**ialA** **Technical service**

SSXXXX

Service Specification for VTS Information Service



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# introduction

This document was produced as part of the work of IALA VTS 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 [1].

## Purpose

The purpose of this Service Specification is to provide an overview of the information that VTS may provide or request from vessels via VTS Information in a technology-independent way, according to the guidelines given in G1128. 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 Information Service at the logical level, including:

* 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; and
* relation of the service to other services.
* the service description:
* service use cases;
* service operational sequence;
* logical operations;
* logical data model; and
* dynamic behaviour.

## 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 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, designing and development activities of other related services.

## Input from other sources

N/A

# Service Identification

This section provides a unique identification of the Service and describes where the Service is in the engineering lifecycle.

|  |  |
| --- | --- |
| **Name** | VTS Information Service |
| **ID[[1]](#footnote-2)** | urn:mrn:iala:techsvc:ssXXXX:0.1 |
| **Version** | 0.1 |
| **Description** | The VTS Information Service specification describes a standardized service implementing the communication between ship and VTS used to deliver information from VTS to vessels and to request information from vessels in a standardized format. |
| **Keywords** | VTS, MS1, Information Service, Ship Traffic Management, S-212 |
| **Architect(s)** | Ramin Miraftabi |
| **Status** | Draft |

# Operational context

1. The aim of a VTS Information Service is to contribute to the safe and efficient navigation of vessels by delivering relevant information from VTS perspective. The service can be implemented to deliver all the information, or it can fulfil and/or enrich the data from other S-100 services. VTS Information Service contains structured messages. The content of the message field is structured or unstructured. All messages must start with message markers information, request, question or answer. The message can be sent to one or multiple vessels.
2. VTS providers should define which information will be provided via VTS Information Service based on for example risk assessment.

The VTS Information Service is intended to contribute to the safe and efficient navigation of vessels by delivering information that VTS determines is relevant. The aim is to reduce the amount of broadcasted information via VHF to all vessels in the area and utilize digital tools to deliver timely and relevant information to relevant parties.

In addition to delivering information, VTS can use the service to request information from vessels that is not covered in other reporting requirements.

WG1 to contribute more on operational context, could include text on e.g.

* Information delivered,
* What is a request
* What is a question
* What is an answer

There are no requirements that a VTS must use the information service for any given use. All of the above are examples and a VTS may choose to not use VTS Information Service in day-to-day operations.

## Use cases for VTS Information Service

The use cases below describe an attempt of describing how and what types of uses there may be for the service. Not all the use cases are expected to be relevant to all VTSs and service implementations may ignore any of the use cases deemed unnecessary.

Consumer implementations must implement support for all of the use cases.

The first seven use cases are based on the use cases on VTS Digital Communications and the rest are technical use cases to establish the pre-conditions of the use cases and to clean up any unnecessary connections or subscriptions after departing the VTS area.

In all use cases the VTS system must be capable of receiving information from the service on the delivery status of the message to the vessel.

Figure High-level view of VTS Information use cases

### Use case 1 – VTS informs vessel of special circumstances with an unknown time frame

*Description –* VTS sends a message to the vessel

*Pre-conditions –* Vessel has subscribed to the VTS Information Service and the vessel is able to display geometries from received messages as a layer on an ENC.

*Typical sequence:*

1. VTS sends message to vessel(s) with the following content: “Keep 1 nm distance to LNG-tanker at point XX°XX.XXXX, YY°YY.YYYYY. Explanatory text for why and how to expect situation to change”
2. Vessel system automatically informs VTS Information Service that information is received and opened
3. Circumstances change and VTS updates the provided information to the vessel(s)
   * There may be multiple updates that are sent
   * Each update must refer to the original message that is being updated
4. Vessel system automatically informs VTS Information Service that update is received and opened
5. Situations ends and VTS sends cancels the provided information
6. Vessel system automatically informs VTS Information Service that cancellation is received. The vessel system must also inform the service when the cancellation has been opened by the user.

### Use case 2 - VTS informs vessel of special circumstances with a specified time frame

*Description –* VTS sends a message to the vessel

*Pre-conditions –* Vessel has subscribed to the VTS Information Service and the vessel is able to display geometries from received messages as a layer on an ENC.

*Typical sequence:*

1. VTS sends message to vessel(s) with the following content: “Sailing competition in area Duckville harbor from HH:MM to hh:mm.”
2. Vessel system automatically informs VTS Information Service that information is received and opened
3. Vessel systems are expected to automatically cancel and remove the information from display after the time frame has ended.

