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The Maritime Connectivity Platform (MCP)

Conceptual Overview

1 NEED FOR THE MARITIME CONNECTIVITY PLATFORM

Digitalisation will change the way of navigation, shipping and maritime transportation. The driving motivation for digitalisation encapsulates everything from improving the safety of navigation, to improving efficiency and protecting the marine environment. In recent years reducing carbon emissions has become of even higher priority– and here also, secure digitalisation of the maritime domain is part of the solution.

Major initiatives have been started - with the International Maritime Organisations (IMO) e-navigation initiative and International Hydrographic Organisations (IHO) development of the S-100 concept as important examples. The overall focus has however, been on data harmonisation with S-100 being a prime example. Other initiatives include the IMO Compendium on Facilitation and Electronic Business and the availability of new physical communication channels provided by improved satellite coverage and development of the VHF Data Exchange System (VDES). Recently initiatives focusing on harmonising the means of data exchange (beyond the physical links) have also emerged, though these are still somewhat immature.

Digitalised services will provide necessary information, functionality and are the basis for a safe cooperation ship to ship and shore to shore. The most important enablers for this intention are:

1) A way for users and machines to **securely authenticate and authorise** themselves to each other.
2) An option to increase the **discoverability of services** to facilitate offering and finding them.
3) An efficient way to **provide services for information exchange and new functionalities** digitally.

The Maritime Connectivity Platform (MCP) aims to provide exactly these core features, and more widely, provide a foundation for the development of digital maritime services. It is a decentralised framework for enabling an efficient, secure, reliable and seamless digital service provision and information exchange between all authorised maritime stakeholders across all available communication systems (for instance VDES, LEO, 4G/5G). It enables maritime actors to use digital services to exchange both public and private information. Both commercial and non-commercial institutions can become part of the global MCP framework using their own installation (that is to say, their own independent 'incidence') of the MCP, thereby making them MCP service providers.

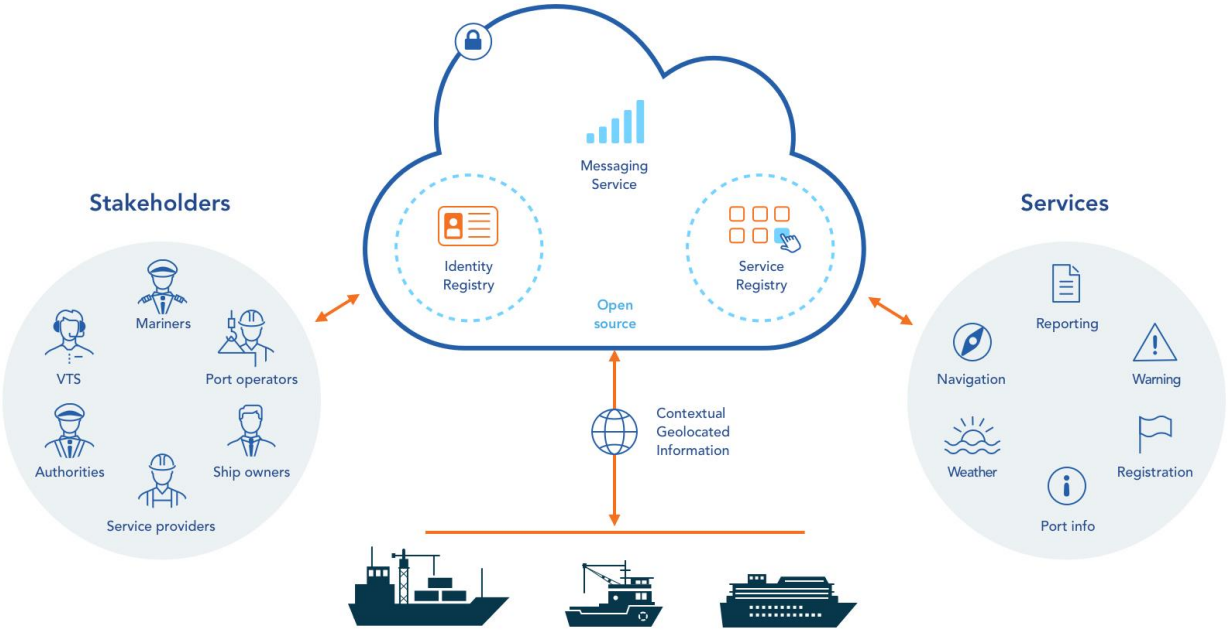

Figure 1 - Overall Concept of the Maritime Connectivity Platform

The MCP brings proven internet standards to maritime navigation and transportation systems by applying open, standardised and powerful vendor-neutral technologies. The MCP was initially created to address the goals of the IMO e-navigation initiative. However, the MCP has the potential to support digitalisation across a much wider maritime domain because it is an open-source solution that relies on the concept of Web Services for identity management and service management and, as such, can support much more than just the IMO's Maritime Services in the context of e-navigation. The approach is based on digital services[1] to access information (like maritime safety information) and functionality (like traffic management).

