Maritime Digitalisation: Sharing timestamps on Port Calls is paramount

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Digitalisation is becoming a key requirement for all business operations in the maritime transport chain

Digitalisation is no longer an interesting aspect in the maritime transport sector. It has become a necessary step towards sustaining any business plans in shipping. While digitalisation started in navigation primarily with AIS and ECDIS, and then with the ship operation centres of larger shipping lines for remote monitoring, as well as in the operation of larger ports, it has now reached out to all actors in the maritime domain. Lately, a lot of attention has been paid to the role of digitalisation for empowering maritime operations to become a part of the maritime supply chain for example, with developments such as connected ports, [1] smart ports,[2] and connected hinterland operations. Each is using digitalisation to better meet the expectations of their clients, the cargo owner and the transport buyer. It is probably correct to say that all business operations today are dependent on digitalisation in one way or another.

While first the focus was on "digitisation" - simply turning paper documents into digital versions, the industry has now crossed the line to digitalisation – where digital data and data exchange replaces traditional methods of passing and receiving relevant, reliable and up to date information within the business and operational processes. With this development the maritime transport sector has started to close the gap that exists with the rest of the global logistics chain. Implementing digitalisation enables actors to provide their clients and partners in the supply chain with the transparency and the electronic data needed to coordinate their activities. Ensuring efficiency and agility, combined with the need to demonstrate responsible and safe supply chain practices, raises important possibilities for today's businesses in the shipping sector.

As more and more actors are embracing digitalisation and the use of sensor technology in their operations, efficiency gains are being experienced, which has, in turn, increased the need for every actor to adopt it in their operations. One example of how to do this is in the effort brought forward by Port Collaborative Decision Making (PortCDM) in which actors utilise instant data sharing to pursue the coordination of activities associated with their port operations.[3] By accessing shared data, the port call actors have a better understanding of how port calls are progressing, which allows them to coordinate and synchronise their activities and be able to cut excess costs and deliver more efficiently and reliably.

International standardisation is necessary to deliver the full benefits of digital data sharing

With the extended use of digital data, it becomes clear that a single data set does not provide the necessary information to gain the benefit of digitalisation in full. The use of digital data from different

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[1] Michaelides M., Herodotou H., Lind, M., and Watson R. T. (2019) Port-2-Port Communication Enhancing Short Sea Shipping Performance: The Case Study of Cyprus and the Eastern Mediterranean. Sustainability Journal, Vol. 11, No. 7, pp. 1912-34

[2] Becha H., Lind M., Simha A., Bottin F. (2020) Smart ports: On the move to becoming global logistics information exchange hubs, Smart Maritime Network, 20/4-2020 (https://smartmaritimenetwork.com/2020/04/20/smart-ports-on-the-move-to-become-global-logistics-information-exchange-hubs/)

[3] Lind M., Watson R.T., Ward R., Bergmann M., Bjørn-Andersen N., Rosemann M., Haraldson, S., Andersen T., (2018) Digital Data Sharing: The Ignored Opportunity for Making Global Maritime Transport Chains More Efficient , Article No. 22 [UNCTAD Transport and Trade Facilitation Newsletter N°79 - Third Quarter 2018] (https://unctad.org/en/pages/newsdetails.aspx?OriginalVersionID=1850)

sources channelled by different data streams,[4] its integration with relevant in-house data, and the sharing of such created information with others, is essential. This has already been highlighted by the current implementations and test beds of PortCDM.[5]

In particular, there is a need for the international standardisation of message formats carried by the various data streams. Proprietary data sets are to be avoided because they are unreadable by those without the bespoke systems for which the data sets are designed or they need to be transformed to enable them to be used by other actors – which may be expensive and time consuming and can lead to some losses in details. Given the international and diverse community in the maritime domain proprietary solutions are not realistic nor desirable. For all the foregoing reasons, standardisation has resulted in the recent development of standards, like S-211 for port call messaging and S-421 for route exchange to include the additional data needed above and beyond that already captured as standardised data streams, such as the logistics chain GS1 EPCIS standard. The International Port Community Systems Association (IPCSA) also highlights the need for standardisation.[6] Combining streams of S-211 data and the newly launched "track and trace standard"[7] by the Digital Container Shipping Association (DCSA) also makes it possible to forecast the expected arrivals of goods in the maritime transport chain to a larger degree than is done today.[8] The DCSA, representing nine major container shipping lines, is also looking into the topic of port call optimisation by improving collaboration structures. They aim at efficiency gains for carriers, ports and other stakeholders by reaching a better predictability of the port call and optimization of berth windows. "The Digital Container Shipping Association (DCSA) has just started an initiative to achieve significant emission reduction thru advanced berth arrival and departure planning at scale. This initiative is based on the findings from PCO and PortCDM and following the IMO Just In Time Arrival Guide[9]" says Henning Schleyerbach (COO, DCSA)

