



**NAVELINK**

# Developer forum

26-10-2023

[Navelink.org](https://navelink.org)

# Agenda

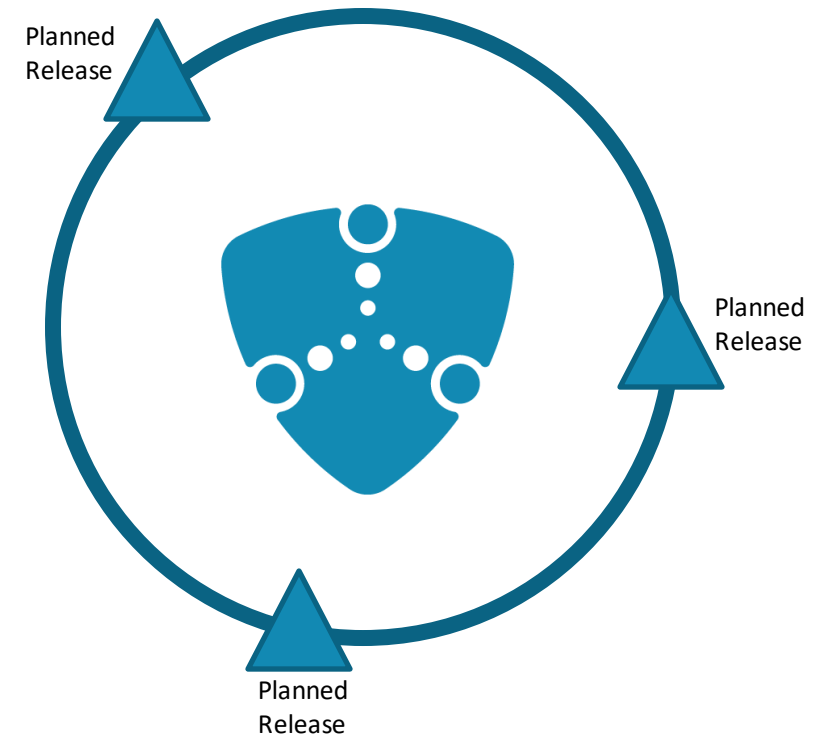
- 1) Navelink Platform status & update
- 2) Navelink Roadmap (Head of concept Navelink)
- 3) Service development discussions & information
  - a) Forum service developers (Each developer)
  - b) Forum security and interoperability (Each developer)
  - c) Ongoing work within the STM-community (Trello) (Each developer)
- 4) Overview of Navelink usage
- 5) Q&A
  - a) New questions (All)
- 6) Presentation – MMS by Oliver Steensen-Bech Haag (MCC)
- 7) Discussion: Navelink + REST + MMS + VDES
- 8) Closing remarks

# 1) Navelink Platform status & update

- Since the last meeting:
  - MIR version 1.2.1 implemented in PROD
    - Stricter validation of input and URLs
    - Release notes can be found at [Navelink.org](https://navelink.org)
  - IALA week in Paris
  - New Project head of Security – Göran Wiréen
- Future
  - Work in progress with creation of SECOM Hotel
    - Preliminary Q1

## Received questions

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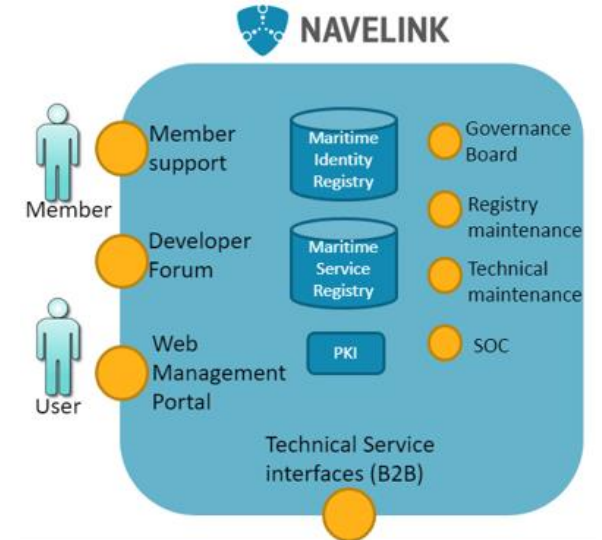


# 2) Navelink Roadmap



- Support new Service Specifications and Designs
- Increase VDES support
- Add GetPublicKey
- Add MMS support
- Increase SECOM Compliance
- Add SECOM Hotel
- Add SecretKeyExchange
- Add MRR usage
- Add Service Ledger support

- Enable subscription on Navelink technical notes
- Enhance functionality to host payload formats
- Add support for Service Payment



