AISM Association Internationale de Signalisation Maritime

IALA International Association of Marine Aids to Navigation and Lighthouse Authorities

REPORT

IALA Seminar

Maritime Digital Infrastructure and Testbeds

30 November to 3 December 2015.

SWEDISH MARITIME ADMINISTRATION

DANISH MARITIME AUTHORITY

IALA AISM

SWEDISH ICT VIKTORIA

KRISO

10 rue Gaudines
78100 Saint Germain en Laye, France
Telephone: +33 1 34 51 70 01 Fax: +33 1 34 51 82 05
e-mail: contact@iala-aism.org Internet: www.iala-aism.org

Report of the IALA Seminar
on
Maritime Digital Infrastructure and Testbeds

Executive Summary

A seminar on the subject of Maritime Digital Infrastructure and Testbeds was hosted by the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) in association with the Swedish Maritime Administration (SMA), Viktoria Swedish ITC, the Danish Maritime Authority and the Korea Research Institute of Ships and Ocean Engineering (KRISO) at the Lindholmen Science Park Conference Centre in Gothenburg, Sweden, from 30 November to 3 December 2015.

The seminar was attended by 44 delegates, representing 12 countries (see ANNEX C).

A series of 20 presentations were given under five broad headings. Presentation sessions were interleaved with working group discussion sessions. It was considered that this format of seminar provides an effective knowledge sharing environment and facilitated discussion amongst a wide range of professionals within the maritime domain as well as from other sectors.

The seminar explored the development and deployment of maritime digital infrastructures (MDI) and related testbeds, with the aim of forming a basis for a future introduction of e-navigation services and solutions. It also considered methods to establish a framework for a maritime digital infrastructure and the sharing of data and information. Nine conclusions were derived.

The seminar found that the adoption of e-navigation and the use of maritime digital infrastructure is dependent on sound business cases with clear tangible benefits.

It was proposed that IALA should consider establishing a collaboration forum across the maritime domain including other IGO, NGO and industry bodies to ensure the harmonised implementation of e-navigation.

Technical details of the maritime digital infrastructure were considered, such as the need for unique universal identifiers and cyber security issues.

Table of Contents

IALA SEMINAR ON MARITIME DIGITAL INFRASTURUCTURE AND TESTBEDS

1. Introduction

A seminar on the subject of Maritime Digital Infrastructure and Testbeds was hosted by the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) in association with the Swedish Maritime Administration (SMA), Viktoria Swedish ITC, the Danish Maritime Authority and the Korea Research Institute of Ships and Ocean Engineering (KRISO) at the Lindholmen Science Park Conference Centre in Gothenburg, Sweden, from 30 November to 3 December 2015.

A list of participants is at ANNEX C.

2. Overall Programme

The overall programme is shown in the following table.

<table>
<tr><th colspan="4">IALA Seminar on Maritime Digital Infrastructure And Testbeds</th></tr>
<tr><th>Monday 30th November</th><th>Tuesday 1st December</th><th>Wednesday 2nd December</th><th>Thursday 3rd December</th></tr>
<tr><td rowspan="3">Registration</td><td>Technical session 4
Identities and Security</td><td>Technical session 8
Testbeds</td><td>Technical session 12
Conclusions
Demonstration of maritime digital infrastructure</td></tr>
<tr><td>Break</td><td>Break</td><td>Break</td></tr>
<tr><td>Technical session 5
Working Groups on identity & security</td><td>Technical session 9
Working Groups on testbeds</td><td>Session 13
Demonstration of maritime digital infrastructure
&
Closing of Seminar</td></tr>
<tr><td>Session 1
Opening of the Seminar</td><td>Lunch</td><td>Lunch</td><td rowspan="6"></td></tr>
<tr><td>Technical Session 2
Maritime Digital Infrastructures</td><td>Technical session 6
Description, Registration, Management of Services and Governance</td><td>Technical session 10
Maritime Digital Implementation</td></tr>
<tr><td>Break</td><td>Break</td><td>Break</td></tr>
<tr><td>Technical Session 3
Working Groups on Maritime Digital Infrastructure</td><td>Technical Session 7
Working Groups (WG) on Description, Registration, Management of Services and Governance</td><td>Technical Session 11
Working Groups (WG) on maritime digital implementation</td></tr>
<tr><td>Welcome reception</td><td>Seminar buffet reception</td><td>Viktoria Swedish ICT Forum Buffé mingle</td></tr>
</table>

3. Conclusions

Following a discussion of the conclusions, the seminar agreed to the following nine conclusions:

1. Adoption of e-navigation and the use of maritime digital infrastructure is dependent on sound business cases with clear tangible benefits.
2. IALA should consider establishing a collaboration forum across the maritime domain including other IGOs, NGOs and industry to ensure the harmonised implementation of e-navigation.
3. There is merit in local and regional implementation as a means to obtain global acceptance of e-navigation solutions.
4. A coordinated, decentralised approach could be used for information sharing and service interaction between different domains. A federated approach to achieve this was considered at the seminar.
5. The Maritime Architecture Framework methodology can be useful for visualising different perspectives and their interrelationships in the maritime domain and e-navigation.
6. There is a compelling need for universal identification of actors and information objects, etc to enable interoperability to exchange information.
7. Cyber security issues need to be addressed in the maritime digital infrastructure.
8. The IALA ENAV Committee could consider applying the hypothesis-driven validation methodology when assessing testbed results.
9. Increased visibility of the themes which are being addressed in testbeds and establishment of special interest groups may enhance collaboration across testbeds.

Annexes to the Report

ANNEX A OPENING OF THE SEMINAR AND TECHNICAL SESSIONS

4. Session 1 - Opening

Chaired by Omar Frits Eriksson, Danish Maritime Authority and Chairman of the IALA ENAV Committee.

All presentations form part of the output of the Seminar.

4.1 Address by Omar Frits Eriksson, Chairman of IALA ENAV Committee

Omar Frits Eriksson welcomed all the participants, and introduced the seminar host and sponsors for the seminar. He thanked the SMA for generously hosting the seminar and thanked the steering group for their fantastic work and attention to detail. He noted the excellent line-up of speakers and participants. Thanking all in advance for the work of the week, he noted that IALA is all the participants in the work as well as the secretariat and hoped that all participants would have a successful seminar.

4.2 Address by Peter Fyrby, Swedish Maritime Administration

Peter Fyrby thanked Viktoria Swedish ICT, KRISO and DMA for co-hosting the seminar. He noted that the pace of development of e-navigation is increasing, driven by developments in ICT. To achieve the benefits of this new technology there is a need for a maritime digital infrastructure and testbeds. The Maritime Cloud is a part of this developing infrastructure. There is also a need to understand the starting point in the present. Noting that the cloud concept originated in 1969, there is a need for action and the opportunity of the seminar is welcome. He mentioned three areas for discussion – technology, business and society.

4.3 Administrative and safety information

Administrative and safety information was provided by Anders Bröjde, Swedish Maritime Administration, by means of a presentation.

4.4 Keynote address,

The keynote address was presented by Aron Frank Sørensen, BIMCO

Presentation abstract

BIMCO has been the leader in developing the Industry Guidelines on Cyber Security on board Ships, which were developed by BIMCO, CLIA, ICS, INTERCARGO, and INTERTANKO. The Guidelines recommend a risk-based approach to cyber security issues. As a result, the Guidelines are non-technical in nature. The presentation provided background information on the Guidelines, which will be submitted to the 2016 sessions of IMO's Facilitation Committee (FAL 40) and IMO Maritime Safety Committee (MSC 96).

Furthermore, industry has initiated the development of an industry cyber security master plan based on the fact that cyber issues are important to all stakeholders in the industry. This initiative has recently been launched with an aim to coordinate the efforts of the industry.

Cyber security is closely connected to e-navigation as the latter is based on digital communication between ship and shore. The cyber security risk increases with the growth of digital communication between ship and shore. Testing of systems should ensure that the ship can navigate safely even if somebody attempts to attack the system and the work of IALA therefore also will have to include cyber security issues.

The key points of the presentation were:

1. Cyber risk is real and awareness needs to be raised.
2. Cyber incident mitigation is a matter for everybody the industry.
3. Protection starts at the manufacturing stage.
4. Testbeds should take potential cyber threats into consideration.

Discussion

With the increasing use of communications and interoperable systems it is inevitable that IALA work will have an impact on ship systems. Working with ISO may be a means of managing this.

Testbeds are inevitably local and there is a need for co-ordination and sharing of testbed results to generate interoperability and avoid duplication of research.

Since it is possible to intercept and possibly change critical data, encryption may have to be considered. A risk based approach is a possible management tool for cyber vulnerability. It was considered that, while cyber attacks on ships are very rare, such attacks in the future are inevitable, with GMDSS being cited as a possible target. Inadvertent virus infections of on-board systems can be introduced by memory sticks. Back-up systems should be maintained for use in the event of main system unavailable. There may be a need for a neutral forum to share information regarding cyber attacks.

There may be a reluctance to introduce and update ICT systems, driven by perceived poor cost benefit. A business case considering the consequences of out-of-date systems may change this perception. Training of ship crew may also be a factor. There are further risks in not having a secure PNT system.

Current ship communications systems do not provide good internet service due to bandwidth limitations.

Citing the example of the telecoms industry which set up ETSI (European Telecommunications Standards Institute) to enable standardisation across the sector, it was suggested that a similar approach should be used for the maritime transport sector.

5. Session 2 – Maritime Digital Infrastructures

Chaired by Anders Bröjde, Swedish Maritime Administration

5.1 Seminar aim, objectives and working arrangements

A presentation was made by Omar Frits Eriksson of the IALA ENAV Committee. The goals of the seminar were outlined as follows:

1. To discuss the development and deployment of maritime digital infrastructures and related testbeds, with the aim of forming a basis for a future introduction of e-navigation services and solutions.
2. An associated goal is to identify steps to establish a framework for a maritime digital infrastructure and the sharing of data and information.

