title": "VTS-TCS",

"description": "Schema for JSON communication between vessel and VTS for communicating traffic clearance. Based on S-211",

"type": "object",

"properties": {

"portCode": {

"description": "portCode is the 5 letter UN/LOCODE of the port this message is pertaining to ",

"type": "string",

"minLength": 5,

"maxLength": 5

},

"vesselId": {

"description": "MRN of vessel",

"$ref": "#/$defs/MRN"

},

"messageId": {

"description": "MRN + UUIDv4 to uniquely identify the message",

"type": "string",

"pattern": "[uU][rR][nN]:[mM][rR][nN]:[iI][pP][cC][dD][mM][cC]:[mM][eE][sS][sS][aA][gG][eE]:[0-9a-fA-F]{8}-[0-9a-fA-F]{4}-4[0-9a-fA-F]{3}-[8-9a-bA-B][0-9a-fA-F]{3}-[0-9a-fA-F]{12}",

"minLength": 59,

"maxLength": 59

},

"reportedAt": {

"description": "Time when a time stamp was reported",

"type": "string",

"format": "date-time"

},

"reportedBy": {

"description": "Entity that reported a time stamp",

"$ref": "#/$defs/MRN"

},

"comment": {

"description": "A freeform comment or message to recipient",

"type": "string"

},

"incomingVoyage": {

"description": "",

"$ref": "#/$defs/MRN"

},

"outgoingVoyage": {

"description": "",

"$ref": "#/$defs/MRN"

},

"locationState": {

"type": "object",

"properties": {

"referenceObject": {

"description": "S-211 defines an enumeration, for TCS use only Vessel is allowed.",

"const": "Vessel"

},

"effectiveTime": {

"description": "The time that is being used as ETA/ETD time",

"type": "string",

"format": "date-time"

},

"windowBefore": {

"description": "Time offset, relative a given time. In hours and minutes (HH:MM)",

"type": "string",

"pattern": "[0-9][0-9]:[0-6][0-9]"

},

"windowAfter": {

"description": "Time offset, relative a given time. In hours and minutes (HH:MM)",

"type": "string",

"pattern": "[0-9][0-9]:[0-6][0-9]"

},

"timeType": {

"description": "The time dimension of a time stamp combined with the state expressing intentions, recommendations or outcomes. TODO this should be defined in a higher level schema. This is a subset of the values allowed by S-211",

"enum": [ "Estimated", "Planned", "Recommended", "Required" ]

},

"timeSequence": {

"description": "The component of a state (as location, service, administrative state) regulating the communicative intent of the state (such as arrived, departed, commenced, completed, requested, request received, confirmed, denied, cancelled). This is a subset of the values allowed by S-211",

"enum": [ "Arrival To", "Departure From" ]

},

"if": {

"properties": { "timeSequence": { "const": "Arrival To" } }

},

"then": {

"properties": {

"toLocation": {

"description": "The arrival location",

"type": "object",

"properties": {

"locationMRN": { "$ref": "#/$defs/MRN" }

},

"required": [ "locationMRN" ]

}

},

"required": [ "toLocation" ]

},

"else": {

"properties": {

"fromLocation": {

"description": "The departure location",

"type": "object",

"properties": {

"locationMRN": { "$ref": "#/$defs/MRN" }

},

"required": [ "locationMRN" ]

}

},

"required": [ "fromLocation"]

}

},

"required": [ "referenceObject", "effectiveTime", "timeType", "timeSequence" ]

}

},

"required": [ "portCode", "vesselId", "messageId", "reportedAt", "locationState" ],

"$defs": {

"MRN": {

"type": "string",

"description": "Marine Resource Name identifier, based on URN. Note that the NID, including the mrn: prefix can be no more than 31 characters long. TODO - this should be defined in a higher level schema.",

"pattern": "[uU][rR][nN]:[mM][rR][nN]:[A-Za-z0-9][A-Za-z0-9-]{0,27}:[A-Za-z0-9()+,-.:=@;$\_!\*'%/?#]+"

}

}

}