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Creating a mature data sharing regime - Thriving in the connected ecosystem

by

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Collaboration is essential

Collaboration requires a willingness to share data.[1] Maritime transport has a strong legacy based on autonomous, often competing, actors in a self-organizing ecosystem. This has meant that shipping's actors are often oriented towards keeping data within their organization. Thus, outsiders make less informed (operational and strategic) decisions. This is an inefficient track for the ecosystem because low coordinative behaviour can mean less than optimal performance for some actors. The gains from collaboration should bias actors to prefer dealing with those who share data.

Current best practices in other markets have long moved away from a data protection bias. In the car industry head on competitors often develop cars together. Their suppliers need to share relevant data as just-in-time logistics doesn't forgive any delays of more than 15 minutes, and such synchronization is possible only through collaboration in the full supply chain. In the aviation industry, airlines have for years realized that they need data sharing to survive. Airline alliances and code share flights are good examples. Here even connectivity of code share flights is guaranteed, which also only works if you share the necessary data. Those that had been very outspoken, saying they do not need or want alliances as they want their flights to always be full, like Emirates and Etihad, have meanwhile moved away from this and now offer code share flights. They have realized that they can survive only when forces are combined.

Walmart, another example, has a business strategy of everyday low prices for its customers. In line with this goal, it pioneered bar code scanning and , like Emirates and

[1] Lind M., Bergmann M., Haraldson S., Watson R.T., Park J., Gimenez J., Andersen T. (2018) The skilled collaborators - the winners in a digitized maritime sector, STM Validation Project

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Etihad, analysing point of sale data. In the mid 1980s, it launched a satellite network, which enhanced its supply chain management process by facilitating data sharing between Walmart and its suppliers. This also enabled the introduction of a vendor-managed inventory, whereby vendors received regular, such as hourly, status reports on their inventory by SKU in each Walmart store. They could then plan their production and distribution more precisely, lowering their and Walmart's costs for the ultimate benefit of the Walmart shopper. Competitors such as Sears and Kmart failed to match Walmart's data sharing strategy, and this was a likely contributor to their loss major market share.

Key players in the maritime field are waking up to this data sharing business need – notice the term business need, not business desire. A look at the 2M (Maersk Line and Mediterranean Shipping Co) shows that key players know they need to collaborate to serve their customers. Transparency, data sharing, and collaboration will be essential assets in the competitive game. Trying the old fashion, protective way of working will reduce, not protect competitiveness.

Digitization empowers connectivity of physical objects and enables sharing of spatial-temporal digital data derived from physical movements and collaborative agreements established and fulfilled. By combining multiple data sources, situational accuracy can be improved and optimization advanced.

For example, data about ship movements is today shared by the use of AIS. The precision of forecasting ship movements, and consequently arrival times with high predictability is possible when there is historical data of ship movements. AIS means that ship operators can follow competitors' movements and amend their routes. At some point, the collective actions of the industry will determine the most efficient routes to sail given different contextual conditions, and everyone could presumably use the same routes. Given such a mindset, vessels might as well share their expected routes and accelerate industry learning.

Collaboration requires data sharing

In the maritime sector, as with nearly all industries, no one can act independently. Sea transport is dependent on multiple players' contributions to the value network. Ecosystems should be efficient in all their parts because there is a need for each organization to base its planning on the actions and intentions of the others. This means that to improve

operational performance data needs to be shared among involved organizations within the ecosystem and merged with each organization's data.

Data sharing for collaborative decision-making is at the core of the Sea Traffic Management (STM) enabler Port Collaborative Decision Making (PortCDM) in which two message formats are promoted; the route exchange format and the port call message format. Within the STM validation project, 13 ports are engaged in validating PortCDM where there have been concerns raised for what would happen with the data that a single organization might share. PortCDM aims at improving situational awareness through data sharing based on the port call message format. Hence, it is vital that all actors contribute with relevant data to a port's system of records to support mutually beneficial port planning.[2] A port is a meta system of production composed of independent, yet interdependent, systems of production linked through a ship's sequence of episodic tight couplings. To optimize this meta system, we need a meta system of records to enable a holistic analysis to improve a port's competitiveness.

