EFFICIENSEA
2.0 GETTING CONNECTED

D1.6
Recommendation on Governance and future perspectives for solutions

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Contents

1 Executive Summary

1.1 Background

The overall aim of the EfficienSea2 Project is to create and deploy innovative and smart solutions to provide improved connectivity. The solutions developed under the Project provide the basis for taking e-Navigation testbeds to full implementation. At the heart of those solutions is the communication framework provided by the Maritime Connectivity Platform (MCP) - formerly the Maritime Cloud - which connects all maritime stakeholders with maritime information services of all kinds. The MCP is comprised of an Identity Registry (providing secure identity management); a Service Registry (for registering, discovering and using services); and a Messaging Service (to exchange information between systems connected to the MCP).

1.2 Governance of the MCP

For simplicity, three models of governance have been considered: a State model, a company model and a partnership model. In considering the three alternatives, the most viable is the partnership model in some form. The exact details of a partnership arrangement will be an issue for the membership of such a partnership. Neither a fully commercial/business arrangement nor a State-run arrangement are, as far as can be seen at this stage of the MCP's development, to be practicable or viable. Whilst State involvement, including some financial support, may be forthcoming in the future and some commercial investment too, until the MCP is up and running and able to demonstrate its utility and viability, and thus attract users and providers of services, the arrangements for governance after the end of the EfficienSea2 Project will need to be based on a partnership: that partnership probably based initially on the membership and arrangements of the Project.

1.3 Business model

As above, three models have been considered: a public good service, a commercial service and some form of hybrid of the two. In considering the three alternative business models, and taking into account the reality of government policies globally and the related financial situation, unless a global commercial business sees an opportunity for profit from the services the MCP can provide, the most viable business model is the hybrid service model in some form. The exact details of such a hybrid service arrangement will be an issue for consideration between governments, providers and users of the MCP as it moves from a project to a continuing service. The key issue will be its sustainability, which will require funding, so it might be established as a non-profit, non-governmental organisation. The current project partners may wish to be involved in future operation of the MCP and new entrants might be attracted. The identification of contributors and investors in continuing operation to demonstrate the utility and viability of the MCP will define the exact hybrid arrangements.

1.4 Business case

A business case was developed by a team drawn from several partners in the Project: including CIRM, OFFIS, MDC, DMA, Chalmers and coordinated by IALA. A version of that business case, updated to include the outcome of the MCP Workshop held at IALA in November 2017, is included as an Annex to this report. It is provided for information and further development, rather than as part of a firm recommendation.

1.5   Implementation, legal and liability aspects

The MCP Workshop also considered implementation, including legal and liability aspects of implementation of the MCP. The issues identified have been included in summary form in Section 5 of the main report.

1.6   Future perspectives

1.6.1   Governance

An assumption throughout this deliverable has been that there will be a provider and operator of the MCP (its platform, maintenance, security, communications, registries, etc.); funding for its continued operation; and providers and users of services. It is assumed that the provision of value-added services to create market uptake will be the driver for the initial adoption of the MCP, not through regulatory action and mandatory requirements. The partnership governance model has been identified as the most likely way forward and might take many forms (consortium, joint venture, foundation, club, etc.) and be given any of those names but might include any stakeholder with an interest in the MCP. At the heart of the governance arrangements will be an agreement defining roles and responsibilities with financial, jurisdictional and liability issues all addressed.

1.6.2   Business model

The hybrid business model lies between a purely commercial business and a public good but where on that spectrum the future business model for the MCP might lie depends on a number of issues. A clear principle for the business model at least at the end of the project and at the outset of the MCP operation, is that it assumes that any costs will be covered by income (earned or granted) and that services will be provided (directly or indirectly) by a non-governmental, independent body on a not-for-profit basis. Looking further forward, there is a clear need to accurately forecast the likely level of use of the MCP (service providers and users) in order to determine the appropriate financial and operational arrangements. Without a forecast of the costs of demand and supply it will not be feasible to determine operating costs (infrastructure provision and support plus management of registries, etc.) and thus the quantum of cost recovery. How the recovery of costs might best be achieved (grants, fees, charges, etc.) will be a key issue for the governing body to determine. The gradual introduction of statutory services delivered via the MCP (e.g. navigational warnings), probably on a non cost-recovery basis, would assist in attracting users to the system and would allow them to become familiar with other MCP-based services. On the assumption that full funding is not provided on a grant or subsidy basis, some form of charging for services will be required. A myriad of options and alternatives might be considered by the governing body including: a fixed and/or recurring (e.g. monthly, annually) contract charge levied on providers and users of services registering on the MCP (i.e. a membership fee); a fixed and/or recurring charge for a particular service; and an ad hoc charge payable for the use of a particular (one-off) service instance. These arrangements may be achieved through separate business models for the identity registry, service registry and messaging service under an overarching partnership governance structure.

1.6.3   Challenges and opportunities

A 'top-down' approach through the relevant international bodies to mandate the use of the MCP is very unlikely to be successful as a technology-based system such as the MCP is likely to be constantly changing and improving which makes agreeing a standard difficult. Even if one was to be

agreed, it would inevitably be out-of-date before entry-into-force of the relevant Convention requirements. An approach with more likelihood of success in the international context is to target MCP services to those systems in use on board ships which complement the mandated equipment and services. Attracting providers of services to the leisure maritime market appears to be an avenue to pursue to encourage both service providers and service users – thus providing an income stream to work towards eventual sustainability.

1.7   Value proposition

- Here will be a summary of the value proposition work.

2 Background

Information exchange between ships and shore currently relies on costly and non-standardised solutions based on old technology resulting, amongst other things, in inefficiencies and administrative burdens. The overall aim of the EfficienSea2 Project is to address these challenges by creating and deploying innovative and smart solutions to provide improved connectivity. The solutions developed under the Project provide the basis for taking e-Navigation testbeds to full implementation. At the heart of the solutions is the communication framework provided by the Maritime Connectivity Platform (MCP) - formerly the Maritime Cloud - which connects all maritime stakeholders with maritime information services of all kinds.

The MCP is comprised of an Identity Registry (providing secure identity management); a Service Registry (for registering, discovering and using services); and a Messaging Service (to exchange information between systems connected to the MCP). The EfficienSea2 project has collaborated with the STM Validation project (EU) and the SMART Navigation project (Korea) in the development of the MCP. The EfficienSea2 project have been the primary driver in the development of the Maritime Identity Register (MIR) and the Maritime Service Register (MSR), whereas the SMART Navigation project is the main driver in the development of the Maritime Messaging Service (MMS). The STM Validation project is mainly conducting large scale testing and validation of the MCP, and providing invaluable feedback from this.

The 32 EfficienSea2 Project partners have contributed to the various solutions and testbeds related to the MCP but to gain the full benefits of the work done arrangements have to be made to implement the Project deliverables on a sustainable basis. This deliverable reviews possible ways forward and makes recommendations on Governance and Business Models, taking into account strategic/political, legal and financial issues (Task 1.4), including future perspectives linked to other related on-going projects (STM, SMART).

2.1 Governance

In order to make any recommendations on future governance of the MCP, some generic examples of governance arrangements are considered. The number of examples is limited and they are intended to provide a 'direction of travel' rather than concrete examples to be strictly followed. In identifying the models a working definition of governance and some working assumptions have been used. The working definition of governance in the context of this deliverable is: The oversight, administration and control of the MCP - but not its operation.

2.2 Working assumptions

To put the future governance of the MCP into context after the end of the Project, some working assumptions have been made. As it is critical to the future operation of the MCP it is assumed that funding will be available. It is also assumed that there will be a provider and operator of the MCP (i.e. its platform, maintenance, security, communications, registries, etc.); providers of services for the MCP and users of those services.

2.3   Governance models

For simplicity, three models of governance are described: a State model, a company model and a partnership model. Clearly there are other models or combinations of models that might have been identified but the three chosen are intended to provide generic descriptions to aid further consideration and discussion of a recommendation. See Table 1.

Table 1: Governance Models

No.	Model	Description
1	State Model	Regulated according to the law or a legally binding arrangement with State involvement
2	Company Model	A written constitution or articles of association Ownership by 'shareholders' and investors A Board of elected or appointed members with duties and responsibilities for strategic direction and oversight An executive that is responsible for operations
3	Partnership Model	An agreement between members Ownership by members Oversight by a group of those members Members responsible for operations

2.4   Consideration of governance for the MCP

Before considering a recommendation based on the models identified in Table 1 above, it is instructive to consider the current governance arrangements under the Project. Although one of the Project partners (DMA – a State institution funded by a government) is providing and operating the MCP it cannot be said to be governing fully as it relies to some degree on cooperation with other project partners. Together with 32 partners, DMA has obtained funding from the European Union's Horizon 2020 program for the project. The funding has been granted under a Grant Agreement entered into between DMA as coordinator and beneficiary, the 32 partners as beneficiaries, and the European Commission Innovation and Networks Executive Agency (the Agency) as grantor.

The beneficiaries have further entered into a Consortium Agreement governing the coordination of the work to be carried out as part of the EfficienSea2 project. The governance structure for the project

consists of a General Assembly (GA) and an Executive Board (the Board). The Board consists of between five and seven members appointed by the GA on the basis of DMA's proposals. The GA makes decisions about the development of the project and the consortium, while the Board implements the decisions and ensures that the project is implemented. It might be argued that, taking the funding arrangements into account, the current governance is comprised of elements of all the models described above. While the current arrangements might be appropriate in a time-limited project, it is not sustainable longer term, particularly when funding issues are considered.

2.4.1   State model

From a theoretical perspective, a State (or group of States) might govern the MCP through a regulatory framework under their national legislation(s) or an international agreement. The organizational, technical, operational, legal and financial provisions might be prescribed and the service to users provided as a 'public good' similar to the provision of safety radio services. On a more practical level, this is considered an unlikely scenario, particularly in view of current government funding policies and priorities worldwide; the likely negative effect on global take-up if only a limited number of States is involved; and possible negative effects on innovation and standardization. The pure State model is, therefore, not considered further.

