STM_Validation_D1.1
Enabling port optimization by a digital collaborative platform
2015-12-31
STM VALIDATION 1.1 – Enabling port optimization by a digital collaborative platform - a first step towards a STM Developer Zone

1 CIMNE, Costa Crociere, Cyprus University of Technology, Finnish Transport Agency, HiQ, Ministry of Infrastructure and Transport, Norwegian Coastal Administration, Port of Barcelona, Swedish Maritime Administration, Svitzer Sweden AB, Transas, Valenciaport Authority, Valenciaport Foundation, and Research Institutes of Sweden (RISE). Kvarken ports, Port of Stavanger as active participants
Authors

<table>
<thead>
<tr>
<th>Name</th>
<th>Organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ferrus Clari G., Gimenez Maldonado J., Deehan S.</td>
<td>Valenciaport Foundation</td>
</tr>
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</table>

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Summary

The maritime sector is a self-organizing ecosystem. Collaboration within the ecosystem needs to be enhanced. Within Sea Traffic Management this is enabled by a service-oriented approach allowing service producers to offer discoverable services building on data exchange standards. There is a need for a community driven approach coordinated by a federation ensuring that standards and processes are established and followed. In order to boost such a development, a Developer Zone is proposed for offering capabilities and sharing experiences, standards and solutions divided into two sub communities of stakeholders; a technical community supporting technical adaptations and a client community supporting the introduction of STM. In this paper, a PortCDM Developer Zone is outlined in preparation for a global dissemination of PortCDM based on the use of standards for data source integration information sharing, collaboration, and messaging. This PortCDM Developer Zone is implemented on top of a content-management system and relies on a prosumer business model, in which stakeholders use and contribute to the content facilitating the creation of positive network effects that in turn should enable inclusion of more valuable content. Governance is enabled by a federated approach in which a PortCDM council will ensure that core standards and processes are settled and that the tasks the assigned developer zone operator are completed on time, budget, and with specified functionality. It is expected that the technical infrastructure for the PortCDM developer zone to a large extent will be established by mid 2016, enabling support for engaged actors to start using PortCDM. During the STM validation project, the PortCDM Developer Zone will be validated and continually refined as a support for the establishment of a STM Developer Zone.
Table of contents

1 Introduction ......................................................................................................................................................... 7
  1.1 Other deliverables from PortCDM testbed during the STM Validation project............................... 8

2 A community approach: A need for worldwide adoption .............................................................................. 10

3 Requirement on a PortCDM Developer Zone ............................................................................................... 11
  3.1 Technical community for infrastructural aspects ................................................................................... 13
  3.2 PortCDM Core Provider ......................................................................................................................... 14
  3.3 Data Providers .......................................................................................................................................... 14
  3.4 Service provisioning ................................................................................................................................. 15

4 Governance ...................................................................................................................................................... 17

5 Business Model for the PortCDM Developer Zone ..................................................................................... 18

6 Initial technical (functional) requirements on the Developer Zone ......................................................... 20

7 Final remarks ................................................................................................................................................... 25
  7.1 Summary and development/implementation plan ................................................................................. 25
  7.2 Generalizing to a PortCDM Developer Zone to STM Developer Zone Purpose of the concept ................................................................................................................................................................. 27

References ............................................................................................................................................................ 29

Annex: Publications related to the PortCDM concept ...................................................................................... 30
Table of figures

Figure 1 Scope of the PortCDM developer zone ................................................................. 7
Figure 2 Stakeholders and overall functionality of the PortCDM Developer Zone ............. 11
Figure 3 PortCDM high level architecture .......................................................................... 13
Figure 4 Stakeholders for service provision (from http://maritimecloud.net/) ................. 15
Figure 5 The role of the PortCDM council and the devzone operator ......................... 17
Figure 6 Mutual dependencies between content attractiveness and engaged stakeholders. 25
1 Introduction

Interactions and physical movements within a self-organizing ecosystem (SOE) characterize maritime activity (Watson & Lind, 2016). The SOE is composed of different actors that are dependent on each other. In order to facilitate enhanced collaboration within the SOE, Sea Traffic Management has been introduced to promote increased safety, increased efficiency and reduced environmental footprint in sea transports. Sea Traffic Management takes a berth-to-berth perspective relying on a common service infrastructure enabling enhanced interaction between stakeholders in the maritime domain.

Due to the self-organized characteristics, the autonomy, and the diversity that the legacy has caused a call for a support for spreading best practices, disseminating emergent standards, and sharing experiences within the ecosystem. The digital era has enabled a possibility for actors within and between ecosystems to virtually meet and share experiences in a regulated way, i.e. sharing of experiences and solutions to others as desired by the source.

As one of several Sea Traffic Management concepts, PortCDM (MONALISA, 2015ab) enables enhanced collaboration among different stakeholders for the well-coordinated approach. The success of PortCDM however relies on a digital interaction between the ship and the port and since ships visit multiple ports an overall efficiency is to be enabled by different ports adopting the same standards and solutions for enabling the coordinated approach.

