

Port Call Efficiency

- the benefits of coordination and synchronization

by

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Sea Traffic Management (STM) was introduced as a concept for the maritime sector to enhance efficiency, safety, and environmental sustainability in berth-to-berth sea transport. To realize the desired effects (including, route optimization, green steaming, shorter turn-around times, just-in-time operations, and better utilization of fixed assets/resources like ships and ports), collaboration between the wide range of very different involved actors is required. In this concept note, we discuss the two underpinning forms of collaboration: coordination and synchronization. Sharing plans and event timings using standardized and agreed formats is a cornerstone to effective STM and is key to effective coordination and synchronization.

Introduction

In organization theory one distinguishes between three types of organizations: markets (think of a bazaar for one-off transactions), hierarchies (think of any manufacturing company), and networks (think of the maritime ecosystem). The maritime ecosystem as such a network, is a self-organized ecosystem, where a range of more or less autonomous/independent actors provide different kinds of services for other actors. However, all the actors are governed by self-interest, and they pursue their goals by providing services that the other actors need. The effectiveness of the entire ecosystem is determined by the extent to which the actors effectively collaborate in it in order to achieve the overall purpose of the ecosystem. In other words, the actors are to varying degrees mutually dependent on each other for the successful performance of most of their individual tasks and contributions in order to achieve overall effectiveness. As stressed in earlier concept notes,¹ effective collaboration is essential to the long-term success of the entire ecosystem. The better actors collaborate, the more efficient the ecosystem.

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, Concept note #2, STM Validation project



Effective collaboration can only take place if there is transparency about desired actions and their status. Accordingly, the actors in an ecosystem need to share relevant data (such as schedules) and inform each other about progress so that they can efficiently execute their component of, say, a port visit. For a better understanding, we distinguish between two collaboration concepts, coordination and synchronization.

Within the Sea Traffic Management concept (STM) one of the core necessary activities for providing essential services is port call coordination and synchronization.² In this concept note, these two activities are explored, and the benefits of successful port call synchronization are identified.

Coordination and synchronization

To understand the difference between coordination and synchronization, let us turn to the Oxford English Dictionary definitions:

- *Coordination is the organization of the different elements of a complex body or activity to enable them to work together effectively.*

Coordination involves one or more linear dependencies – such as customs clearance must be organised before a vessel can be unloaded.

- *Synchronization is the operation or activity of two or more things at the same time or rate.*

Synchronization deals with one or more joint dependencies – a large ship usually needs tugs in order to come alongside safely. Both the tug and the ship need to meet at the same place at the same time in order to complete their tasks effectively.

Both of these definitions and examples embrace the concept of dependencies, but they are very different. We can think of coordination as the type of one-directional dependency, when one event has to precede (or follow) another. Synchronization on the other hand is a more complex bi- or multi-directional dependency, when two or more events must occur at the same time (or one immediately following the preceding event). When there is no time gap in a pair of linear dependencies (in other words, just-in-time operations), then full synchronization is achieved.

In the context of port operations, optimal synchronization is an ambitious target, because it means that, for example, a vessel and its pilot meet at exactly the agreed time and place

² MONALISA 2.0 (2015) Port Collaborative Decision Making Description, D2.3.1-4.4, MONALISA 2.0

so that neither party wastes time waiting for the other. Tug operations, berthing, and many other events in a port visit should be similarly synchronized to minimize waiting times.

Coordination is a necessary prerequisite for effective synchronization as it sets a central framework for the interaction patterns of the actors within an ecosystem. Coordination is like a master plan that outlines the priority of actions, plans, and the sequence of communication flows. Synchronization occurs within the context of such a master plan in those situations where two or more actors need to work together for a joint action.

Synchronization in complex business networks

A manufacturer can usually synchronize its operations internally. It has the power of command and control and the required systems and processes to ensure coordination in the form of such things as a master production schedule. Within the boundaries of a company (a hierarchy), coordination and synchronization are often easier to achieve as all relevant data are more accessible, there are common corporate goals and a single coordinating actor with the power to command.