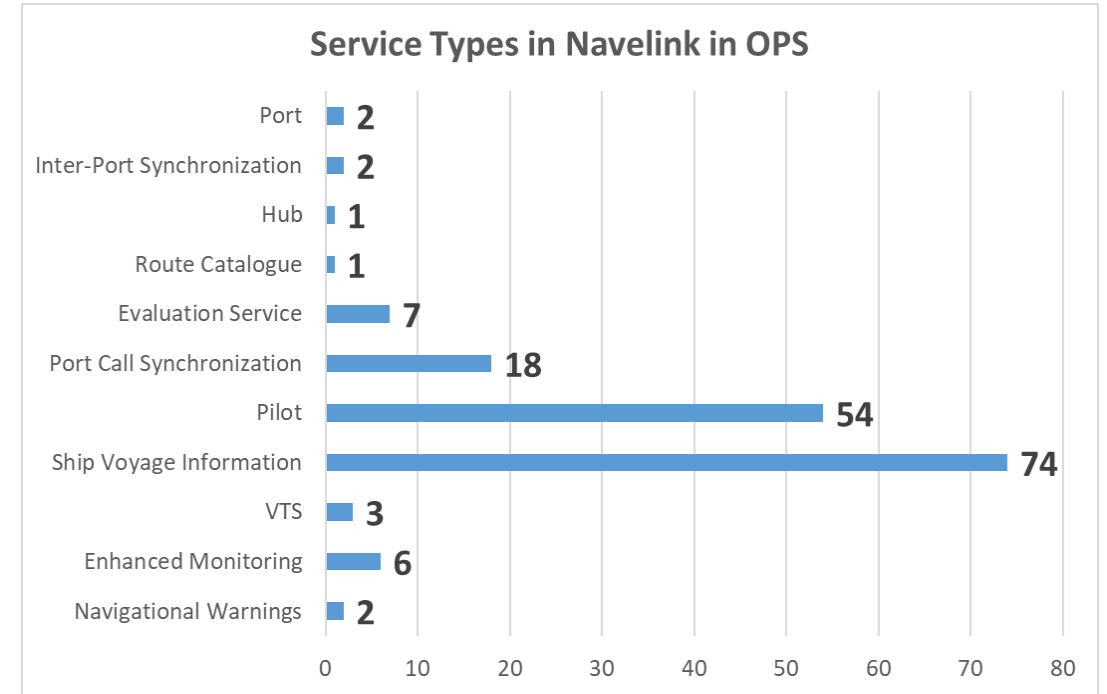
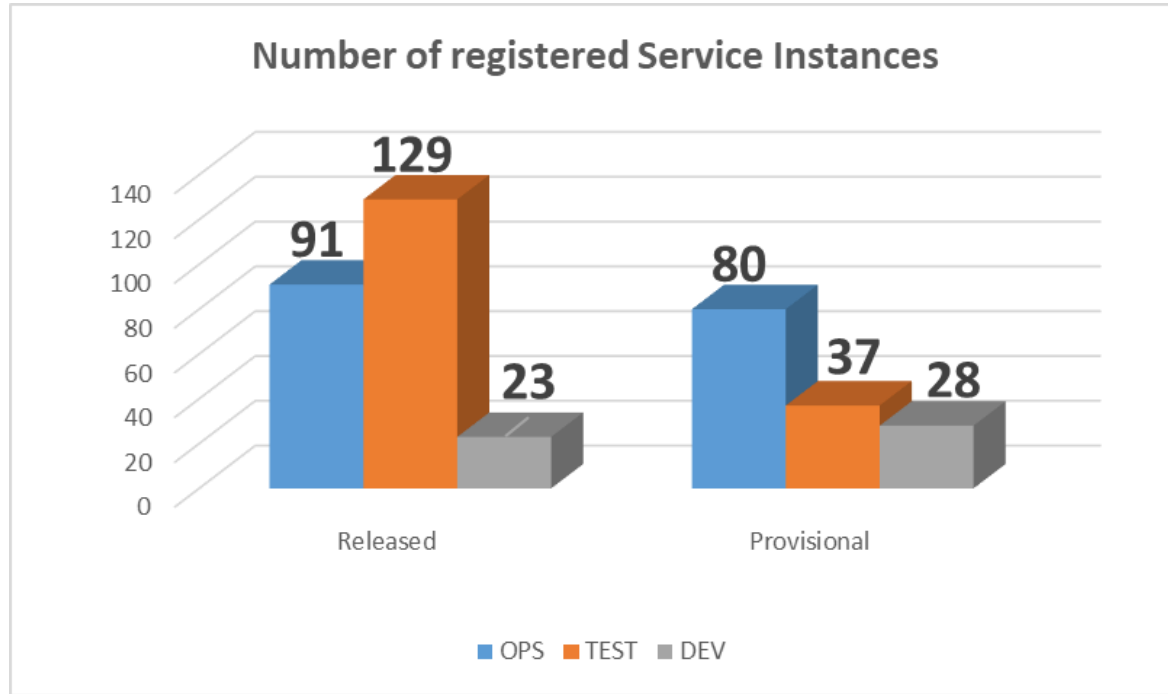
# 3) Service development discussions & information

- Forum service developers
  - Common discussions
- Forum Security and interoperability
  - Common discussions
- Ongoing work within the STM-community
  - Common standardization work: S-124, S-421, SECOM, General STM news