### Use case 3 - VTS sends information with no time frame

*Description –* VTS sends a message to the vessel

*Pre-conditions –* Vessel has subscribed to the VTS Information Service and the vessel is able to display geometries from received messages as a layer on an ENC.

*Typical sequence* -:

1. VTS sends message to a vessel(s) that for example complements other S-100 services or uses this service to send S-100 service information that has not been yet developed or is not in use in the current VTS area
   * The message can be in any form that the VTS provider chooses (e.g. free-text, attached file, picture)
2. Vessel system automatically informs VTS Information Service that information is received and opened
3. Vessel systems are expected to have an archival system in place so that mariners can return to the message and view its contents after initially opening it and hiding it from display.

### Use case 4 – VTS asks questions from vessel using a form

*Description –* VTS sends a message to multiple vessels at the same time

*Pre-conditions –* Vessel has subscribed to the VTS Information Service and the vessel is able to display geometries from received messages as a layer on an ENC

*Typical sequence* -:

1. VTS asks question from vessels with the message marker “Question”, for example “Are you able hold your position?” with structured form allowing only a yes/no answer as part of message.
2. Vessel system automatically informs VTS Information Service that question is received and opened
3. Vessel answers to VTS YES/NO
4. VTS system automatically informs vessel that answer has been received and opened

### Use case 5 – Vessel sends information to VTS

*Description* - Vessel sends information to VTS

*Pre-conditions –* Vessel has subscribed to the VTS Information Service and the VTS is able to display geometries from received messages as a layer on an ENC

*Typical sequence* -:

1. Vessel sends observation to VTS with the message marker “Information”, for example “Marine mammal(s) observed in a certain point and heading to given direction.” Location and heading also specified in structured content for automated display use.
2. VTS system automatically informs vessel that answer has been received and opened
3. VTS can ask further questions about the observation
4. VTS processes information based on their own operational instructions
5. Vessel systems are not expected to cancel the sent information.

### Use case 6 – Vessel asks a question from VTS

*Description* – Vessel asks for information from VTS by asking a question

*Pre-conditions –* Vessel has subscribed to the VTS Information Service and the VTS is able to display geometries from received messages as a layer on an ENC

*Typical sequence* -:

1. Vessel asks a question from VTS with the message marker “Question”, for example “Can we start diving operations?” Any additional information, e.g. location, can be delivered as a part of the structured content of the message.

While VTS is expected to have the ability to asks questions via structured forms, vessels are not expected to have the capability of providing a form editor to the mariner. When the consumer (i.e. vessel) is sending a question only free-text answers are allowed as the option for answers.

1. VTS system automatically informs vessel that answer has been received and opened
2. VTS answers the question by free text.

### Use case 7 – Vessel requests information from VTS

*Description* – Vessel requires information from VTS

*Pre-conditions –* Vessel has subscribed to the VTS Information Service and the VTS is able to display geometries from received messages as a layer on an ENC

*Typical sequence* -:

1. Vessel requires information from VTS and sends a message with the message marker “Request” and content “Send reporting requirements.”
2. VTS system automatically informs vessel that answer has been received and opened
3. VTS replies to the request

### Use Case 8 – Vessel subscribes to VTS information service

*Description* – Vessel is nearing VTS area and subsribes to the applicable VTS Information Service

*Pre-conditions –* Vessel has the URI for the applicable VTS Information Service from some source (e.g. via service discover, see TODO)

*Typical sequence* -:

1. Before vessel enters the area covered by the VTS Information Service it must subscribe to the applicable service in order to receive messages. The actual process of how this is done onboard is not defined in this specification.
2. Vessel systems contact the service at the known URI of the service and provide the necessary means to establish communication. This step must be defined in the implementing service designs of this specification as the method depends on the selected implementation technology.

### Use Case 9 – Cleanup of old messages

*Description* – Service and VTS system clean up old / obsolete information from display

*Pre-conditions –* Service has received information from VTS that is no longer deemed valid and needs to be cleaned up

*Typical sequence* -:

### TODO

### Use Case 10 – Cleanup of old subscriptions

*Description* – Service and VTS system clean up old / obsolete subscriptions from vessels

*Pre-conditions –* Service has subscriptions from vessels

*Typical sequence* -:

### TODO

### Use case XX – Vessel can discover compatible VTS Information Services

*Description* – a vessel can discover the available compatible VTS Information Services within their area of interest from maritime service registries.

