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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
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Table of contents

1 Introduction ................................................................................................................................................. 6
  1.1 Background ......................................................................................................................................... 6
  1.2 Objectives of the PortCDM Council .................................................................................................... 7
  1.3 Other deliverables from PortCDM testbed during the STM Validation project .................................... 7
2 The assignment and composition of the PortCDM Council ................................................................. 9
  2.1 The assignment of the PortCDM Council ............................................................................................ 9
  2.2 The composition of the PortCDM Council .......................................................................................... 9
  2.3 The organization of the PortCDM Council .......................................................................................... 10
3 PortCDM as object of interest for the Council ......................................................................................... 11
4 Conclusions and recommendations ......................................................................................................... 16
Annex A: Sources of inspiration for the establishment of a PortCDM Council ........................................ 17
  4.1 Ecosystem leadership and federative governance .............................................................................. 17
  4.2 Airport CDM council ......................................................................................................................... 18
  4.3 Comité International Radio-Maritime (CIRM) .................................................................................... 19
  4.4 PortCDM and e-Navigation ................................................................................................................ 20
  4.5 Sea Traffic Management governance structure ............................................................................... 20
Annex B: Publications related to the PortCDM concept ............................................................................. 22
Table of figures

Figure 1 The role of the PortCDM Council - basis, tasks, and objectives ......................... 10
Figure 2 States constituting time stamps according to the port call message standard .......... 11
Figure 3 Layered architecture as one solution for the introduction of PortCDM in different ports ........................................................................................................................................ 13
1 Introduction

1.1 Background

Port Collaborative Decision Making (PortCDM), together with Voyage management and Flow management, is one of the three concepts\(^2\) enabling a holistic approach to Sea Traffic Management. Its overall purpose is to increase efficiency, improve safety and reduce the environmental footprint for all stakeholders in the maritime ecosystem from berth-to-berth including the sea voyage of all types of ships and the port operations in all types of ports. At the core of Sea Traffic Management is operational benefits enabled by information sharing by the use of the inter-operable infrastructure concept SeaSWIM.

PortCDM provides information services enabling actors involved in port calls to share real-time data from different information sources to enhanced coordination.

The data concerns time-related port information about estimates of the different actors’ of when an event is planned, when it is about to occur, and when it actually occurred. These are all recorded in a standardised way. Sharing information in a standardized way, allows data to be used by its own or in combination with other data across organizational and traditional operational boundaries. A new level of situational awareness enables different actors to optimally plan upcoming operations based on shared intentions and process status in real-time. By using information services for enhanced interoperability, application services for situational awareness, to be used as e.g. functional displays and dashboards, would be possible to derive.

PortCDM is designed to validate the value of sharing information in the port and beyond. By using time stamps being shared by PortCDM port calls could be monitored from the moment they are declared and record states that are planned for or reached by enabling port operators, shore-side actors and ship voyage stakeholders to collaborate and thereby provide information required to plan, decide and execute in a proactive as opposed to a reactive way. The strong legacy of self-organization and autonomous actors has led to the need for standardized processes and interfaces to stimulate and enable real-time collaboration between involved actors in the berth-to-berth voyage.

An important outcome of the STM validation project is the proposal for governance structures to enable the continuous adoption of the Sea Traffic Management concept among different actors in the maritime sector.

Taking inspiration from the aviation sector different governance structures have been identified, the PortCDM Council is one of these.

The purpose of this document is to provide guidance for such a PortCDM Council related to its role, objects of governance, and routines of how to organize its work. The intent of this document is to lay out the broad charter for a PortCDM Council and leave the inaugural Council

\(^2\) In STM ‘concept’ is used to characterize a proposed Socio-Technical System (model, framework) describing governance structures, staff, physical assets, and information systems for operating ports. There are three concepts in STM; PortCDM, Voyage Management, and Flow Management using a common infrastructural concept, SeaSWIM.
to determine the composition of its on-going membership, and the structures and systems necessary to meet its charter.

After this introduction the proposal for assignment, membership structure and the organization of the PortCDM Council is discussed. This is followed by a short description, but detailed in its essence, of PortCDM as the domain areas for the PortCDM Council to be concerned with is followed. This document concludes with a summary and recommendations. This document also includes some other governance initiatives (c.f. annex A) of similar areas as a source of inspiration to be used by the forthcoming PortCDM council in organizing its tasks.