The introduction of the route exchange format and the port call message format

The need for standardisation associated with sea transport berth-to-berth was recognised and addressed during the EU funded MonaLisa2 and STM Validation project. A standard for Route Exchange was developed and has now been included in the ECDIS Test standard IEC 61174:2015 (ed 4). The benefits for standard route exchange was realised both for shore side authorities, getting a better picture on the expected traffic in their area of responsibility, but also allowing ship operation centres to improve fleet coordination by knowing the actual position of their ships, but also details on the intended voyage. It was also identified that besides route exchange, a need for sharing timestamps associated to events in a port call were necessary to cater for data exchange throughout the sea voyage berth-to-berth. It was identified that the existing standards were not addressing the full need and as such a Port Call Message Format (PCMF) was developed and tested within the PortCDM testbeds activity during the STM Validation project.

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[4] Pigni F., Piccoli G., Watson R. (2016) Digital Data Streams: Creating Value from the Real-Time Flow of Big Data, California Management Review, Vol 58 (3)

[5] Lind M., Ward R., Bergmann M., Haraldson S. (2019) How to boost port call operations, Insight no 10, Global Maritime Forum

[6] Morton R., De Cauwer N. (2019) Why Standards Matter, Port Technology International - edition 85

[7] https://dcsa.org/dcsa-releases-track-and-trace-open-api-definitions/

[8] Lind M., Simha A., Becha H. (2020) Creating value for the transport buyer with Digital Data Streams, 9/3-2020, Maritime executive (https://www.maritime-executive.com/editorials/creating-value-for-the-transport-buyer-with-digital-data-streams)

[9] GEF-UNDP-IMO GloMEEP Project and the GIA (2020) Just In Time Arrival Guide – Barriers and Potential Solutions

On the Route Exchange side, the IEC has followed the IMO guidance by using the IMO Common Maritime Data Structure (CMDS) and is working on the migration of the current format in IEC 61174:2015 into a new standard IEC 63273 "S-421 Route Plan Based on S-100" (S-421).

For the Port Call Message Format, the International Port CDM Council (IPCDMC), initiated during the STM Validation Project and now operating as an independent organisation, has also migrated the PCMF into an IMO CMDS compliant standard, S-211. S-211 has been endorsed by IALA and is registered in the IALA domain of the IHO GI Registry, which is the agreed host for the IMO CMDS.

As envisioned in the IMO Overarching Architecture on e-Navigation, the CMDS comprises data standards with a specific maritime focus, all compatible with each other for the purpose of combining different data when needed rather than defining a single, monolithic and harder to maintain all-encompassing standard. As such S-421 has a specific focus on the voyage information and S-211 on the Port Call.

In order to promote the international use of the standards, IMO has included them in the definition of the IMO Maritime Service 4, MS 4 – Port Support Service, as depicted in figure 1 below.

4.8 Associated technical services

Name	ID (MRN)	Description	Standardization body
PortCallMessageExchangeService		Standard for exchange of timestamps and related data associated with a port call – Data Standard will be S-211	IPCDMC through IALA
VoyageInformationService		Standard for exchange of voyage related information including waypoints and timestamps – Data standard will be S-421	IEC

Figure 1 MS 4 Description - IMO MSC.1/Circ.1610 (2019)