The objectives of the seminar were outlined as follows:

1. Exchange views on developments on digital infrastructure and data and information sharing.
2. Facilitate discussion amongst a wide range of professionals within the maritime domain as well as from other sectors.
3. Provide IALA with proposals, concepts and examples for further discussion to formulate guidance on the development and deployment of a maritime digital infrastructure.
4. Cooperation between stakeholders involved in the provision of VTS/AtoN services in the context of e-Navigation.

5.2 Presentation: Concept and definition of digital infrastructure incl SIP and e-maritime (regional perspective)

The author was Mikael Lind, Viktoria ICT, Sweden.

The presentation was made by Anders Dalen, Viktoria ICT, Sweden.

Presentation abstract

The fast evolution of information and communications technology impacts the maritime industry in a number of ways. The possibilities and expectations of technology to develop and support current activities are increasing. In light of this, IMO has highlighted a few focus areas of particular importance to ensure the quality and appropriateness of the developed solutions. To implement these solutions a digital infrastructure is necessary to facilitate the use of the available information effectively.

There are three major challenges that this digital infrastructure has to meet; (1) the maritime industry is a highly complex sector consisting of multiple stakeholders with different business models, (2) the maritime industry is not an enterprise but a self-organised ecosystem of enterprises and this impacts on how information can be accessed, and (3) is the limited trust and unclear consequences of sharing information. The SeaSWIM specification for a maritime service infrastructure meets these challenges by promoting: (1) standardised interfaces and data models for highly modular services, (2) distributed design that leaves the control of the information with the provider, and (3) a federated governance and ownership of the digital infrastructure that makes sure standards and interfaces stay relevant as technology continues to evolve.

The key points of the presentation were:

1 Need (e-navigation SIP for efficiency, safety and environment).

2 Challenge (information accessibility).

3 Proposal (SeaSWIM layered specification for a distributed maritime service infrastructure).

4 Open issues (governance and ownership).

Discussion

Experience has shown that federated systems can have 33% of their constitution devoted to the relationship between the federated entities and hence concern was expressed regarding the proposal for a federated approach to e-navigation. It was agreed that the proposed system needed validation and this is planned over three years.

5.3 Presentation: Key elements of maritime digital infrastructures

The presentation was made by Jens Jensen of the Danish Maritime Authority, Denmark.

Presentation abstract

The Maritime Transport sector is ready to move into the digital information age and increase the utilisation of ICT technology to improve the safety, security and efficiency of maritime transport. Yet most contemporary digital solutions are available only to particular industry clusters targeted at achieving a competitive advantage or provide regional solutions targeting a regional priority. These non-standardised developments add to the overall complexity of global maritime activity, rather than achieving interoperability and driving down development costs for the sector at large.

Through a series of initiatives and projects, the needs and requirements of different maritime stakeholders have been collected and analysed. A few key enablers could make a world of difference to driving down the complexity and cost of developing interoperable maritime digital services. The presentation considered what are these key enablers, are they achievable, and can the maritime transport sector agree on managing these, or are the competitive and political forces too strong to collaborate for the benefit of the maritime sector at large?

The key points of the presentation were:

1. Standards and infrastructural support for open digital identity management and access control to digital services is needed across the maritime domain.
2. Standards and functional support for managing the evolution of interoperable digital services (definition, qualification, publication, discovery).
3. Many digital interactions, particularly ship-shore, could benefit from standardised communication functions that support roaming and location-based interactions.
4. Governance and business models related to the key enabling standards and infrastructure functions above that can be trusted and are acceptable to the global maritime community are paramount.
5. No single existing organisation can cover all of the above.

Discussion

Concern was expressed regarding the practice of using the terms e-navigation and e-maritime interchangeably. It was felt that the capabilities of e-navigation may enable e-maritime in the future.

IMO was seen as the main driver for adoption of e-navigation on board ships. No case has been made for shipping agents. There is a need for business case drivers and public promotion to generate enthusiasm for adoption of e-navigation systems.

5.4 Presentation: Industry community groups – a case story.

The presentation was made by Fred Pot, UPnP, USA.

Presentation abstract

Governance of the 1040-member UPnP Forum was described in terms of organisation, membership levels, development and maintenance of UPnP and IoT protocols, certification of product compliance to protocols, availability, and access to self-certification test software and evaluation of test results. The presentation also covered an overview of how UPnP works and tools available to generate machine readable service descriptions that comply with S-2XX.

The key points of the presentation were*:*

1. The Governance Model used by the UPnP Forum may well provide a basis for setting up the governance structure of protocols and standards that will need to be developed to implement the e-navigation digital infrastructure.
2. The UPnP Forum publishes open protocols that allow components in a complex system to interoperate while minimising configuration of interfaces between components.
3. Rather than developing protocols for maritime digital infrastructures, testing them and setting up certification and governance processes and procedures from the ground up, it may well worthwhile to consider adopting open, technology independent, mature and widely accepted UPnP/IoT protocols that have been formalised into ISO/IEC standards.

Discussion

It was clarified that plug and play protocols can be used for interoperability between applications, services of devices.

5.5 Objectives for Working Groups

The seminar broke into three Working Groups (WG), to discuss maritime digital infrastructure and deliver objectives set at the end of session 2:

WG1 Available infrastructure — Leader: Anders Dalen (session 3, Mikael Lind (sessions 5, 7, 9), Per Setterberg (session 11)

WG2 User and Service Provider community groups — Leader: Jin Park

WG3 Standards, regulations and governance Leader: Jens Jensen

In addition to the presentations, a list of questions was presented to the working groups at the beginning of each WG session as a means of stimulating discussion and analysis of the topic. Questions for each session were designed to stimulate discussion on the topic of the session rather than elicit direct answers to the questions. Working groups were requested to respond to the topic of the session, addressing the general topic defined in the session title and produce conclusions / new direction proposals / new insights / etc on the topic, bearing in mind the focus of the WG.

6. Session 3 – Working Groups on Maritime Digital Infrastructure

Coordinated Anders Bröjde, Swedish Maritime Administration, Sweden.

6.1 WG1 Available infrastructure

The working group prepared the following conclusions:

- The digital infrastructure for e-navigation is available or adoptable from other sectors, however, implementation is hampered, which was the focus of the discussion.
- Gaps
  - Silos of initiatives (overlapping scopes and little coordination);
  - Regional initiatives (competition instead of harmonization);
  - Slow adoption of new infrastructure (IMO is SOLAS focused).
- Goals
  - Voluntary adoption of infrastructure for e-navigation.
- Ways forward
  - Set up a joint global working group (all actors are represented);
  - Coordination (testbeds, initiatives);
  - Communication (marketing benefits – value/efficiency, safety);
  - Prepares standards and suggestions for IMO to “rubber stamp”;
- Back door!? (introducing solutions at the back of the bridge – cf. ECDIS).

6.2 WG2 User and Service Provider community groups

The working group prepared the following conclusions:

- The working group identified four drivers (or compelling needs) for a maritime digital infrastructure from the governmental side: (1) provision of services digitally (automated machine-to-machine services), (2) improvement of information delivery to the mariners (organisational policy) to enhance the safety of navigation, and (3) seamless roaming between SOLAS and Non-SOLAS vessels and (4) reducing the cost of infrastructure. Some countries do not have such drivers while acknowledging benefits from it.
- Key quality attributes of services related to maritime digital infrastructure may include quality of service provider, delivery, authorisation of infrastructure, availability, security including “identity” and authentication, service discoverability, and machine readability and usability.
- Prioritisation of services might be determined by their criticality, relevance to safety and relevance to efficiency.

6.3 WG3 Standards, regulations and governance

The working group prepared the following conclusions:

- Standards can originate from many organisations.

- Coordination of standardisation efforts across the maritime domain is needed.
- Good standard proposals often originate out of industry group or project initiatives that demonstrate end user benefit.
- At an appropriate maturity level good standard proposals should be introduced to IMO for endorsement when ships or relevant service provisions are involved.
- Much work has been done in the field of intermodal transport chains by non-UN standardisation organisations such as GS1.

7. Session 4 – Identities & Security

This session was chaired by Nick Ward, GLA R&RNav, UK & Ireland

7.1 Presentation: Current developments in maritime and voyage identifiers

The topic was presented by Jens Jensen, Danish Maritime Authority, Denmark.

Presentation abstract

Unique Identifiers are one of the key enablers of digital interactions. Identifiers help to keep track of identities representing entities in an interaction, or objects about which information is being exchanged, by providing unique references. A unique and verifiable digital identity of actors taking part in a digital interaction is the basic enabler in assessing the risk of trusting another party in sharing information or performing a business transaction.

The maritime domain consists of many stakeholders that utilise many identifiers. A ship may be identified by its IMO number, its Name, its MMSI number. Yet not all ships have IMO or MMSI numbers, a name is not guaranteed to be unique, and stakeholders such as ports certainly do not have IMO numbers. How can digital identities be managed?

With the outset of a need to establish a standard for unique and persistent identifiers for Information related to Aids to Navigation (AtoN), in order to facilitate harmonised representation of information exchanged between AtoN Authorities, Hydrographic Offices and users, the concept of Maritime Resource Names has been brought forward by IALA, building on the concept of Uniform Resource Names defined by the Internet Engineering Task Force (IETF).

The key points of the presentation were:

1. Identifiers are needed to support digital interactions, and need to be unique.
2. Maritime Resource Names provide well defined semantics for describing identifiers in extendable namespaces, and allow delegation of authority to issue identifiers, while identifiers remain unique.
3. Identifiers by themselves do not provide security – functions for asserting Level of Assurance are needed in some.