1.2 Objectives of the PortCDM Council

The objective of the international PortCDM Council is to ensure the implementation, use, management and further development of PortCDM as an integral part of STM. This may be divided into the following sub-objectives, all of which are based on increased transparency enabled by information sharing empowered by digitization:

- Improve efficiency and optimisation of port calls through widespread adoption of Sea Traffic Management standards and compliant systems.
- Maximize contributions to safe, secure and environmentally optimized operations in ports.
- Achieve greater cooperation among all actors and stakeholders in the maritime industry, including governments and international organizations;
- Influence appropriate international and national legislation, rules, policies, standards and practices based on established policies affecting the interests and priorities of ports;
- Advance the development of the port information environments by enhancing public awareness of the economic and social importance of port development;
- Maximize cooperation and mutual assistance among ports, between ports, and shipping lines, between ports and hinterland actors as well as between other relevant actors;
- Provide members with holistic industry knowledge, advice and assistance, and foster professional excellence in port management and operations;

1.3 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., Arcona 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 B to this report contains a list of the numerous publications that have been generated during the conduct of the project.
2 The assignment and composition of the PortCDM Council

2.1 The assignment of the PortCDM Council

The assignment of the PortCDM Council is to establish a platform of standards and services to enhance the efficiency and effectiveness of collaborative port decision making related to improving port operations. These standards include:

- Digital messages related to port call operations and coordination.
- Informational processes related to port call operations and coordination.
- Measurements of all port call operations efficiency.
- Conception of the port call process.

These services should include:

- Certification of PortCDM compliant software for port call decision-making and operations. The actual analysis for certification is to be done under the assignment from the Council.
- Development of forums to enable knowledge exchange to enhance port decision-making and operations.
- Roadmaps (including maturity level analysis of selected ports) indicating the planned direction of PortCDM to enable planning by participants and potential software and services vendors.
- Consulting with potential software and service vendors to establish technological directions and innovations that can promote efficiency and effectiveness of collaborative port decision.
- Managing co-innovation risk to ensure that all necessary partners cooperate effectively to deliver innovations required advancing collaborative port decision-making.
- Managing adoption risk to ensure that all necessary partners cooperative effectively to implement innovations required to advance collaborative port decision-making.
- Managing execution risk to ensure that all necessary partners continue to cooperate effectively to maintain the PortCDM goals.

2.2 The composition of the PortCDM Council

Adoption of PortCDM by a critical mass of actors is necessary for the success of substantive uptake of PortCDM. The composition of the council should represent the following stakeholders:

- Major ports using PortCDM and corresponding association participating in PortCDM (e.g. IHMA).
- Port authorities of nations broadly participating in PortCDM
- Shipping companies and corresponding associations (including classification societies) participating (e.g. ICS, BIMCO, InterTanko, CLIA, InterManager) in PortCDM
- Terminal operators participating in PortCDM.
- Service Providers and corresponding associations (e.g. Tug boat operator, Linesmen, Pilots, System providers etc)
- Other appropriate parties whom the Council deems are critical to the success of PortCDM.

2.3 The organization of the PortCDM Council

In establishing its systems and structures, the Council should examine councils with similar purposes, such as CIRM (Committee International Radio-Maritime), AirportCDM Council, and review informed opinion on matters such as ecosystem leadership and federative governance. To summarize, the basis for the PortCDM Council, its tasks, and objectives are depicted in figure 1.

As earlier indicated, the founding members of the council will be encouraged to further elaborate on the way of working, division of labour in different committees (as e.g. developers, users, evaluators etc.), how often to report, how often to meet etc. International IGOs and NGOs (e.g. IALA) should be used as inspiration to define guideline, similar to how it is implemented as A-CDM (AirportCDM). On a regional level country authorities or existing port cooperation organizations could be activated to guide local councils.
3 PortCDM as object of interest for the Council

The foundation of PortCDM assumes that a set of standardized data sharing, essentially real-time sharing of time stamps, will be leveraged for enabling:

- Enhanced coordination for vessels to arrive with improved predictability
- Increased berth productivity
- Better capacity utilization of port and terminal assets
- Improved punctuality of vessels
- Shortened port stays
- Reduction of waiting times and hand offs (lean management)
- Reduced bunker consumption of ships and improved energy efficiency in ports.