A port is an ecosystem with multiple actors and maritime transports is characterized of that ships continually visit different ports. As it looks today there is diversity of how different ports operate and which interaction that is required. In the STM validation project 13 ports are simultaneously engaged in introducing PortCDM as a mean for enhanced coordination in port calls. A developers’ zone is proposed to manage a controlled and distributed approach to enable knowledge sharing and joint development of services, standards, service specifications, methods, and protocols among these 13 ports. A PortCDM developers’ zone is characterized as a “technical and social arena for collaboration between actors within and between port communities”. This “community and developers” zone, joining forces for exploring and contributing to technical and operational dimensions of port optimization, is to complement and support the development and dissemination emergence of the Port CDM concept managed by the PortCDM concept team and the Port CDM council.

The scope of this zone is to facilitate collaboration among authorities, commercial operators and third-party developers. The design idea is that the developers’ zone will facilitate the sharing of PortCDM commonalities and experiences. The work procedures and logic of the developers’ zone should also reflect competitive business needs of industrial partners. The developer zone should thus not just be established as a support for ports involved in the STM validation project. The establishment of the PortCDM developer zone should also support the engagement of additional
ports, and other actors engaged in port operations, to bring in the principles of PortCDM into their operations, is rather to be enabled by actions undertaken by different participants in the STM validation project. Consequently, primarily and short-term goal, the developer zone should support the engaged 13 ports in collaboratively introduce PortCDM and use it for port call optimization, and secondly and the more long-term objective of the developer zone should support the introduction of PortCDM in a multitude of ports (see figure 1). Such support should be channelled to different stakeholders based on basis provided by different by different engaged stakeholders using the developer zone as a digital collaboration arena. The developer zone should also connect stakeholders that have a need for knowledge and competence with the ones that have capabilities.

This also means that considerations need to be taken of how to maintain the developer zone after the realization of the STM validation project. Consequently, an important part of the developer zone is to facilitate dissemination of PortCDM as a standardized concept for port call optimization.

Already now an interest is paid from additional ports to adopt PortCDM for coordinated port calls. This is both driven from an interest to explore short-sea shipping by the committed ports in the STM validation project engaging at least seven additional ports in the Mediterranean and the Nordic test bed and based on that additional stakeholders (shipping companies, ports, and system suppliers) have shown interest to introduce PortCDM. This also means that the Developers’ Zone need to have relational capabilities resulting in positive network effects.

In this report the concept of developer zone is explored as an enabler for knowledge sharing and joint development of services, standards, and service specification. The report covers needs from PortCDM, as an example for what other Sea Traffic Management concepts would need, requirements on technical and social level, governance structures, and business models for the maintenance of the developer zone. This is the first version of the milestone “Report with methodology for governance of the developers’ zone (D1.1.1)” in the STM validation project.

1.1 Other deliverables from PortCDM testbed during the STM Validation project

Activity 1 - PortCDM testbeds, has been arranged in four sub activities:

- **Sub activity 1.1:** Establishment and maintenance of developers’ zone, which was reported upon in Lind M., Haraldson S., Karlsson M., Mellegård N., Eriksson G., Olsson E., Zerem A., Giménez J., Ferrús G., Deehan S., Watson R. T. (2015) Enabling port optimization by a digital collaborative platform – a first step towards a STM Developer Zone, STMVal_D1.1, as deliveries for M1.1.1 and M1.1.2

- **Sub activity 1.2:** Demonstration of the Port CDM concept which was reported upon in Viktoria Swedish ICT, Valenciaport Foundation (2015) Demonstration plan for PortCDM Test Beds in STM validation project 2015-2018, STMVal_D1.2, as a delivery for M1.2.1 – M1.2.13

- **Sub-Activity 1.3:** Refinement of the Port CDM concept which is reported upon through this report: Lind M., Haraldson S., Ward R., Bergmann M., Andersen N-B., Karlsson M., Zerem A., Olsson E., Watson R., Holm H., Michaelides M., Evmides N., Gerosavva N., Andersen T., Rygh T., Arjona Arcona J., Ferrus Clari G., Gimenez Maldonado J., Marquez...
M., Gonzalez A. (2018) Improving port operations using PortCDM (Final PortCDM concept description incl. generic specification of identified services), STMVal_D1.3, as a delivery for M1.3.1

- **Sub-Activity 1.4: Collaboration for definition and sharing of Port CDM commonalities**
which was reported upon in Lind M., Haraldson S., Watson R.T., Ludvigsen P., Bergmann M., Andersen N-B. (2016) Role and routine of the PortCDM Council, STMVal_D1.4, as a delivery for M1.4.1

Further, the annex to this report contains a list of the numerous publications that have been generated during the conduct of the project.
2 A community approach: A need for worldwide adoption

PortCDM enables well-coordinated port calls. It is expected that well-coordinated port calls enabled by the principles of PortCDM leads to:

- **reduced waiting times**: reduced unnecessary waiting times / anchoring times
- **increased predictability**: increased ability to predict state changes, i.e. when operations are planned for and/or actually occurs, based on estimates in relation to the outcome
  - The closer to the realization a lower degree of deviation is allowed and the frequency of updates will be higher
- **increased punctuality**: increased ability for different actors to perform their actions in time in relation to the timeline defining the dependencies between different states (+/- acceptable deviation)
- **increased/or kept level of berth productivity**: increased berth productivity due to reduced waiting times for operations between actual time of berth and actual time of departure from berth
- **increased capacity utilization**: increased utilization of available infrastructure and resources based on an increased degree of just-in-time operations

PortCDM builds upon seven components, adapted for each port, for reaching well-coordinated port calls:

1) An adapted **state chart** compound of selected states as a basis for optimal coordination
2) A **timeline** reflecting dependencies between different states
3) Processes of **sharing** of intentions when certain states are planned to be reached and processes of sharing of actual state changes by involved port actors
4) **KPIs measures** for governance towards optimal port call processes
5) **Automatic connection** to data sources, building on standard API's and message standards
6) Processes for **data quality assurance** building on multiple sources of the same time stamp instance providing actors insights of when to update
7) A **technical architecture** enabling (trusted) service interaction between involved port actors

There is a need for conformity of port call optimization among diverse ports due to three reasons:

- many maritime actors do have interests in multiple ports, such as e.g. shipping companies making port calls to multiple ports, port actors operating in several ports (such as agents, tug operators etc.), system providers providing infrastructural support for
- the practice of port operations have not been standardized enough why basis for sharing experiences and contributing to the development of the port community, as part of maritime operations, as a whole is suffering
- integration to hinterland activity, as a mean for integrated transportation chains, in which sea transports is a part, rely on standardized ways of sharing information about upcoming events
3 Requirement on a PortCDM Developer Zone

There are numerous stakeholders that would use and contribute to the PortCDM developer zone. In the figure below some stakeholder categories have been depicted. The developer zone builds upon maintain (sourced) content continually attracting new members and keeping existing members active in the community. It is however important to stress that a developer zone does not exclude human agency – it is rather a technical support for supporting orchestrators, contributors, and users to collaborate on matters that are of common concern. A Developer Zone as a system cannot supervise human actions, but rather function as an enabler for collaboration between the different stakeholders associated to the Developer Zone. People need to drive the process and have different roles where the PortCDM Developer Zone functions as a support.

Figure 2 Stakeholders and overall functionality of the PortCDM Developer Zone

3.1 Usage community for operational aspects

The purpose of the usage community, as a social community, is to encourage collaboration among stakeholders that have an interest of enabling coordinated port calls by information sharing solutions. This means both sharing of solutions and experiences (including effects) between actors within the port, between ports, and within port communities at large. The PortCDM developer zone should be the information sharing platform providing support for the
enhancement of port calls coordination by information sharing solutions. First of all, this part of the developer zone should:

- support the (local) port communities in the implementation of the PortCDM concept
- allow port communities to disseminate and share knowledge and experiences in the process of establishing, running and evaluating Living Labs (Haraldson et al, 2015)
- establish a forum for discussion around PortCDM concept and PortCDM implementations (successes and pitfalls)
- support port communities to share performance measures and solutions for enabling improvements. The format of what is being shared will be evaluated throughout the process.
- support port communities to share reference implementations related to different contextual factors

Secondly, this part of the developer zone should also:

- allow port communities and other actors to report upon best practices, developments, challenges, and contemporary efforts
- allow participants in the PortCDM community to share best practices and state of the art solutions.
- allow a forum for reporting upon supporting tools for enhanced coordination of port calls
- enable subscription services, such as RSS subscriptions, based on when selected content has been updated
- allow Q&A functionality
- connect actors having capability in supporting others in the implementation of PortCDM (e.g. certified PortCDM consultants) with actors that have a need for support in its adaption of the principles of PortCDM in its operations
- provide functionality to raising shortcomings in the technical and operational aspects in the PortCDM concept to have them categorised to facilitate the community in responding with fixes or work arounds
3.1 Technical community for infrastructural aspects

The purpose of the technical community is to support the technical adaptation of the PortCDM concept in the port environment. This includes service distribution, service consumption, PortCDM SIP implementations, and front-end adaptation. The main stakeholders for the technical part of the PortCDM Developer Zone can be described based on the high-level architecture of PortCDM, as shown in figure 3.

The PortCDM core components are shown at the centre of figure 3 as PortCDM DMP (Data Management Platform) and SIP (Service Integration Platform). These are the most basic components required to enable information exchange as defined by the PortCDM concept (MONALISA, 2015abc). PortCDM SIP and PortCDM DMP are to be seen as instances of generic STM concepts. At the bottom of figure 3 are data providers who submit to the PortCDM DMP notification of available data, and respond to request to access that data. At the top of figure are actors supplying service specifications, implementation, as well as service providers and consumers.

The main stakeholders for the technical part of the PortCDM Developer Zone can thus be identified as:

- **PortCDM Core provider**: the stakeholder who implements and or deploys the core components of PortCDM (e.g. the data management platform, service integration platform, and messaging service);
- **Data providers** are the stakeholder who create or deploy connectors that provide data to PortCDM;
- **Service providers and service consumers** comprise stakeholders that specify, implement, deploy or consume PortCDM compliant services.

Each of these groups of stakeholders will require shared as well as specific topics in the PortCDM Developer Zone. For the various topics, the Developer Zone will need to provide: technical documentation, best practice and recommendations, example code, and structured discussion forums. Typical topics shared among the stakeholder groups include:

- PortCDM architectural overview along with example scenarios/use cases;
- Relations between PortCDM and other STM concept, with examples (such as data flow principles);

Figure 3 PortCDM high level architecture
— Relevant STM/PortCDM standards, and information about the standardization process;
— STM/PortCDM governance news feed and event calendar.

Below follows a detailed description of each of the identified stakeholder groups, along with descriptions regarding their technical support needs.

For many of the proposed topics below, the contents needs to be extendible with (moderated) community provided material, and linked with interactive forums (c.f. e.g. http://www.stackexchange.com).