7.2 Presentation: Internationally accepted unique identifiers

The topic was presented by Mia Lenman, GS1, Sweden.

Presentation abstract

Identifiers give companies efficient ways of accessing information about items in their supply chains, and share this information with trading partners. Because GS1 ID keys are globally unique, they can be shared between organisations, increasing supply chain visibility for trading partners on both a local and a global level.

GS1 ID Keys enable organisations to assign standard identifiers to products, consignments, documents, physical locations and more. They also allow organisations to connect physical events and related information in an efficient way.

The key points of the presentation were:

1. Internationally accepted ID is GS1's business;
2. Opportunities with globally unique identifiers;
3. Use case Rail and RoRo.

Discussion

Identifiers will only work if users cooperate. Auditing of identifiers is carried out.

Identifiers are mainly numbers rather than alphanumeric as alphanumeric is difficult when using bar codes.

7.3 Presentation: Security models for digital infrastructure

The topic was presented by Kwangil Lee, ETRI, Republic of Korea.

Presentation abstract

The maritime cloud is defined as a communication framework for the e-navigation. As a communication framework for maritime digital infrastructure, the security including authentication and authorisation becomes an important issue so as to provide safe, secure and reliable information exchange and harmonisation. The presenter considered the possible security models for the maritime digital infrastructure. This includes the public key interface (PKI) structure for the device and user authentication. In addition, single sign-on techniques were addressed for handling multi-authentication entities.

The key points of the presentation were:

1 Maritime Cloud.

2 Security.

3 Authentication.

4 Public key interface (PKI).

7.4 Security models of digital infrastructures in relation to identity mechanisms

The topic was presented Brigid Cosgrave, INTTRA, Denmark.

Presentation

The presentation commenced by acknowledging that it is a mammoth task to adapt, adopt and engage with digital infrastructure to facilitate global communications. A proposal was put forward for an architecture for the Internet of Ships which comprises an internet of services, an internet of things and smart objects, an internet of knowledge, and an internet of people.

A new technology paradigm is required that shifts shipping from management, planning and administration to new services, new tools, new software packages, new interfaces and new user interaction solutions.

The key points of the presentation were:

1 Internet of ships.

2 Need for paradigm shift in future maritime transport infrastructure planning.

7.5 Session 4 conclusions

- Unique, backward compatible, expandable (scalable / forward compatible) identifiers are needed.
- Identifiers should preferably be human readable and take account of context and existing standards.
- There is a compelling need for universal identification, but multiple identifiers will exist for different purposes – the question is how to combine or link them.

- A federated, decentralised approach is needed for information sharing and service interaction, with a standard for delegated issue of identifiers and a recommendation on the approach to security.

8. Session 5 - Working Groups on identity & security

Coordinated by Nick Ward, GLA R&RNav, UK & Ireland.

8.1 WG1 Available infrastructure

The working group prepared the following conclusions:

8.1.1 Requirements of identifiers

- Unique, context dependent, standardised format;
- Delegate the responsibility for managing identities in existing organisational structure/infrastructure;
- Multiple identifiers for different purposes.

8.1.2 Assess existing standards and organisations

- Adapt to existing standards and organisational structures.

8.1.3 Identify security threats, authentication methods and assurance levels.

- Adapt or acknowledge diverse solutions;
- Identify/use security levels used for different purposes.

8.1.4 A federated approach to information sharing and service interaction (breaking the silos)

- Do not use IOS - too limited and is not necessary;
- Two tentative roles for the federation (not complete list):
  - Agree the standard;
  - Make recommendation of how to cope with different security levels.

8.2 WG2 User and Service Provider community groups

The working group prepared the following conclusions:

8.2.1 Need to have attributes for identifiers

- Unique;
- Decentralised;
- Flexible;
- Backward compatible;
- Expandable (i.e. forward compatible);
- Implementable;
- Convertible.

8.2.2 Nice to have attributes for identifiers

- Human readable;
- Context.

8.3 WG3 Standards, regulations and governance

The working group prepared the following conclusions:

8.3.1 Identifiers and Security are different issues

- Issuing unique identifiers is one thing.
- Providing functions of ‘Authentication’ (proof of identity with a certain Level of Assurance).

- Providing assurance that an identity actually represents a particular legal entity is yet another issue.

8.3.2 Identifiers are strongly context dependant.

- Different identifiers are issued for different contexts. Different identities may represent the same entity in different contexts.
- While it is relevant for IALA to harmonise identifiers for AtoN, identifiers for other resources depend on the resource context. SOLAS ships are clearly IMO domain.
- While 'proper identifiers' need to be unique, 'names' or other 'non-unique' attributes are frequently used to allow humans to cope with complexity.
- Provision of unique identifiers that facilitate interoperability needs to be a process of proper governing organisations setting the definitions, but issuing the identifying numbers needs to be delegated.

Harmonisation of digital identification of actors across the different stakeholders in the maritime sector would have a dramatic impact on the efficiency of shipping and thus world trade. There thus exists a compelling need to harmonise digital identity management within the industry. Since this need spans contexts belonging to several different governing bodies, an open solution is needed.

9. Session 6 – Description, Registration, Management of Services and Governance

This session was chaired by Edward Hosken, UK Hydrographic Office, UK.

9.1 Presentation: Developments of service description and registration mechanisms.

The topic was presented by Alexander Neuhaus, Frequentis, Denmark.

Presentation abstract

The author gave an overview about the concepts to be utilised for registering services in the Maritime Cloud (MC) and for managing the previously registered services during the lifetime of the services.

The concept of a service is paramount to the Maritime Cloud. Therefore, developing a standard proposal for making service specifications that contain information readable by humans and machines, as well as service-instance specific information is required at the very beginning to allow service providers to develop services which conform to the standard. The principles of service-orientation shall be independent of any vendor, product or technology and therefore, some concepts for service registries already used in other domains was introduced and one concept was proposed, based on existing standard RFC5582, which could be adapted for Service Registry & Discovery and reused in the EfficienSea 2 Project. This concept would support both centralised and federated deployment and many of the cornerstones of a Software Oriented Architecture, like loose service coupling, reusability, autonomy, or discoverability.

The key points of the presentation were:

1 Concepts to be utilised for registering services in the Maritime Cloud (MC).

2 Managing the previously registered services during the lifetime of the services.

3 Service Registry & Discovery.

4 Software Oriented Architecture.

9.2 Presentation: Techniques and mechanisms for management of services including evaluation and qualification

The topic was presented by Mikael Lind, Viktoria Swedish ICT, Sweden.

Presentation abstract

Two demands for innovative development and use of services in the maritime sector need to be combined; low entry barriers for third-party providers, and standardised and transparent processes for service portfolio management. Service portfolio management focuses both on the actions performed by a governing federation, i.e. an alliance of organisations providing trust to service discovery and consumption, and the actions performed by the service provider and the service consumer. For different classes of services, different federations take responsibility that includes services corresponding to the quality level that the federation requires. Federations could be both single and multi-organisational consisting of commercial and/or authorities/associations depending on the scope of the services included in the responsibility. The federation also has the task of stimulating the development of standardised messages.

Based on a lifecycle approach to services needed, mechanisms, roles, and means for stimulating the emergence of trusted and valuable services were brought forward in the presentation. Special attention was also paid to processes for emerging standardisation, service classification (a service taxonomy), and necessary underlying infrastructures (the developer zone). As part of the qualification process components for access management, authentication, message standards, and standardised interfaces to services and data sources must be ensured.

The key points of the presentation were:

1 A lifecycle approach to services – from proposal to liquidation.

2 A federated approach to management of services.

3 The notion of evolutionary standardisation.

4 Industrial emergence versus authority-based control.

9.3 Presentation: Roles and models for digital infrastructure in the maritime domain (the MAF)

The presentation was made by Axel Hahn, OFFIS, Germany.

Presentation abstract

Starting with the IMO reference architectures and the Maritime Service Portfolio, a number of proposals for e-Navigation Architectures and Reference Architecture are made. To provide a common basis for discussing system architectures for e-navigation, (reference) architectures and mapping of different approaches for an Architectural Framework were discussed internationally recently. The Maritime Architecture Framework (MAF) is a reference for definition and design of testbeds for e-navigation systems and services. It helps to define the context of the testbed, to check completeness and provides a basis to discuss the outcome and results of the testbed. Additionally it provides a basis for integration of testbeds e.g. for larger demonstrators. This presentation introduced the background, context and concepts of the Maritime Architecture Framework.

The key points of the presentation were:

1 Providing an organisation framework for maritime e-navigation systems and services.

2 Defining the context and basis for discussing reference architectures. Different concepts can be mapped and compared.

3 Supporting the design, implementation and integration of e-navigation systems and their architectures.

9.4 Ericsson's Maritime ICT Cloud and connected vessel solutions – an industry example of service interaction and information sharing

The presentation was made by Douglas Watson, Ericsson, UK.

Presentation abstract

At present ships rely on manually updated traffic, cargo, port, weather and safety information that is sent point-to-point rather than made available to all parties simultaneously via a network. This is a time-consuming process and the lack of access to real-time data significantly increases the margin for error.

Vessels at sea have systems in place that allow them to monitor critical functions and fuel usage, set and maintain an optimal course and ensure the welfare of their crew, but they are not particularly well integrated with fleet management systems onshore and they do not maximise the potential of real-time data.

The maritime ICT Cloud delivers benefits in three main categories: voyage optimisation, cargo monitoring and crew welfare. Fuel is the single biggest expense for any ship owner, and also a major source of emissions that are harmful to the environment.

The key points of the presentation were:

1 Digital infrastructure and transformation.

2 Maritime Cloud.

3 Connected vessel.

Discussion

There is connectivity between data clouds in the system provided by Ericsson.