In multi-organizational business networks (or ecosystems) with many actors, coordination and synchronization require data sharing and exchanging plans across different systems and spheres of control to ensure that the episodic tight coupling of two or more actors is first coordinated and then synchronized. This is required because the customer normally expects that the different parties involved will internally coordinate among themselves to satisfy established expectations.

In e-commerce, the retailer and the actors in the delivery chain, for example a shipper and a shipping company, coordinate so as to deliver on the day/hour promised. Internally, the retailer synchronizes picking and packing, but also needs to coordinate externally with regard to the pick-up for delivery. The delivery company might also coordinate with the customer to identify a specific delivery time slot or location. A recent example from Amazon illustrates the level of coordination that is possible delivering goods directly to the trunk of a GM or Volvo vehicle.³ One of the customer's input to coordination in this transaction is to remotely provide trunk access through a digital signal sent to their vehicle.

³ <https://www.bloomberg.com/news/articles/2018-04-24/amazon-starts-delivering-goods-to-gm-volvo-trunks-in-the-u-s>

Getting all contributors in a multi-organizational network, such as a port environment, to share data, coordinate and synchronize their activities may not be easy to achieve. An individual party in the collaboration chain could easily be tempted to optimise for itself at the expense of others in the chain rather than considering what is best for the overall flow. While better coordination and synchronization might make a port operate faster and more efficiently as well as lowering costs, if this comes at any additional cost to an individual participating entity, then they may not be keen to contribute unless their loss is compensated. Notwithstanding this, if customers or competitors become aware that efficiencies can be made that will result in savings and efficiencies for them, then alternative suppliers will be sought – resulting in a short-term gain for the non-conforming individual actor but ultimately, their long-term loss.

Port call synchronization

In most cases in the maritime sector, the two main synchronizing bodies in relation to port calls are the ship and the port, with a focus on the terminal. While other actors, like the port authority, may play a central and essential role in providing the overall (static) context and need for coordination, the dynamics of the cargo transport make the ship the obvious core synchronising entity. The ship, either represented by the ship's captain or by the ship lines' fleet management centre, has a particularly strong interest in ensuring that a port visit is synchronized so as to ensure that the ship maintains its schedule. In that context, the port authority is then an important actor in a port visit because it provides the services to ensure safe passage to/from the berth and by also providing/enabling nautical services and keeping the fairway in a good condition. In addition, special contractual agreements, like between ship lines and their terminals, may influence synchronization.

Traditionally, a shipping company's assignment is governed by charter parties, the contract between the charterer (shipper) and the shipping company, without taking into account the capabilities in the port. This can result in a ship arriving at the border of a port and waiting for service.⁴ In extreme cases, there might be days of waiting and thus wasted ship time and fuel. These are failures of synchronization.

Coordination requires the sharing of intentions as well as informing concerned parties about upstream progress. This occurs across a continuum from no coordination (each event is completed before planning begins for the next event) to complete coordination (all

⁴ Watson R.T., Holm H., Lind M. (2015) Green steaming: A methodology for estimating carbon emissions avoided, International Conference on Information Systems (ICIS), Fort Worth

events are planned in advance and the transition between events is carefully managed and adjusted as necessary). There might also be bundles of coordination between some of the actors in the chain (for example, between the pilot and the tug operators), but there may be less need for such close coordination between the bundles. Similarly, synchronization operates over a spectrum from no synchronization (there are waiting times between coordinated events) to complete synchronization (zero waiting time between coordinated events). Coordination is a necessary prerequisite for synchronization.

Synchronization of the overall process should not impinge upon any actor's right to manage its internal operations. Once event timing has been set, each operator has decision rights for its own actions, so it can optimize within the synchronization frame. For example, optimizing movement of containers related to a specific berthing event to reduce operational costs. Nevertheless, the combination of synchronization of collective actions and internal management for individual action optimization is a formula for fast turnarounds and port efficiency.

The boundaries drawn around collections of entities and the power of command within those entities directly influences coordination and synchronization. If a port or any other transport hub could operate as a single entity and operate in an environment where up to date (and relevant) data are shared to enable quality decision making, it could synchronize by exercising its power to command. At the same time, it could give external parties a single point of contact to enable external coordination and synchronization.