3.2 PortCDM Core Provider

In the long term, PortCDM core will be a set of standardized interfaces—the API descriptions and data models required to provide a compatible implementation. Based on these interfaces and their descriptions, implementations can be provided by commercial actors. Within the scope of the STM Validation project however, an open source reference implementation will be developed and deployed for validation purposes.

The PortCDM Core will provide basic functionality for port call data exchange and for service provisioning as defined by the PortCDM concept. For PortCDM core providers, the PortCDM Developer Zone will need to provide support for:

— **Implementation.** Stakeholders that intend to provide an implementation for the core platform need detailed specification for the PortCDM core interfaces, data models, and interaction principles;

— **Maintenance and adaptation.** Stakeholders that intend to maintain or adapt the open source PortCDM core platform need access to the source code and documentation for the implementation developed within the STM Validation project;

— **Deployment.** Stakeholders that intend to host the PortCDM core platform need support in how to deploy and configure the open source implementation.

All of the topics described above shall be extendible with community provided material, and supported with structured and moderated discussion forums.

3.3 Data Providers

The various actors that participate in staging port calls typically manage their operations using dedicated supporting IT systems. In the PortCDM scenario, a selection of the data managed by these systems shall be made available to other authorized actors. To enable seamless publication of data to PortCDM, system specific connectors need to be developed. These connectors extract relevant data from a support system, and submit that data to the PortCDM core platform.

It is envisioned that data providers will be, not only a large and diverse stakeholder group, but also a very important one—the availability of high quality real-time data is a key success factor for PortCDM. Therefore, the material provided in this section of the PortCDM Developer Zone must be continually growing and improving. Most likely, this means that there need to be incentives for the community to provide and improve the available material.

In order to support data providers, the PortCDM Developer Zone needs to provide:
— **Architectural overview and interaction principles.** The Developer Zone shall describe architectural principles relevant for submitting data, and interaction principles for ensuring that only authorized actors can access the submitted data;

— **Example implementations.** Example code shall be available to illustrate various techniques that can be employed when developing data connectors, and that exemplifies how to evaluate whether access to the data shall be granted upon request;

— **Best practice and recommendations.** There shall be a section available for community provided best practice stories, and recommendations regarding data connector development and deployment.

Except for the section relating to the architectural overview, the topics above will need to be strongly community driven. Especially important is to establish a vibrant interactive forum.

### 3.4 Service provisioning

A key to establishing a maritime software ecosystem is service provisioning. Service provisioning is the concept in which services can be specified, implemented, deployed and consumed. Service provisioning is the mechanism by which the core PortCDM platform can be extended with additional functionality by third-party organizations.

The principles for service provisioning are illustrated in figure 4 (see [http://maritimecloud.net/](http://maritimecloud.net/) for more information), as will be enabled by the service registry as defined within the SeaSWIM concept of STM [MONALISA, 2015cd].

![Figure 4 Stakeholders for service provision (from http://maritimecloud.net/)](http://maritimecloud.net/)

The four main stakeholder groups shown in figure 4 are:

— **Service specification producer.** This stakeholder group provides a service specification (API) along with documentation (e.g. requirements) for the APIs. The specification producer will typically, but not necessarily, also be the service implementer; for instance, a standardization body can provide standards in the form of a specification and leaving the implementation to third-party development organizations (e.g. the PortCDM core platform);
— **Service implementers.** This stakeholder group provides implementations of service specifications; i.e. provide functionality that realize the service specifications;

— **Service providers.** This stakeholder group deploys a set of service implementations for consumption. With a standardized STM/PortCDM the market for a service has the potential to be global. It may on the other hand not be feasible for a development organization to deploy their service implementation globally. Therefore, the deployment of services at specific geographical locations may best be managed by organizations that already have a presence;

— **Service consumers.** This stakeholder group will typically provide end-user functionality realized by the functionality provided by multiple services.

For the PortCDM Developer Zone to support the service provisioning, there is a need for a tight integration with the SeaSWIM service registry. The service registry shall provide the means to publish API specifications, documentation, and to announce the availability of implementations and deployed instances (cf. the SWIM registry in the SESAR project http://eur-registry.swim.aero/services).

Most important for the integration of PortCDM Developer Zone with the SeaSWIM service registry, is to support the relationship “use service” shown at the bottom of figure 4. This relationship represents a third-party client application accessing an open PortCDM compliant API. To support this relationship, the PortCDM Developer Zone needs to provide:

— A convenient means for a service specification and/or implementation provider to maintain a high quality **API documentation**;

— **Problem reporting** facility (preferably open) allowing developer feedback;

— **Discussion forum** (cf. [www.stackexchange.com](http://www.stackexchange.com));

— **Feature request** facility allowing developer feedback.
4 Governance

To keep the PortCDM Developer Zone as a trusted arena and facilitate the dissemination of the PortCDM concept, a PortCDM council will be used as the governing body. The PortCDM council is compound of actors based on knowledge and credibility in port-related activities. The PortCDM council has the responsibility in establishing processes for standardization, processes for service approval (ensuring that services become PortCDM compliant), processes for maintaining PortCDM SIP and PortCDM DMP, as well as placing and following up the assignment for PortCDM DevZone operations (see figure 5). The PortCDM council will establish necessary standardization committees.