9.5 Supply chain visibility platform - everything connected

The presentation was made by Norbert W Kouwenhoven, IBM, Netherlands.

Presentation abstract

The presentation explained how the IBM Supply Chain Visibility Platform (SVP) works, and why its architecture is attractive for use in competitive commercial environments.

IBM´s Supply Chain Visibility Platform solves two main issues facing international trade and shipping:

- the lack of full end-to-end supply chain visibility;
- lack of the means to efficiently and cost effectively share common data and documents.

SVP provides global standards based event repositories in the cloud to:

- Securely store supply chain event data & documents;
- Share data with authorised partners on a need-to know basis;
- Discover, and on demand query, trade lane events;
- Subscribe to events and keep track of the whereabouts of supply chain objects.

The key points of the presentation were:

1 IBM Supply Chain Visibility Platform.

2 Why have a SVP, what is an SVP, and how does an SVP work.

3 Differentiators and business (and government) benefits.

Discussion

Discovery is not a problem for IBM users as the system provided includes a discovery service.

While the main users of the Supply Chain Visibility Platform are large companies, size is not a determining factor in the adoption of the platform. Benefits are mainly for companies trading cross borders.

Platform data is suitable for analysis, providing an opportunity for sector efficiency analysis.

9.6 Session 6 conclusions

- Actors lack end to end visibility for tracking entities though a maritime logistics chain.
- E-navigation has a technology push and application pull (safety, efficiency, environmental factors).
- The Maritime Architecture Framework aims to bring different approaches together.
- Service definition language is being developed.
- Centralised and decentralised service registration both have pros and cons.
- Emergent standardisation may be necessary to stimulate innovation.

10. Session 7 - Working Groups on Description, Registration, Management of Services and Governance

Coordinated by Edward Hosken, UKHO, UK.

10.1 WG1 Available infrastructure

The working group prepared the following conclusions:

10.1.1 The need for an approval process and its role

- Approval is needed for different purposes (different types of services require different approval processes - from non-approval to full approval);
- Continuum from what the authority wants to achieve versus provide trust for the services to be consumed;
- Look into the automobile industry (e.g. (open) infotainment systems not interfering with core functionalities of the car).

10.1.2 e-Maritime versus e-navigation

- The debate of positioning e-navigation and e-Maritime is not useful since the concepts are so associated with organisational power (IMO vs. European level);
- Proposal to launch another concept - MARITIME INFORMATICS - as a concept taking a holistic approach to sea transports including commercial, logistical, and navigational aspects empowered by ICT/digitalisation. Maritime informatics is not bound to a specific organisation and enables interfaces and episodic couplings within and between ecosystems.

10.2 WG2 User and Service Provider community groups

The working group prepared the following conclusions:

- There might be chances for developers or implementers of e-navigation solutions to find errors in regulations, circulations, specification or concept of service. In this case, testbed lessons learned process, which will be described in the revision of IALA's testbed guideline, would be useful for promulgation of the findings.
- Federation approach might have a chance to be applied successfully in e-navigation and e-maritime as well. Moreover maintaining standards through federation(s) within areas relevant to IALA would give more efficient way of iterations to it. For this, technical clarifications on the definition of "federation" are required.

10.3 WG3 Standards, regulations and governance

The working group prepared the following conclusions:

- The term Maritime Cloud continues to raise concern over ownership and storage of data. A term other than 'Cloud' should be considered. (The intention is NOT to store all maritime data in a 'Cloud', but to provide enablers for data sharing, such as harmonised identity management and service discovery).
- A solution to address the connectivity of ships (not always on) must be identified. Responsibilities may be changing as a result of development. Maybe it could be the responsibility of the ship (owner) that a connection point representing the ships is available and 'always on' – and that store-and-forward in case of limited connectivity is the responsibility of the ship.
- Dual responsibility for safety services may be considered. Providers of safety information are required to push the information, however consumers of safety information could be equally required to pull safety information, to ensure they are updated, when connectivity is re-established.
- It is questionable if the facilitation of a 'service cloud' is achievable in the same manner in the maritime domain as presented from the automotive industry through providing SIM-cards in cars from their birth. The business models of manufacturers of car, who also have significant aftersales business, is significantly different from the business models of shipyards. The SIM card is tied to telecommunication infrastructures not equally available to maritime mobile entities. Other ways to introduce harmonised identity management regimes must be explored.
- A discussion of the relationship and differences between e-navigation and e-maritime proved that, similar to how the term 'Cloud' continue to raise concerns, the term 'federated governance' presented during the seminar is unclear, causing conflicting perceptions and raising concerns.

10.4 Session 7 conclusions

- The debate on the links between e-navigation and e-maritime is difficult and maybe not helpful as neither is well defined.
- E-navigation is not a useful term - maybe 'Maritime Informatics' is better.
- The question of whether federation within the maritime cloud is likely to be acceptable to all stakeholders, can only be answered if the role of federated parties is well defined.
- IALA must be careful to include other IGO/NGO and industry bodies in the assessment of testbeds and resultant proposals.

11. Session 8 – Testbeds

This session was chaired by Alwyn Williams, GLR R&RNav, UK & Ireland.

11.1 Presentation: Harmonisation of data and services: from existing to new infrastructures

The topic was presented by Edward Hosken, UK Hydrographic Office, UK.

Presentation abstract

Existing infrastructures for the delivery of navigational information will be reviewed within the context of the transition from paper to digital products and services. This will include a description of the WEND principle for Electronic Navigational Chart (ENC) coverage and distribution, together with an outline of the World-Wide Navigational Warning Service. The role of regulations and the importance of standards were discussed.

Principles of a richer information environment and improved interoperability will provide the background to consideration of the practical aspects of a transition to a fully digital

operating environment. The principles of S-100 and the development of Maritime Service Portfolios will be described together with comment about current implementation plans and discussion of how harmonisation amongst international organisations does not necessarily deliver harmonisation at the user level. The status of current development of S-100 product specifications were outlined.

Finally, the role of collaborative testbeds was discussed within the context of demonstrating potential to a wide stakeholder community. This highlighted the importance of user feedback to justify increased data production, user centred system design, and enhanced service delivery, by commercial and state providers.

The key points of the presentation were:

1 Current distribution of navigational information.

2 Role of regulations and standards.

3 S-100.

4 MSPs.

5 Importance of test-beds.

Discussion

Introduction of S-100 is delayed due to the fact that it is a totally different data model compared with S-57 combined with the inherent slow pace of developing international standards.

11.2 Presentation: Related Testbeds

The topic was presented by Nick Ward, GLA R&RNav, UK & Ireland.

Presentation abstract

Testbeds play a vital role in the development and implementation of e-navigation. They allow new solutions to be evaluated in realistic situations, but without adversely affecting operational systems.

This presentation described projects and testbeds underway, completed or planned, which are related to the development of Maritime Digital Infrastructure. Examples were provided of practical demonstrations that can contribute to the development of the Common Maritime Data Structure (CMDS), based on the IHO S-100 standard.

The key points of the presentation were:

1 Role of testbeds in demonstrating e-navigation solutions.

2 Relevant testbeds.

3 Examples for Common Maritime Data Structure.

4 Experience with S-100.

5 Lessons for implementation of digital infrastructure.

Discussion

Governance of the CMDS lies with various organisations with IHO taking an overall governance role. The IALA domain in S-100 is managed by IALA.

11.3 Presentation: Testbed collaboration between projects

The topic was presented by Thomas Christensen, Danish Maritime Authority, Denmark.

Presentation abstract

With the outset in the MoU on establishing a global e-navigation testbed between Denmark, Sweden and Korea, the presenter spoke about

accomplishments within this framework and initiatives it has spawned, such as the establishment of the Maritime Cloud Development Forum.

The key points of the presentation were:

1 E-navigation testbed collaboration.

2 Maritime Cloud Development Forum.

3 Collaborative software development.

Discussion

There are no plans to expand the maritime cloud.

It was considered that the maritime cloud would be the subject of an IALA Guideline.

11.4 AIS under keel testbeds in practice – Jonathon Pearce

The topic was presented by Jonathon Pearce, OMC International, Australia.

Presentation abstract

There are local commercial maritime testbeds which may result in useful outcomes but the size and nature of the testbeds are not known or promulgated to the wider maritime community. This presentation considered the local AIS UKC testbed that is underway in the Singapore and Malacca Straits area and explains the issues and potential pitfalls of standalone testbeds. It considered the lack of adoption of testbed guidelines, integration of outcomes with previous testbeds and that results may not be distributed due to commercial contractual constraints.

The key points of the presentation were:

1 e-navigation testbed collaboration.

2 Singapore and Malacca Straits testbed.

Discussion

Clutter in ship antenna installations is common and the effects of antenna positioning is being examined in the Malacca Straits testbed, although it is not a core issue.

Loading of the VDL is being carried out in the Malacca straits testbed using OMC tools over a four month period.

12. Session 9 - Working Groups on Testbeds

Coordinated by Alwyn Williams, GLA R&RNav, UK & Ireland.

12.1 WG1 Available infrastructure

The working group prepared the following conclusions:

12.1.1 Why use testbeds?

- To develop and validate concepts.
- Show benefits for end-users.
- Identified gap:
  - Limited sharing of results between stakeholders;
  - Include as part of the plan for how to perform testbed reporting in relation to contemporary efforts.
- The situation:
  - Limited accessibility to external stakeholders;
  - Limited knowledge about existing testbeds in other organisations;
  - Lack of awareness for existing guidelines;

- Lack of incentives for joining forces;
- Lack of understanding/incentives of how to transform from testbed to implementation.

- Could IALA take a more active role in enabling knowledge sharing between testbeds and facilitating the formulation of goals? IALA should!