# 4) Overview on Navelink usage

2023-10-25



## Events since last Dev Forum:

Services in DEV

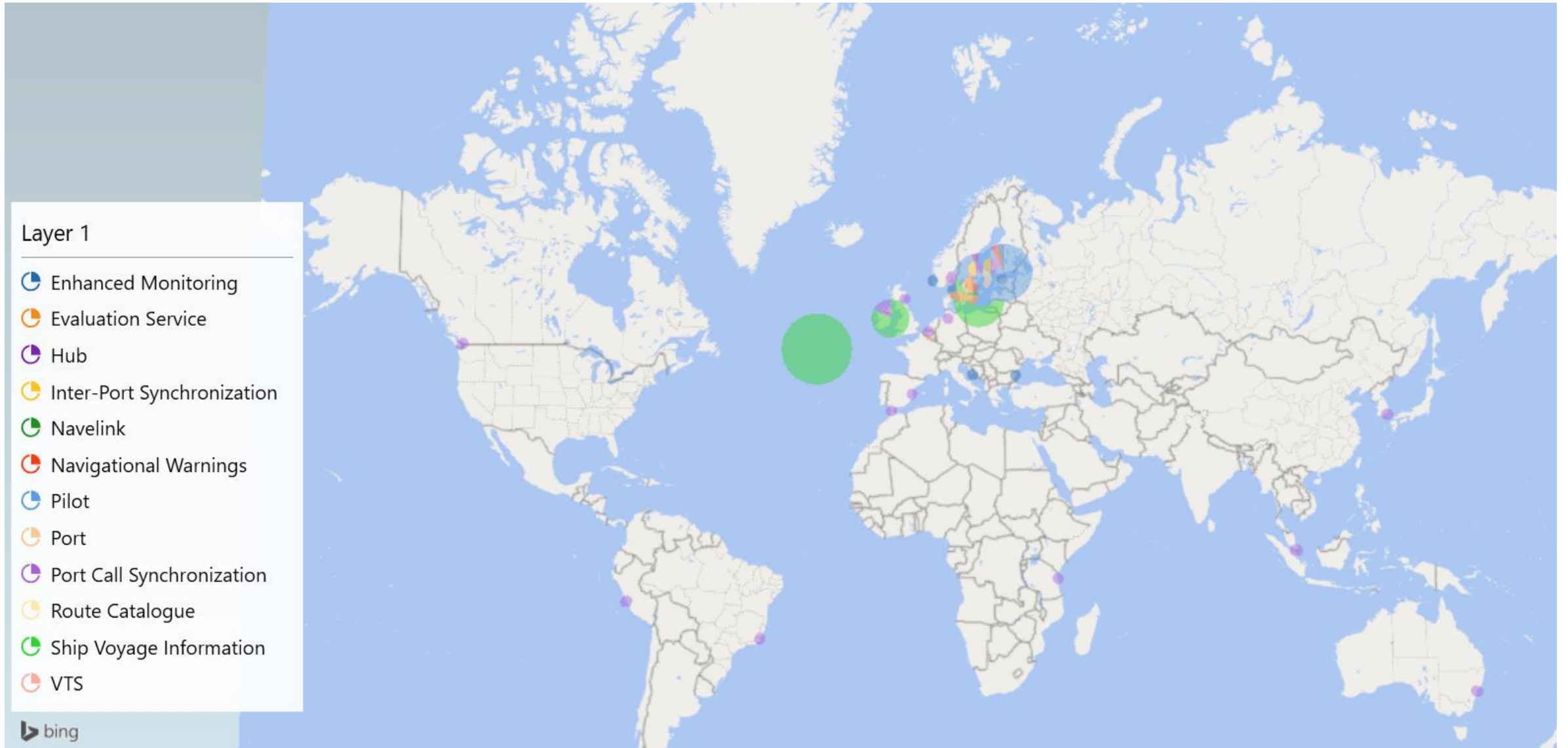
## Navelink Operational environment Service Registrations

Service Specifications: 1 (Voyage Information Service v2.2)

Service Technical Design: 1 (Voyage Information Service Design v2.2)

Service Instances: 171

# Operational environment



## 5) Q&A

- Any Questions? The floor is open.



## 6) Presentation

- MMS by Oliver Steensen-Bech Haag (MCC)

# What is the MMS?

- A messaging service intended to offer transparent seamless information transfer across different communication links in a carrier agnostic manner.
- Direct messaging using MRN as the locator
- Subject-based publish/subscribe of messages – subject-casting
- Store-and-forward of messages



# Components of the MMS

## .MMS Agent

- The entry-point to the MMS
- Links an application to one or more MMS Edge Routers

## .MMS Router Network

- Consists of a number of MMS Routers
- Routes messages based on either MRN or subscription topics

## .MMS Edge Router

- Acts as the link between MMS Agents and MMS Routers
- Can connect to the MMS Router Network through various different communication links
  - e.g. IP, VDES, VSAT, etc.



# Protocols

- Maritime Message Transfer Protocol – MMTP

- The transfer protocol between MMS Agents via the MMS Router Network
- Senders and receivers of direct messages are identified using MCP MRNs
- Multicast messages are identified with a subject string
- Messages are signed by the sender making it possible for receivers to authenticate them

- Secure Maritime Message Protocol – SMMP

- Provides further security guarantees than MMTP
- Not fully specified yet



# MMTP

- Messages are defined and encoded using Protobuf
- Protocol Messages contain the operation that should be performed – e.g. sending, receiving, etc.
- Response Messages contain the response to a protocol message
- Application Messages contain routing information and payload of direct and subject-cast messages