*Typical sequence* -:

1. Service is registered in the Maritime Service Registry (MSR)
2. Mariner plans a route
3. During planning the ship system regularly checks that it has the service endpoints of all compatible VTS Information Services that cover the area of the route. If parts of the route are not covered by any VTS Information service, the ship system must search for VTS information services from the MSR.
4. MSR sends list of available services along route from its own area of responsibility. The MSR will also forward the search to all other participating MSRs and return the list of available services from other MSRs.

## Data flows

Figure 2 gives an overview of the dataflows for the VTS Information Service as described in the use cases.

Figure VTS Information Business Process

## Functional and non-functional requirements

### Functional requirements

|  |  |
| --- | --- |
| **Requirement ID** | RESF001 |
| **Requirement Name** | TODO |
| **Requirement Text** | TODO |
| **Rationale** | TODO |
| **Author** |  |

### Non-functional requirements

|  |  |
| --- | --- |
| **Requirement ID** | TCSNF001 |
| **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. The technical designs must describe how this is managed. |
| **Rationale** |  |
| **Author** |  |

|  |  |
| --- | --- |
| **Requirement ID** | TCSNF002 |
| **Requirement Name** | Availability |
| **Requirement Text** | The actual SLA of the service must be defined by instance owner. The service should be highly available and be considered a critical component of the VTS system. |
| **Rationale** | In IALA G1111 Section 3.1 [8] the availability requirements for VTS systems are defined. As the service is required for successful digital exchange of VTS information and such exchange may occur at any time of the day the service should be available whenever VTS system is available. |
| **Author** |  |

|  |  |
| --- | --- |
| **Requirement ID** | TCSNF003 |
| **Requirement Name** | Performance – timeliness |
| **Requirement Text** | The service must provide a technical 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. The technical designs must describe how this is managed. |
| **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** | TCSNF004 |
| **Requirement Name** | Uniqueness |
| **Requirement Text** | TODO |
| **Rationale** | TODO |
| **Author** |  |

## Other constraints

### Relevant Industrial Standards

1. IALA Guideline G1128 1.6 The Specification of E-navigation Technical Services
2. IALA Guideline G1143 3.1 Unique identifiers for maritime resources (MRN)
3. IHO Standard S-100 5.2.0 IHO Universal Hydrographic Data Model <https://iho.int/uploads/user/pubs/standards/s-100/S-100_5.2.0_Final_Clean.pdf>
4. IALA Guideline G1183 1.1 Provision of MCP Identities
5. IEC 63173-2 Committee Draft 80/1149/CD Secure communication between ship and shore (SECOM)
6. IEC 63173-1 Committee Draft 80/1148/CD S-421 Route Plan based on S-100
7. IACS UR E26/27 Rev1 International Association of Classification Societies <https://iacs.org.uk/resolutions/unified-requirements/ur-e>
8. IALA Guideline G1111 2.0 Establishing Functional Performance Requirements

### Operational nodes

Table Operational Nodes

|  |  |
| --- | --- |
| **Operational node** | **Remarks** |
| Route plan or route | *Route plan* is the common definition of what is being shared. For brevity, route is used as a synonym for route plan throughout this specification. |
| Vessel | *Participating ship* that is required to participate with vessel traffic services and is sailing or expected to sail in a VTS area where there is coverage of technical service. |
| Mariner | In this document mariner means a person who is part of the bridge team that is responsible for the navigation of the vessel. |
| VTS | *Vessel traffic services (VTS)* means services implemented by a Government with the capability to interact with vessel traffic and respond to developing situations within a VTS area to improve safety and efficiency of navigation, contribute to the safety of life at sea and support the protection of the environment. |
| VTS centre | *VTS centre* responsible for a one or several *VTS Areas* for which the *VTS provider* is authorized to deliver vessel traffic services. A VTS centre is responsible for VTS information service within its coverage area. |
| VTS operator | *The personnel of the VTS centre,* means persons performing tasks associated with vessel traffic services, trained in vessel traffic services operations and appropriately qualified. |
| VTS system | *The VTS system is the VTS software, hardware, communications and sensors.* This excludes personnel and procedures. |
| Service | *Implementation of the VTS Information Service.* This is used to differentiate the service from a server as there may be multiple servers capable of accepting incoming requests / data. |
| Consumer | *The vessel system interacting with the service.* There may be a proxy server between the consumer and the service to facilitate data exchange but the consumer can always be understood as the on-board system(s) used to interact with the service. |

# Service Overview

## Logical operations

The following logical operations must be provided in the designs that follow this specification ((x = required, o = optional):