12.1.2 Open questions

- Look into the definition of a testbed.
  - Administrative level?
  - Commercial level?
  - Knowledge level?
- Guidelines for e-navigation are there – but not recognised – why?
- Could e-navigation.net be used as a point of departure?

12.1.3 Proposal

- Orchestrate connectivity and the dissemination of the results, preferably by electronic means.
- Support the bottom-up building of a repertoire of themes / goals that are being addressed in respective testbeds.
- A map of the areas where the testbeds are situated.
- Provide input to the revision of the IALA guidelines.

12.1.4 The need

- Definition guidelines for themes.
- There should be an incentive to get your e-nav testbed acknowledged (as e.g. by IALA):
  - Different stakeholders do have different incentives, e.g.
    - Financiers should be interested in seeing that the applicant is aware of other initiatives;
    - Industry looking for an established testbed to tap into;
    - Project managers looking for parties to share knowledge.
- How do we ensure that the whole scope of maritime transport is covered?
- IALA should take a role in ensuring connectivity between testbeds by enabling the community to relate to / define themes.

12.2 WG2 User and Service Provider community groups

The working group prepared the following conclusions:

- One of the drivers for the governance by IALA on its relevant e-navigation solutions comes from its contribution to validation of the solution in global aspects.
- The crucial starting point of harmonisation is efficient sharing of information on testbeds, i.e. http://www.e-navigation.net.
- Maintaining a viable list of gaps would be an effective way of harmonising and coordinating testbed activities on the global scale.
- Consider gaining experiences and insights from other domains with regard to governance and harmonisation principles, such as the connected vehicle initiative (http://www.dot.gov/testbed).

12.3 WG3 Standards, regulations and governance

The working group prepared the following conclusions:

- As part of the implementation process there is a need to work with concrete services in the form of testbeds to be wiser on infrastructure needs;
- The e-nav 'App store';
- The proposed coordination forum between organisations will play a very central role in coordinating infrastructure developments as well as services development;
- Special interest groups are needed to specify services. Special interest groups could provide generic test tools to perform validity checking of services / data packages;
- If Services related to safety of navigation are going to provide information transfer into type approved environment, the services need to be quality assured.

12.4 Conclusions session 9

- There is insufficient knowledge transfer between testbeds in the e-navigation community, despite efforts by IMO and IALA to provide guidelines on reporting of testbed results and the establishment of the e-navigation portal.
- There exists an opportunity to learn from other industries on how to harmonise testbeds.
- A communication plan is needed to inform end users on e-navigation and its relevance to them.
- The IALA Council are asked to review a previous proposal to establish a collaboration platform to ensure that harmonisation of services in testbeds occurs without impacting innovation.

13. Session 10 – Maritime Digital Implementation

This session was chaired by Thomas Christensen, DMA, Denmark.

13.1 Presentation: Steps to establish a framework for a maritime digital infrastructure and the sharing of data and information

The topic was presented by Mikael Lind, Viktoria Swedish ICT, Sweden.

Presentation abstract

The maritime sector is a compound of numerous autonomous agents. To reach efficient, safe, and sustainable transport involving multiple parties, information needs to be shared in a regulated and trusted way among the parties. For this purpose a framework for maritime digital service infrastructure to be used by different providers of services on different layers (i.e. the layers of communication, information, and application) is needed. Today's infrastructure is often vendor specific and the biggest players have established their own communication backbone. It is therefore a challenge to transform the industry towards a common platform. Benefits for using such an infrastructure need to be shown based on improvements in efficiency, safety, and sustainability in maritime activity.

The presentation was a call for a multi-party effort to join forces for an open communication and service infrastructure based on solid incentives for the main players to adopt such a common infrastructure. The first step towards the establishment of a digital maritime service infrastructure is to formulate a number of hypotheses together with relevant stakeholders that need to be validated in order to create arguments for its introduction and remove uncertainty. For this purpose, a structured approach for validating diverse hypotheses has been developed. This approach is to be used in different testbeds validating different concepts for improving maritime activity using information sharing platforms. A core hypothesis states that, in order to stimulate the use of a common infrastructure the control of how to access which information and condition of use is to be decided by the information owner. If true, this means that distributed solutions to information management are preferred before centralised solutions.

The key points of the presentation were:

1 The importance of proof-of-concept for different parts.

2 Benefits overriding resistance to sharing data.

3 The notion of trust – how to ensure that information owners trust their sharing of information – towards purposeful sharing carried by services.

4 Incremental steps for a common framework.

5 Joining forces with other initiatives – within the maritime sector and as inter-modal bridge.

Discussion

Contextual factors are very important in validation of test cases and issues will only emerge during the test period.

The proposal deals with organisational, business and technical challenges but considers policy rather than political challenges.

13.2 Presentation: Full scope of the interaction between ship and shore side under e-navigation based on user requirements

The topic was presented by Jin Park, KRISO, Korea.

Presentation abstract

Through harmonising navigation-related information, e-navigation will enrich interactions between ships and between ship and shore as well. Especially, interactions between ship and shore would be implemented in the form of e-navigation services. E-navigation services need to be based on user requirements for both ship-board user and shore-based user.

This presentation described user requirements for the SMART-Navigation project, the Korean nation-wide e-navigation project. The requirements are mainly based on the outcomes from a preliminary study for the SMART-Navigation project, which focuses on e-navigation services for non-SOLAS vessels in addition to the services for SOLAS vessels. Although there have been many studies to identify and analyse user requirements for e-navigation services, studies dealing with non-SOLAS vessels are rare. The presentation illustrated berth-to-berth interactions between ship and shore on the premise that e-navigation services are available at every phase of navigation. Incorporating non-SOLAS vessels within the boundary of e-navigation service area increases the need for a maritime digital infrastructure supporting seamless data roaming. The presentation ended with a description of key features of a maritime digital infrastructure for e-navigation services.

The key points of the presentation were:

1 E-navigation service.

2 User requirements.

3 Non-SOLAS vessel.

4 Seamless data roaming.

5 Maritime digital.

Discussion

In discussion, it was stated that the underlying assumptions were validated where possible by looking at other projects. There was some disagreement with the underlying assumptions.

13.3 Presentation: Collaboration with / between existing infrastructures / industry players

The topic was presented by Kilyong Kim, GMT Co Ltd, Korea.

Presentation abstract

Mr Kim described the requirements and issues for maritime digital infrastructure in Korea and the future plan from the implementer's viewpoint.

The key points of the presentation were:

6 Requirements for maritime digital infrastructure in Korea.

7 Future of maritime digital infrastructure in Korea.

Discussion

In discussion it was confirmed that the project will comply with S-100.

14. Session 11 - Working Groups on Testbeds

Coordinated by Thomas Christensen, DMA, Denmark.

14.1 WG1 Available infrastructure

The working group prepared the following conclusions:

- Maritime digital infrastructure does not require IMO approval or endorsement;
- It is better to commence digital infrastructure locally rather than regionally initially to avoid project delay due to complexity;
- There are different levels of message delivery - received by ship, displayed on a particular display or acknowledged by an operator. Acknowledgement requirement depends on the use-case, service interaction patterns need to be described for the use-cases. Bandwidth is sometimes a bottleneck;
- For some use-cases the maritime world needs closed loop communications, which would need to be supported by a MDI.
- Acknowledgement requirements may put demands on the communication link (AIS, VDES vs. IP etc.)
- Some applications' bandwidth needs will be met by AIS or VDES while others will not. Commercial applications are likely to drive the requirement for bandwidth.
- An independent study of available communications solutions in relation to bandwidth / installation and data transfer pricing would be very valuable.

14.2 WG2 User and Service Provider community groups

The working group prepared the following conclusions:

- MDI must facilitate both of narrow and broad bandwidth carriers.
- Individual service definitions must take into account the characteristics of the carriers.
- There will be a need for resilience in identity registry, service registry and messaging server through the use of decentralised architecture.
- Ship reporting and "Single Window" service have potential to be killer apps.

14.3 WG3 Standards, regulations and governance

The working group prepared conclusions on standards, regulations and governance which are incorporated into the seminar output.

15. Sessions 12 – Conclusions and Demonstrations

Chaired by Omar Frits Eriksson

15.1 Conclusions

Nine conclusions were agreed as listed in the main report.

15.2 Demonstration of maritime digital infrastructure

The following applications were demonstrated at the seminar:

1 AMSA dynamic under keel clearance and transit planner with met ocean data service - Jonathon Pearce, OMC International.

2 UKHO marine information portal to allow mariners to send hydrographic data updates to UKHO and distribution of hydrographic notes using free crowd sourcing app – Edward Hosken, UKHO.

16. Session 13 – Demonstrations & Closing

Chaired by Omar Frits Eriksson.

16.1 Demonstration of maritime digital infrastructure

The following applications were demonstrated at the seminar:

3 Virtual AtoN management tool (USAIMS) covering buoy data overlaid on S-57 ENC, AIS AtoN and radio coverage, port data, USCG ATONIS access, buoy data and moorings, – Dave Lewald, USCG.

4 Port collaborative decision making (CDM) concept from Mona Lisa 2, Activity 1, work package 7 – Mikael Lind, Viktoria Swedish ICT. Empowered by Sea Traffic Management, PortCDM (Port Collaborative Decision Making) has been introduced as a concept to enable a well-coordinated port visit. At its focus is the creation of the basis for port actors to optimise their operations and synchronising with arriving vessels leading to increased predictability and reduced waiting times. Optimally, the vessel's turn-around process should be as fast as possible, enabled by involved actors' integrated performance. Using an information sharing solution, building on SeaSWIM and maritime cloud, in which involved actors share estimated and actual state changes to others to optimise the planning and realisation of the port visit. This information sharing solution builds upon a division of a back-end (capturing the underlying logic) and a front-end (the end-user interface for enabling distributed coordination). In this presentation the design principles of PortCDM were brought forward and a demonstration of the application developed as a front-end being used in port of Gothenburg and Port of Valencia in real-life tests. This will form the basis for discussing necessary architecture, integration with existing port systems by the use of standardised port visit message formats, data model, state chart, timeline, and information services in a service integration platform (PortCDM SIP). The PortCDM service integration platform (SIP) and an emergent STM developer zone empowering community building between users and between developers constituting the basis for worldwide dissemination of the concept where the implementation can be adapted for each port.