Overall, the MCP consists of three components, each addressing one of the three core features (c.f. Figure 1):

- **Maritime Identity Registry** (MIR) - for secure and reliable exchange of information, it supports safe authentication and usage to all services, using identity information provided by trusted stakeholders. It facilitates confidentiality, integrity and authenticity in information exchange between users and between machines. The MIR uses existing standards such as MRN (Maritime Resource Names), OpenID Connect and X.509 certificates.
- **Maritime Service Registry** (MSR) - for registering, and discovering all relevant e-navigation and e-Maritime services, commercial and non-commercial, authorised and non-authorised, for free and against payment. The MSR can be seen as a sophisticated 'yellow pages' phone book of maritime services that can be searched for using a number of different criteria.
- **Maritime Messaging Service** (MMS) – for allowing authorised maritime stakeholders to send and receive messages in an efficient, reliable and seamless manner within the MCP. The MMS aims to mitigate limitations with regard to limited connectivity at sea and the use of various communication technologies.

The need for each component is described in more detail in the following subsections.

[1] The digital services implement the technical services as described by the IMO concept for implementing maritime services.

1.1 Maritime Identity Registry - Need for Authentication

The prerequisite for the digitisation of the maritime domain is a trustworthy provision of digital services for information exchange. For example, when a vessel approaches a port or waters controlled by a Vessel Traffic Services (VTS) centre it is dependent on receiving some information from them. However, it is not only important to receive the respective information, but also to verify from whom the respective information was sent and who the service is provided by. Otherwise, arbitrary participants could, for example, deliberately send out false information in order to disrupt the processes. In this case the recipient, would not be able to differentiate which information is the original and which is the falsified information. To solve this problem, the respective participants need be able to authenticate each other securely. In the paper world, authentication is done by a handwritten signature of the authorised person. In the digital world this is done by using digital certificates.

The MCP features - as one of its core components - an identity registry, where all entities that wish to exchange information are registered and have a digital certificate issued to them. Thus, a vessel registered with the MCP identity registry and having a digital certificate issued from it, can authenticate itself (prove its identity) to the VTS centre, and thus provide data to the VTS centre which the VTS centre can trust the origin of. The principle of authentication is a cornerstone in contemporary digital solutions.

1.2 Maritime Service Registry - Need for Service Discoverability

Exchange of information in the maritime world has traditionally been based on radio communication - where "discovery" of the service was simply a matter of being within range of the radio station and tuning into the right frequency. New digital solutions are however, predominately using the internet to facilitate information exchange and this presents a new challenge with regard to service discoverability. The internet is global, and a service on the internet can in principle be located anywhere in the world and accessible from anywhere in the world. Thus, a mechanism for discovering internet-based services is needed; for instance when a ship wishes to receive information from a VTS centre.

For this purpose, the MCP features a maritime service registry, where maritime stakeholders can register services for others to discover. It is possible to search for services in a flexible manner, including but not limited to, searching for services from a specific provider(s), services providing specific information and services covering specific geographical areas.

1.3 Maritime Messaging Service - Need for a Messaging Service

The maritime domain has certain specific challenges when it comes to data exchange between different entities in addition to authentication and service discoverability. These include the use of both IP (Internet Protocol) and non-IP based communication and the fact that some entities (primarily vessels) are mobile and often have poor and/or intermittent connectivity.

In order to facilitate efficient and reliable information exchange in the maritime domain, the MCP features a messaging service that supports seamless and carrier agnostic data exchange across IP and non-IP networks. The MMS also provides message queuing for use when connectivity is poor or unstable.

The MMS supports the use of VDES, including both terrestrial and satellite components.

2 GENERAL PRINCIPLES, RELATIONS TO OTHER STANDARDS AND GOVERNANCE

2.1 General Design Principles

The development of the MCP concept has been guided by the following principles:

Decentralisation: With an ambition that the MCP should be used for all kinds of data by all types of organisations globally, the MCP needs to be fully decentralised both for technical and political reasons. Thus, all components (MIR, MSR and MMS) will exist in multiple instances operated by different organisations around the world. In simple terms, this means there is no 'one' MCP. Rather any organisation may run their own incidence of the MCP as they see fit, yet the architecture of the MCP allows authentication, service discoverability and messaging to function across different MCP service providers.

