Activity 2 - MONALISA 2.0

Defining Sea Traffic Management
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Partly inspired by the air traffic project SESAR, Activity 2 of MONALISA 2.0 set out to generate a definition of Sea Traffic Management (STM). In this activity the current situation has been analysed, STM performance targets have been developed, and a target concept and a master plan have been chiselled out. It all boils down to identifying what needs to happen in order to achieve successful STM deployment.

“It’s quite a challenging task given that this is not a concept that can be described by painting just a single picture. We have tried to cover all bases and have taken a bird’s eye view of the legal, administrative, commercial and operational aspects from the perspectives of all actors. Information flows among the different actors, and the technical aspects of information exchange, have also been considered”, says Mikael Hägg at Chalmers University, who is co-activity leader together with Mikael Lind, Research Manager at Viktoria Swedish ICT.

“Maritime transport lacks effective data sharing practices, which leads to imperfect common situational awareness resulting in a lack of process integration, lowered efficiency, and increases the likelihood of accidents and environmental damage.” says Richard T. Watson, Visiting Professor at Viktoria Swedish ICT.

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Bringing new tools into the maritime industry

Considerable parts of the maritime industry still operate according to rules and standards that solved problems in a different time. Chartering contracts and freight negotiation are not designed to consider fuel consumption to the extent needed. Today’s captains do their utmost to run their ships as economically as possible but there’s a lack of adequate information in the right time to take proper decisions.

“There is no focus on fuel minimisation in the captains’ contracts today. If we can understand the details of the contracts, and suggest how they may be updated, there is a lot to be gained. Reducing speed by 1% gives a reduction of fuel consumption by 2%”, says Mikael Lind.

With the long-standing tradition of ‘freedom of the seas’ the maritime sector is still to a large extent a self-organizing ecosystem where actors act very much on behalf of themselves. The prevailing need to know mind-set must be replaced by a need to share approach in order to have all actors involved in a more effective way.

“In order to establish a successful STM concept, with a number of new standards and a framework for information exchange, we have to know that we have a buy in from all stakeholders. The concept will only be accepted, and new technology developed, if the actors know that their data integrity will not be compromised, and that they are able to convert it to business value”, says Mikael Hägg.

The maritime baseline

Intelligent exchange of information is the key to improved maritime safety and efficiency. It is also crucial for the minimisation of the environmental impact of seaborne transports. However, in order to meet the demands of the future, the maritime industry must modernise its information exchange. This requires standards, in terms of information, processes and services regarding how data is made available to ships, ports and authorities.

A smoother supply chain

Modern ports are quite effective, but nevertheless there’s still a great deal of potential to improve operations in order to enhance the running of ports and their terminals. A lack of accurate information at the right point in time limits ports from operating at a higher efficiency rate. That may cause traffic congestion and an unnecessarily high impact on the environment.

Access to updated information from ships regarding arrival times, and what services they need, would allow the ports to plan ahead and become much better service providers.

“Synchronisation of port activities is urgently needed. A federative approach of information sharing, such as STM, will allow all actors, both ashore and on board, to be involved in collaborative decision-making in a way that has never been seen before in the maritime domain”, says Mikael Lind.

Safety

On board, the knowledge of the movements of other ships is limited due to the lack of certain information. With devices such as radar, GPS and AIS a lot can be perceived but still, captains out there do not know the routeing intentions of other captains or if they will abide by them. A proper exchange of routes will take the maritime industry a big step closer to the aviation domain where everybody knows what everybody’s doing. This will also give early trigger warnings to shore-based surveillance authorities when a ship is a deviating or behaving remarkably strange.

“Moving a ship from A to B is not exclusively a navigational process. It also involves and is affected by a number of other processes, such as cargo handling, customs, towage, availability of pilots, etc. Today many of these processes add an onerous administrative burden, particularly for the vessels. Even though there are a lot of on-going initiatives aiming to simplify those processes, and make them more efficient, they lack a holistic approach. That is what makes the MONALISA 2.0 project so important and unique”, says Caterina Cerrini at IB Italy, who identified and mapped the current situation in the maritime industry.
Envisioning the future of STM

MONALISA 2.0 has a performance-based approach that aims to create enablers and drive management decisions toward the goals: increasing safety and efficiency in the maritime sector, as well as decreasing the environmental impact of seaborne transports, says José Andrés Giménez Maldonado, Valencia Port Foundation, Spain.

The methodological approach is inspired by the SESAR project that was highly successful in improving a number of key areas in the European aviation sector. The objective of this programme, among others, was to straighten out air navigation corridors and to reduce fuel consumption during airport approaches.

MONALISA 2.0 has defined a number of strategic objectives and goals for the short-term, as well as a long-term vision. In order to achieve the vision for 2030, there are 39 defined key performance indicators (KPI) tied to the three primary areas.