# MMTP

```
message MmtpMessage {
  MsgType msgType = 1;
  string uuid = 2;
  oneof body {
    ProtocolMessage protocolMessage = 3;
    ResponseMessage responseMessage = 4;
  }
}
```

```
message ApplicationMessage {
  ApplicationMessageHeader header = 1;
  bytes body = 2;
  string signature = 3;
}
```

```
message ResponseMessage {
  string responseToUuid = 1;
  ResponseEnum response = 2;
  optional string reasonText = 3;
  repeated MessageMetadata messageMetadata = 4;
  repeated ApplicationMessage applicationMessages = 5;
  optional string reconnectToken = 6;
}
```

```
message ProtocolMessage {
  ProtocolMessageType protocolMsgType = 1;
  oneof body {
    Subscribe subscribeMessage = 2;
    Unsubscribe unsubscribeMessage = 3;
    Send sendMessage = 4;
    Receive receiveMessage = 5;
    Fetch fetchMessage = 6;
    Disconnect disconnectMessage = 7;
    Connect connectMessage = 8;
  }
}
```



# MMS Agent

- Will most likely be implemented as software libraries that can be used by applications to connect to Edge Routers
- Discovers Edge Routers on a local network using mDNS
- Can connect to an MMS Edge Router in two ways:
  - Authenticated using a MIR issued certificate – enables sending, receiving and subscribing to direct and subject-cast messages
  - Anonymously – enables receiving and subscribing to subject-cast messages
- Connects to Edge Routers over WebSockets



# MMS Edge Router

- .Supports store-and-forward for messages to and from MMS Agents and the MMS Router Network
- .Can choose between different communication links – like IP or VDES – for sending and receiving messages
- .Advertises subscriptions and direct messaging information on behalf of MMS Agents
- .Can advertise its presence on a local network using mDNS
- .Connects to MMS Routers mutually authenticated WebSockets





# MMS Router Network

- Forms the routing backbone of the MMS
- Uses libp2p<sup>1</sup> as the basis for message routing and publish/subscribe functionality
- Consists of a decentralized and connected network of routers and beacon nodes
- All nodes are connected either directly or indirectly to each other over IP

1: <https://libp2p.io/>



# Beacon Nodes

- .Static nodes that are used by router nodes to discover other router nodes
- Similar to how tracker nodes are used in BitTorrent
- .Are not participating in routing of messages



# Router Nodes

- Facilitates routing of MMTP messages using libp2p
- Has a WebSocket based interface that MMS Edge Routers can connect to
- Advertises subscriptions and direct messaging information on behalf of MMS Edge Routers
- Supports store-and-forward of messages to and from connected Edge Routers and the Router Network