Table Logical interfaces

|  |  |  |  |
| --- | --- | --- | --- |
| **Operation** | **Description** | **Required** | |
| **[Node X]** | **[Node Y]** |
| Send information | TODO | x | x |
| Receive information | TODO | x | x |
| Send acknowledgement | An operation that allows sending of an acknowledgement that VTS information has been delivered to end system or opened by end user. | x | x |
| Receive acknowledgement | An operation that allows the reception of an acknowledgement. | x | x |
| Subscribe to changes | VTS system must have a way to inform the vessel of what kinds of changes to the information they want to receive automatically.  The consumer must have a way to subscribe to the results of long running processes or processes that require human interaction and thus an asynchronous response. | x | x |
| Request information | The consumer must support the service requesting a information (see 3.1.10).  The service may support the consumer requesting a specific information or searching for information (see 3.1.12) | x | o |
| Discover service capabilities | The consumer must have way to discover if the service supports requesting a specific piece of information or searching for information. | x |  |
| System status | For service registries and service consumers to be able to check if service is up an interface must be defined that allows the checking of service without sending a valid message. | x | x |
| Service registry updates | The service must be able to update its own metadata in the service registry according to the service registry definitions. This is required to maintain updated certificates in the service registry as well as to allow other automatic updates to service information. | x | x |
| Search service registry | The consumer must have a way to search a maritime service registry for VTS information services that it is compatible with its area of interest.  The service must have a way to search a maritime service registry for the consumer endpoint if it is registered. | x | x |

In this table the requirement that a vessel has an interface means that the vessel must have access to an interface that ensures that the incoming data is transported to the vessel’s on-board systems. It does not mean that the vessel must have connectivity all the time or that the vessel must accept random incoming connections. However, the vessel systems must have a way to send data to the service and get the technical sign-off of a successful transmit in a synchronous call.

What this means is that the end-to-end acknowledgment that is described in use cases and sequence diagrams differs from the technical acknowledgment that signals a successful end of transmission. This service and others that work between shore and vessel are often components of a more complex system. As such, the technical ok of a single transmission being complete does not indicate that a message has been delivered end to end. Thus, a separate mechanism for acknowledging delivery of end-to-end transmission is required. This is done by adding a method for acknowledging when the VTS information has been delivered to the end system and opened by a recipient and visualizing this acknowledgement in the sending systems to facilitate e.g. operational acknowledgment.

### Search Service Registry

Service discovery is a required functionality of both the service and its consumers.

The consumers must be able to search for valid VTS information exchange services that the consumer supports and cover its area of interest. For this functionality to work, the following parameters are expected:

* The technical service design MRN and version number that the service implements that the consumer supports.
* Geometry of the area of interest. See 4.2.1

If the service has not received a callback parameter, the service must be able to search the service registry for the consumer to discover valid endpoints for the consumer. The following parameters are expected in this case:

* The technical service design MRN and version number that the service implements.
* The MRN of the consumer.

The actual method and logic of service discovery is outlined in G1191.

### Service registry updates

The service should be able to update the supported versions of the technical service design, its certificates and endpoint automatically to the service registry. The service must also define the geometry of the area that the service covers to allow for service discovery.

If registered in a service registry, the consumer should also be able to update the supported versions of the technical design, its certificates and endpoint automatically to the service registry.

The actual method and logic of service discovery is outlined in G1191.

### System status

Both the service and consumer endpoints must support a way of checking that the endpoint is available via e.g. a ping interface without sending a valid message.

### Send and receive acknowledgment

Both the service and consumer must have a method of sending and receiving acknowledgments of delivery to end systems. As many of the operations are asynchronous and may depend on multiple intermediate systems there is a need to be able to show to the end users of the systems the status of message delivery that exceeds the technical status of the initial message transfer. This interface must require the presence of the message identifier (see 4.2.4).

### Send message

TODO

### Receive message

TODO

### Subscribe to information

TODO

### Discovering service functionality

The consumer must have the ability to discover all of the interfaces provided by the service. The service must provide an interface that supports the discovery of available functionality.

## Logical parameters

Here we will cover the abstract logical parameters that are common for multiple interfaces. Actual parameter structures, response structures or error handling is not specified. These will be defined in more detail in the technical design documents.

### Callback

For most operations initiated by the consumer a callback parameter is expected that defines how or where the service may respond to the consumer. This parameter is not required, but if it is not present, the consumer must be available in a service registry for discovery (see 4.1.1). The actual method of the callback depends on the service design.

### Geometry

When sharing geometries as a search parameter the geometry may either be an actual representation of the route with all waypoints and legs represented or a simplified representation of the geometry that can be any of the following (non-inclusive)

* List of waypoint coordinates
* A simplified polygon of the route
* A simplified version of the route

Any padding that is needed for the geometry when creating the geometry (e.g. for searches of services along a route) must be added by the creator of the query. Recipients can use the incoming geometry as is.