Data sharing within Sea Traffic Management

One of the most important corner stones of STM is to enable the provider of the data to decide who should have access to what is shared. This can conflict with deriving the situational awareness necessary for making informed decisions in the planning of different tasks related to port call operations. Situational awareness requires that a variety of data and multiple sources are aggregated to a holistic and contextual image.

Within the STM validation project, a major challenge was what data shipping terminals should and are willing to share with other actors. PortCDM must ensure that everyone can align their actions in relation to what is known. Consequently, this means that, for example, many actors are highly dependent on the estimated time of arrival to the berth (ETA berth). The greater the precision of this estimate, the higher the level of alignment of actions among involved port call actors and a resulting increase in efficiency.

We have learned that the precision in the estimated time of departure is often used as a basis for planning, with an unfortunate low degree of predictability. This in turn affects the terminal's capabilities of planning the next port visit, the ship's capability of planning its next sea passage, and all other port call actors' possibilities to plan their operations.

[2] Lind M., Bergmann M., Haraldson S., Watson R.T., Park J., Gimenez J., Andersen T. (2018) Enabling Effective Port Resource Management: Integrating Systems of Production Data Streams, STM Validation Project

PortCDM addresses this issue by facilitating the sharing of timing estimates on what happens between the arrival to and departure from berth, which provides a good basis for determining the probability of leaving on time. To such a process there are five core events resulting in 10 possible timestamps to share among actors. In the following table, accurate time types and states for these timestamps are depicted for a berth visit associated with cargo operations.

Time type	State
Estimated / actual	Time of Arrival Vessel Berth
Estimated / actual	Time of Cargo Operations commenced
Estimated / actual	Time of Cargo Operations completed
Estimated / actual	Time of Ready-To-Sail
Estimated / actual	Time of Departure Vessel Berth

Within the STM validation project, terminals have, however, raised concerns, due to competitive concerns, about sharing their plans related to cargo operations. This means that different estimated events should be prioritized in terms of what should be shared. Taking the list above, it is reasonable to ensure that estimates / actuals of the time of arrival and departure to/from the berth are prioritized, estimates / actuals of ready-to-sail comes second, and actuals of cargo operations commenced and completed as third.

Berth productivity is of competitive concern and is measured by taking the time of cargo operations divided by the time at the berth. Bearing in mind that cargo operations can be followed visually by anyone, data about cargo operations might as well be shared for the benefit of optimizing berth productivity before the actual berth visit. By sharing estimates of cargo operations commenced and completed and by using ETA/ETD berth with high predictability, potentially poor productivity measures can be avoided in the planning stage rather than becoming an actual outcome of a berth visit.

PortCDM promotes the sharing of data about planned and conducted events to enhance the coordination capabilities of all involved actors. Agreements on the extent of data sharing among port call actors is a measure of the maturity of collaborative capabilities of a port.

Maturity of collaborative willingness

When a port adopts a collaborative agenda, it is naïve to think that everyone will initially be willing to share all they know. Sharing matures with evidence of the benefits. Maturity

should be thought about in relation to providing high precision time stamps together with the efficiency of operations (such as throughput time). At the lowest level of maturity, some pieces of data must be shared, and the amount of data required to share emerges as ports seeks higher maturity levels. A maturity level communicates expectations and commitments of a participating entity. Building on the shipping terminals example, the lowest maturity level is to ensure ET/AT arrival/departure for berthing. At a higher maturity level, the estimates and actuals for ready to sail are shared. At the highest-level, data associated with cargo operations are shared.

Implications for access management

PortCDM encourages that each actor uses time stamps shared by others as coordination mechanisms for planning its operation in the port call process. Essential timestamps are captured in a system of records that can be shared in accordance with the desires of the information provider. Collaborative capabilities empowered within PortCDM has the following principles of access management (see also figure below):

- In internal collaboration, all data provided are shared among all port call actors to allow for a common situational awareness. Both sources derived from internal as well as external collaboration are used. Data shared with a port by an external actor is made available to anyone who is qualified as an internal collaborator or is part of the port call, dependent on the desires of the information provider (see below on remarks of different sharing principles).
- Episodic tightly coupled actors, such as ships / shipping companies intending and/or paying a visit to a port, can only consume port call information from the port to be visited.
- Ports can access a ship's port call information from prior ports visited or those it intends to visit.
- Ports can access hinterland operators' information related to actors intending to visit the port. Hinterland operators can access port call information related to port call transshipment of goods to or from the hinterland operator.
- Information service providers desiring to access port call information need to establish collaboration agreements with local port governance or the data owner.