2.4.2   Company model

The company model aims to describe the governance operations of a commercial organization. Whilst the MCP will have to secure funding to ensure sustainability it is unlikely to attract investors (shareholders) seeking a financial return. The identification and engagement of a Chairman and Board of Directors to oversee an executive that operates the MCP would be problematic without securing funding and investment from shareholders. A governance arrangement based on the company model, that is a purely profit-making commercial business arrangement is, therefore, impractical and not considered further. In the longer term, a purely commercial arrangement could be envisaged if the MCP demonstrates its commercial viability through extensive global take-up of its services. Commercial and funding issues are, however, considered in more detail in the related business cases.

2.4.3   Partnership model

The partnership model is an arrangement with elements similar to that which governs the Project. Future governance of the MCP based on a partnership arrangement might be based on an agreement in which ownership is by its members (effectively shareholders), oversight of operations and policy is by some or all of those members with members themselves responsible for operations, either directly or through some other enterprise, with the aim of providing a sustainable service.

2.5   Way forward

In considering the three broad alternative arrangements for governance of the MCP, the most viable is the partnership model in some form. The exact details of a partnership arrangement will be an issue for the membership of such a partnership. The two broad alternatives: fully commercial/business or State-run are not, as far as can be seen at this stage of the Cloud's development, to be practicable or viable. Whilst State involvement, including some financial support, may be forthcoming in the future and some commercial investment too, until the MCP is up and running and able to demonstrate its utility and viability, and thus attract users and providers of

services, the arrangements for governance after the end of the EfficienSea2 Project will need to be based on a partnership: that partnership probably based on the membership and arrangements of the Project and be carried over into the other associated projects (STM and SMART).

3 Business model

In order to make any recommendations on the future business arrangements for the MCP, some generic examples are considered. The number of examples is limited as for the governance model and, as above, they are intended to provide a 'direction of travel'. In identifying the models a working definition and some working assumptions have been used. The working definition of business model in the context of the project deliverable is: A plan or framework for the successful (sustainable) operation of the MCP. So this is not a business plan.

3.1 Working assumptions

As with discussion on the governance arrangements above, it is assumed that funding will be available after the end of the project. It is also assumed that there will be a provider and operator of the MCP (i.e. its platform, maintenance, security, communications, registries, etc.); providers of services for the MCP and users of those services. Some possible arrangements on how the MCP might be established and operated in the future are considered below.

3.2 Business models

For simplicity, three business models are described: a public good service, a commercial service and a hybrid service, the latter lies somewhere between the two ends of the spectrum represented by the other two models. The exact definition of any future hybrid service will depend on the levels of involvement and investment by the providers and operators of the MCP and the interest of its users. As above, the three models are generic descriptions to aid further consideration and discussion of a recommendation. See Table 2.

3.3 Consideration of a business model for the MCP

In the context of making a recommendation on the deliverable of future perspectives of solutions, the term business model is used in broad terms to describe how the MCP's core purpose might best be delivered through its organizational structure, trading practices, operational processes and policies. The model also aims to take into account social and cultural contexts. As a technology-based service, some consideration of other such services in both the general marketplace and in the maritime world is also appropriate.

Table 2: Business Models

Number	Model	Description
1	Public good service	Access for providers and users of services free of charge. State funding support or subsidy. No commercial activity.
2	Commercial service	Access for providers and users of statutory services on a cost-recovery basis. Providers of value-added or any other services charged at commercial rates for access to the MCP.

		Users pay providers at commercial rates
3	Hybrid service	Access for providers and users of statutory services free of charge or at minimal cost. Providers of value-added services charged at a cost commensurate with commercial viability (sustainability) Users pay providers at commercial rates

3.3.1 Public good service

In the context of the project, the term 'public good' is used in its general sense as something useful for the public generally and as a benefit to be shared by society, free of charge to the user. In the maritime context, freely available weather forecasts and warnings are analogous. The MCP as a public good service assumes that access to it for providers and users of services are free of charge to them through some State funding or other subsidy of operating and management costs. As the service is provided free to users, no commercial activity is involved and no financial gain (profit) available to the operators of the MCP or the providers of services.

3.3.2 Commercial service

A commercial service would aim to make a profit for owners and operators or, at least, to make sufficient income to cover costs of operation, maintenance and investment to ensure on-going operation. A commercial service might consider providing access for providers and users of statutory services (public good services) on a cost-recovery basis as a method of attracting users and ensuring a break-even on running costs. A fully commercial MCP would charge for access at commercial rates to gain a profit from providers of value-added or other services and might also gain income from providing a service such that users pay providers at commercial rates. A commercially-operated MCP would be a technology-based information access profit-making business.

3.3.3 Hybrid service

Somewhere between the extremes of a public good and a profit-making business lies some form of hybrid model. Such a model would have elements of both. Access to the MCP for users of statutory services might be free of charge with providers of such services also gaining access without charge or alternatively contributing to running costs through some marginal or minimal payment. As the MCP aims to provide value-added services, providers of those services might be charged at a cost commensurate with operational viability and sustainability: sufficient to cover operating and maintenance costs. Depending on how the initial infrastructure investment is to be provided or financed, some contribution to replacement costs might also be charged. As a provider of a technology-based information access system but not of the services themselves, the MCP service users might pay service providers at commercial rates.

3.4   Way forward

In considering the three broad alternative business models for the MCP, and taking into account the reality of government policies globally and the related financial situation, unless a global commercial

business sees an opportunity for profit from the services the MCP can provide, the most viable business model is the hybrid service model in some form. The exact details of such a hybrid service arrangement will be an issue for consideration between governments, providers and users of the MCP as it moves from a project to a continuing service. The key issue will be its sustainability, which will require funding, so it might be established as a non-profit, non-governmental organisation. The current project partners may wish to be involved in future operation of the MCP and new entrants might be attracted. The identification of contributors and investors in continuing operation to demonstrate the utility and viability of the MCP will define the exact hybrid arrangements. Further consideration of a possible hybrid model is given below.

4 Future perspectives

This deliverable (D1.6) aims to make a recommendation on governance and also to address future perspectives of solutions. A sub-task of this work (1.4) is to work with strategic, political, legal and financial issues in bringing the MCP to market, including identifying possible governance and business models. To address future perspectives, consideration also has to be given to organizational, technical and operational issues including those related to the international maritime environment. Many of these issues will also form part of the complementary business case. An assumption throughout this deliverable has been that there will be a provider and operator of the MCP (its platform, maintenance, security, communications, registries, etc.); funding for its continued operation; and providers and users of services. Some possible future perspectives on how this assumption might be met are considered below based on the ways forward identified for both governance and business models. It is assumed that the provision of value-added services to create market uptake will be the driver for the initial adoption of the MCP, not through regulatory action and mandatory requirements.

4.1 The partnership governance model

The partnership governance model has been identified as the most likely way forward. The arrangements for establishing that model and how it might work are further considered below. The partnership might take many forms (consortium, joint venture, foundation, club, etc.) and be given any of those names but might include any stakeholder with an interest in the MCP. At the heart of the governance arrangements will be an agreement defining roles and responsibilities with financial, jurisdictional and liability issues all addressed.

4.1.1 Stakeholders/membership

As noted above, the EfficienSea2 Project is a consortium of 32 partners. The individual members of the consortium, comprised of interested parties representing the shipping industry, governments, academia, equipment manufacturers and NGOs, are all stakeholders with an interest in the project and in its outcome. Any future governance partnership, particularly in the short to medium term (from 2 to 5 years after the end of the project), would be best comprised of interested project members, strengthened, where appropriate, with additional stakeholders able to bring significant support, funding or synergies. Expressions of interest from potential members of a future governing body should be obtained in advance of the end of the project.

EfficienSea2 is not the only research project aiming to implement the features of the IMO e-navigation strategy and to enhance safety at sea. Two related projects: the Sea Traffic Management (STM) validation project and SMART-Navigation (SMART) provide complementary facilities and services. In considering a sustainable MCP, the synergies with these two projects, which will continue after the end of the EfficienSea2 project, are important. The MCP Development Forum (MCPDF) has been established to coordinate various initiatives (including these projects) and seeks to ensure adoption of a set of international standards and guidelines, a technical operational infrastructure, a governance structure and an organizational framework.

4.1.2 Organizational/legal framework

Using the project governance arrangements as a basis (i.e. a General Assembly of all consortium members and an executive Board comprised of an agreed number of consortium members) a similar governance arrangement for the MCP in the short term is suggested. This governing body might be termed a 'foundation' if the MCPDF membership is included or a 'consortium' if some or all of the original project partners are involved. The body would best be established as an independent non-profit organization governed by its executive board under the law of one European member country. It should establish an agreement or charter setting out its purpose, powers, procedures and terms of membership and appointment. By law, its activities will be limited to applying its funds and assets in accordance with its purpose: the provision and operation of the MCP.

4.1.3 Roles and responsibilities

The governing body will be responsible for providing strategic leadership and oversight, which includes assurance of the provision of secure, high quality and reliable services and financial accountability. To assure efficient, secure, reliable and seamless electronic information exchange between service providers and all authorized maritime stakeholders the governing body will establish the requirements for access to the registries and closely monitor operation of all the core components of the MCP. Whilst the MCP will initially address systems that are not part of the international mandatory carriage requirements, the governing body will work towards extending its scope to address services required by international regulation.