The time stamps are reflected in figure 2. The time stamps are to be captured as a generic list of states that would be possible to use for coordinating a port call at a port. Each port will analyse port calls and select those time stamps from a generic state catalogue (a port call message standard format catalogue) that would be used for enhanced collaboration within the port.

These states are combined with a time type to generate a time stamp which constitute the core of the port call message format (PCMF). A time stamp is the combination of a time type (estimated, actual, targeted, cancelled, or recommended), a state (location state or service state), and associate resources to execute a service.³

³ C.f. The port call message standard, version 0.51 (2016-12-02), STM validation project
The enhanced collaborative capability is achieved through four **PortCDM operational services**:

- port call optimization (within the port),
- port call synchronization (towards sea operations / voyage management within STM),
- port call monitoring, and
- port call improvement.

This means that the following information sharing is enabled:

- port call actor-to-port call actor
- ship-to-port,
- port-to-port, and
- port-to-hinterland.

In the future, there will most likely be more operational services included in the service repertoire of PortCDM.

PortCDM is an inter-operable concept allowing involved and related port call actors, including the vessel as a key port call actor, to share time stamps among each other. Optimally, this will be done by machine to machine connectors to/from different systems, such as Port Community Systems, Single Window, Private actors’ systems, shipping ERPs systems, VTS, etc. The aim is to facilitate seamless interoperability, which will contribute substantially to value generation for the port actors of each used system in the port.

Currently, only to a very limited extent are time stamps captured in existing systems. Therefore, it also becomes necessary to provide additional manual connectors allowing non-connected, or semi-connected, actors to provide additional time stamps enabling coordination of the port call. This is both acknowledged in the conclusions from MONALISA 2.0⁴ and is also clearly experienced in the validation efforts within activity 1 of the STM validation project. Further, the PortCDM concept builds upon identifying/producing the same time stamp from multiple sources enabling the user of PortCDM to validate data quality.

Both machine-to-machine and manual connectors are enabled by a standardized payload format, the port call message standard, and using the SeaSWIM infrastructural concept,⁵ specifying a standardized way of authentication and service provisioning. Within PortCDM manual connectors are solved by providing generic applications (with an automated connector) where an operator can enter timestamps manually when there is a lack of IS-support for an operational procedure or actor. Building on the layered model used to define Sea Traffic Management within MONALISA 2.0⁶ a connector is to be regarded as an information service sharing time stamps to others (via the PortCDM concept). This further means that services at PortCDM instances (southbound for distribution of information and northbound for consumption of PortCDM information services (c.f. figure 3 below)), being used at different

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⁴ c.f. Port CDM Report, MONALISA 2.0 – D2.7.1, 2015
⁵ c.f. The SeaSWIM concept, STM validation project
⁶ c.f. The Target concept, MONALISA 2.0 – D2.3.1, 2015
ports would be discoverable for provision of time stamps from e.g. approaching vessels, collaborating ports, and different port call actors, in a SeaSWIM and STM compliant way facilitating standardized information exchanges.

Further, PortCDM also intends to enhance increased connectivity to the voyage at sea, to previous and next port, and to hinterland operations acting as a key component in a transparent door-to-door flow.

To position the PortCDM concept’s different dimensions, a layered architecture has been proposed to overcome the challenges of enhanced interoperability within the port, and towards external actors such as other ports, to the vessel, and to hinterland operations. This layered architecture, building upon the standards that are covered by the PortCDM concept, is depicted in Figure 3.

**Figure 3 Layered architecture as one solution for the introduction of PortCDM in different ports**

The proposed architecture addresses the following layers:

- **PortCDM connectors**, which enable machine-to-machine SeaSWIM compliant connectivity between different information providers to the PortCDM message broker (PortCDM backend). Connectors are external to the PortCDM message broker, while data provider’s systems are responsible to ensure PortCDM compatibility. They are external in the sense that they would exist within the system environment being providing information to, and consuming messages to/from the PortCDM message broker.

- **PortCDM message broker** (PortCDM backend) acting as a message broker of port call messages to subscribers of such messages. One core service is also the builder of
port call structures, as the foundation for situational awareness, which is based on a continuous feed of port call messages, is regarded as a natural trusted extension (as a tailored API). A time stamp, and consequently a port call message, is a combination of a time type (estimated, actual, targeted, cancelled, or recommended), a state (location state or service state), and associate resources to execute a service for a port call. Consequently, subscriptions of port call structures as well as port call messages are thus supported by the PortCDM backend. A solution for enabling actors to place trusted extensions/tailored APIs within the framework of the PortCDM backend is also proposed.