Examples of KPIs:

**Safety:** Annual rate of human related errors due to maritime accidents associated to ship navigation. A reduction of 50% in 2030 of accidents associated to grounding and collisions.

**Sustainability:** Annual fuel consumption and greenhouse emissions generated by shipping and port operations. A reduction of 7% in fuel consumption by 2030 due to better route planning and execution, and just-in-time operations.

**Operational efficiency:** Integrated performance among involved actors and average turn-around time of ships in ports. A reduction of 10% on the average waiting time of vessels at ports in 30% in 2030.

José Andrés Giménez Maldonado
Director of Sustainability, Safety and Security, Valenciaport Foundation

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**STM definition**

Sea Traffic Management (STM) is a concept encompassing all actors, actions, and services assisting maritime traffic from port to port. STM is a part of the multimodal logistics chain, encompassing sea as well as shore based operations. The STM concept includes concepts for strategic and dynamic voyage management, flow management, port collaborative decision making (PortCDM), and the service based communication infrastructure concept SeaSWIM. STM is service-oriented approach to secure sharing and enhanced use of data from the maritime space in real time, in order to improve safety, environmental performance and efficiency in the maritime transport chain.
Voyage Information Service is a comprehensive service that defines ‘packages’ of information regarding each voyage. This serves as the basis for collaboration and includes both static and dynamic information, like the name of the ship and its particulars, as well as the anticipated route, including port calls. Within this process a unique voyage ID (UVID) will be issued that serves as a link between the strategic voyage management and all the other STM concepts. The supplier of the data remains the owner of the information deciding who will be able to use it.

"A smooth information exchange will improve safety and efficiency, but fierce competition makes seafarers reluctant to share information with other ships as well as with ports and authorities. One of our main challenges is to demonstrate usefulness and to implement a service provisioning infrastructure enabling enhanced information sharing that different maritime stakeholders trust", says Mikael Lind.

Concepts forming the STM backbone
STM consists of four closely interacting concepts aimed at improving efficiency, safety and reducing the environmental impact of maritime transport by facilitating secure information exchange based on a common digital service infrastructure.

"We have identified four concepts enabled by a fifth one, SeaSWIM. We have to show the actors in the industry that sharing information generates business value in order to tip the scales in favour of acceptance for SeaSWIM, the framework of the new digital infrastructure", says Anders Dalén, Senior Researcher at Viktoria Swedish ICT.

Strategic Voyage Management
Strategic Voyage Management is the pre-voyage phase starting with business matters regarding freight and passengers, focusing on the overall performance and the bigger picture, and is mainly driven by economic perspectives like why, how, who, when and where in order to have the best contracts. In this early phase different collaborators are nominated who the information owner considers should be allowed to access its information.

"A maritime transport requires a lot of activities to take place, both on board the ship as well as ashore. During the strategic phase the planner ‘paints a picture’ of everything that needs to happen during the journey and coordinates the activities with the service suppliers", says Sten Terje Falnes at the Norwegian Coastal Administration.

Dynamic Voyage Management
Dynamic Voyage Management (DVM) is the subsequent process, where all the strategic plans and decisions will be optimised on board the contracted ship in its actual seaborne conditions. The voyage will be optimised iteratively and dynamically along with the streaming flow of information.
“The main objective with DVM is to iteratively adjust the original voyage plan in order to always run the ship in the most cost-efficient way, using all possible in-data. Today this process is executed onboard with manual updates via classic sources as telephone, fax, mail, pilot books and charts. STM aims at allowing new technology to speed up and secure the current process with real-time access to adequate data from relevant stakeholders and service providers”, says Björn Andreasson.

**Route Exchange Service**

Route Exchange Service takes today’s navigational processes to the next level. When ships on route continuously communicate their intentions, better navigational choices can be made. This service will be an additional tool reducing the risk of collisions as well as optimising the flow of traffic.

**Flow Management**

Flow Management concerns optimising the flow of traffic, particularly in restricted waters, confined or high-traffic density areas, canals and near ports.

"Monitoring the traffic and providing the right information to the vessels is key to helping them avoid groundings and collisions”, says Gabriel Ferrus Clari at Valencia Port Foundation.

**Flow optimisation service**

With flow optimisation, a shore-based operator monitors traffic and can give advice to ships in order to avoid potential traffic congestion and problems further along its route.

**System Wide Information Management (SeaSWIM)**

SeaSWIM is a concept for distributed information management adapted to the characteristics of sea transports that specifies the fundamental components of a trusted infrastructure for organisations to use in their service interaction, enabling trusted and regulated information exchanges. An approach to a common service and identity registry enabling peer-to-peer service distribution/consumption is proposed.

This maritime service infrastructure enables the actors to share information on their terms, which allows them to collaborate. It will be tied to a governance organ of partners, a federation, in order to gain representation and an unfaltering trust in the maritime industry.