4.2 The hybrid business model

The hybrid business model lies between a purely commercial business and a public good. Where on that spectrum the business model for the MCP should lie depends on a number of issues, which are discussed in more detail below. A clear principle for the business model at least at the end of the project and at the outset of the MCP operation, is that it assumes that any costs will be covered by income (earned or granted) and that services will be provided (directly or indirectly) by a non-governmental, independent body on a not-for-profit basis. See Figure 1.
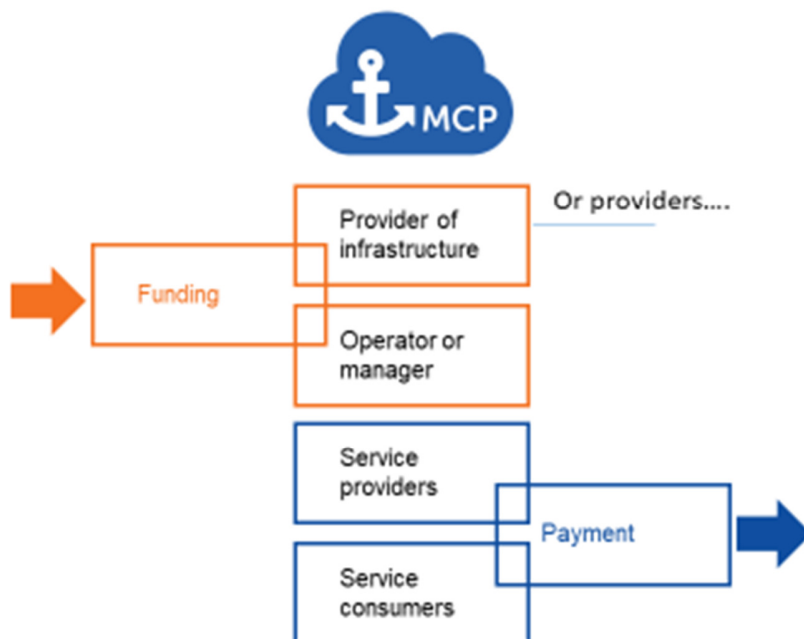
Figure 1. The hybrid business model.

4.2.1 Sustainability and funding

Although the annual basic cost of providing the MCP is not anticipated to be very high (hardware, software, maintenance, etc.), nevertheless funding has to be identified and secured to ensure not only initial provision but a reliable, accessible and sustainable platform for the delivery of services. That funding might be in the form of grants (from government(s), research institute(s), stakeholders or industry) or income from charges for access to the MCP or a combination of sources. At the end of project funding, some guarantees or pledges of future funding (short or medium term) will be required from stakeholders if a viable MCP service is to be maintained, even if only on a limited service or geographical basis.

Looking further forward from the transition from the provision of services via a project-supported MCP to services provided by an independent, non-governmental body with its own governance and business model, there is a clear need to accurately forecast the likely level of use of the MCP (service providers and users) in order to determine the appropriate financial and operational arrangements. Without a forecast of the costs of demand and supply it will not be feasible to determine operating costs (infrastructure provision and support plus management of registries, etc.) and thus the quantum of cost recovery. How the recovery of costs might best be achieved (grants, fees, charges, etc.) will be a key issue for the governing body to determine.

One possible business model scenario is for the MCP's key components: the identity register, service register and messaging service to be run independently by providers having their own defined

business objectives under the auspices of a governing body. These options are considered in more detail in Annex 1.

4.2.2 Statutory and non-statutory services

It has been suggested that the advent of MCP services should be aimed at non-statutory services (i.e. value-added services or new services not required by national or international regulations) and/or at maritime users that are outside international mandatory requirements (e.g. inshore craft, leisure craft users, etc.). This method of introduction of the MCP has some merits as it allows systems to be used and tested without having to gain international agreement under relevant conventions. It also allows for updating and revision of services on a timely basis. The gradual introduction of statutory services delivered via the MCP (e.g. navigational warnings), probably on a non cost-recovery basis, would assist in attracting users to the system and would allow them to become familiar with other MCP-based services.

4.2.3 Charging methodology

On the assumption that full funding is not provided on a grant or subsidy basis, some form of charging for services will be required. A myriad of options and alternatives might be considered by the governing body but they can be broadly categorized into 3 possible streams of revenue: a fixed and/or recurring (e.g. monthly, annually) contract charge levied on providers and users of services registering on the MCP (i.e. a membership fee); a fixed and/or recurring charge for a particular service; and an ad hoc charge payable for the use of a particular (one-off) service instance. These options are considered in more detail in the Business Case at Annex 1

4.2.4 Utility and viability

The services delivered via the MCP have to be useful, accessible and sustainable. A key element in gaining acceptance will be take-up by industry (shipping, ports, etc.) and authorities (Governments, responsible authorities (SAR services, MET services, etc.)). Opportunities exist for the provision of services via the MCP that are also provided in other ways: weather forecasts and navigational warnings are good examples. Any additional costs for providers of such services is likely to be marginal. Some enhancement of the utility and viability of such services will probably be required to encourage service users.

The use of the MCP for reducing the administrative burden on both ships' staff and shore authorities is an area that probably offers advantages and might provide an avenue for encouraging additional use of the MCP. The automated updating of information without human involvement and the provision of reliable information to and from ships and shore through integration of systems offers worthwhile benefits to all.

5   Implementation

There are many variables to consider in moving from a Project-based MCP to a sustainable, operational MCP, some of which are identified in Table 3.

MCP realization roadmap // Type of challenge	Short term 1-2 years	Medium Term 2-5 years	Long term 5+ years
Financial	Find money/secure funding	Governments	Industry Organizations Companies
Management	Establish final business and governance models Consider private entity Develop a communication plan Define and introduce a foundation for governance (legal/board responsibility taken)	MCP supported by internationally recognized body (ITU, IMO,…) Ensure maintenance and continuous innovation of the MCP	Establishment of self-sustaining community
Operations		Contract MSR and MIR suppliers	
Technical	Get the 'killer apps' up and coming Securing the communication systems in place (technical level VDES etc.) Experts, professionals, technologies, processes in place	Structure and platform in place	Services and security systems
Market	Dissemination activities (conferences, workshops, papers…) Get MIR up and running with relevant processes for adaptation in the market MCP awareness - in the market and sell the MCP	Existence on the market Commercial VDES equipment available	
Implementation issues		Validation and integrity measures implemented in MCP - enforced by a high-level group/governance	

MCP realization roadmap // Type of challenge	Short term 1-2 years	Medium Term 2-5 years	Long term 5+ years
Strategic challenges	Business model included in reports by the project consortium, how are we on the targets (financially)		Existing international legislation, recommendations Implementation of ITU Recommendations on MIR (in 10 years)
Provider value		Populate the service registry by a new project (funded by EU or privately)	
User value			

Table 3: MCP realization roadmap

(This table was prepared at the MCP Workshop held at IALA in November 2017 and should be seen as the basis for future development.)

5.1   Legal and liability aspects

The transition to a post-project governance structure is not considered to be problematic based on the work done to date and the anticipated way forward. The intellectual property rights supporting the MCP are open-source based so there are no apparent issues for continued development and operation of the MCP. Trademark rights should be registered for the relevant trademarks used by the MCP (logo, name, etc.) and relevant domain names also registered.

5.2   Ownership of MCP

The 'ownership' of the MCP will depend on the chosen governance model, that 'governing entity' will be responsible for providing and maintaining the standards at the MIR and MSR level while the root certificate is anticipated to fall under the ITU. Local entities, perhaps acting on a regional, national or local basis may develop and maintain instances of the MIR and MSR, subject to meeting the terms and requirements of the governing entity. Establishment of national instances of both MIR and MSR may be necessary for some governments to adopt the MCP. The relationships between the governing entity, local entities and service providers and consumers are illustrated in Figure 2 below, with a dashed line indicating a federation of identity registers.
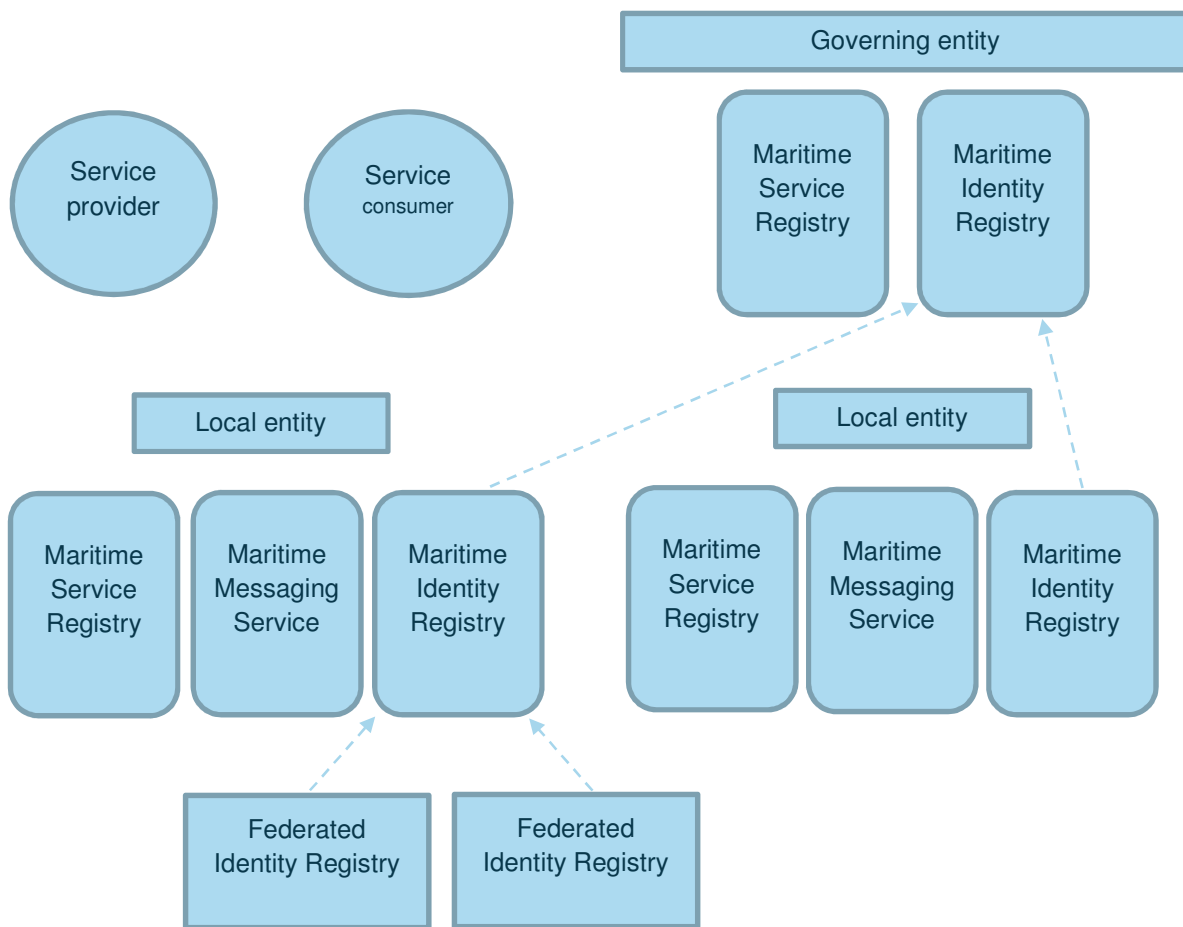
Figure 2. Relationships between entities, service providers and users

5.3   Legal relationships

The legal relationships, including rights, obligations and potential liabilities between the various entities will depend on the governance structure and business model finally adopted by the MCP but may exist between: service providers and service users and the governance entity, local entities and local entities responsible for the federated identity registries as well as between the governance entity, the local entities and the entities responsible for the federated identity registries.