16.2 Seminar debrief

It was felt that the seminar format was good, enabling much discussion and sharing of information and ideas.

16.3 Seminar report

Seamus Doyle noted that the seminar documents and photographs would be available on the seminar file sharing server under marsem.e-navigation.nl for one month. The draft seminar report is posted on the file share server and the final report will be posted within one week and will be available long term on the IALA website.

16.4 Closing of the seminar

Omar Frits Eriksson thanked everyone for attending and working so hard. He said that the seminar was of great value and that he hoped that it had been professionally beneficial to all the delegates. He thanked the members of the Swedish Maritime Administration for their excellent hosting of the event, the steering group and session chairs, IALA Secretariat and the delegates for making the seminar such a success.

He wished everyone a safe journey home and declared the seminar closed.

ANNEX B SOCIAL EVENTS

16.5 Welcome reception

On Monday 30 November, delegates were welcomed at a reception at the Lindholmen Science Park Conference Centre.

16.6 Buffet reception

On Tuesday 1 December, delegates enjoyed a buffet reception at the Lindholmen Science Park Conference Centre.

16.7 Buffé mingle reception

On Wednesday 2 December, Viktoria Swedish ICT welcomed delegates with a Buffé mingle with Viktoria Swedish ICT partners at the annual Viktoria Swedish ICT Forum event.

ANNEX C LIST OF DELEGATES

Country

Australia **OMC International**

Captain Jonathon PEARCE
RH 7 Dorset House , 5 Church Street
Wimborne
Dorset, BH21 1JH
UK

Phone	+44 7833 517 006
Fax	
Mobile phone:	+44 7833 517 006
e-mail (main):	jonp@omc-international.com
e-mail (alternative):	jpearce@aleau.com

Austria **Frequentis AG**

Mr Alexander NEUHAUS
Innovationsstrasse 1
1100 Vienna

Austria

Phone	+43 181 150 3368
Fax	
Mobile phone:	+43 664 60850 3368
e-mail (main):	alexander.neuhaus@frequentis.com
e-mail (alternative):	

BIMCO **BIMCO**

Mr Aron Frank SORENSEN
Bagsvaerdjev 161
2880 Bagsvaerd

Denmark

Phone	+45 4436 6851
Fax	+45 4436 6868
Mobile phone:	+45 29131768
e-mail (main):	afs@bimco.org
e-mail (alternative):	

CIRM **Comité International Radio Maritime**

Mr Richard DOHERTY
202 Lambeth Road
London, SE1 7JW

UK

Phone	+44 20 3411 8345
Fax	
Mobile phone:	+44 7747 634734
e-mail (main):	rd@cirm.org
e-mail (alternative):	

Country	

Denmark

Danish Maritime Authority

Mr. Omar Frits ERIKSSON
Carl Jacobsen Vej 31
DK-2500 Valby

Denmark

Phone	+ 45 7219 6316
Fax	
Mobile phone:	+ 45 2167 6644
e-mail (main):	ofe@dma.dk
e-mail (alternative):	

Danish Maritime Authority

Mr Thomas CHRISTENSEN
Overgaden oven Vandet 62B
Postboks 1919
DK-1023 Copenhagen K
Denmark

Phone	+45 91 37 60 00
Fax	+45 3257 4341
Mobile phone:	+45 2511 1854
e-mail (main):	thc@dma.dk
e-mail (alternative):	

Denmark

Danish Maritime Authority

Mr Jens Kristian JENSEN
Carl Jacobsen Vej 31
DK2500 Valby

Denmark

Phone	+45 72 19 63 18
Fax	+45 91 97 60 01
Mobile phone:	
e-mail (main):	jkj@dma.dk
e-mail (alternative):	

Danish Maritime Authority

Mr Kasper NIELSEN
Carl Jacobsens Vej 31

2500 Valby
Denmark

Phone	+45 25111854
Fax	
Mobile phone:	
e-mail (main):	kasperni@gmail.com
e-mail (alternative):	

Country		
Finland	**Furuno Finland Oy**	
	Mr Hannu PEIPONEN Niityrinne 7 P O Box 74 FI-02270 Espoo Finland	
	Phone	+358 400 301289
	Fax	+358 9 43556710
	Mobile phone:	+358 400 301289
	e-mail (main):	hannu.peiponen@furuno.fi
	e-mail (alternative):	
Finland	**Navielektro Ky**	
	Mr Miika KOIVISTO POB 137 Kaarina FIN-20781 Finland	
	Phone	+358 400 822460
	Fax	
	Mobile phone:	
	e-mail (main):	miika.koivisto@navielektro.fi
	e-mail (alternative):	
Germany	**Federal Waterways & Shipping Administration**	
	Mr. Jan-Hendrik OLTMANN Northern Region Office Kiellinie 247 24106 Kiel Germany	
	Phone	+ 49 431 3394 5701
	Fax	+ 49 431 3394 6399
	Mobile phone:	+49 172 152 6928
	e-mail (main):	jan-hendrik.oltmann@wsv.bund.de
	e-mail (alternative):	
	OFFIS e.V.	
	Mr Axel HAHN Escherweg 2 Oldenburg 26121 Germany	
	Phone	
	Fax	
	Mobile phone:	+49 163 781 85 88
	e-mail (main):	hahn@wi-ol.de
	e-mail (alternative):	

Country		
IALA	**IALA** Mr. Seamus DOYLE 10, rue des Gaudines 78100 Saint-Germain-en-Laye France	
	Phone	+33 1 3451 7001
	Fax	+33 1 34 51 82 05
	Mobile phone:	353 87 98 77 983
	e-mail (main):	seamus.doyle@iala-aism.org
	e-mail (alternative):	
Intertanko	**International Association of Independant Tanker Owners** Capt Johan GAHNSTROM 30-33 St Clark House Minories LONDON EC3N1DD United Kingdom	
	Phone	+44 788 400 2068
	Fax	
	Mobile phone:	
	e-mail (main):	johan.gahnstrom@intertanko.com
	e-mail (alternative):	
Korea	**Ministry of Oceans and Fisheries** Mr Kwang AN 94 Dasom 2-ro Sejong 339-012 Republic of Korea	
	Phone	+82 44 200 5816
	Fax	
	Mobile phone:	
	e-mail (main):	ankwang@korea.kr
	e-mail (alternative):	
Korea (Republic of)	**ETRI** Dr Gaeil AN 218 Gajeongno, Yuseong-gu Dajeon 305-700 Republic of Korea	
	Phone	+82 42 860 4830
	Fax	
	Mobile phone:	+82 10 3907 5900
	e-mail (main):	fogone@etri.re.kr
	e-mail (alternative):	

Country		
Korea (Republic of)	**ETRI** Mr. Kwangil LEE 218 Gajeong-ro, Yuseung Gu Daejeon 305-700 Republic of Korea Phone Fax Mobile phone: e-mail (main): e-mail (alternative):	 +82 42 860 5025 +82 10 4455 0533 leeki@etri.re.kr
	GMT Co. Ltd. Mr Kil Yong KIM 7th floor Pangyo W-CITY Sungam 617012 Republic of Korea Phone Fax Mobile phone: e-mail (main): e-mail (alternative):	 +82 02 488 6502 yonjjang@gmtc.kr
Korea (Republic of)	**Korean Research Institute of Ships & Oceans Engineering (KRISO)** Dr Jin Hyoung PARK 32, Yuseong-daero 1312 beon-gil Yuseong-gu, Daejeon Republic of Korea Phone Fax Mobile phone: e-mail (main): e-mail (alternative):	 +82 42 866 3608 +82 42 866 3699 +82 10 3405 7624 jin.h.park@kriso.re.kr jin.h.park@kaist.ac.kr
	Ministry of Oceans and Fisheries Mr Changkyun KIM 94 Dasom 2-ro Sejong 30064 Republic of Korea Phone Fax Mobile phone: e-mail (main): e-mail (alternative):	 +82 44 200 5830 kchangkyun@korea.kr

Country		
Netherlands	**Ministry of Infrastructure and the Environment** Mr Jeffrey VAN GILS Centre for Transport and Navigation Lange Kleiweg 34 2288 GK Rijswijk The Netherlands	
	Phone	
	Fax	
	Mobile phone:	+31 6 514 2 70 66
	e-mail (main):	jeffrey.van.gils@rws.nl
	e-mail (alternative):	jvgils71@gmail.com
Netherlands	**Ministry of Infrastructure and the Environment** Mr. Pieter PAAP Schoemakerstraat 97 Delft 2628 VK Netherlands	
	Phone	+31 64 663 6190
	Fax	
	Mobile phone:	+31 6 466 36 190
	e-mail (main):	pieter.paap@rws.nl
	e-mail (alternative):	pieter.l.paap@quicknet.nl
	Netherlands Coastguard Mr. Eddy WISSE Rijkszee-en Marinehaven 1 1871ZZ Den Helder Netherlands	
	Phone	+31 223 658 312
	Fax	
	Mobile phone:	+31 61 04 64 582
	e-mail (main):	eddy.wisse@kustwacht.nl
	e-mail (alternative):	
New Zealand	**Vega Industries Ltd** Mr Peter ORRE PO Box 50443 Porirua 5240 Wellington New Zealand Based in Munich, Germany	
	Phone	+49 89 649 12 26 24
	Fax	
	Mobile phone:	+49 151 2121 9234
	e-mail (main):	peter.orre@vega.co.nz
	e-mail (alternative):	