# Bootstrapping of Router Network

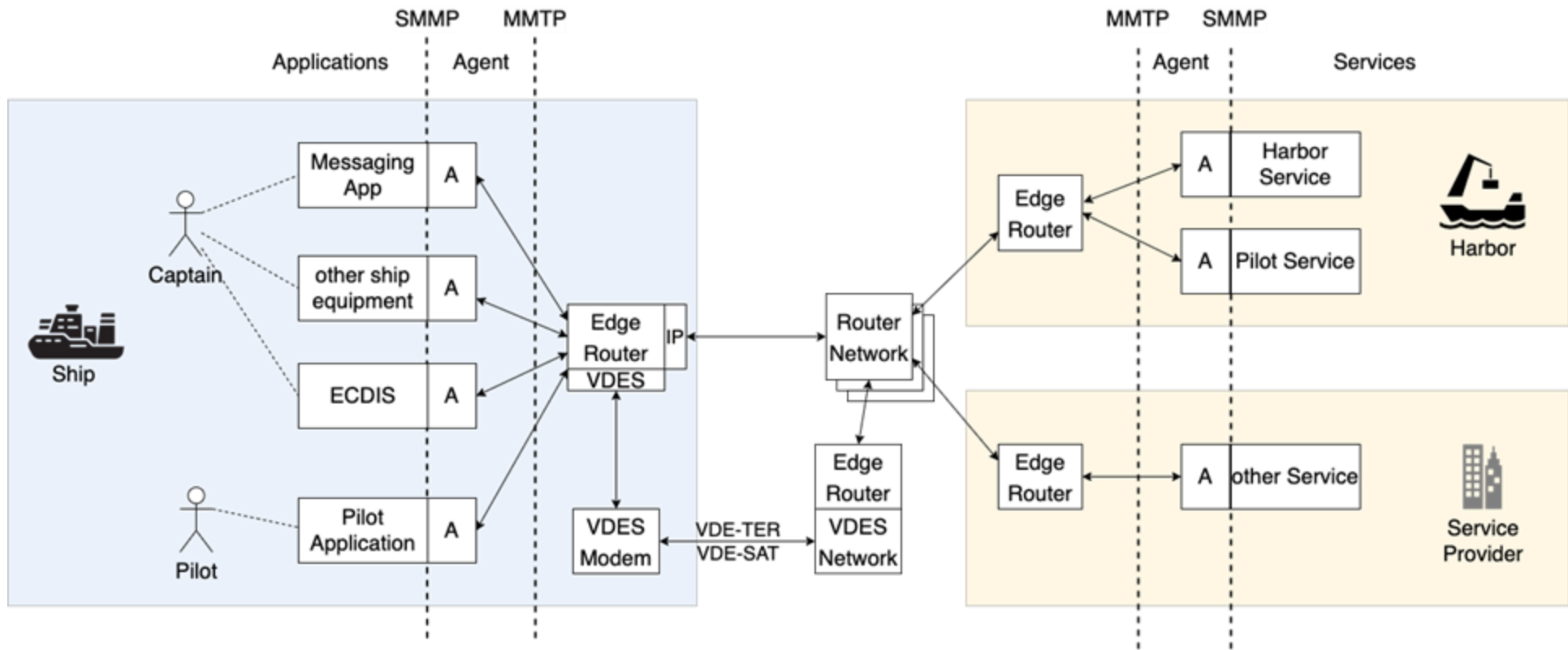


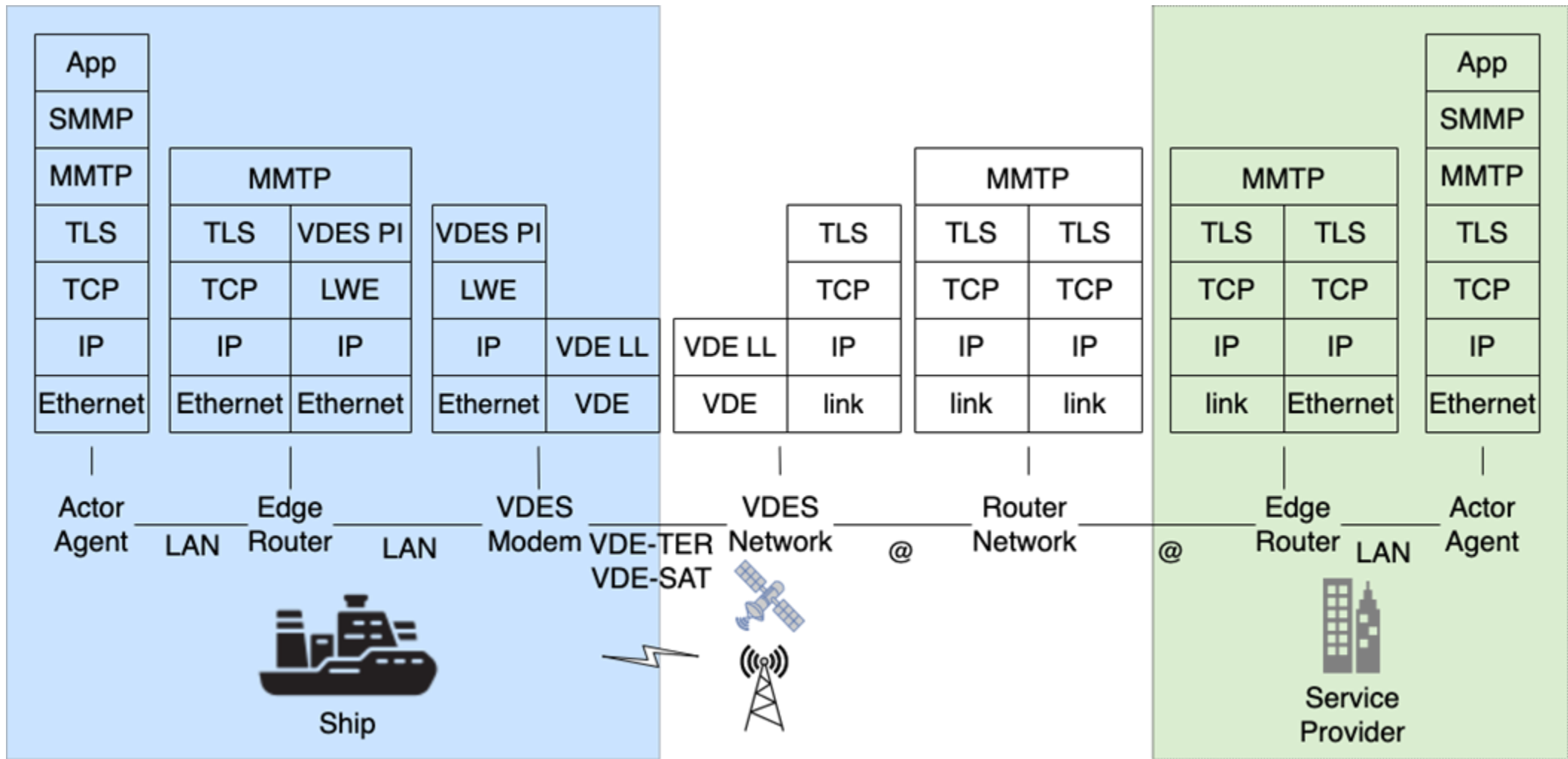
# Bootstrapping of Router Network



# Bootstrapping of Router Network









# Ongoing and Future Work

- Further development of the MMS specification
- Standardization of the MMS specification in RTCM Special Committee 139 on Digital Maritime Messaging Service
- Prototype implementations, and later on reference implementations, of the different components of MMS



# Further Reading

•Draft MMS specification:

–[https://maritimeconnectivity.github.io/maritimeconnectivity.net/docs/20230814\\_MCC\\_MMS\\_Spec\\_draft.pdf](https://maritimeconnectivity.github.io/maritimeconnectivity.net/docs/20230814_MCC_MMS_Spec_draft.pdf)