5.3.1   Liabilities

It is anticipated that the governing entity's liability towards service providers and users for the use of both MIR and MSR would be limited as the providers and users would be required to accept the governing entity's terms of use when registering in a MIR. To the extent that liability is accepted for the MIR, suitable insurance would be required. The terms of use should contain a choice of law clause to ensure legal certainty with respect to liability and therefore enable the MCP to function across jurisdictions. The terms of use and the choice of law should be thoroughly tested for validity under the laws of different jurisdictions.

Disruption to service providers or service consumers' commercial (or statutory) operations may, in turn, cause losses for third parties not directly using the MCP. This might be caused by a failure of the

governing entity with respect to MIR and MSR standards but such an event is not expected to make the entity liable to third parties for loss or damage incurred in this regard.

5.3.2   Local entity liabilities

To ensure that local entities operating MIR and MSR manage their activities safely, securely and efficiently they should meet standards set by the governing entity. If a business model is adopted whereby service providers and users contract directly with local entities for the use of MIR and MSR, suitable terms of use should be established. Alternatively, and possibly preferably, service providers and users should contract with only the governing entity for the use of MIR, MSR and MMS so that contractual liabilities will not arise with local entities, even if some of the functions and services are not provided by the governing entity but by the local entities. For federated identity registries with elements provided by other external registries, it will be that external registry that is liable for authentication failures, etc.

5.3.3   Data liability issues

Local entities providing MMS may potentially be subject to criminal liability for transmitted information. The liability can be mitigated by having service providers and users provide indemnities (under the terms of use) for any liability (criminal or civil) arising due to the information they transmit.

The situation with respect to logging of data and activities is unclear. Relevant regulation may require the governing or local entities to maintain records of activities in the MIR, MSR and MMS. For commercial reasons in respect of payment to or by service providers and users some recording of data is anticipated. Some or all of these activities are likely to be the subject of data protection regulation. Although the governing entity is unlikely to be involved in the storage of sensitive data, local entities providing MIR functions and entities responsible for federated registries may be subject to data protection regulation, as they will potentially be storing sensitive information. The same applies for local entities providing MMS functions. The position regarding security certificates is unclear in view of the fact that the MCP does not store sensitive data. Location based contracts might be set up with agreed availability and performance metrics to verify system performance.

6   International context

As noted in the discussion above, the MCP has the possibility to deliver services of many types to many users, in restricted geographical area(s) or globally. Those services can be broadly described as statutory or non-statutory, i.e. those that are regulated through international agreements and others – although this simplifies the situation to ease consideration of the relevant issues. The international context, where standards are prescribed internationally by IMO, IEC and others, relate chiefly to the world's merchant fleet and fishing fleet, although the many and complicated provisions have a myriad of applicability provisions based on size, area of operation, ship type, etc., etc. In some instances, the users of craft that go to sea for purely leisure purposes are also affected (radio, LSA, etc.) by Convention requirements. Identifying the international context is, therefore, problematic but some general conclusions may be reached, as discussed below.

The importance of adoption of the MCP internationally has been recognized and standardization through ITU and other international bodies is considered in a separate document (D1.21).

6.1   Convention requirements

For the purpose of discussion, the SOLAS Convention requirements are considered, particularly those related to safety of navigation – an area that the MCP aims to enhance. The IEC, ISO and other standards which apply to ship and shore equipment are also relevant to the MCP but are not considered further. Ship's equipment is highly regulated, not only in carriage requirements for different ships but also in the performance that is required. Highly regulated systems such as Radar, ECDIS and GMDSS radio have been developed over time and their improvement and enhancement subject to international agreement. The MCP might supplement the provisions and services they provide to the navigator but any form of integration with the MCP would require international agreement on the basis of international standards and proven benefits.

6.1.1   Challenges

A 'top-down' approach through the relevant international bodies to mandate the use of the MCP is very unlikely to be successful for a number of reasons, including the fact that a technology-based system such as the MCP is likely to be constantly changing and improving (as is seen in regular updates to computer operating systems, applications, etc.) which makes agreeing a standard difficult. Even if one was to be agreed, it would inevitably be out-of-date before entry-into-force of the relevant Convention requirements.

At least one element of the work being undertaken in the project: a demonstration of a VHF Data Exchange System (VDES), will support the IMO e-Navigation initiative and aims to provide robust ship-to-ship and ship-to-shore communications supporting safety, security and SAR operations. Whilst a prototype has been developed and tested under the Project, some channel allocation conflicts will delay potential use of VDES. Even with a 'fair wind' in the relevant international bodies (IMO, ITU, IEC, WRC, etc.) it is unlikely that operational capability can be established before 2019/20. Full capability with a satellite service is not anticipated until after 2021, which demonstrates the difficulty of establishing new mandatory systems and facilities like the MCP on an international basis

6.1.2 Opportunities

An approach with more likelihood of success in the international context is to target MCP services to those systems in use on board ships which complement the mandated equipment and services. Areas such as route planning, reporting, and value-added elements to statutory provisions (e.g. enhanced weather information display, information transfer, etc.) are areas which offer opportunities for MCP based services of interest to the international fleet.

Services provided by the MCP may also be of interest to the leisure maritime users whose craft do not carry the range and depth of equipment required by international conventions but which nevertheless have a requirement for similar information for safety of navigation purposes. Attracting providers of services to the leisure maritime market - be they safety services or purely information services – appears to be an avenue to pursue to encourage both service providers and service users. Simple and effective services developed for one market might soon be taken up by others (local workboats, offshore operators, etc.) – thus providing an income stream to work towards eventual sustainability.

7   Conclusions regarding governance

The MCP aims to connect all maritime stakeholders with maritime information services of all kinds. The solutions developed under the Project provide for improved connectivity and support the implementation of e-Navigation. In order to gain the full benefits of the work done, the Project deliverables need to be implemented on a sustainable basis. Without either mandatory implementation of the MCP internationally through the relevant bodies or a commercial provider of the services underpinning the MCP (registries, messaging service, etc.) to ensure that sustainability, its full potential may remain elusive. The ways forward for future governance and business models described above are considered to be the most realistic solutions to finding that sustainability taking into account strategic/political, legal and financial issues involved. The development of the MCP outside the Project but in support of other related on-going projects (STM, SMART) is almost certainly necessary to underpin its future.

8   Recommendations regarding governance

It is recommended that the arrangements for governance after the end of the EfficienSea2 Project be based on a partnership: that partnership probably based on some or all of the members of the Project, supplemented as necessary by others, including commercial companies where possible. It is recommended that a hybrid business model, that is one that lies between a purely commercial business and a public good, would be the most likely to succeed if an appropriate balance between the two can be identified and established. It is also recommended that close links to other related international projects be identified, developed and strengthened before the end of the Project, in order to allow development to continue, where needed, and effective implementation demonstrated to encourage service providers and users.

9 The value propositions and challenges of Maritime Connectivity Platform

Maritime Connectivity Platform (MCP) has been developed in order to take connectivity and information sharing to another level in the maritime industry. The MCP will enable authorized maritime stakeholder to connect across various available information systems. Further it encompasses the possibility to use interoperable services and standards ensuring a secure and seamless information exchange.

The MCP uses a Service-Oriented Architecture making it a solution comparable with a Yellow-phone book with authentication mechanisms. The MCP consists of a number of components. The most essential being the Identity Registry (IR) and the Service Registry (SR). The SR is a list of the services available through the MCP. The IR keeps track of all units and users communicating via the MCP. A number of options exists for federating user access in order to speed up the implementation process.

Service Providers (SP's) can publish service protocols and/or specifications on the MCP. Equipment Manufacturers (EM's) can enable MCP in their systems and integrate them in the equipment's specifications. Service consumers (SC's), for example seafarers, shipping companies, port authorities and agents, can discover the services offered on the MCP and develop/utilize suitable solutions.

Figure 3. The architecture of the MCP.

With the intention to use the MCP as a worldwide communication infrastructure for the maritime domain, it is imperative to explore the users' perception about the challenges and barriers for its development and further mass utilization.

The below referenced study carried out by Chalmers University, aims to explore the business potential and value propositions of the MCP.

10   Process of involvement

In order to unveil how the stakeholders can get value from the MCP a number of focus groups where established during June-August 2017 in Copenhagen. Namely:

- o Ship-owners (service consumers, SC), consisting of 4 representatives
- o Service providers (SP), represented by 5 people from different companies
- o Equipment manufacturers (EM), represented by people from 4 different companies

In addition, a questionnaire was sent 26 delegates from maritime authorities and organization as well as to another 18 delegated from relevant maritime associations and organizations. Both groups also took part of a workshop about the topic in Paris, November 2017.

The process ensured detailed and qualitative input from the SC, SP and EM groups and well as quantitative input from a relatively high number of authorities and other relevant organizations.
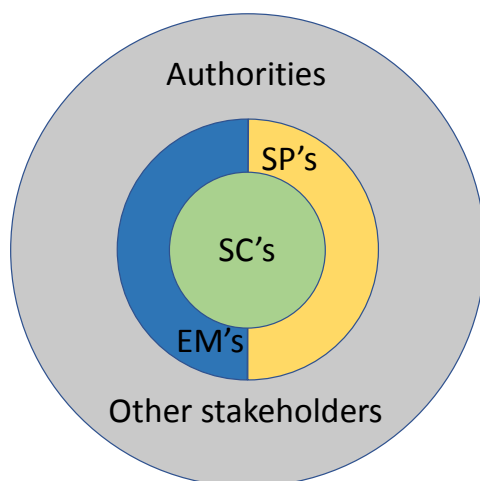
Figure 4. The composition of the participants.