- PortCDM modules for situational awareness and analytics to be used in proprietary and common dashboards for enhanced coordination among involved port call actors.
- PortCDM dashboards for using different modules in proprietary and common settings by the different port call actors.

The four layers that different service providers can use to provide and consume maritime information services as defined for the proposed STM information framework\(^7\) are related to the layered architecture as follows; connectors are information services, PortCDM back-end are information services, while modules and dashboards are to be regarded as application services used for operational services.

The ambition with PortCDM is to enable enhanced utilization and interaction of the different systems being used within the port. Because there are very many systems operating in the port and the challenge of getting these to adopt enhance functionality based on STM/PortCDM a complementary solution for a common dashboard (PACT\(^8\)) is also proposed.

Keeping in mind that the overall goal is that time stamps are shared that would enhance the coordination ability among port call actors, experiences of the application of PortCDM has shown that some essential time stamps are not captured in any of the systems used that are associated to the port calls. This has driven where existing systems are enhanced or the introduction of complementary solutions (as e.g. SeaNAPP\(^9\)) for enabling additional entering of necessary time stamps. Such solutions are however external to the PortCDM solution, still enabling the PortCDM backend to stay as a platform for machine-to-machine interaction.

The PortCDM connectors should operate per SeaSWIM standards using the payload formats recognized by the PortCDM concept. It is essential that a PortCDM backend is operating per the requirements specified by the STM / the PortCDM Council (see below) to:

- Avoid that one system provider would limit the possibilities for other systems providers to enhance their functionality based on STM/PortCDM
- Enabling that third-party actors are introduced as service innovators.

\(^7\) c.f. The Target concept, MONALISA 2.0 – D2.3.1, 2015

\(^8\) Within the STM validation project, a Port Actor Coordination Tool (PACT) has been created as a front-end application, using information services from the PortCDM backend, to provide situational awareness for involved port call actors.

\(^9\) Within the STM validation project, an application service (SeaNAPP) has been created as a tool for enabling users to provide time stamps manually
This would entail the PortCDM backend to function as an open information service platform that allows access to information regulated by the information provider. A PortCDM backend should thus act as an open platform enabling different third-party actors to provide new services in the light of enhanced connectivity throughout the berth-to-berth sea voyage.

Further, an eco-system of modules for application services is expected to evolve. This means that such modules could be offered by different service providers and consumed in different settings. Again, it is essential that such modules are not tied to a specific system / port call actor.

To summarize, there is a need for an organization that can develop and maintain, among other issues that emerge, a standardized:

- Port call message format (PCMF) *(according to the latest version granted by the STM validation project and promoted by IALA)*
- PortCDM concept definition *(under revision within the STM validation project)*
- Generic guidelines for the implementation of the PortCDM concept *(according to the latest version granted by the STM validation project)*
- An open PCMF catalogue (i.e. the generic state catalogue) *(according to the latest version granted by the STM validation project)*
- Port call structure ontology *(as being defined within the STM validation project)*
- Criteria for accreditation of PortCDM application services and PortCDM data services *(to be defined)*
- Definitions of Key Performance Indicators (KPIs) and how to measure, analyse and publish these *(according to the definitions made by the STM validation project)*
- Access point for information provision (South bound interfaces) and information services per the STM information framework for subscription on PortCDM information (northbound interfaces). PortCDM would to be instantiated at each port allowing different information exchanges within and outside the port *(according to the latest versions granted by the STM validation project)*

As illustrated in the figure 3, it is also necessary to establish and maintain standards for:

- Front-end modules allowing the combination of such modules within proprietary and open systems
- Dashboards that could hold the front-end modules, i.e. application services and combinations of these in the same / complementary views for situational awareness, to enhance coordination and analytics
- Front-end modules, i.e. application services, combining STM compliant modules within proprietary and open systems for presentation in the dashboards.

It is also essential that the proposed Council reflect the adoption of PortCDM within the context of Sea Traffic Management and SeaSWIM standards development.