Country		
Norway	**Norwegian Coastal Administration** Mr. Richard AASE PO Box 1502 6025 Alesund Norway Phone Fax Mobile phone: e-mail (main): e-mail (alternative):	 +47 52733315 +47 527 33201 +47 91866969 richard.aase@kystverket.no
	Norwegian Coastal Administration Mr Tommy HAUGSNES PB 466 5501 Haugesund Norway Phone Fax Mobile phone: e-mail (main): e-mail (alternative):	 +47 48882142 +47 481182142
Sweden	**GS1 Sweden AB** Ms Mia LENMAN Västra Järnvägsgatan 15, 12th floor Box 1178, SE-111 91 Stockholm Sweden Phone Fax Mobile phone: e-mail (main): e-mail (alternative):	 +46 (0) 8 50 10 10 00 +46 (0) 704 953 761 mia.lenman@gs1.se
Sweden	**SAAB TranspondeurTech AB** Mr. Johan LINDBORG Labslecksgatan 3 58941 Linköping Sweden Phone Fax Mobile phone: e-mail (main): e-mail (alternative):	 +46 739 18 94 90 +46 131 823 77 +46 739 18 94 90 johan.lindborg@saabgroup.com

Country

Sweden **Swedish Maritime Administration**

Mr Per SETTERBERG
Tegelängsgatan 1
Norrköping 60178

Sweden

Phone
Fax
Mobile phone:
e-mail (main): per.setterberg@sjofartsverket,se
e-mail (alternative):

Swedish Maritime Administration

Mr Peter FYRBY
601 78 Norrköping

Sweden

Phone +46104784650
Fax
Mobile phone: +46734321070
e-mail (main): peter.fyrby@Sjofartsverket.se
e-mail (alternative):

Sweden **Swedish Maritime Administration**

Mr Björn ANDREASSON
Box 344
fagersta 73726

Sweden

Phone +46 104 784 630
Fax
Mobile phone:
e-mail (main): bjorn.andreasson@sjofartsverekt.se
e-mail (alternative):

Swedish Maritime Administration

Mr Anders BRODJE
Lindholmspiren 5
SE41756 Gothenburg

Sweden

Phone +46 10 478 60 53
Fax
Mobile phone: +46 72 724 60 53
e-mail (main): anders.brodje@sjofartsverket.se
e-mail (alternative):

Country		
Sweden	**Swedish Maritime Administration**	
	Associate Prof. Mikael LIND C/O Viktoria Swedish ICT Lindholmspiren 3a SE41756 Gotherburg Sweden	
	Phone	+46 705 66 40 97
	Fax	
	Mobile phone:	+46 705 66 40 97
	e-mail (main):	Mikael.Lind@viktoria.se
	e-mail (alternative):	
Sweden	**Viktoria Swedish ICT**	
	Mr Almir ZEREM Lindholmspiren 3A SE 417 56 Göteburg Sweden	
	Phone	+46 705 66 40 97
	Fax	
	Mobile phone:	
	e-mail (main):	almir.zerem@viktoria.se
	e-mail (alternative):	
	Viktoria Swedish ICT	
	Mr Anders DALEN Lindholmspiren 3A SE 417 56 Göteburg Sweden	
	Phone	+46 705 66 40 97
	Fax	
	Mobile phone:	
	e-mail (main):	anders.dalen@viktoria.se
	e-mail (alternative):	
UK	**Ericsson**	
	Mr Douglas WATSON Midleton Gate, Guildford Business Park Guildford, Surrey GU2 8SG UK	
	Phone	+44 (0) 7920 284241
	Fax	
	Mobile phone:	
	e-mail (main):	douglas.watson@ericsson.com
	e-mail (alternative):	

Country		
UK	**General Lighthouse Authorities for UK & Ireland**	
	Dr Nick WARD 12 Mariners Drive Swanage Dorset BH19 2SJ UK	
	Phone	+ 44 1929 426 021
	Fax	
	Mobile phone:	+44 7795 367050
	e-mail (main):	nick.ward@gla-rrnav.org
	e-mail (alternative):	nick.ward@fsmail.net
	General Lighthouse Authorities for UK & Ireland	
	Dr Alwyn WILLIAMS c/o Trinity House The Quay Harwich UK	
	Phone	+44 1255 245 134
	Fax	
	Mobile phone:	+44 7739 151253
	e-mail (main):	alwyn.williams@gla-rrnav.org
	e-mail (alternative):	
	UK Hydrographic Office	
	Dr Edward HOSKEN Admiralty Way Taunton Somerset TA1 2DN UK	
	Phone	+44 1823 337 900
	Fax	
	Mobile phone:	+44 7824 408 173
	e-mail (main):	edward.hosken@ukho.gov.uk
	e-mail (alternative):	
Ukraine	**State Hydrographic Service of Ukraine**	
	Mr Oleksii SHPACHENKO 23, Ggarina Avenue Kyiv 02660 Ukraine	
	Phone	+38 044 29 66 040
	Fax	+38 044 296 60 40
	Mobile phone:	+38 097 338 03 22
	e-mail (main):	shpachenko.a@yhydro.gov.ua
	e-mail (alternative):	shpakakash@gmail.com

Country		
Ukraine	**State Hydrographic Service of Ukraine** Mr Iurii MARUSHCHENKO 23 Gagarina Ave, Kyiv 02660 Ukraine Phone Fax Mobile phone: e-mail (main): e-mail (alternative):	 +38 044 292 32 98 +38 067 912 35 17 navigation@hydro.gov.ua
USA	**INTRRA** Ms Bridget COSGRAVE One Upper Pond Road Parsippany NJ07054 USA Phone Fax Mobile phone: e-mail (main): e-mail (alternative):	 +1 479 999 909 bc@everyeuropeandigital.com
USA	**INTRRA** Mr William SCHWEBEL One Upper Pond Road Parsippany NJ07054 USA Phone Fax Mobile phone: e-mail (main): e-mail (alternative):	 +1 646 532 1239 bill.schwebel@inttra.com
	UPnP Mr. Fred W. POT 3855 SW 153rd Drive Beaverton OR 97003 USA Phone Fax Mobile phone: e-mail (main): e-mail (alternative):	 +1 503 619 5223 +1 206 850 7664 fpot@enavsolutions.org fpot@comcast.net

Country

USA **US Coast Guard**

Mr. Dave LEWALD
Commandant (CG-NAV-3)
2703 Martin Luther King Ave SE Stop 7418
Washington DC 20593-7418
USA

Phone	+1 202 372 1549
Fax	
Mobile phone:	+1 228 342 3917
e-mail (main):	Robert.D.Lewald@uscg.mil
e-mail (alternative):	Lewald555@live.com

ANNEX D WORKING GROUP PARTICIPANTS

Working Group 1 Available infrastructure

	Name	Organisation / Country
1	Anders Dalen (Chair Day 1)	DMA, Denmark
2	Mikael Lind (Chair Day 2,3)	Viktoria ICT, Sweden
3	Douglas Watson	Ericsson, UK
4	Bjorn Andreasson	SMA, Sweden
5	Alexander Newhaus	Frequentis, Austria
6	Johan Lindborg	Saab, Sweden
7	Miika Koivisto	Navielektro OY, Finland
8	Kasper Nielsen	DMA, Denmark
9	Jonathon Pearce	OMC, UK
10	Peter Orre	Vega, New Zealand
11	Kilyong Kim	GMT, Republic of Korea
12	Gaeil An	ETRI, Republic of Korea
13	Richard Doherty	CIRM, UK
14	Brigid Cosgrave	INTTRA, Denmark

Working Group 2 User and Service Provider community groups

	Name	Organisation / Country
1	Jin Park (Chair)	KRISO, Republic of Korea
2	Jeffery Van Gils	Ministry of Infrastructure & Environmental Management, Netherlands
3	Edward Hosken	UK Hydrographic Office, UK
4	R. David Lewald	U.S. Coast Guard, USA
5	Omar Frits Eriksson	DMA, Denmark
6	Thomas Christensen	DMA, Denmark

Working Group 3 Standards, regulations and governance

	Name	Organisation / Country
7	Jens Jensen (Chair)	DMA, Denmark
8	Almir Zerem	Viktoria Swedish ICT, Sweden
9	Jan-Hendrik Oltmann	WSV, Germany
10	Fred Pot	Maritime Management Consultant, USA
11	Oleksii Shpachenko	State Hydrographic Services, Ukraine
12	Jurii Marushchenko	State Hydrographic Services, Ukraine
13	Alex Hahn	OFFIS, Germany
14	Chang Kyun Kim	Ministry of Oceans and Fisheries, Republic of Korea
15	Kwang An	Ministry of Oceans and Fisheries, Republic of Korea
16	Johan Gahnstrom	Intertanko, UK
17	Richard Aase	Norwegian Coastal Administration, Norway
18	Tommy Haugsnes	Norwegian Coastal Administration, Norway
19	Alwyn Williams	GLA R&RNAV, UK
20	Pieter Paap	Ministry of Infrastructure, Netherlands
21	Eddy Wisse	Netherlands Coast Guard, Netherlands
22	Anders Brodje	SMA, Sweden