The DevZone operator will undertake the role of maintaining the PortCDM Developer Zone in accordance with the assignment and established processes. The DevZone operator will act as content orchestrator, relationship manager, and technical coordinator for the DevZone infrastructure. Incentives and compensation for the DevZone operator need to be explored in order to ensure that the assignment of contributing to an active, technical and operational, developers’ community is fulfilled.

Figure 5 The role of the PortCDM council and the devzone operator
5 Business Model for the PortCDM Developer Zone

Building on Rosemann et al (2011) the overall goal is to ensure a developers’ zone with a continually expanding user base and attractive content. As source of inspiration the design criteria of the developers’ zone builds upon four distinct characteristics of a digital complementary asset (Rosemann et al, 2011):

- **Non-excludability**, i.e. every user with Internet access can consume the Developer Zone services without any constraints. This design criterion should be applied as far as possible. However it is also important to reflect that some information is only to be shared within a limited community. Therefore it is essential to facilitate the sharing of abstracted information.

- **Non-rivalry**, i.e. consumers of the Developer Zone services does not compete with each other as the available resources are practically unlimited.

- **Versatility**, i.e. the Developer Zone services should be easy to use

- **Positive Network Effects**, i.e. content of the Developer Zone should create positive network effects. The PortCDM Developer Zone is based on a prosumer model (Toffler, 1980), i.e. the user contributes to the value proposition of the Developer Zone by using it (uploading and consuming information).

To ensure that the PortCDM Developer Zone becomes a live, sustainable and growing arena it becomes essential that it is continually filled with attractive content. The only way forward is that stakeholders associated to the Developer Zone are active in contributing and using the Developer Zone actively. An orchestrator, as a human agency, does need to facilitate this knowledge sharing process. Thus, different stakeholders’ incentives for using and contributing to the Developer Zone need to be explored and affirmed. As e.g. the industry might not want to publish the source code of competitive services, but rather publish the specification of the service. However, publishing source code of other services that are regarded as non-competitive and common to enable a rapid introduction of PortCDM for practical use would be beneficiary.

The first choice to enable is therefore to establish enough content, collaboration structures, possibilities to disseminate, and a large enough user base for creating the first version of the developers’ zone. This is to be enabled by actions performed within, and actors associated to, the STM validation project.

Further, KPI:s for measuring usage of the developer zone need to be established and used for informing processes of orchestration, coordination, and management performed by the DevZone operator. These KPI:s should be related to provision and use of content, memberships, interactions and combinations of these aspects.

The establishment and maintenance of the PortCDM developer zone will be financed by the STM validation project during 2016-2018. After the STM validation project there are multiple options for the business model of the developer zone, such as advertising, usage fee, grants from the maritime community, share of business deals achieved via the Developer Zone etc. The basic assumption is that actors that have an interest in that PortCDM continually becomes disseminated throughout the maritime sector should finance the maintenance of the developer.
zone. During this period different business models will thus be explored and at the end of 2018 recommendations for further maintenance will be made.

It is however expected that the PortCDM developer zone infrastructure being established during 2016-2018 reach such maturity so that the cost for further maintenance is held as low as possible. This means that the maturity of the technical infrastructure must have reached a high degree financed by the STM validation project via the activities performed by different partners of the STM validation project. Even though that the technical infrastructure is in place as soon as possible, and then growing in maturity until 2018, there will be a need for an orchestrator/coordinator and content managers, and a technical coordinator assigned to DevZone operations. Since the PortCDM Developer Zone builds upon a prosumer model content engaged stakeholders in the communities should enable provision of content as much as possible.
6 Initial technical (functional) requirements on the Developer Zone

As can be revealed from figure 5 above there are numerous functionalities that need to be provided to facilitate the emergence of active technical and usage communities. This includes:

- Access management facilitating who should be able to access which information
- Workflow management facilitating processes of publishing content, updating, or settling new, standards, as well as managing the approval and holding a repository of PortCDM compliant services
- Catalogue of API’s, PortCDM compliant services, and templates
- Content management including documents, experiences (including video)
- Discussion forums, subscription services based on diverse criteria (such as making a stakeholder aware when a particular content has been changed), Q&A services, and report on technical and operational shortcomings
- Usage statistics (engagement and used content) and possibility to rank different content (including the relationship to which stakeholder group that access which content)
- Relationship management including membership services and exposition of service offers to others
- Support for dissemination (video) of stories (PortCDM and not PortCDM issues)

The DevZone platform serves thus as a common repository for frequent asked question, documentation, discussion and forums for integrating PortCDM into with existing port system and business processes. The platform intends to facilitate the integration of PortCDM with an online resource of content for all involved actors that takes part in the integration process. The functionality of the DevZone platform is proposed to be centred around a content management system (CMS) that encompasses the ability of defining workflow management for different workgroups, working in multiple settings to delegate publishing rights based on group and type of content. This standpoint is based on what has been identified in the efforts of facilitating the uptake of PortCDM in different ports. Viktoria Swedish ICT, Valencia Port Foundation, and Port of Barcelona have formulated these requirements, as complements to non-functional requirements such as costs, scalability, performance, and user-friendliness. The requirements are summarized in the table below.