An example of such an arrangement is in the implementation of Airport Collaborative Decision Making (A-CDM) at the Frankfurt Rhein-Main Airport (FRA) in Germany. The different actors have agreed that DFS (German Air Traffic Control) at FRA is the lead point in the coordination of A-CDM for the airport.

This arrangement at FRA is one example of orchestration, a matter of local implementation. It is most unlikely that there is a single 'orchestrator' of the whole port call from the port's point of view. Different actors within the port, in different phases of the port call process, both related to planning and realization of the port call, can have power of command. The interplay between different actors taking and releasing power of command needs however to be clear and is a matter of local coordination.

Stakeholder benefits from better coordination and synchronization

Sea Traffic Management (STM) was introduced to enhance efficiency, safety, and environmental sustainability in berth-to-berth sea transport. To realize the benefits of port call synchronization, such as route optimization, green steaming, short turn-around times, just-in-time operations and better utilization of fixed assets/resources like ships and ports, coordination and synchronization of operations by a multitude of actors is essential. Technical standards governing the reliable exchange of data are the basis for achieving this coordination and synchronization. However, as mentioned earlier, full and effective synchronization may require that one (of the otherwise independent actors) be assigned decision authority on behalf of all the relevant actors in the ecosystem in different phases, prior and during the realization, of the process, in order to make the most effective and mutually beneficial synchronization decisions.

To support the realization of efficient port call operations and provide the basis for establishing well-founded communication⁵ in internal and external collaboration, Port Collaborative Decision Making (PortCDM) has been put forward as an enabling concept for supporting the coordination and synchronization of port call operations. By sharing relevant data⁶ the actors engaged in a port call gain insights on how well forthcoming and ongoing port calls are coordinated and synchronized. This window on situational awareness also provides a way to identify points in a port call where improved coordination and synchronization are required.

The need for three-party relationships

It might be useful to consider port call synchronization within three sub-ecosystems; the shipping company, the port with its actors (with the port authority and terminal operator as two of the core actors), and the hinterland operator as shown in figure 1.

In each of these three sub-systems, it is possible to identify one particular actor, who could be largely responsible for synchronization. These actors would have a special

⁵ In complex eco-systems such as maritime transports, it is highly essential that the communication creating coordination and synchronization is built upon structures of agreements and fulfilment of assignments, as e.g. a recommended time of arrival coming from the port to the ship needs to be anchored in the possibilities for the port to actually serve the ship if the ship follows the recommendation. The whole process of synchronization and cooperation is anchored in a collaborative way to make decisions on timing and execution so that all actors are benefitting, i.e. the concept of Port Collaborative Decision Making (PortCDM)

⁶ 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

responsibility to coordinate and synchronize the others in their zone of decision rights. The captain (master) is largely responsible for any activity related to the ship (including boundary areas like ETA and actual arrival), the terminal is a key operator as it is responsible for synchronizing cargo operations, and there is typically a hinterland operator, who is responsible for bringing the cargo from the quay to its destination. From this point

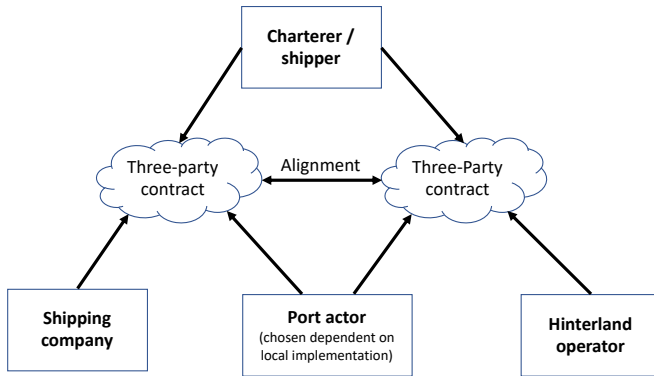


Figure 1 Concept of three-party-contract

of view, the port authority is an enabler for ensuring safe passage of the ship to and from the berth.