The council also must maintain change management processes for the evolving needs of standards and new research / innovation needs.
4 Conclusions and recommendations

It is recommended that given the self-organizing nature of the shipping industry, a Federated Governance approach structure is adopted. The members of the PortCDM Council should address the issues identified in this document and others that fit within the spirit of its charter and emerge as the industry innovates.

The council should include, dominant actors in the maritime industry to ensure that the council can perform its role of developing and implementing standards for enhanced digital collaboration within the area of port call optimization. Appropriate members would be major ports, shipping associations, shipping lines, industry systems providers, and maritime authorities. To ensure that major actors are represented, the Council might specify membership composition in terms of industry roles. By selecting influential actors together with different roles (such as developers, users, evaluators etc.), the PortCDM Council should become a centre of gravity for ensuring a proactive development of the maritime sector. Many stakeholders such as, Global Container Carriers, Dry-bulk and Tanker Vessel Owners and Operators, Port Authorities, Nautical Service Providers (Pilots, Linesmen, Bunkers providers, Tugboat operators), Government Agencies (e.g. Port state control, Customs, Quarantine, Immigration, Phytosanitary agencies), Country Maritime Authorities, Government and Non-commercial Associations, e.g. IMO, EMSA IALA, Container Terminal Operators, System Vendors (Vessels domain), System Vendors (Landside domain), and VTS Operators would naturally benefit from being parts in the PortCDM information sharing environment.

The PortCDM council should further ensure any development in this sector is compliant and supported by the relevant regulations, guidelines and recommendations of IMO, in specific the IMO e-Navigation initiative. Any reporting standards should utilize the IMO e-Nav Common Maritime Data Structure (CMDS). The PortCDM Council should ensure that any PortCDM establishments are compliant with CMDS.

A lot of actions have been taken to spread knowledge of the STM project. The establishment of a PortCDM Council would serve as a host for those that are interested, within and outside Europe, to participate in the adoption of PortCDM, and STM, solutions globally. This means that dissemination actions performed within the STM validation project are encouraged to enhance the recruitment of members to the Council.

Because of their leadership in the PortCDM concept development and associated PortCDM testbeds within the STM validation project, it is proposed that RISE Viktoria and Valencia Port Foundation assume the responsibility of coordinating the establishment of the Council. Later, when sufficient Council members have joined the Council to provide it with the necessary breadth of representation and knowledge to fulfil its charter, a final structure can be put in place in accordance with the suggestions in this document with any necessary modifications.
Annex A: Sources of inspiration for the establishment of a PortCDM Council

A PortCDM Council, while new to the shipping industry, is not a new governance phenomenon. In a variety of sectors, approaches have been adopted to ensure that the needs of diverse stakeholders are reflected in pursuing standardized (digital) collaboration. For example, banks have established a consortium that supports the standardised exchange of financial transactions between institutions. In this section, some approaches are reflected inspiring the setup for the PortCDM Council.

4.1 Ecosystem leadership and federative governance

The shipping industry is a self-organising ecosystem. Members have a high degree of autonomy and typically interact with many different stakeholders. Thus, innovation, among other necessary collaborative tasks within ecosystems, in the industry generally requires cooperative efforts because more than one party will likely be affected. Furthermore, because of members' high degree of autonomy, leadership is a challenge and federative governance is one appropriate way of management. Federative governance is appropriate when (forced) operational performance is to be achieved within an ecosystem constituted by autonomous agents. Under this approach, there is a governing body comprised of members of the various stakeholders that makes or recommends decisions for the industry. The concept of federation is a conglomerate of different types stakeholder that would have a role to influence the rules of collaboration within the ecosystem. The division of influence would be a design made by the members. For example, it establishes standards for data exchange about vessel arrival at a port. While the membership is representative, it is often weighted towards the more influential stakeholders because their support is usually necessary for adoption and implementation success.

To ensure successful innovation, federated governance must be able to address and mitigate three major risks:

- co-innovation risk
- adoption chain risk
- execution risk

These risks arise from the dependencies that are typically found in a self-organizing ecosystem where parties must cooperate to achieve their goals. Thus, Federated governance should establish a reporting mechanism to ensure that the parties jointly developing an innovation are working collectively and effectively (e.g. developing a standard for data exchange between terminal operators and vessels).