**Governance and Monitoring Service**

The Governance and Monitoring Service ensures SeaSWIM compliance and credibility. It monitors that the information maintains good quality and provides a confirmation that it has reached the parties that were selected in the nomination process. The service makes sure that all actors have access to the right information and that they make their decisions based on the most recent data.

**Voyage optimisation, synchronised port approaches, and optimised port operations leading to fast turn-around processes**
Port Collaborative Decision Making (Port CDM)

Port CDM concerns the optimisation of the port call by increasing predictability based on situational awareness formed by actors’ communication about their intentions as well as actual outcomes in real-time. A closer collaboration between the actors in the ports and the vessels provides conditions for improved traffic coordination.

“Ports will subscribe to information about the vessel’s anticipated arrival and get back to them with a precise recommended time of arrival when all is set to receive them. Extending the planning horizon will, among other things, prevent long mooring times outside the port, saving time and bunker”, says Sandra Haraldson, Senior Industrial Researcher at Viktoria Swedish ICT.

Port Call Synchronisation Service

Port Call Synchronisation Service aims at improving the overall efficiency of port calls. If the ship communicates an estimated time of arrival well in advance, the port can provide the captain with a slot time, and he or she can adjust the speed of the ship to arrive just in time. The service also allows the ship to communicate needs for diverse port services, in advance, and via one interface rather than communicating with a number of different actors. This service reduces fuel consumption and the time waiting during port calls and optimises port efficiency.

Multi-stakeholder collaboration enabled by sharing of information about intentions and actual state changes for synchronized port calls.

Sandra Haraldson
Senior Researcher at Viktoria Swedish ICT
There is an amazing potential for optimisation in the maritime domain and MONALISA 2.0 holds an ambitious vision for the future of the industry. It is, however, important to note that even though projects like MONALISA 2.0 and its STM concept can serve as a catalyst for change, all stakeholders in the industry have to join forces in order to reach the defined targets.

**Implementing the target concept**
The STM Master Plan envisions how the performance gaps between current operations and expected future operations can be closed.

“We have identified a number of major opportunities for improvement in the industry and broken them down into several smaller operational improvement steps. In order to bolster the development we have also identified a number of actions that need to be taken, such as technical development as well as changes in regulations and in operational procedures”, says Per-Erik Holmberg, Business Manager and Researcher at Viktoria Swedish ICT.

**Four Lines of Change**
In order to meet the performance objectives four lines of change have been developed encompassing the various operating environments. They are:
- information sharing environment
- planning the voyage
- voyage execution
- integrated port operations.

**Let the future unfold**
The STM Master Plan is intended to be a key instrument in the maritime industry adoption of STM. It will contain the overall transition sequence to implement the STM target concept including a vision and an overview as well as the specifics.
The Operational Improvement steps have been allocated to the different Improvement Phases depending on when they are deemed feasible to deploy.
“In order to reach a desired outcome the development must be managed in a dynamic and comprehensive manner. All stakeholders must be engaged throughout the process and they need to recommit at each decision-making point along the voyage lifecycle”, says Björn Andreasson.

The STM Master Plan illustrates what major operational changes need to be made in order to reach the goals set for the short, medium and long term.

The time leading up to 2030 is divided into three Improvement Phases:
1. Creating the foundation: 2015-2020
2. Increasing operational capability: 2020-2025
3. Achieving STM performance goals: 2025-2030

The STM Master Plan is available on the web, www.stmmasterplan.com, where the user, easily and intuitively, can click their way into the specifics. This e-Master Plan ensures that the latest version is always available and it will serve as an internal working document as well as making it easy to share the STM development with all stakeholders. It will also serve as the one access point where the user will find links to relevant STM documentation, such as concept descriptions, that is needed to understand the STM Master Plan.

In conclusion
Historically speaking, the maritime industry is the most effective mode of transport, as well as the most environmentally friendly alternative. If the industry harnesses the technological advancements of the past few decades, and the different actors start to collaborate, it can play an important role in balancing the world’s current challenge of protecting the environment with the need for continued economic development.

Even though accidents actually are decreasing in the maritime world there's is a gigantic gap to the performance standards that the aviation domain can show. With the STM concept in full operation, however, the likelihood that the gap will shrink is substantial.

“The e-Master Plan allows us to provide a comprehensive view of the concept and to deliver the greatest benefit to all stakeholders at the same time as they can choose to read only the parts they are interested in”, says Per-Erik Holmberg.

Per-Erik Holmberg
Business Manager and Researcher at Viktoria Swedish ICT
“Historically speaking, the maritime industry is the most effective mode of transport, as well as the most environmentally friendly alternative. If the industry harnesses the technological advancements of the past few decades, and the different actors start to collaborate, it can play an important role in balancing the world’s current challenge of protecting the environment with the need for continued economic development.”