The various stakeholders relations to each other can be illustrated as in figure 4. In the center you can find the SC's, consisting of e.g. personnel on-board vessels, shipping companies, VTS stations, port authorities etc. In the next layer you will find the SP's and EM's. The EM's produce equipment, typically for vessels, with software and interfaces enabling the MCP. The SP's will be the various arrays of providers of maritime services, ranging from publication of nautical charts, navigational warnings to reporting systems and onboard system monitoring services - to name some examples. In the outer circle you find all other relevant stakeholder influencing the developing and the frameworks for the MCP to operate in. This could be flag and coastal states, the IMO as well as research or other relevant international organizations.

The process of involvement was handled by Chalmers University in Gothenburg and lived up to the high academic standards for research.

10.1 Group interviews

The below highlights some of the output from the group interviews.

10.1.1 SC's

The service consumers, based on input from ship-owner representatives, had the following business objectives.

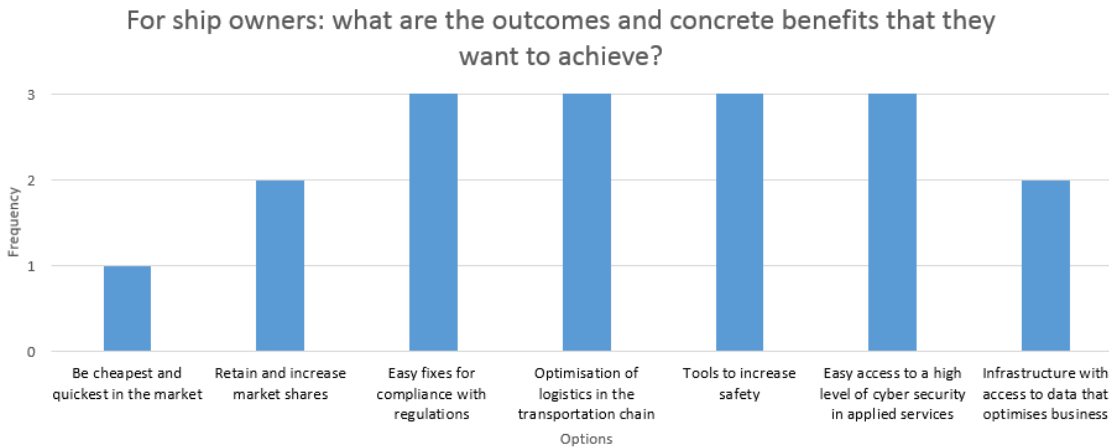**For ship owners: what are the outcomes and concrete benefits that they want to achieve?**

Figure 5. Goals of the ship owners.

Thus, the aspects regarding safety, compliance, optimization and high level of cyber security were in focus. Cost was rated lower in this context.

When it came to the questions regarding obstacles for SC's, one of the most mentioned was the administrative burdens and the difference in reporting formats.As a clear answer to these challenges and obstacles, the expected benefits from the MCP are highlighted below in figure 6.

For ship owners: How do MCP products and services create gains to them? How important and relevant the MCP means to them?
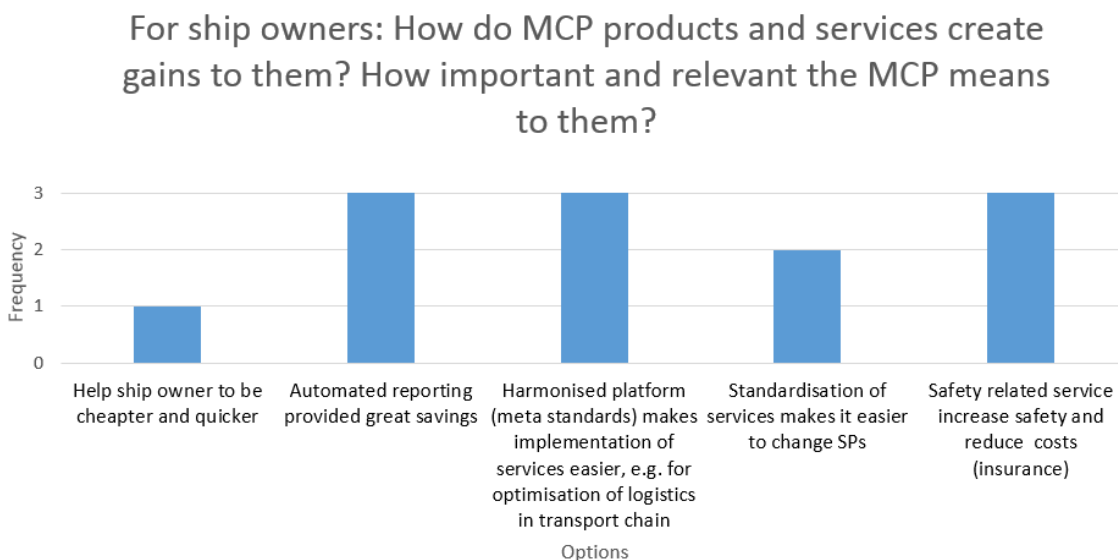
Figure 6. Desired benefits via the use of MCP for the ship owners.

Namely automated reporting features as well as safety related services adding to the general level of safety. Further harmonization in terms of protocols and interfaces were also highlighted.
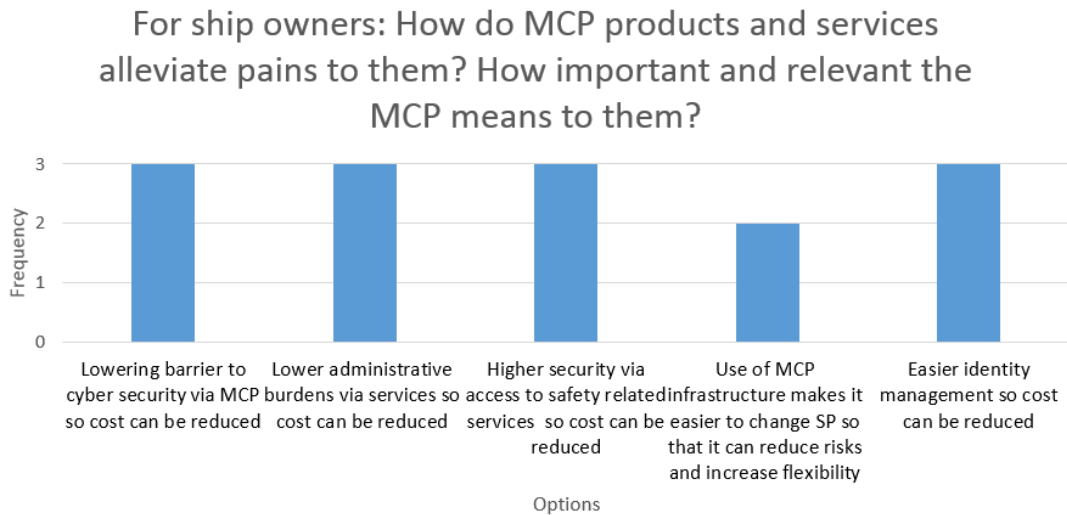
For ship owners: How do MCP products and services alleviate pains to them? How important and relevant the MCP means to them?

Figure 7. Expected alleviated pains via the use of MCP for the ship owners.

For relieving the SC's pains, most topics were highly rated, e.g. making it easier to have a high level of cyber security, and again lower level of administrative burdens.

10.1.2 SP's
When asked how the MCP could be relevant for the service providers, most of them saw a benefit in the standardized approach - making the access to market easier and simpler.

For service providers: How do MCP products and services create gains for them? How important and relevant it means to them?
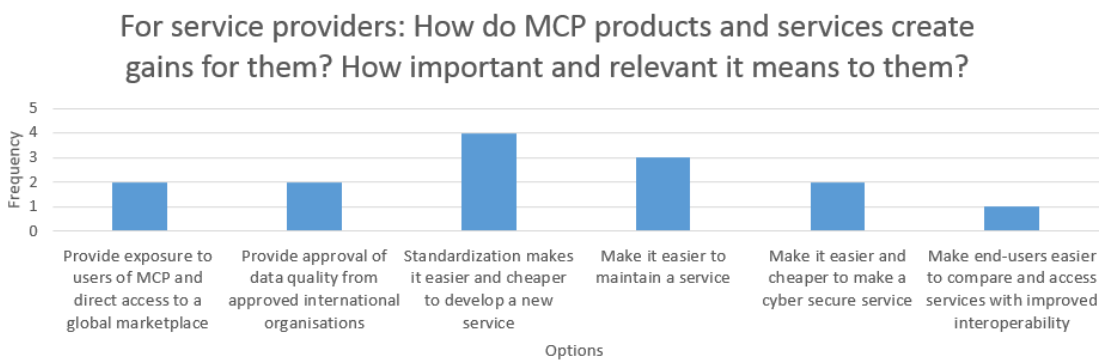
Figure 8. Desired benefits via the use of MCP for the service providers.

When asked which pains the MCP could mitigate, the handling of user identification was highlighted. Meanwhile saving costs and resources in development for the SP's were also accentuated again.

10.1.3 EM's
When it came to the EM's, they were amongst other asked about the obstacles associated with the jobs. They came with the following responses.