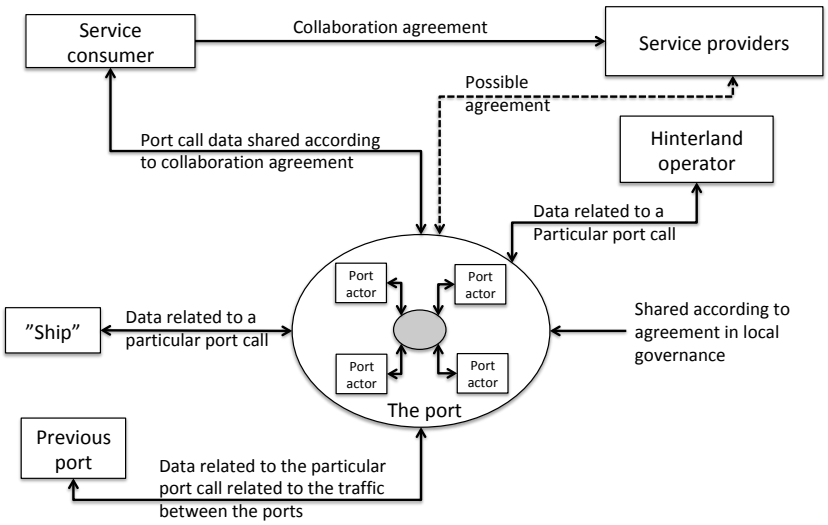

Figure: Sharing time stamp data between different types of actors

The principles of access management need to allow the data provider to choose which sharing principle should be adopted. The table below depicts four, combinable, principles of access management. There are two different dimensions: the actor level and the type of data shared. The first dimension emphasises that data is either shared for all port call actors within the port or just for the port call actors involved in a particular port call. In the second dimension, a distinction is made between the volume of time stamp data shared (a minimal or a full set of states according to the recommendation of PortCDM to support enhanced coordination).

	Minimal state	Full state
Port level	A minimal set of time stamps are shared with and within the port	Time stamps regarding all critical states of a visit are shared with and within the port
Actor level	A minimal set of time stamps associated with a port call are shared among everyone associated with a port call	Time stamp data regarding all critical states associated with a port call are shared among everyone associated with a port call

These different principles can be combined, such as minimal state coordination at the port level combined with full state coordination at a port call level. This would mean, for example, that ETA berth and ETD berth are shared among all actors within the port, while, for instances, terminal data on cargo operations commenced/completed (and potentially the other would be shared just within the cluster of actors engaged in realizing the particular port call.

Access management also requires considering regional vs. global concerns in providing access to the data. This means, among other things, that a port's local governance should decide which data can be shared outside the port, but possibly within a regional context. On the global level, the country, via its maritime authority, would decide which data should be shared between ports in different countries.

Concluding remarks

STM is based on the premise that the data owner decides on who shall be able to access the data it provides. By regarding the port as a hub, this would mean that the data provider authorizes access to all actors within the port. This would enrich situational awareness for a port's actors and enable a port to operate as an efficient system of production. Limited sharing of data restricts PortCDM to a system of engagement, which means that actors only share intentions to enable episodic coupling among each other, but a port perspective would enable integrated coupling across a port visit.

The Tragedy of the Commons describes a situation where the farmers with a right to a common area of land decided individually to increase their herd size. As a result, there was overgrazing, the land degraded, and it was no longer able to support grazing any animals. The Tragedy of the Digital Commons occurs when those who similarly rely on a shared resource, such as a harbour, don't share data to enhance their common interest and lose business to those who realize that extensive data sharing enhances efficiency and service and attracts customers. A mature port avoids the productivity losses of the Tragedy of the Digital Commons.

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