Vendor independence: It must be possible to implement, run and maintain the MCP on various technical infrastructures without relying on any vendor specific or proprietary features.

Openness: The MCP must be open for all stakeholders and other interested parties in the maritime industry and beyond. It is a call to join forces and together take the industry into the digital era.

Non-profit governance: While MCP instances could and should be run by both private and public interests, based on different business models and incentives, it is of great importance that governance of the MCP concept itself maintains its not-for-profit character.

Service-oriented architecture: In the context of service-oriented architecture, a service usually refers to a set of related software functionalities that can be re-used for different purposes together with policies that govern and control its usage. The MCP embrace this definition but also envisage a much broader scope that includes services which do not rely solely on machine-to-machine communication, such as services delivered over telephone calls (voice or fax), email, websites, NAVTEX and other "primitive" solutions.

Proven technologies: The MCP concept relies on well-proven industry standard technologies, such as web-services, OpenID Connect, X.509 certificates, and the like, but will remain open for, and follow the development of, new and emerging technologies.

2.2 Relations to other maritime standards

The MCP is well aligned with other existing maritime standards - some of which have actually been derived from work done in relation with the MCP. Primary maritime standards / guidelines relating to the MCP include;

- G1128 The Specification of e-navigation technical services

  This IALA guideline describes how to create technical service specifications and these are aligned with the format of services registered in the MCP service registry

  G1128 was derived from work done on the MCP

- G1157 Web Service Based S-100 Data Exchange

  Describes how to create technical services following G1128 that uses web services (internet based)

- G1143 Unique identifiers for maritime resources (MRN)

  An IALA guideline that describes MRN unique identifiers which are used throughout MCP

  Like G1128, MRN was a "by-product" of the MCP development

- IEC 63173-2 SECOM – Secure exchange and communication of S-100 based products

  A standard that describes how to develop services that can deliver S-100 date to a vessel

  SECOM requires the existence of an identity registry and a service registry, i.e. MCP

  This standard is aligned with both G1128 and G1157

- IALA G1161 – Evaluation-of-Platforms-for-the-Provision-of-Maritime-Services

  An IALA guideline that explains the need for all the components of the MCP; identity registry, service registry and messaging service

- G1117 VHF Data Exchange System (VDES) overview

  Provides an overview of VDES which extends the Automatic Identification System (AIS) adding new technology. The use of MCP MMS in relation with VDES is described.

2.3 Governance - The MCP Consortium (MCC)

In order to govern the MCP, an international consortium – the Maritime Connectivity Platform Consortium (MCC) – has been established. The MCC is a neutral and independent entity that operates in a strictly not-for-profit and transparent way. The consortium has been structured in a similar way to the World Wide Web Consortium, and thus has a small number of host members and a larger number of regular members. All members form the General Assembly – the highest authority of the MCC – in which the host members have a right of veto. All host members are (and must be) not-for-profit organisations.

The MCC was established in 2019 by the following not-for-profit organisations (host members): The *General Lighthouse Authorities of UK and Ireland (GLA)*, the *Korea Research Institute of Ships and Ocean Engineering (KRISO)*, the *German Aerospace Centre (DLR) (former OFFIS), Research Institutes of Sweden (RISE)* and the *University of Copenhagen*. The *Danish Maritime Authority (DMA), Swedish Maritime Administration (SMA)* and the *Ministry of Ocean and Fisheries of the Republic of Korea (MOF)* joined the MCC as governmental observers.

In addition to this, an *Advisory Board* for the consortium has been established, which has representatives from relevant international organisations and associations.

The MCC undertakes the following activities:

- Developing and maintaining all standards associated with the MCP
- Defining criteria for being MCP service providers
- Endorsing organisations to be MCP service providers
- Facilitating root certification for the endorsed MCP identity service providers
- Developing and maintaining an open source MCP reference implementation
- Provides a public (free) MCP demonstrator, not for operational usage

The consortium encourages all relevant stakeholders (commercial and non-commercial) to join the Consortium and participate in the development, governance and promotion of the MCP.

3 FURTHER INFORMATION

The MCP consortium operates and maintains a webpage for the MCP, on which all information about the consortium itself and general MCP information including standards and information about MCP instance providers can be found. The webpage can be found at the URL: www.maritimeconnectivity.net