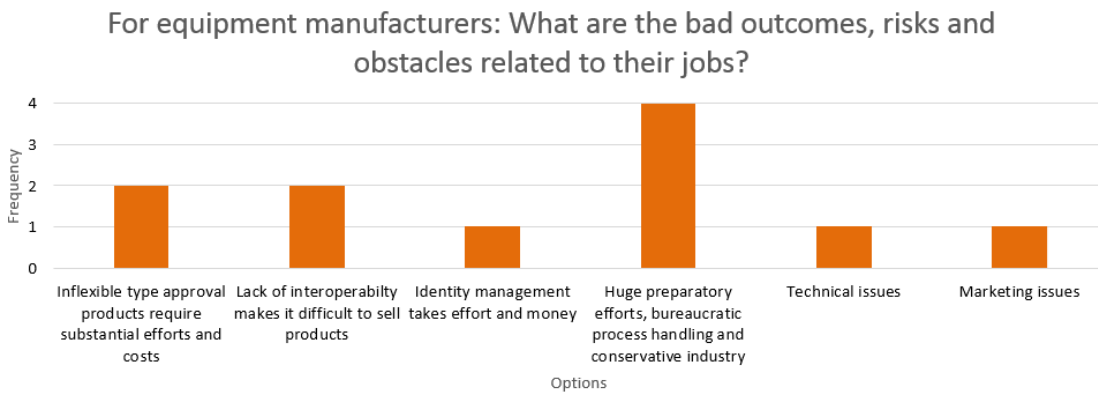**For equipment manufacturers: What are the bad outcomes, risks and obstacles related to their jobs?**

Figure 9. Undesired risks and outcomes for the equipment manufacturers.

As can be seen, they agreed that the processes of bringing new solutions to the market often face huge efforts, partially due to the bureaucratic procedures and conservative maritime industry as a whole.

When it came to the benefits of the MCP, the replies were more subtle.

For equipment manufacturers: How do MCP products and services create gains for them? How important and relevant it means to them?
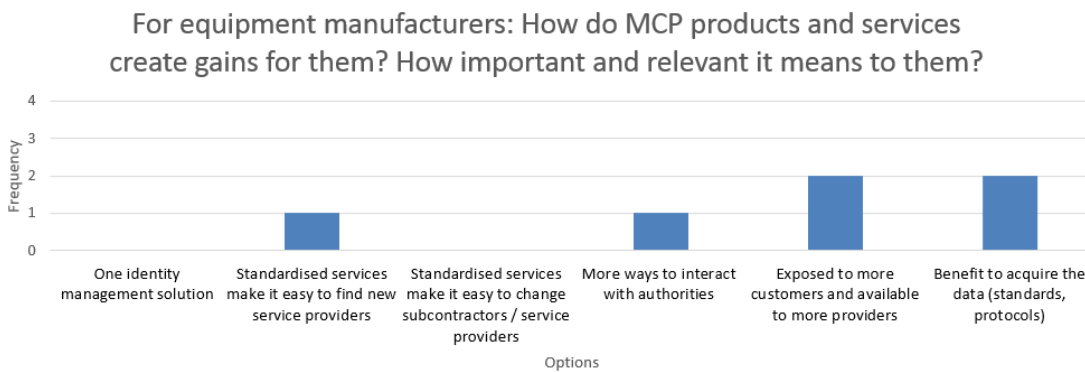
Figure 10. Desired benefits via the use of MCP for the equipment manufacturers.

Notably is the absence of having identity solutions and standardized services. The most important were the exposure to new market segment and to benefit by analyzing relevant data based on standardized protocols.

10.2   Questionnaires from the workshop

Below, the general output and finding of the questionnaire from the workshop for authorities and organizations are highlighted.

The participants highlight the importance of:

- Interoperability of systems
- The systems and protocols are standardized
- Higher level of cyber security
- Handling of user identities

Whereas the following was marked as less important:

- Business collaboration opportunities and marketing
- The lock-in effect of customers

In terms of the expectation for the development timeline and implementation of the MCP the respondents where not that optimistic. Around 25% expected implementation of the MCP to be in 5 years or less. About 50% expected a timeline of 5-10 years, whereas the remaining part expected 10 years or more.

11   Summary of findings

11.1   Values

In a number of areas, it was found that the MCP brings clear value to the stakeholders in the maritime business.

Topics	Value	Valuable to who?
One common global infrastructure	The MCP's SOA eases information exchange, coordination between units and entities and reduces information silos. Further it fosters harmonization of services within safety, regulated information exchanges and eases enforcement.	SP, SC, EM, Other
Standardization	The MCP makes information discoverable, accessible and available. The MCP enables interoperability and harmonization of systems e.g. safety related information exchange or maintenance- or safety critical. This can be future developed to reduce the administrative burden and increase efficiency.	SP, SC, EM, Other
Identification registry	The MCP enables user identification and authorization thereby can substantially reduce the administrative and development burden.	SC
Automation	Reducing manual work with digitalization	SC
Cyber security	Quote: *"Most significant value should be increase in … security",* with the use of a global identification registry and secure message channels, a very high level of security and trust can be developed to achieved the important and critical communication exchange to replace unsecure email channels.	SC, Other
Flexibility	Flexibility in choosing services and the enabling of interoperability and integration of services	SP

11.2   Challenges

However, feedback from each group also highlighted a number of challenges that should be addressed.

Challenge	Description	Challenge to who?
MCP's business model and governance model	There needs to be a stable future platform and governance model in place due to the ambiguity and un-clarity of the business model and governance, e.g. future support, service and availability, quotes: *"Who's going to pay for implementation", "…risk of commercialization: afraid the platform will create barriers to especially small companies. If the platform is going to be commercialized, then the big players, including those who are involved in the projects, will be able to buy the information, and the small ones will be left out"*	EM. Other
Motivations	The MCP needs to a have critical mass utilization for stakeholders being willing to invest integrating the MCP in their organizations. Will providers and consumer of services be sufficiently motivated to move their operations to the MCP? One example is that dominant SP's in the market are not necessarily prone to publication of service standards or service integration when their customers have been already fully immersed in their own eco-system. Quotes: *"Now we are already working on some other platforms that are pleasant. Every ship owners may have their own purchasing tools or systems, so what would make them to use this?"*	SC, EM, SP, others
IT Competences	A perceived lack of IT competences on the SC side. Quote: *"Ship owners today are less competent on IT and also IT infrastructure onboard vessels. This is also creating obstacles", "The problem is…lack of competencies on the ship owners to fix the problems. I do not see the infrastructure to make it global is there, in many ways"*	SC
Global regulatory adaption and enforcement	Required changes and adaptions of guidelines and regulations must be thoroughly examined with the introduction of the MCP on a global scale	EM, SC. Other
Feasibility	The MCP essentially provides an ambitious vision to connect all stakeholders in the	EM, SC

	maritime business, therefore its success might largely depend on the joint efforts from upstream and downstream of the supply chain, the authorities and even the governmental organizations. A regulatory push might be necessary	
Cyber security and trust	Who owns the date and information collected and logged by the MCP? *"Barriers: the unknowns, cybersecurity, and start-ups with little or no experience disrupting an ecosystem of trust.", "We have problem with personal data regulations. We need to certify and prove we are protecting personal data all the time", "If you want to do more than a marketing platform, then you're looking at picking up data from one vessel and sharing data with manufacturers and also other ship owners. It could be valuable, if they are willing to share that knowledge."*	SC
System complexity	Quote from user inputs: *"Main barrier is complexity which will increase by very much and is not balanced by a sufficient increase in software and system quality", "Barriers include difficulties to explain to high level decision makers"*	SP, Other

12   Summary of value proposition

In summary, the introduction and deployment of MCP has great potentials to bring values to information sharing and unprecedented opportunities to the future development of the maritime eco-system. Meanwhile to seek its lasting impact, it is also necessary to be broad-minded, comprehensive and preparatory for the organizational and social challenges for the MCP to bring value to society.

13   Recommendations on exploitation of solutions

- Here will be examples on how to exploit the different solutions from the project in a table format.
- E.g. standards, port reporting, hydrographic data, oceanographic data, nautical charts, route exchange, space weather, ice charts, etc.

14   Future perspectives on exploitation of solutions

- Here will be perspectives on the potential impact of the solutions.

15 Overall conclusion

The following synopsis will form the overall conclusion (to be finalised):

- Hybrid model is recommended
- There are a number of organizational and social challenges to be considered, in order for the MCP to reach lasting impact.
- In order to gain the full benefits of the work done, the Project deliverables need to be implemented on a sustainable basis.
- Without either mandatory implementation of the MCP internationally through the relevant bodies or a commercial provider of the services underpinning the MCP its full potential may remain elusive.
- The ways forward for future governance and business models described above are considered to be the most realistic solutions to finding that sustainability taking into account strategic/political, legal and financial issues involved.
- The development of the MCP outside the Project but in support of other related on-going projects (STM, SMART) is almost certainly necessary to underpin its future.
- Recommendations on exploitation of solutions
- Future perspectives on exploitation of solutions

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16 Annex

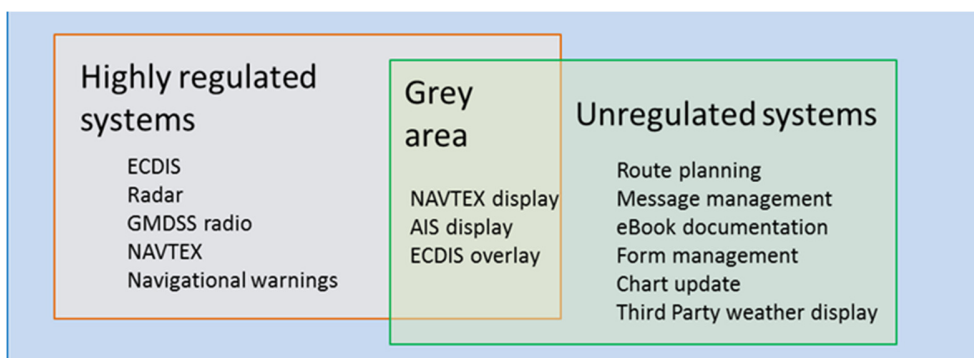## 16.1 Maritime Connectivity Platform Business Case

Version 1.4, December 2017

16.1.1 Background

This Annex was prepared to inform discussion of the Maritime Connectivity Platform (MCP) within the EfficienSea2 Project (ES2), including the Workshop on Implementation held at IALA in November 2017. The MCP concept has been developed as "A communication framework enabling efficient, secure, reliable and seamless electronic information exchange among all authorized maritime stakeholders across available communication systems", based on the International Maritime Organization (IMO) e-navigation strategy. The objectives from the strategy to which the MCP contributes are listed below (numbered as in that strategy):

> 3. facilitate communications, including data exchange, among ship to ship, ship to shore, shore to ship, shore to shore and other users;

> 4. provide opportunities for improving the efficiency of transport and logistics;

> 7. integrate and present information on board and ashore through a human-machine interface which maximizes navigational safety benefits and minimizes any risks of confusion or misinterpretation on the part of the user;

> 8. integrate and present information onboard and ashore to manage the workload of the users, while also motivating and engaging the user and supporting decision-making; (IMO MSC 85/26 Annex 20).