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<thead>
<tr>
<th>Req.id.</th>
<th>Requirement</th>
<th>Testability</th>
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<tbody>
<tr>
<td>1.</td>
<td>Group and user-based control of content publishing to different nodes or sub-nodes in the content tree</td>
<td>Content provider belonging to one group-role with specific access to only one node in the content tree cannot publish content to another sibling or parent node</td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Details</td>
</tr>
<tr>
<td>---</td>
<td>-----------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>1.1</td>
<td>Sub-node publisher related to publishing rights to a specific sub-node in the content tree.</td>
<td>The sub-node publisher can only publish content in the designated sub-node where rights have been granted.</td>
</tr>
<tr>
<td>2.</td>
<td>Option to setup of publishing workflow, that handover content to editorial user/group before published publicly</td>
<td>Content is handover to the user-group with editorial rights before being published publicly.</td>
</tr>
<tr>
<td>2.1</td>
<td>Handover is dependent on user/group with editorial right for the sub-node, if no user/group has editorial right on sub-node level the action is handed over to the parent or top node user/group</td>
<td>Content is handover to the closed user-group that has editorial rights for a sub-node or if not set, passed on the closed parent node editorial user-group</td>
</tr>
<tr>
<td>3.</td>
<td>Scheduling publication for content, node(s) and sub-node structure</td>
<td>Content in top node or sub-node is published at specified time and date</td>
</tr>
<tr>
<td>4.</td>
<td>Restrict read access to content belonging to a sub-nodes in the content tree, dependent on user-group role</td>
<td>Content in sub-nodes cannot be accessed without login and that the user is part of a user-group</td>
</tr>
<tr>
<td>5.</td>
<td>Localisation of content, content can be provided in one or more languages. Sub-nodes in the content tree does not need to be provided in default language</td>
<td>Content providers can specify the specific languages for the current content and easily be selected by the reader. Content in sub-nodes can presented in other languages than the default one</td>
</tr>
<tr>
<td>6.</td>
<td>RSS-feeds to notify reader of content update</td>
<td>Linkable RSS-feeds for content</td>
</tr>
<tr>
<td>7.</td>
<td>Import on request external content from other content system such as Atlassian Confluence, JIRA and other platforms</td>
<td>Import external content on user request over HTTP by using URI</td>
</tr>
<tr>
<td>8.</td>
<td>Highlight content with image and passover-popup content dialog on front-page to focus on content in sub-nodes</td>
<td>Clearly visible on the front-page notifying the user of current content in focus, by image and popup dialog</td>
</tr>
<tr>
<td>9.</td>
<td>Rich-text editing editor for content editing</td>
<td>Available rich-text editor when editing content</td>
</tr>
<tr>
<td>9.1</td>
<td>Highlight programing languages and scripts when mixed with text content</td>
<td>Content marked as programing language will be highlighted when read</td>
</tr>
</tbody>
</table>
Workgroups can be any constellation of actors that take part in integrating PortCDM with a specific port or actors that collaborate regarding topics that concerns the endeavour of introducing and disseminating PortCDM in the world. System wide templates that are controlled centrally for the entire platform determine the workflow management of publishing content. Setting up new workgroups based on templates provide a quick and standardised process for manage groups and editorial rights to content. The concept of the workflow templates provides a lean handling when changes are made to the system wide processes for publishing content. The templates also accommodate a means to tailor workflow for specific groups that has specific requirements.

Beside the workflow the DevZone platform also uses templates for all content that is published or drafted. This provides a similar approach concerning flexibility when changing the look and feel for content and will be replicated for the whole platform when changes are made to templates. This includes the ability to style specific sections of content on a page for highlighting sections. Content templates also include placeholder for widgets like calendar, sharing in social media channels, related content and more.

The platform support flexible management of user groups and users, so users can have different roles in different groups they belong to. User that has the role of an author in one group can have editorial rights for another group, groups of user can be assign to specific folder or nodes in the content structure to delegate content management to varies port participating in the project.

To find CMS that can accommodate the intended functionality for DevZone platform a review of available online documentation has been conducted. The top tree candidates of CMS (Magnolia CMS, Alfresco CMS, and Hippo CMS) have a rich set of documentation. Where search for documentation has been ambiguous or unclear about functionality the review reflects this with a comment. The three CMS has both a community and enterprise solution. The table below reflects the functionality of the enterprise version for the reviewed systems.

<table>
<thead>
<tr>
<th>Functionality</th>
<th>Magnolia CMS</th>
<th>Alfresco CMS</th>
<th>Hippo CMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>User and front-end</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rich content without web programming (video, HTML5, etc.)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Responsive design (smartphone, tablet, desktop)</td>
<td>Yes</td>
<td>Not clear</td>
<td>Yes</td>
</tr>
<tr>
<td>Role-based management of content and publishing workflow for user groups and users</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>User groups and user rights assignable per top-sub content nodes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Enabling port optimization by a digital collaborative platform - a first step towards a STM Developer Zone

### Publishing workflow and scheduling of publishing content per top-sub nodes
<table>
<thead>
<tr>
<th></th>
<th>Magnolia CMS</th>
<th>Alfresco CMS</th>
<th>Hippo CMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Templates for pages and widgets
<table>
<thead>
<tr>
<th></th>
<th>Magnolia CMS</th>
<th>Alfresco CMS</th>
<th>Hippo CMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Highlight content sections (like programming language etc.)
<table>
<thead>
<tr>
<th></th>
<th>Magnolia CMS</th>
<th>Alfresco CMS</th>
<th>Hippo CMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not clear</td>
<td>Not clear</td>
<td>Not clear</td>
<td>Not clear</td>
</tr>
</tbody>
</table>