•Prototype implementations of MMS Edge Router, Router and Beacon:

–<https://github.com/maritimeconnectivity/MMS>

•Prototype implementation of MMS Agent:

–<https://github.com/maritimeconnectivity/mms-agent-go>

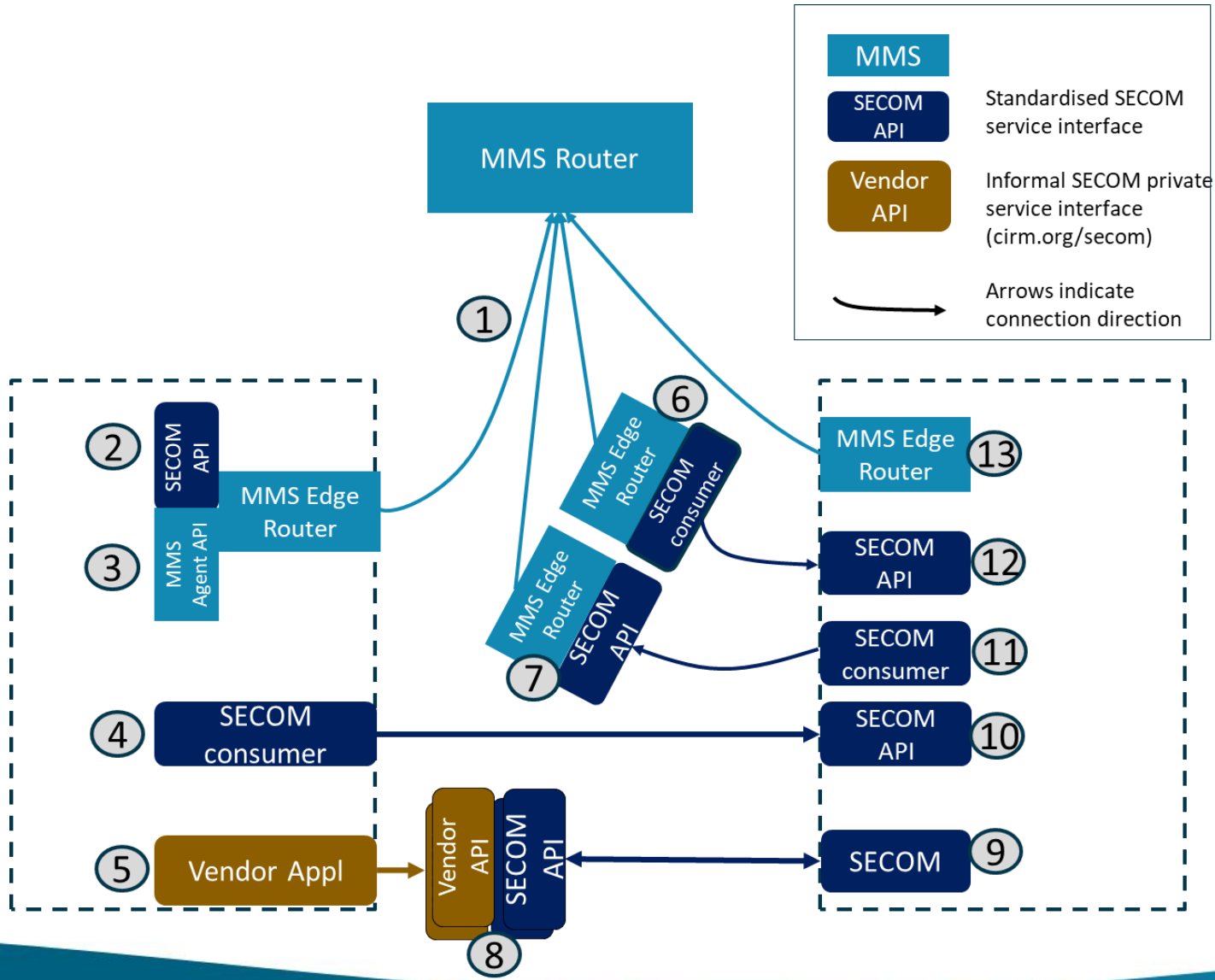


Thank you!

Got any questions?