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10 S.E. Jørgensen Mejer Nielsen, Ecosystem as self-organizing critical systems, 1998
11 Mona Lisa 2, Strategic Action Plan, 2011
12 For reference see: http://www.iedp.com/articles/innovation-ecosystems/
Similarly, a reporting mechanism is required to ensure that appropriate stakeholders are cooperating to ensure that mutually beneficial innovations are adopted by all involved parties (e.g. implementing digital message exchange between terminal operators and vessels) and once implemented are executed effectively.

4.2 Airport CDM council

The aviation industry started a few years back the implementation of Airport CDM. EuroControl defines it as follows:

“Airport CDM (A-CDM) aims at improving the overall efficiency of airport operations by optimising the use of resources and improving the predictability of events. It focuses especially on aircraft turn-round and pre-departure sequencing processes.

Increased predictability can be of significant benefit for all major airport and network operations; it raises both productivity and cost-efficiency.”


A-CDM defines five very specific phases necessary for a successful roll-out:

1. Information Phase
2. Analysis Phase
3. Cost-benefit analysis (CBA)
4. Implementation Phase
5. Validation and operation of CDM elements

Key to A-CDM is “harmonious and standardised implementation of Airport CDM” (EuroControl 2016). Therefore, EuroControl has developed an “Implementation Manual”. Each Airport develops its A-CDM, creating individual local A-CDM procedures, based on this manual. An example for Frankfurt Rhein Main Airport can be found at http://www.cdm.frankfurt-airport.com/content/fraport-ag-cdm/en.html.

Details on the experience of the European aviation community of A-CDM can be found in the EuroControl publication “A-CDM Impact Assessment 2016”.

To develop, implement and execute an A-CDM, different stakeholders at a given airport usually form a council to define, monitor and control the A-CDM agreement. Those stakeholders typically involve airport operators, aircraft operators, ground handlers, ATC and the ATM

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13 EuroControle Homepage at http://www.eurocontrol.int/node/10666/concept_introduction.php, retrieved Dec 2016

Network (e.g., European Air Traffic Flow Management - CFMU). Organizations like Airport Council International (ACI) and the International Air Transport Association (IATA) are supporting the councils in different airport in developing their A-CDM procedures (example see above) to ensure the work of the councils are compliant with the International Civil Aviation Organization (ICAO) resolution on A-CDM (ICAO Doc 9971)15.

A-CDM works based on the level of engagement and agreement among key stakeholders.

Level one of cooperation is the local level at a given airport. Here the stakeholders define their interpretation of A-CDM as described above.

Level two is on a region, either within a country or transnational if required for a given region.

Level three is on a continental level. An example is the cooperation within EuroControl.

Based on the decision of the councils at the different levels, the A-CDM procedures can reach different maturity levels. In other words the council decides to which degree the CDM will be defined and executed.

Canso (Civil Air Navigation Services Organisation) defines 7 maturity levels:

- **Level 1**: sharing flight lists with scheduled times
- **Level 2**: sharing basic information such as actual flight times
- **Level 3**: sharing advanced information such as a radar display, traffic load, works planning…
- **Level 4**: sharing analysis based on provided information.
- **Level 5**: sharing decisions
- **Level 6**: making collaborative decisions
- **Level 7**: sharing efforts and contribution to improve the global performance.16

In summary A-CDM councils define their way of collaboration based on local, regional, and continental needs within the guidelines given by the competent bodies on the different levels.

Upon its formation, the PortCDM Council is encouraged to review the A-CDM as a model for its structure, systems, and operation. It should also keep in the mind the different circumstances and needs of the airline and shipping industries and how these impact collaboration. As e.g. the self-organizing nature and the legacy of non-centralized governance within the maritime sector, compared to the aviation sector, would naturally give rise to different management structures.

### 4.3 Comité International Radio-Maritime (CIRM)

CIRM is the industry association for the maritime electronic industry. CIRM members are working together to improve the conditions for the utilization of equipment and services, both on the ship, but also on shore. CIRM works closely with other maritime stakeholders, IGOs

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15 ICAO Doc 9971, ICAO, 2013
16 Canso Perspective, Bastien Bernard, A-CDM Subgroup, CANSO, 2015
and NGOs, and is therefore an active partner in projects like EfficienSea 2. CIRM members are essential contributors to STM and supporters of the PortCDM concept.

Given the international structure of CIRM and realizing the world-wide reach of maritime trade, CIRM promotes harmonization of efforts like PortCDM across regional boundaries, in full support of the IMO e-Navigation concept.