S-211 catering for the needs of PortCDM and more

S-211 enables the necessary data exchange in a standardised way to support the collaboration and synchronisation between ships and ports, between departure ports and next arrival ports, and between destination ports and hinterland operators. As it focuses on the data exchange between those actors, it includes the key information for use within a given port on the plans and progress of those plans during a port call. The scope of S-211 is that it is, nothing less and nothing more than, ***a format for port call messages allowing standardised sharing of data on intentions and outcomes of movements, services, and administrative events related to a given port call.***[10] To cater for other needs, as described above, in compliance with the CMDS concept, the actors implementing and using S-211 can combine S-211 data with other data, like S-421 and data from other data streams to enhance their specific operations. Other systems operating within the a port, affecting one or several actors, such as resource management systems, port community systems (PCS), and Terminal Operating

[10] https://www.ipcdmc.org/standards-and-guidelines

Systems (TOS), will all be complemented by access to these standardised data streams of time stamps[11] and thereby strengthen their capabilities, too. Same as for all S-100 based standards (CMDS), the timestamp used are based on the definitions in ISO 8601:2004. S-211 builds upon the combination of time-type (actual, planned, estimated, etc.), state type (location state, service state, administrative state), and time sequence (arrival, departure, commenced, completed, etc.) where each participant is able to define states (of plans and progress) in line with their needs. As such S-211 uses and complies with the technical ISO definition of the time stamp syntax, but also defines operational related aspects of those timestamps. As such the shared S-211 data set contains the information on events associated with a port call, with the related details, including dates and times.

The International PortCDM Council

The IPCDMC serves two purposes: providing necessary technical support for PortCDM and overseeing the further development of PortCDM. The Council with its global reach, aims to maintain the necessary overarching guidelines, processes and procedures to make PortCDM a successful international concept to improve maritime transport as it relates to port operations and ports' interaction with ships. It has developed and maintains the global guidelines for PortCDM implementation, including operational rules and compliancy criteria. An important development is the concept of seven maturity levels to guide PortCDM implementation.[12]

In accordance with IPCDMC procedures, the IPCDMC Technical Working Group (TWG) is maintaining S-211 as needed, given the experience and growing needs by organisations and manufacturers implementing S-211. Any relevant organisation is invited to join the TWG and contribute to the further development and enhancement of this important standard.

Towards compliancy of S-211 with base standards and adoption by standardisation bodies

The main interest of the IPCDMC is to secure support for the realisation of PortCDM globally, by providing foundations for regional and local adaptations and implementation. PortCDM emerged from a sea transport centric viewpoint but is now moving towards being used in support of ports as transport hubs. This means that the applicational scope of PortCDM is moving beyond the sea window of the port to include a port's efforts in acting as a transhipment hub. To support the emergence of the port as a coordinated transhipment hub there is an obvious need to ensure standards are compatible with time stamp data sharing aimed at the other means of transport to and from a port as well.

For this purpose, there are several standardisation bodies working collaboratively on standardised data exchange and sharing along the transport chain. Building upon the last 20 years of the e-navigation initiative, the IMO/MSC has provided "component" standards to support its common maritime data structure (CMDS) framework. Recently, the IMO has focused on introducing an IMO Reference Data Model as part of the "IMO Compendium on Facilitation and Electronic Business"[13]. The IMO Reference Data Model, in which the definitions of core objects associated with shipping are defined, drawing upon already defined terms where these are maintained by relevant standardization

[11] Time stamps using the Port Call Message Format video https://www.youtube.com/watch?v=0Ga-o9yyONw

[12] Lind M., Bergmann M., Andersen T., Haraldson S., Ward R., Andersen N-B., Michaelides M., Watson R.T., Ferrus G., Zerem A., Gimenez J., Karlsson M. (2019) Achieving compliance in collaboration and data sharing with PortCDM, Implementation note #1, International PortCDM Council (www.ipcdmc.org)

[13] IMO (2020), FAL.5/Circ.41

bodies (such as UN/CEFACT, WCO, WTO, IHO, IALA).[14] S-211 builds upon the definitions brought forward by these harmonized definitions. The IMO reference data model seeks to ensure that standards that emerge, like S-211, are compatible and interoperable with all the other relevant data exchange standards and formats.