Within each of the three sub-ecosystems, one designated actor could synchronize all activities within its assigned zone of responsibility if the other involved actors were willing to give it decision rights on synchronization. At the same time, the

actor responsible in one sub-system must coordinate with the actor responsible for the next sub-system in the chain. Today, this work is typically performed by ships' agents.

In order to get one-step closer towards full synchronization, we suggest that three-party contracts may be an appropriate mechanism. As one can see in figure 1, two types of three party contracts may be implemented with the help of the shipper. Such contracts could ensure coordination between two of the sub-systems and the charterer/shipper. These three-party contracts could govern the actions pursued by the different actors inside each of the three sub-systems. From the port's point of view, it is necessary to distinguish a relevant party. It could typically be the port authority or the terminal operator depending on how the port is organized. The overall purpose is to synchronize operations to avoid sub-optimization.

Figure 1 depicts the possibility for the charterer / shipper introducing incentives for actors to synchronize their actions. In the particular case shown in figure 1, the terminal operator is the synchronizer of a multi-modal shift.

The specific culture and attitude in the maritime ecosystem (shipping line, terminal and hinterland) need to be taken into account when preparing for a change for introducing third-party contracts. Agreeing on three-party contracts and enabling the sharing of data to support this new mode of operations will be a change in mindset worthwhile exploring.

Initially, all actors may not welcome it, since it likely requires some loss of autonomy by individual participants

The introduction of three-party contracts, as an alternative or a complement to traditional charter parties⁷, would mean that actors would largely need to adopt a slot management system to ensure that scheduling obligations can be met with confidence. This would be a key part of ensuring the success of port call synchronization and the release of real benefits. Depending upon which actor takes the role of being the party in the contract in the port, the time span of the slot could be different. For instance, if the port authority were the party in the contract, then the slot should cover from port arrival to departure. Alternatively, if the terminal operator were the party in the contract, then the slot should cover from berth arrival to departure.

Stakeholder value from port call synchronization

Effective port call synchronization will provide shipping companies with real benefits because of reduced turnaround times, just-in-time arrival/departure, and minimal waiting times. At the same time, other port call actors can expand their planning horizons to harvest efficiency from more precise knowledge of when, where, and for how long resources will be committed. Hinterland operators would also benefit from being better able to coordinate their operations.

However, we need to remember that many ports in the world are driven by the principle of first come, first served. Thus, it is challenging to synchronize activities both internally and externally. However, by not synchronizing port call activities, can result in increased ship transit speeds to meet false deadlines, thereby increasing bunker consumption or ships idling at anchor awaiting port resources and reducing their utilization voyage delays. The concept of virtual arrival, reducing a vessel's speed when there is a known delay in the destination port, has been experimented with by some actors as a way to overcome the uncertainty of arrival and departure times and was included in several charter agreement templates.^{8 9} However, this innovation has yet to be implemented as a standard practice.

⁷ In the implementation process of three-party contracts, these might need to co-exist alongside charter parties and be back-to-back with them.

⁸ BIMCO „Virtual Arrival Clause for Voyage Charter Party”, <https://www.bimco.org/Contracts-and-clauses>, 2018

⁹ <http://www.intertanko.com/upload/virtualarrival/virtualarrivalinformationpaper.pdf>



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Conclusion

Understanding the difference between coordination and synchronization is important to achieving higher levels of efficiency. Coordination is a prerequisite and it is setting the baseline, but synchronization is where the complexities, and ultimately the largest pay-off will surface. Obviously, there are major differences between ports, and one should not think 'one size fits all'. That said, the global maritime ecosystem in general and port operations in particular everywhere, would benefit from applying STM concepts to improve coordination and synchronization. Synchronization is the most ambitious goal, and it will require the creation of zones of control, such as in a port, where one party has the decision rights to dictate which resources are committed when and for how long. Within a zone of control, one party will have the decision rights to negotiate with external parties, such as visiting ships, to synchronize their actions. Handing over some decision rights is essential if full synchronization is to be achieved, but it may be a difficult decision for members of a self-organizing ecosystem who cherish their autonomy.

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