CIRM is looking for an integration of ship systems in the overall concept of PortCDM. While most the coordination within a local PortCDM is between the port stakeholders, the ship is the initiating nucleus of those activities coordinated within a PortCDM. Automated, structured and harmonized digital ship reports are the essential initiations for PortCDM activities and as such need to be included in the concept.

CIRM’s members are developing solutions, both on the equipment as well as on the services side of the equation, to enable PortCDM. CIRM is also interested to promote positive development through STM in Europe in other regions of the world to foster international adaption of generic rules and procedures around this concept in all regional clusters.

### 4.4 PortCDM and e-Navigation

The IMO already agreed on an e-Navigation Strategic Implementation Plan (SIP).\(^{17}\) Within the SIP 16 different “Marine Service Portfolios” (MSP) are defined. PortCDM is supporting a series of those MSPs, in specific MSP1 – VTS Information Service, MSP2 – Navigational Assistance Service, MSP3 – Traffic Organization Service, MSP4 – Local Port Service, MSP6 – Pilotage Service and MSP7 – Tug Service.\(^{18}\)

A key MSP for PortCDM is MSP10 – Maritime Assistance Service (MAS). This MSP is looking at communication between coastal states, ships officers and other maritime stakeholders to supply assistance. The ship facing aspects of PortCDM are playing right into this field. PortCDM further is extending MSP8 – Vessel Shore Reporting to the extent that it for one is utilizing existing ship reporting processes, but further helps harmonizing and standardizing ship reporting on the aspects related to PortCDM.

Given the aim of PortCDM to support international maritime trade, it is important that the concept is compatible to regulations and guidelines of the international body responsible for that – the IMO. The fact that PortCDM is aligned with IMO e-Nav SIP links PortCDM well into the regulatory environment of shipping. Further development of PortCDM as well as the establishment of an international PortCDM Council must take the IMO e-Nav initiative into account, both as a supporting initiative as well as an activity PortCDM needs to be compliant with.

### 4.5 Sea Traffic Management governance structure

This section will describe the way STM project functions now as well as the ambitions of establishing an STM governance structure which will include the PortCDM Council.

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\(^{17}\) IMO NCSR 1/28, annex 7 and IMO MSC 94/21

\(^{18}\) IMO NCSR 1/28, annex 7
STM’s governance body and structures are still in their early stages. The long-term ambition of Sea Traffic Management requires a form of governance that can help maintain, support and develop its processes in a changing environment. The goal of STM governance is to enable inclusive and secure cross-domain and cross-organisational data and information transfer throughout the maritime industry for the purpose of operational benefits. The aspiration towards this goal means to balance operational qualities, business value and trust from the maritime ecosystem. Since STM consists of stakeholders and processes throughout the sea voyage and in ports all this domain knowledge needs to be represented.

Success for STM’s governance will be measured by the sustained improvement in efficiency, safety and environmental impact over the whole maritime ecosystem. The ability to realize and communicate these results will depend on the input and trust of the collaborating partners. During the STM Validation project appropriate procedures to govern the key pieces of voyage, flow, and port call management will be evaluated. The PortCDM Council is one governing body for enable this development. By sharing the same goal but differing in focus, STM governance and the PortCDM Council will provide complementary perspectives. While STM will focus on the complexities of combining domains with different information models, standards and needs, the port management perspectives can focus on prioritising the challenges and opportunities within its domain. The benefit is mutual between the collaborating bodies. For example, the PortCDM Council or another established interest group would establish trust for STM’s governance and provide valuable insight on how to develop and better support their processes. STM’s governance would, in turn, provide appropriate operational support and business value for the maritime ecosystem in accordance with these insights.

Within the STM validation project, a PortCDM developer zone, as a component of the STM developer forum, has been established. The overall purpose of the PortCDM developer zone is to lower the barriers for the introduction of the PortCDM concept, share solutions, and report experiences from implementation and application of the PortCDM concept, in the maritime sector.
Annex B: 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


Lind M., Haraldson S., Watson R.T., Ludvigsen P., Bergmann M., Andersen N-B. (2016) Role and routine of the PortCDM Council, STM validation project


industry more profitable through PortCDM, Concept Note #17, STM Validation Project (https://www.ipcdmc.org/galerie)


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