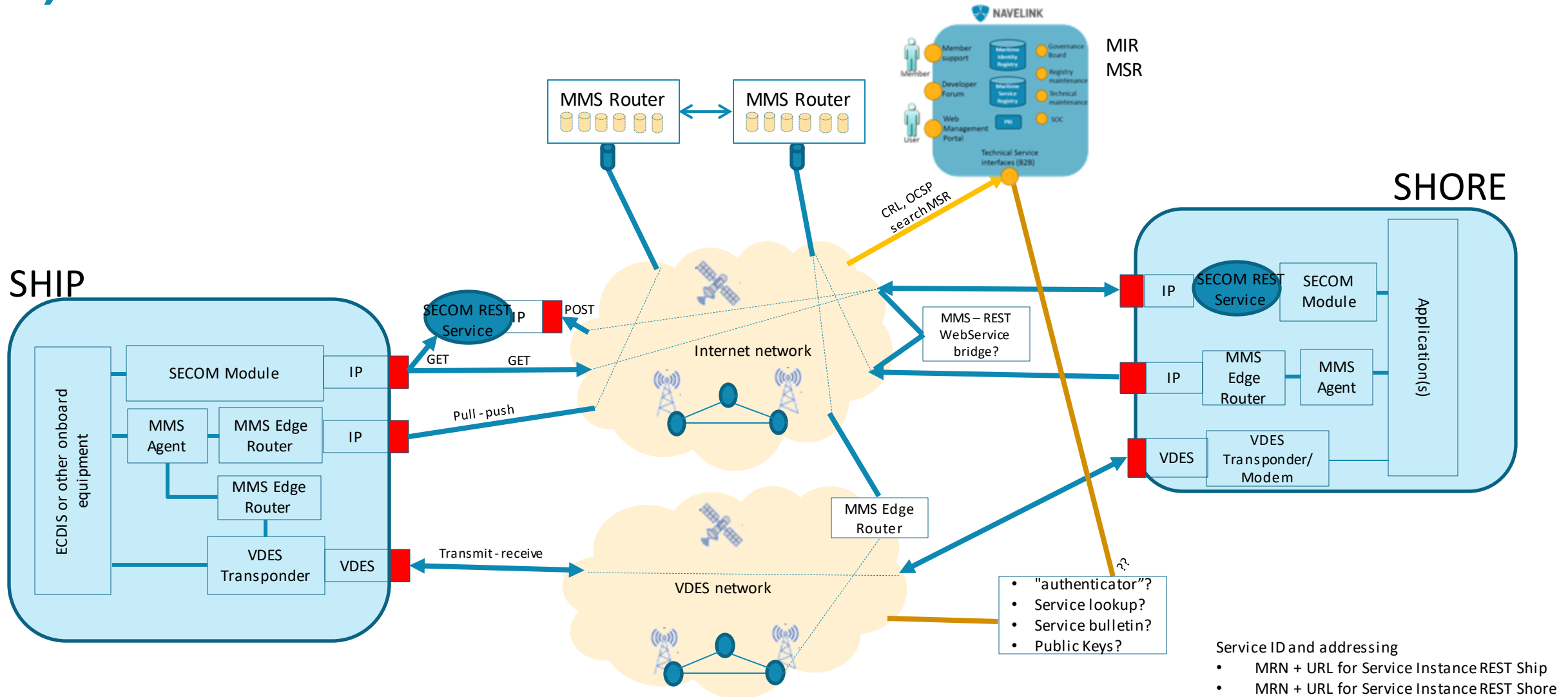


# MMS – SECOM integrations points



- ① MMS network can be either internet or VDES
- ② SECOM API as user front to MMS
- ③ MMS Agent interface as user front
- ④ SECOM consumer calling other SECOM service
- ⑤ Vendor application as user front to SECOM service. Also called the SECOM private side. Can be either based on informal private API or existng communication between e.g. ship and fleet operation.
- ⑥ Bridge from MMS to SECOM service
- ⑦ Bridge from SECOM service to MMS
- ⑧ SECOM service hosted by "anyone" with a private side (vendor API) and the public side (the standard API)
- ⑨ SECOM Service and application allowing both outgoing and incomin calls to SECOM Service.
- ⑩ SECOM Service allowing incoming calls
- ⑪ SECOM consumer application
- ⑫ SECOM Service allowing incoming calls
- ⑬ MMS

# 7) Discussion: Navelink + REST + MMS + VDES

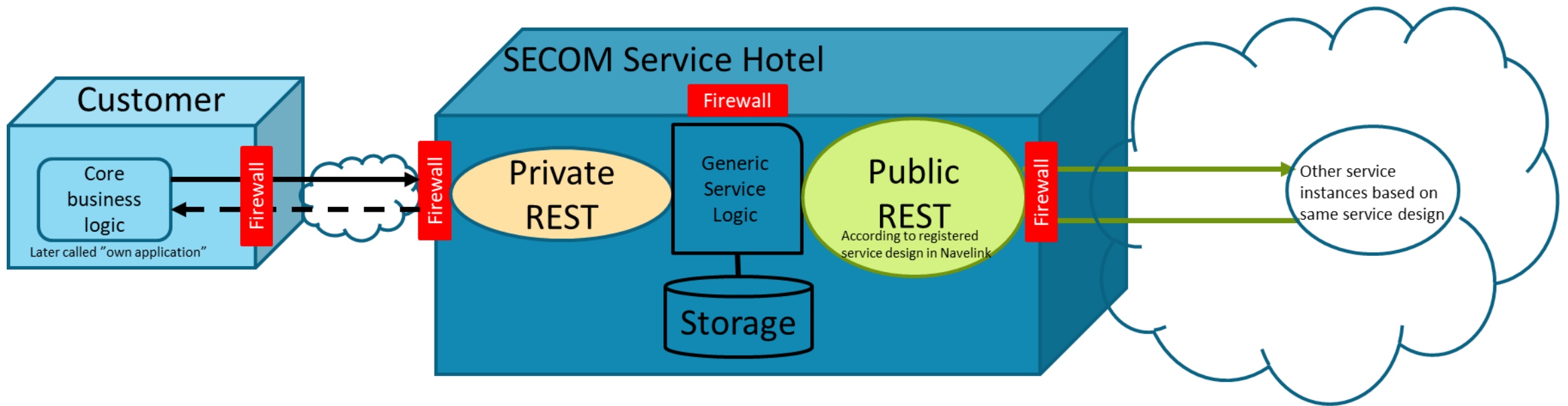


- "authenticator"?
- Service lookup?
- Service bulletin?
- Public Keys?