A new partnership between IMO, the World Customs Organization, the United Nations Economic Commission for Europe and the International Organization for Standardization has been signed to support increased maritime digitalization. The partnership agreement paves the way for updating the IMO Reference Data Model and for its further development towards harmonization of data standards in other areas, beyond the FAL Convention, such as exchanging operational data that could help facilitate just-in-time operation of ships.[15]

The foundations for S-211 were developed within the MONALISA and STM validation projects[16] and S-211 are now being used in several applications. Recently HVCC and Carnival reported that successful trials have been conducted to support just-in-time shipping through the exchange of time stamps for just-in-time arrivals of cruise ships into Hamburg using the port call message standard.[17]

After the journey from introducing the port call message format in 2014, validating it in nine large-scale testbeds resulting in several iterations with many automatic data connectors, established to cater for machine-2-machine data exchange, the message format has now been brought forward as a standard within the CMDS.

Various publications have attracted a high readership and shown support for the development and implementation of PortCDM and the use of S-211. This includes organisations such as UNCTAD[18].

Call for collaborative action

There are thousands of ports in the world serving multiple types of shipping as part of providing useful timestamps to support the port call process, S-211 is continuously being updated as new use cases beyond PortCDM are identified for time stamp data sharing. These updates are managed and considered by the participants of the IPCDMC and proposed to IALA for subsequent international recognition as an updated standard. Having an appropriate membership in the IPCDMC is important for identifying new requirements and for having appropriate industry expertise to consider them.

This is therefore a call to join the IPCDMC and to contribute unbiased collaborative action, not skewed to any single regional or local port initiative, in the ongoing development and validation of the implementations of time stamp data sharing. The S-211 standard covers the whole maritime sector, not a specific port, not a specific shipping company. It is a collaboration to improve maritime transport.

Further information and how to engage can be found at the IPCDMC homepage at http://www.ipcdmc.org.

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[14] Lind M., Simha A., Becha H. (2020) Creating value for the transport buyer with Digital Data Streams, 9/3-2020, Maritime executive (https://www.maritime-executive.com/editorials/creating-value-for-the-transport-buyer-with-digital-data-streams)

[15] Partnership agreement signed for maritime digitalization to support flow of trade by ship, IMO What`s New 27/04/2020 (http://www.imo.org/EN/MediaCentre/WhatsNew/Pages/default.aspx)

[16] Lind M., Bergmann M., Watson R.T., Haraldson S., Park J., Gimenez J., Andersen T., Voorspuij J. (2018) Towards Unified Port Communications - from a project format to a global standard, Concept Note #9, STM Validation Project (https://www.ipcdmc.org/galerie)

[17] https://www.hvcc-hamburg.de/en/press/real-time-data-exchange-between-ship-and-port/

[18] Lind M., Ward R., Bergmann M., Haraldson S., Zerem A. (2019) Digitalizing the port call process, UNCTAD Transport and Trade Facilitation Series No. 13, UNCTAD (https://unctad.org/en/pages/PublicationWebflyer.aspx?publicationid=2663)

About the authors

Michael Bergmann: With experience in software engineering, the aviation and maritime industry, Michael Bergmann owns the maritime consultancy company BM Bergmann-Marine. He holds various positions, including Observer, participant and advisor at the IMO, IALA and IHO, Director at Comité International Radio-Maritime (President 2013-2018), Fellow of the Royal Institute of Navigation, Associated Fellow of the Nautical Institute, Member of the council of the German Institute of Navigation and initiator and secretary of the "International PortCDM Council"

Michael Schröder has 30+ years' experience in the maritime industry with both an operational and IT background. He has a position of Project Manager eSolutions at Hapag-Lloyd and is representing the carrier in various standardization organizations such as the SMDG, UN/CEFACT, DCSA or BIC. He is actively promoting Standardization along the maritime Supply Chain, and developed the VERMAS message for VGM reporting.

Robert Ward was the Secretary-General of the International Hydrographic Organization (IHO) until his retirement in late 2017. Prior to that he was the Deputy Hydrographer of Australia. For more than 20 years he represented Australia and subsequently the IHO at the highest international levels and has played an influential role in the development and implementation of global digital data exchange standards for nautical charting services that now also underpin the IMO's e-Navigation concept of a maritime digital information environment.

Trond Andersen is Marine Advisor at NOFO - The Norwegian Clean Seas Association for Operating Companies. He has long experience as a navigator in international shipping, mainly from shuttle tankers. The Norwegian Mapping Authority was the place of work for over eight years, with responsibility for shipping operations. Prior to his current position in NOFO, he was harbour master at Port of Stavanger.