However, the vision reaches beyond the IMO strategy, matching the goals of the EU e-maritime initiative and more. It is envisaged that the Maritime Connectivity Platform will initially encompass unregulated services, expanding gradually to take in regulated services, as the required procedures and regulations are adopted. An overview of this process is illustrated below:

A prototype of the MCP has been developed through several European initiatives and one non-European initiative, SMART-Navigation project (SMART) of Korea[1]. This needs to be further matured

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[1] Descriptions on the Maritime Message Service (MMS) and its business cases are contributions by the SMART-Navigation project.

in order to support future operational e-navigation services globally. This Business Case[2], sits between the Business Model[3] and the Business Plan[4], which will guide the later stage of implementation.
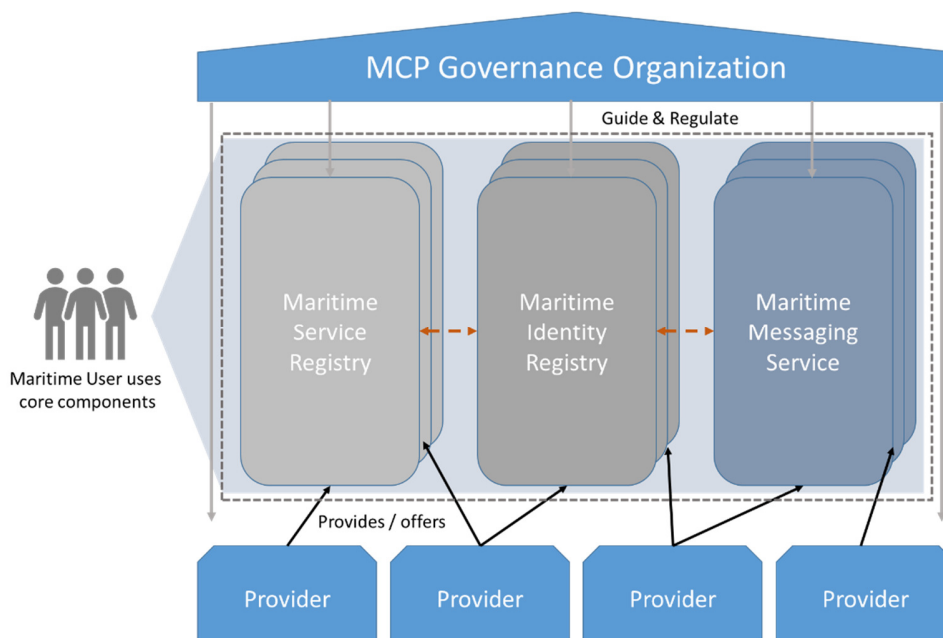
16.1.2 Description of the product or service

The MCP is not a concrete instalment of a system. It is in fact a collection of three standalone components or core services which have been designed and implemented to be used together and collaboratively to deliver maximum values to users. However, they could be run separately by independent organizations or companies as long as the MCP Governance Organization permits.

The MCP Core Components are:

1. Maritime Identity Registry (MIR)
2. Maritime Service Registry (MSR)
3. Maritime Messaging Service (MMS)

All the core components are Open Source. These are covered in more detail in the subsections below. It is anticipated that all MCP components will be open source to ensure international compatibility. Each component can be run by an acknowledged provider. Each has their own business goals and therefore their own business models and business cases according to the business objectives of its particular providers. In addition to that, an independent organization responsible for overarching guidance, regulation and governance issues for the operational use of those standalone components should be established. This organization has its own business models and cases.

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[2] A business case captures the reasoning for initiating a project or task. (Wikipedia)
[3] A business model describes the rationale of how an organization creates, delivers, and captures value, in economic, social, cultural or other contexts. The process of business model construction is part of business strategy. (Wikipedia)
[4] A business plan is a formal statement of business goals, reasons they are attainable, and plans for reaching them. It may also contain background information about the organization or team attempting to reach those goals. (Wikipedia)

The figure above shows the envisioned structure for the MCP. Describing it bottom up, acknowledged Provider, e.g. companies or authorities, hosts standalone instances of the core component. A provider may host one or more instances of the core components. Each instance can be linked to other core component instances due to the open source approach. The Providers may have divergent business objectives for running core components, the functionality of them stays the same. Maritime stakeholders such as ship operators or shore-based operators are using this MCP infrastructure for services such as casting Maritime Safety Information or Voyage Planning according to e-Navigation and Maritime Service Portfolios.

Finally, the operational process of running and using the MCP environment is ensured via guidelines and regulations coming from an independent MCP Governance organization.

The Maritime Identity Registry

For secure and reliable identity information, it provides a single login to all services, using identity information provided by trusted stakeholders. The MIR has been developed within ES2.

The Maritime Service Registry

For registering, discovering and using all relevant e-Navigation and e-Maritime services, commercial and non-commercial, authorised (e.g. by IMO) and non-authorised, for free and against payment. It can be seen as a sophisticated yellow pages phone book or the equivalent of an App Store. The MSR has been developed within ES2

The Maritime Messaging Service

A navigation messenger service using the MIR, MMS is a data roaming service among different maritime communication links and a trustful digital service broker. The MMS makes it possible to exchange information in various casting modes by using maritime IDs registered on the MIR, enabling machine-to-machine data communication at global scale. The MMS enables intelligent exchange of information between communication systems connected to the Connectivity Platform, taking into account the current geographical position and communication links available to the recipient. As a trustful digital service broker, it relays a service request on behalf of a Service User (SU) and relays response from a Service Provider (SP) to the SU. The MMS is a service that could be registered as part of the MCP Service Registry. MMS instances could be provided by authorities or third party Service Providers such as a satellite communication service provider. The MMS is developed within the SMART project.

16.1.3 Operational description

SPs and SUs will register on the MCP. The registration will enable the SPs and the SUs to make use of the MCP. The registration is done via an Identity Registry of one of the Identity Registry Providers. The SP could include any entity (international, regional and national authorities, ports and commercial organisations) that has a service to offer. The SU could include any entity (SP and/or vessel) that wishes to consume a service offered on the MCP. Registered SPs are able to list their services on the MCP. The registration will include the provision of a certificate from a Certificate Authority (CA). It is possible that the MCP governing body could become a CA. The cost of registration, integration and ongoing maintenance and support required of a widely available CA are inhibiting factors.

SUs are able to browse the list of available services, select the required or desired service and then, depending on how the service is offered, consume it. The services offered can be consumed through one of the following two primary methods:

1. Consume the offered service automatically (this requires that: a) the service be offered in a manner that allows automatic consumption and b): the application consuming the service is

able to use an Interface Description Language (IDL) (e.g. WSDL or HATEOAS) to automatically consume the service); or

2. Include the service as part of the software application in the environment which will consume the service.

The number of services and the complexity of the services being offered on the MCP to SU will range from nano-services through to the complex Maritime Service (MS) capability. MSs may eventually be a SU's preferred combination of nano-services and micro-services.

Registered SUs are able to consume offered services. Registered SPs are able to discover SUs and use this in the development and offering of services. SPs will be able to access a 'Sand Box' version of the MCP to assist in the development and testing of services to be offered on the MCP to SUs.

Dependency between core components

Although the core components are designed to work together, they do not necessarily need to be used together. The MIR may be used independently of the other core components to offer authentication of identities, and trusted communication possibly provided through other means than the MSR and MMS. In order to register services in the service register, the service provider needs an identity in the MIR. If a service provider requires the authentication of the service user, then obviously, the service user also needs to be registered in the MIR. Some services may be provided without the service provider requiring the authentication of the service user. In this case the service user does not need to be in the MIR. The service user will still be able to authenticate the service provider.

The MMS will require both of the communicating entities to be registered in the MIR. The MMS will also require the use of the MSR, since the MMS itself will be a service in the MSR. As a digital service broker, the MMS needs to be registered as a special SU and it accesses the MSR for service request relay.

16.1.4 Realisation Strategy

The MCP will be realised over a period of years through initial agreements among interested partners, followed bv wider, multi-national agreements, leading on to international adoption. The MCP is to be made available on a redundant or Connectivity Platform based (e.g. Red Hat Open Shift) platform to ensure >99.5% availability to both SPs and SUs.

The MCP software will be written and tested based on the ES2 project work, SMART project work and the various data structure and protocol standards already in place. It will be developed specifically in collaboration with various maritime standards groups, including IALA, specifically for the implementation and use of the MCP.

The ES2 initial SP project is the integration of the Danish Maritime Authority (DMA) NAVTEX messaging into the MCP as a service. SMART will provide the MCP with sustainability, which will relieve concern about its staying power as a platform for real world services, by applying the MCP as its service platform for ships to access services.

How the product or service is different to what exists or is soon to exist

The MCP is seen to be unique in that it is a vendor and technology neutral directory of a range of maritime centric web enabled services that can be consumed by registered SUs. Most existing Maritime Information Systems (MIS) environments that use Service Oriented Architecture (SOA) (https://en.wikipedia.org/wiki/Service-oriented_architecture) have services that are consumed only within the same customer's environment.