ANNEX E SEMINAR PROGRAMME

DAY 1 – Monday, 30 November

Time	Activity	20151202
1200 - 1300	**Registration and Lunch**	
1300 - 1400	**Session 1 - Opening of the Seminar**	**Omar Frits Eriksson**
1300 - 1315	Welcome from IALA	Omar Frits Eriksson, IALA
1315 - 1330	Welcome from SMA	Peter Fyrby, SMA
1330 - 1335	Administration & Safety Briefing	Anders Bröjde, SMA
1335 - 1400	Keynote address - Cyber security – how should this be tackled by the industry	Aron Frank Sørensen, BIMCO
1400 - 1530	**Session 2 - Maritime Digital Infrastructures**	**Chair: Anders Bröjde**
1400 - 1410	Seminar aims & objectives	Omar Frits Eriksson, DMA
1410 - 1420	Introduction to working arrangements and programme	Omar Frits Eriksson, DMA
1420 – 1440	Concept and definition of digital infrastructure including SIP and e-maritime (regional perspective)	Anders Dalen, Viktoria Swedish ICT
1440 – 1500	Key elements of maritime digital infrastructures	Jens Jensen, DMA
1500 - 1520	Industry community groups – a case story	Fred Pot, UPnP Forum
1520 – 1530	Objectives for Working Groups	Anders Bröjde, SMA
1530 - 1600	**Break**	
1600 - 1730	**Session 3 – Working Groups (WG) on Maritime Digital Infrastructure**	**Co-ordinator: Anders Bröjde**
1600 – 1730	WG1 – Available infrastructure and gaps	Leader: Anders Dalen
1600 – 1730	WG2 – User and Service Provider community groups	Leader: Jin Park
1600 – 1730	WG3 - Standards, regulations and governance	Leader: Jens Jensen
1730 – 1800	Plenary report of conclusions of WG discussion	Anders Bröjde / WG leaders

1800 – 2000, Welcome Reception, Lindholmen Science Park Conference Centre

Dress code Casual

DAY 2 – Tuesday, 1 December 2015

Time	Activity	
0900 - 1030	**Session 4 - Identities & Security**	**Chair: Nick Ward**
0900 – 0920	Current developments in maritime and voyage identifiers	Jens Jensen, DMA
0920 - 0940	Internationally accepted unique identifiers	Mia Lenman, GS1
0940 – 1000	Security models for digital infrastructure	Kwangil Lee, ETRI
1000 – 1020	Internet Of Ships IoS Big Challenges 2015- 2020	Brigid Cosgrave, INTTRA
1020 – 1030	Objectives for Working Groups	Nick Ward
1030 - 1100	**Break**	
1100 - 1300	**Session 5 – Working Groups (WG) on identity & security**	**Co-ordinator: Nick Ward**
1100 - 1230	WG1 – Available infrastructure and gaps	Leader: Mikael Lind
1100 - 1230	WG2 – User and Service Provider community groups	Leader: Jin Park
1100 - 1230	WG3 - Standards, regulations and governance	Leader: Jens Jensen
1230 – 1300	Plenary report of conclusions of WG discussion	Nick Ward / WG leaders
1300 - 1400	**Lunch**	
1400 - 1530	**Session 6 - Description, Registration, Management of Services and Governance**	**Chair: Edward Hosken**
1400 - 1420	Supply chain visibility platform - Everything connected	Norbert W Kouwenhoven, IBM
1420 - 1440	Roles and models for digital infrastructure in the maritime domain (the MAF)	Alex Hahn, OFFIS
1440 - 1500	Developments of service description and registration mechanisms	Alexander Neuhaus, Frequentis
1500 - 1520	Techniques and mechanisms for management of services including evaluation and qualification	Mikael Lind, Viktoria Swedish ICT
1520 - 1540	Ericsson's Maritime ICT Cloud and connected vessel solutions – an industry example of service interaction and information sharing	Douglas Watson, Ericsson
1540 – 1550	Objectives for Working Groups	Edward Hosken
1550 - 1610	**Break**	
1610 – 1730	**Session 7 – Working Groups (WG) on Description, Registration, Management of Services and Governance**	**Co-ordinator: Edward Hosken**
1610 – 1700	WG1 – Available infrastructure and gaps	Leader: Mikael Lind
1610 - 1700	WG2 – User and Service Provider community groups	Leader: Jin Park
1610 - 1700	WG3 - Standards, regulations and governance	Leader: Jens Jensen
1700 – 1730	Plenary report of conclusions of WG discussion	Edward Hosken / WG leaders

1800 – 2000 Buffet reception, Lindholmen Science Park Conference Centre

DAY 3 – Wednesday, 2 December 2015

Time	Activity	
0900 - 1030	**Session 8 - Testbeds**	**Chair: Alwyn Williams**
0900 - 0920	Harmonisation of data and services: from existing to new infrastructures	Edward Hosken, UKHO
0920 - 0940	Related testbeds	Nick Ward, GLA R&RNAV, UK & Ireland
0940 - 1000	Testbed collaboration between projects	Thomas Christensen, DMA
1000 - 1020	AIS under keel clearance testbeds in practice	Jonathon Pearce, OMC International
1020 - 1030	Objectives for Working Groups	Alwyn Williams, GLA R&RNAV, UK & Ireland
1030 - 1100	**Break**	
1100 - 1300	**Session 9 – Working Groups (WG) on testbeds**	**Co-ordinator: Alwyn Williams**
1100 - 1230	WG1 – Available infrastructure and gaps	Leader: Mikael Lind
1100 - 1230	WG2 – User and Service Provider community groups	Leader: Jin Park
1100 - 1230	WG3 - Standards, regulations and governance	Leader: Jens Jensen
1230 – 1300	Plenary report of conclusions of WG discussion	Alwyn / WG leaders
1300 - 1400	**Lunch**	
1400 - 1530	**Session 10 - Maritime Digital Implementation**	**Chair: Thomas Christensen**
1400 - 1420	Steps to establish a framework for a maritime digital infrastructure and the sharing of data and information	Mikael Lind, Viktoria Swedish ICT
1420 – 1440	Full scope of the interaction between ship and shore side under e-Navigation based on user requirements	Jin Park, KRISO
1440 - 1500	Collaboration with / between existing infrastructures / industry players	Kilyong Kim, GMT Co Ltd, Korea
1500 - 1515	Objectives for Working Groups	Thomas Christensen
1515 - 1545	**Break**	
1545- 1700	**Session 11 – Working Groups (WG) on maritime digital implementation**	**Co-ordinator: Thomas Christensen**
1545 - 1630	WG1 – Available infrastructure and gaps	Leader: Mikael Lind
1545 - 1630	WG2 – User and Service Provider community groups	Leader: Jin Park
1545 - 1630	WG3 - Standards, regulations and governance	Leader: Jens Jensen
1630 - 1700	Plenary report of conclusions of WG discussion	Thomas Christensen / WG leaders
1700 - 1730	**Meeting of WG chairs**	**WG + session chairs, Omar Frits Eriksson, Seamus Doyle, Thomas Christensen**

1730 – 1930, Buffé mingle with Viktoria partners and customers at the yearly Viktoria Forum event (sponsored by Viktoria Swedish ICT). Dress code Casual

DAY 4 – Thursday, 3 December 2015

Time	Activity	
0900- 1030	**Break**	
0900 - 1030	**Session 12 – Plenary – Conclusions & Demonstrations**	**Co-ordinator: Omar Frits Eriksson**
0900 – 0930	Conclusions from Seminar	Omar Frits Eriksson, DMA
0930 – 1030	Demonstrations	Various
1030 - 1100	**Break**	
1100 - 1230	**Session 13 – Plenary – Demonstrations & Closing**	**Chair: Omar Frits Eriksson**
1100 - 1130	Demonstrations	Various
1130 – 1145	Seminar Debrief	Omar Frits Eriksson, DMA
1145 – 1200	Closing of the seminar	Omar Frits Eriksson, DMA
1200 – 1300	**Lunch**	

ANNEX F SEMINAR INPUT PAPERS

Including the presentations made during sessions, the following papers were input to the seminar:

Title / Author (if required)	Presented by
Technical Programme Technical Infrastructure draft 20151202	IALA Secretariat
ENAV17-14.2.6 Questions on a Digital Infrastructure Framework for e-navigation (rev3)	IALA Secretariat
WG Questions - Maritime Digital Infrastructure Seminar 20151127	IALA Secretariat
1.4 Keynote presentation	Aron Sorensen
2.1 Aims and Objectives of Seminar	Omar Frits Eriksson
2.3 Concept and definition of digital infrastructure	Anders Dalen
2.4 Key elements of maritime digital infrastructures	Jens Jensen
2.5 Industry community groups - a case story v3.2	Fred Pot
4.1 Current developments in maritime and voyage identifiers	Jens Jensen
4.2 Unique Identifiers 20151201	Mia Lenman
4.3 Security model for digital infrastructure v4	Kwangil Lee
4.4 20151201 IALA Goteberg INTTRA Internet of Ships	Brigid Cosgrave
6.1 E2 Service description and registration mechanisms	Alex Neuhaus
6.2 Techniques for Service management	Mikael Lind
6.3 IALA MAF Presentation 20151201	Axel Hahn
6.4 Connected Vehicle Cloud - IALA 1 December 2015	Douglas Watson
6.5 Supply Chain Visibility Platform - Everything connected Final	Norbert Kouwenhoven
8.1 Harmonisation of data and services (UKHO) 20151130	Edward Hoskins
8.2 20151202 - Testbeds Presentation for DI Seminar v2	Nick Ward
8.3 Testbed collaboration between projects - thc 2	Thomas Christensen
8.4 AIS Testbed Project-20151202	Jonathon Pearce
10.1 Incremental steps to establish a framework for digital infrastructure	Mikael Lind

Title / Author (if required)	Presented by
10.2 Full Scope of Interaction between Ship and Shore under e-Nav	Jin Park
10.3 Requirements for Maritime Digital Infrastructure Implementer View in South Korea	Kilyong Kim

ANNEX G SEMINAR OUTPUT DOCUMENTS

Title
Report of the IALA Seminar on Maritime Digital Infrastructure and Testbeds

****