- Service ID and addressing
- MRN + URL for Service Instance REST Ship
  - MRN + URL for Service Instance REST Shore
  - MRN for MMS Queue Ship
  - MRN for MMS Queue Shore
  - MRN + URL for MMS Router

# Introduction

The main purpose with the SECOM Service Hotel is to provide customers with REST Services compliant with the IEC standard 63173-2 SECOM. Navelink will host the services on behalf of the customers, and the customers applications connects to the private REST service. Other consumers will connect to the SECOM Public REST service.



## 8) Closing remarks

- Welcome back!
- Next Developer Forum at 16/11-2023

# Meeting notes (1/3)

- Work has begun on creation of a SECOMHotel
- GetPublicKey has been implemented in Navelink. You can now create an offline list of certificates among other things.
  - This was a request in relation to VDES verification
  - Currently it is in DEV and TEST but if you want it added to the PROD environment, please let us know.
- Peter(Saab) had an open question: We are increasing VDES support in Navelink, and do we have any users yet or plans to use VDES here?
  - The service registry and the signing of data will be independent regardless if you use MMS, VDES, SECOM or other. We still want to find the data we will consume and be able to authenticate the data.
  - A lot of companies are curious of VDES work at Saab.
  - Kongsberg will do some VDES and Navelink testing but it is not scheduled yet.
- There is ongoing work with S-124 that is almost finished with a service design following SECOM standard for navigational warnings. There is also ongoing work in IALA working group to get a technical design regarding S-421.
- Hopefully we will also see more services based on SECOM technical designs in the service registry.
- There is also an ongoing discussion about the need to separate the signer of the information and the signer of the transport of that data.
  - A lot of layers of security to the transfer of data.
- Tommy (SMA) as part of the STM community reports that much is happening in the world and if you have questions or input to STM, please contact him at SMA and he will assist you.
- The biggest growth currently is in the Dev environment



# Meeting notes (2/3)

- Oliver Steensen-Bech Haag (MCC) gave a presentation on MMS (se slides 11-28 above)
  - MMS basically consists of 3 different components.
    - *The MMS Agent (the entry point to MMS)- will probably be implemented as software libraries*
    - *The MMS router (consists of a number of MMS routers)- Supports the store-and-forward for messages to and from MMS agents and the MMS Router Network.*
    - *MMS Edge router (acts as a link between agents and routers)*
  - SSMP provides greater security guarantees than MMTP
  - In MCP they are using Protobuf to define and encode messages.
    - Protobuf is made by google and is pure binary format rather than jsons text format. Thus taking less space than json and not needing special UTF encoding or the like.
  - MMS Router Network forms the routing backbone of the MMS
  - Routers can use beacon nodes, static nodes, to discover other router nodes in the network. It displays a list of routers it knows are in the network, making a new router able to connect to the network.
  - The router nodes themselves facilitates the routing of MMTP messages using libp2p
  - Edge routers on the ship may have 2 different connections, one using IP and one using VDES on the ship, so the edge router can take different paths depending on the scenario/service
  - Ongoing and future work includes the MMS specification and getting it standardized in RTCM Special Committee 139. They are also currently developing a prototype implementing the specification.
- Peter (Saab) asks: Resources for satellite VDES are quite different, how will the MMS stack work with them or have you only considered the ships?
  - Stefan (Sternula) works on this currently (but could not participate on this meeting). And as far as Oliver knows they take the MMS payload and forwards it where it needs to go, but in principle it should be possible to implement the MMS stack in the satellites themselves.
  - As far as MCC has worked for now they have not put much effort to how the specification should work in the middle layer, only on the two sides of it and not the transport itself. But it is a valid point that MMS WG should think about when making the specification.

# Meeting notes (3/3)

- Who will provide the MMS routers do you foresee?
  - Oliver (MCC): I think that would probably be the MCP providers such as Navelink and any other future providers. Probably equipment providers will also implement them and most likely we will have software implementations of the components to add to your own solution.
  - The system currently has no guidelines on subject formats, but they will also need to be created e.g. for navigational warnings ect.
  - Mikael (Navelink): Do you foresee these subjects to be something to look-up?
    - Oliver (MCC): We have guessed how to find the subjects and think the service registry may be a good option for that.
- Mikael (Navelink): Is this part of the digital incubator?
  - Oliver (MCC): I think we are mostly focused on SECOM there, but I think MMS has also been discussed and is of interest there.
- MMS – SECOM integration points are currently being discussed and some thoughts can be seen on slide 33. Another thing under discussion is using the SECOM interface but the MMS is what is used in the background. If you have any input, please contact us.
- Peter (Saab): The satellite is important in VDES and it will be complicated to connect to the satellites for a longer amount of time. How many VDES satellites should a ship connect to is a question that is under great discussion currently.
  - Maybe add ship-shore-satellite to the image on slide 34?
  - The VDES transport and the satellite transport should maybe be separated.
  - One major use of VDES is ship-to-ship, not necessarily through the satellites if they are close to each other but maybe through the MMS Edge routers
- Next meeting 2023-11-16



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