### Multi-language support and assignable default language per top-sub content nodes
<table>
<thead>
<tr>
<th></th>
<th>Magnolia CMS</th>
<th>Alfresco CMS</th>
<th>Hippo CMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### RSS-feed
<table>
<thead>
<tr>
<th></th>
<th>Magnolia CMS</th>
<th>Alfresco CMS</th>
<th>Hippo CMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Linking external content
<table>
<thead>
<tr>
<th></th>
<th>Magnolia CMS</th>
<th>Alfresco CMS</th>
<th>Hippo CMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not clear</td>
<td>Not clear</td>
<td>Not clear</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### User statistics
<table>
<thead>
<tr>
<th></th>
<th>Magnolia CMS</th>
<th>Alfresco CMS</th>
<th>Hippo CMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Internet resources

<table>
<thead>
<tr>
<th></th>
<th>Magnolia CMS</th>
<th>Alfresco CMS</th>
<th>Hippo CMS</th>
</tr>
</thead>
</table>

---

Table 1: CMS functionality review

Table 2 outline the technical details of the reviewed CMS systems.

<table>
<thead>
<tr>
<th>Technical details</th>
<th>Magnolia CMS</th>
<th>Alfresco CMS</th>
<th>Hippo CMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extension module language</td>
<td>Java</td>
<td>Java</td>
<td>Java</td>
</tr>
<tr>
<td>System integration interface</td>
<td>REST API</td>
<td>REST API</td>
<td>REST API</td>
</tr>
<tr>
<td>Development environment tool</td>
<td>Maven, Groovy</td>
<td>Maven, Groovy</td>
<td>Maven, Groovy</td>
</tr>
<tr>
<td>Application server</td>
<td>Tomcat 8, JBoss Wildfly 4</td>
<td>Tomcat 7, JBoss EAP 6, Weblogic 12</td>
<td>Tomcat 8</td>
</tr>
<tr>
<td>Database</td>
<td>MySql 5, Derby 10, Oracle 10, MS Sql 2012, Postgres 9</td>
<td>MySql 5.6, MS Sql 2012, Oracle 12, Postgres Sql 9.3</td>
<td>MySql 5.6, Oracle 12</td>
</tr>
</tbody>
</table>

---

2 According to: http://tinyurl.com/ovv7qex

3 Extension module: http://exdocpickerbase.forge.onehippo.org/
A CMS is chosen as the backbone for the PortCDM Developer Zone, additional supporting systems and front-end interfaces for enhanced social interaction need to be further explored. The PortCDM Developer Zone does also rely on relationship management functionality for supporting the emergence of positive network effects. Whether the user group functionality provided by selected CMS is enough does thus need to be explored.
7 Final remarks

7.1 Summary and development/implementation plan

Successful deployment of PortCDM depends to a significant degree on supporting both technical and business operational aspects in its target environment. Such support will be provided as a developer zone—the PortCDM Developer Zone.

The PortCDM Developer Zone is envisioned to be mainly an online resource containing static and interactive material (e.g. documentation and discussion forums) pertaining to both operational and technical aspects of PortCDM.

The PortCDM Developer Zone has thus the role of supporting and spreading knowledge about the application of the PortCDM concept as a response to existing challenges informed by best practices in the maritime sector. In this report the purpose, organization, requirements, and scope of the PortCDM Developer Zone has been outlined. The overall goal is to facilitate the use of standardized solutions building upon instant sharing of information (intentions, and actual occurrences) among diverse stakeholders engaged in a port call. Explicitly this concerns supporting and sharing experiences from the implementation of different technical solutions, adaptations made in processes and collaboration schemas, evaluations, data quality, and optimization (prior and during the port call) among diverse actors related to port calls in ports adopting PortCDM.

The target group for PortCDM Developer Zone are all ports in the world and actors associated with these ports. The primary concern of the PortCDM Developer Zone is to support the adoption of PortCDM in the 13 ports engaged in the STM Validation Project. The second concern is to use the base established for the 13 ports to reach out to other ports. Adopting PortCDM means that actors are acting PortCDM compliant (in operations and via systems) according to the requirements set by the PortCDM council.

The technical part of the PortCDM Developer Zone (the technical community) will contain support for deploying, and for developing systems compliant with, PortCDM. Typical stakeholders of the technical part of the PortCDM Developer Zone are: the provider of the core PortCDM platform; data providers who integrate their systems to submit data to PortCDM; service providers that provide PortCDM compliant services; service consumers that provide (typically) end-user functionality by using PortCDM data or PortCDM compliant services.

The operational part of the PortCDM Developer Zone (the usage community) will contain support for assisting port actors in adapting their operations and use of digital tools to take advantage of PortCDM. Typical stakeholders of the operational part are Port looking for / using PortCDM, Individual port actors, Maritime Authorities, Third party service providers, Data Analytics actors, PortCDM developers, and Shipping companies.

The PortCDM Developer Zone builds upon that valuable content continually is included creating positive network effects where the generation of content is dependent of enough
stakeholders contributing to the PortCDM developer zone (c.f. figure 6). The Developer Zone builds thus upon a prosumer model.

In order to support the orchestration of the development of the PortCDM Developer Zone communities and technical infrastructure that two measuring processes are proposed to established and used for taking different actions:

- measuring the engagement of stakeholders (newcomers and trends) and also showing the most active ones (as readers and/or as contributors) during a certain time period
- measuring the quality of the content, new content added, and consumed during a certain time period. Principles of how to measure and value content quality are to be explored in the validation of the PortCDM Developer Zone.