### Message identifier

In all operations where an acknowledgment is requested, a unique identifier of the message must be present that the acknowledgment can refer to. This is typically referred to as a transaction identifier, correlation id and so on.

### Service discovery

The typical parameters used in service discovery are defined in 4.1.1. It is important to note that searching for multiple versions of a service design that can be used is possible to ensure that the search returns all compatible versions and not just a single version.

It is also important to note that from a service discovery point of view the version of the actual implementation should not have any significance.

# Service Data Model

The basis of the data model used in this service is S-212. TODO

Figure Abstract object model of the VTS information data

Message can contain

Geometry

Time

Pictures

Symbols

Form (eg questions that require structured answer)

Free text

Time frame

Attached file

## Container type

As both the service and consumer of the service are expected to create the S-212 messages that are sent and neither typically has an IHO producer code only the use of plain S-212 messages as payload is supported. The service and its consumers must not expect to receive the message in an S-100 exchange set or dataset.

The rationale for this is that there is no need to create a globally unique filename and/or path combination for the message that is required in both the S-100 exchange set and dataset metadata. The message being shared in this service can be considered ephemeral and the S-212 format of the message does not need to be kept in storage for either the consumer or service.

## End-to-end verification of data

Because the VTS information shared in conforming applications do not have the full set of metadata and external structures of an S-100 exchange set, the signature of the message required in TODO must accompany the message in other means. In normal direct communication between consumer and service this is normally handled by communication headers and may be provided by the protocol. The service design must specify how the signature is transmitted.

## Message markers

TODO explain message markers

Message markers are denoted in S-212 by the attribute XXX and may contain the following values:

* + Question
  + Information
  + Request
  + TODO

## Coordinate systems

The coordinate system used must be defined. It should be EPSG:4326 according to S-100 and the coordinate order when using EPSG:4326 must always be latitude longitude. Service and consumer are not required to ensure correct handling of other coordinate systems or coordinate orders.

It is adequate to define the used coordinate system for the bounding box of the message. All subsequent geometries must default to the coordinate system defined for the root bounding box unless another coordinate system is explicitly defined for that geometry.

# Service Dynamic Behaviour

**TODO**

## Acknowledgement messages

The sequence diagrams shown have multiple references to acknowledgments being sent of delivery to end systems (ship or VTS system) or opening of the message. This is due to the asynchronous and multi-hop nature of the communication where the technical transmission of a message from one component to another does not always signify the successful transmission of the message from one end system to another.

Thus, the sequence diagrams show and prescribe when acknowledgments must be sent either on the successful delivery of the information to the end system or of the opening of the information by a user. If the received information is automatically displayed on VTS or ship systems, the opened acknowledgment can only be sent after the user has in some way interacted with the information.

## Service discovery

The method for service discovery using maritime service registries (MSRs) is described in more detail in G1128.

To allow service discovery in the maritime domain, the service must be registered in a maritime service registry that participates in the global search.

If the consumer allows automated requesting of information, it must be discoverable in a MSR that participates in global search.

The consumer must support searching for compatible instances of the service in MSRs by using the geometry of the route and an applicable version of a service design based on this specification. The geometry of the route may be simplified if required.

The service must support searching for consumers based on the vessel’s MRN; or IMO or MMSI number.

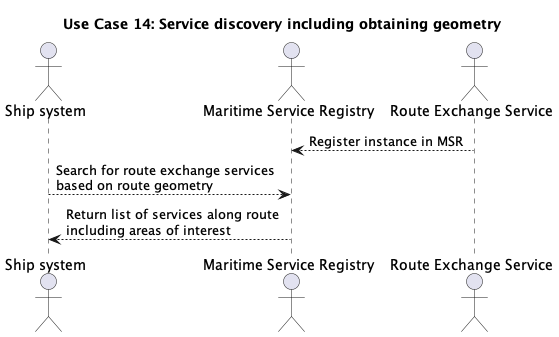


Figure Service discovery flow

**TODO**

# Definitions

|  |  |
| --- | --- |
| 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 Centre, Maritime Authority, Ship, Port, Weather Information Provider, etc. |
| 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 centres, 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 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 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 centres, organizations (e.g., meteorological), commercial service providers, etc. |

# Abbreviations

API Application Programming Interface

MRN Maritime Resource Name

MSR Maritime Service Registry

VTSO VTS Operator

XML Extendible Mark-up Language

XSD XML Schema Definition

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1. Author to insert actual service name and version number [↑](#footnote-ref-2)