The trend is to expose services to the public via user-friendly (software programmer friendly) REST[5] web services (UBER and TWITTER are good examples of REST web services outside the maritime environment). The MCP will initially address systems that are not part of the mandatory carriage environment due to the regulatory and potential liability concerns. However, with universal adoption, it will be possible to incorporate systems that are covered by international regulations.
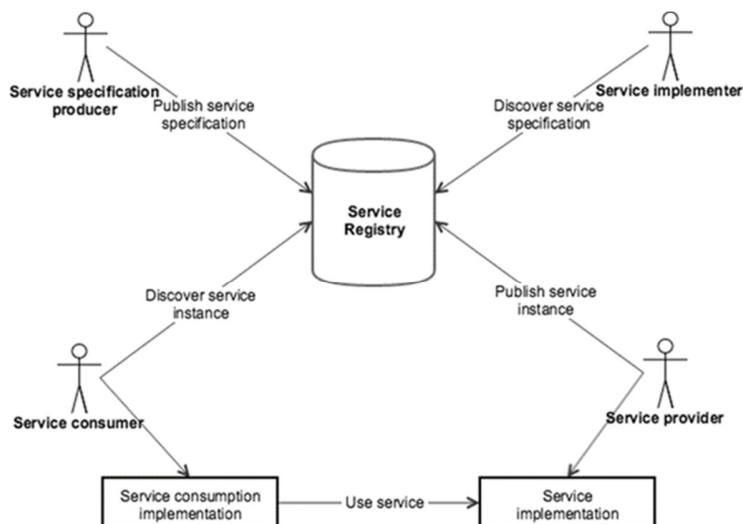
Market analysis

The MCP will not primarily be a commercial operation, so this analysis is provided to show how it will function in a market environment, rather than how it will compete with other operations.

The organization running the MCP would need to generate revenue to do so. This analysis should assess whether this is possible. Due to the different functions and objectives of the MCP Core Components, this market analysis is divided into three, one for each component. Each market analysis is structured as follows:

1. The target market

2. Existing and potential competitors

3. Unique market position

4. Expected market share

5. How this market share is to be obtained

Maritime Service Registry market analysis

According to the Conceptual Model of the MCP (see ES2 publications), a Maritime Service Registry has the following general functions (see figure below).
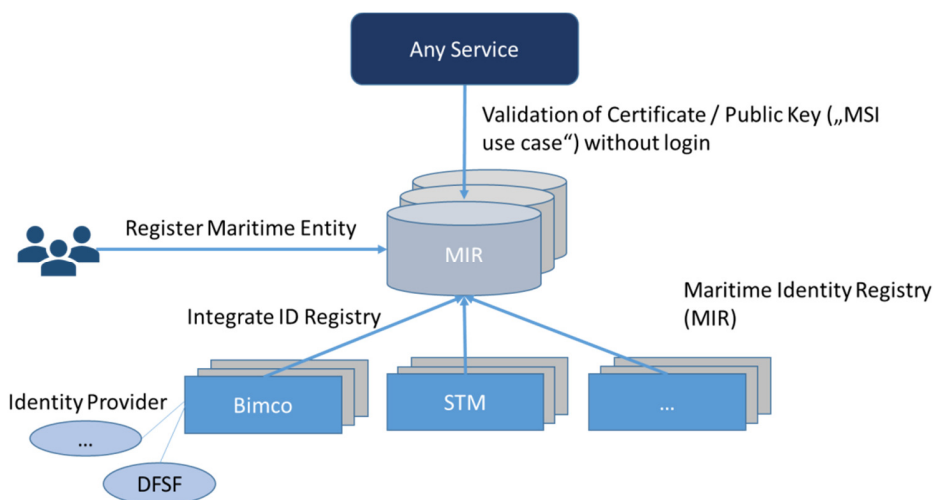

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[5] Representational state transfer or RESTful Web services are one way of providing interoperability between computer systems on the Internet. REST-compliant Web services allow requesting systems to access and manipulate textual representations of Web resources using a uniform and predefined set of stateless operations. (Wikipedia)

Derived from this, some options for revenue generation are shown in the table below:

Revenue generation method	Implementation
Pay per service instance	A percentage paid for each service instance consumed
Pay per service contract	An amount paid for a monthly service
Pay per MCP membership	
Part of a Bouquet of services	The MCP adds a cost based on one of the above methods and the SP bills the SU for the bouquet of services that includes a few from the MCP and a few from their own in-house environment (i.e. engine management, documentation and spares management system).

The Maritime Identity Registry market analysis

According to the basic functionality of a MIR as described in the Technical Specification of the MCP, a federated approach of the MIR provides at least the following options for revenue generation (see figure below).

Revenue generation method	Implementation
Register Maritime Entity	An amount paid, either daily, monthly, yearly for being registered in a MIR. The Identity Provider receives the amount
Integrate Identity Registry	An amount is paid (either one time, monthly, yearly) for integrating an own MIR instance in a federated MIR infrastructure
Validation of Certificate / Public Key without login	For verification of safety related information such as Maritime Safety Information

Maritime Messaging Service market analysis

As an inherent service which will be registered on the MSR, the MMS has three main revenue generation functions:

1. navigation messenger

2. data roaming between maritime communication links

3. digital service call brokerage.

Revenue generation method	Implementation
Navigation messenger	With this function, the MMS may share revenue with the MIR as this may enrich the value of MIR by providing the registered users with an inherent service. SPs delivering their service via MMS need to pay for MMS coordination as the globally coordinated MMS allows the SPs to apply various casting models easily. This would be especially useful when a push model is used by SPs.
Data roaming between maritime communication links	Communication service providers who want their customers to be connected to the users on different networks need to pay for this as it may attract more customers to them.
Digital service call brokerage	Non-IP communication service providers, such as satellite communication companies, need to pay for this function as they would have benefits from data traffic required for using web-based services.

Maritime Connectivity Platform Governance Organization market analysis

For governing the MCP, a neutral umbrella organization shall be installed in order to provide regulations and guidance for harmonized operation of loosely coupled instances of MCP Core components. The type of this organization is not defined yet. The business cases for this organization can be the hosting of Root Certificates and providing them to acknowledged providers. Moreover, such an organization shall be able to provide additional conformance certificates and (technical) support for implementing MIR, MSR and MMS. In addition to that, the organization could provide a MSR, which provides operational service specification for references as well as training for future end-users but also fosters further development.

The target stakeholders

The stakeholders would fall into the following groups:

1. Service Providers (SPs)

2. Service Users (SUs)

3. Maritime Connectivity Platform hosting agents

4. Authorized specification bodies

5. Equipment manufacturers (primary and secondary systems)

These are considered below:

Service Providers

The SPs are those entities that are able to offer a service to potential SUs. The SPs would need to comply with the accreditation criteria to join the MCP ecosystem.

Service Users (SUs)

SUs are those entities that are able and willing to consume the services offered by the SPs.

Maritime Connectivity Platform hosting agents (MCP agents)

The MCP is expected to have a primary and secondary component where the primary databases/registers will be managed in the primary environment and secondary systems will be updated on a regular basis from the primary system.

Authorized specification bodies

Bodies such as IEC would be recognized as specification bodies under the MCP and would have certification authority for value-added (commercial navigation-aid) services.

Equipment manufacturers

Manufacturers of primary and secondary systems would be accepted as equipment providers in the MCP, given appropriate compliance with standards.

Terms and Conditions

All stakeholders in the MCP would be required to accept the Terms and Conditions that would govern participation, including the provision and consumption of services and the various commercial arrangements including:

1. Pay As You Go

2. Monthly contract

3. One time membership fee

4. Part of a bouquet of services

Existing and potential alternatives

The existing range of complementary alternatives includes all companies that are involved in MIS provision, moving asset Internet of Things (IOT), Vessel Traffic Services (VTS) suppliers and Big Data analytics companies that include SOA as part of their offering.

From a service information provision perspective, the MCP is a virtual equivalent of the North American Maritime Exchange concept that places an organisation at the centre of a port or coastal authority to handle the identification and sharing of information and services in a port environment (http://www.misnadata.org/index.htm). The MCP, however, is more focused on supporting machine-to-machine interactions while MISNADATA focuses on human-to-machine interactions.

Given the rapid growth of the IOT the growth of Smart VTS systems and the establishment of Big Data enabled MIS with REST web services as a standard part of most new solutions being deployed, the MCP has a growing range of potential alternatives with a number of common traits:

1. The existing SOA solutions that have been created over time are compliant to all maritime centric published standards and include what customers demand to satisfy specific requirements contained in the system Request For Proposals (RFP)

2. Customer relationships are consistently nurtured

3. High levels of service (24/7/365) are demanded and offered

4. Revenue generation methods that are protected by commercial and relationship building activities

5. The significant pressure on MIS and associated service providers to significantly reduce price

6. The direct cost of offered services decreasing due to Big Data, data analytics and Artificial Intelligence applications empowering the traditional maritime operational environment

7. Newer MIS business models that are focusing on two primary strategies:

    a. Garnering a large customer base comprised of traditional and new users of services

    b. Broadening the range of services offered to satisfy the entire maritime ecosystem enabling the berth to berth requirement and potentially extending to include the customer to client requirement

The ever decreasing development cycle time, increasing feature set of MIS environments and the intense focus on Cyber Security by existing players in the MIS market segment places the MCP concept, development and implementation under time, performance and cost pressure. The implementation of the MCP on a global scale will have to deal with national Cyber Security agendas.

Analysis of the competitive environment will be made more complex by the global focus of the MCP.

Unique status of MCP
The MCP is currently unique in that it can be seen as an independent/neutral broker as a directory and service linking service. Single point of reference, open source, global and international (Test ID registers for IALA, CIRM, BIMCO and others to follow).

How the position is to be obtained
The position is to be obtained through a strategy of:

1. Making the MCP application Open Source

2. Using published standards for supplying and consuming the MCP services

3. Standardising the remainder of the data formats and standards through various maritime bodies (e.g. IALA)

The MCP will initially address systems that are not part of the mandatory carriage environment because of regulatory and potential liability concerns.

Value Propositions
Besides the general values based on the technical functions of the MSR and MIR (Discover service, authenticate maritime entity), audits given by the MCP-foundation could generate revenue and provide trust between organizations within the MCP.

Further value propositions for the MIR could include:

1. Access management to provide capability for the protection of sensitive data

2. Authentication, verification, validation based on the main functionalities of the MIR

3. Establishment of trustworthiness of (registered) maritime entities.

For the MSR the discovery of services and the provision of existing service specifications are the potential key features.

16.1.5 Timeline

A suggested timeline is given below.

MCP Timeline