For this purpose network diagrams could potentially be used showing who and what is at core and who and what is at the boundaries.

The first version of the PortCDM Developer Zone will be established during the first quarter of 2016 building on one of the top three candidates of CMS. Viktoria Swedish ICT and Valencia Port Foundation will collaboratively establish this first version. The first version will include the following core functionality, specifically:

- Setup a standard CMS system as the backbone of the PortCDM Developer Zone
- Identify and assign human roles associated enabling active and live communities
- Identify and implement complementary modules to ensure the overall goal with the PortCDM Developer Zone
- Establish a front-end interface promoting providers and users of content according to the ambitions with the PortCDM Developer Zone
- Identify which statistics functions that would need complementary infrastructure in relation to used CMS
- For the technical community, APIs and documentation for the PortCDM core components as well as a selection of services will be published. The primary target stakeholder groups are: PortCDM core providers (for maintenance and deployment) and data providers
- Explore an initial architecture and specification for the integration of the SeaSWIM service registry with the PortCDM Developer Zone

It is expected that engaged ports (and other actors associated with introduction of PortCDM in the 13 ports) will be able to use the PortCDM Developer Zone by the 1st of April. During the second quarter of 2016 the following functionality will be added:

- Adapt the CMS system to more precisely according to the goals with the PortCDM Developer Zone
- Explore integration with SeaSWIM service registry
- Extend the technical documentation available on the Developer Zone and establish interactive discussion forums, with specific focus on data providers and PortCDM core providers (for maintenance and deployment)
It is expected that the PortCDM Developer Zone to a large extent will be functioning according to the requirements formulated above at the end of the second quarter of 2016. This means that the actions related to the development of the PortCDM Developer Zone during 2016 – 2018 to a large extent could be filled with content based on members’ engagement. An important next step is to formulate a strategy for how to ensure the continual inclusion of, and quality assurance of, content by the engaged communities and continual recruitment of members.

7.2 Generalizing to a PortCDM Developer Zone to STM Developer Zone Purpose of the concept

As stated in the introduction, efficiency in sea transports cannot be reached without enabling enhanced collaboration within the self-organized ecosystem that characterize maritime activity. PortCDM does thus not exist in isolation. The PortCDM Developer Zone is therefore to be regarded as a section of a larger Sea Traffic Management (STM) Developer Zone. This is important due to that:

- there exist mutual dependencies between different concepts within STM, such as e.g. between voyage management and PortCDM
- the different concepts within STM rely on the same infrastructural service oriented architecture, such as SeaSWIM
- the same stakeholders will need to be engaged in different concepts of STM, in order to ensure a holistic approach to STM in sea transports. Such overlap of the same stakeholders being engaged give rise to network effects due to a larger variety of the content.

In this respect size matters; an STM Developer Zone with a larger scope will include more relevant and valuable content than a PortCDM Developer Zone, and thereby contribute to the enlargement of the user base. A larger user base will then enable a larger contribution of more content. An STM Developer Zone being used for different stakeholders, especially service providers needing support for development and exposure of their services, service consumers to rely on quality-assured services, and federations (i.e. conglomerates of organizations), acting on behalf of the community, to ensure the use of standards, is a key enabler for the introduction of STM at large. A STM Developer Zone enables both a holistic approach to STM and sharing of commonalities within the different concepts. The overall goal is to secure engagement from different stakeholders to bring in STM into operations and services. Important to stress is that the Developer Zone should reflect incentives for engagement from different stakeholder group, as e.g. ensure that the industry can work in a spirit of co-opetition.

It is therefore expected that the structure adopted for PortCDM Developer Zone is generalized to a STM Developer Zone in which the same functionality is used. This probably means that the STM Developer Zone should be divided into different sections where some parts are oriented more specifically to PortCDM while other parts are oriented more specifically to other STM concepts (such as Voyage Management and Flow Management). Other aspects, covering more overarching parts, would be part of a more common section of this STM Developer Zone.

During the STM validation project it has been decided to establish and explore the use of a PortCDM Developer Zone. It will therefore be prioritized to technically establish this as soon
as possible enabling possibility for 1) starting to use it by adding content and associating different stakeholders, and 2) evaluate the use of it and make refinements of the technical infrastructure. In this way a solid base for expanding towards a STM Developer Zone would be created.
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MONALISA (2015b) PortCDM Validation Report, MONALISA 2.0 – D2.7.1, 2015
MONALISA (2015c) STM – The Target Concept, MONALISA 2.0 – D2.3.1, 2015
MONALISA (2015d) Target Information-Systems and Information-Technology Description, MONALISA 2.0 – D2.3.1-6, 2015
Annex: Publications related to the PortCDM concept


Lind M. (2016) Port Call Message Standard, version 0.5, ENAV19-6.6, IALA


Lind M., Bergmann M. (2018) Functional Definitions of Port Call Message – The Ability of the Port Call Message Format to address functional definitions for nautical port call information, STM Validation project


Lind M., Haraldson S. (2016) New KPIs will show how ports become more efficient with PortCDM, Newletter December 2016, STM validation project


STM VALIDATION 1.1 – Enabling port optimization by a digital collaborative platform - a first step towards a STM Developer Zone
industry more profitable through PortCDM, Concept Note #17, STM Validation Project (https://www.ipcdmc.org/galerie)


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