Shore-side e-Navigation Infrastructure Requirements

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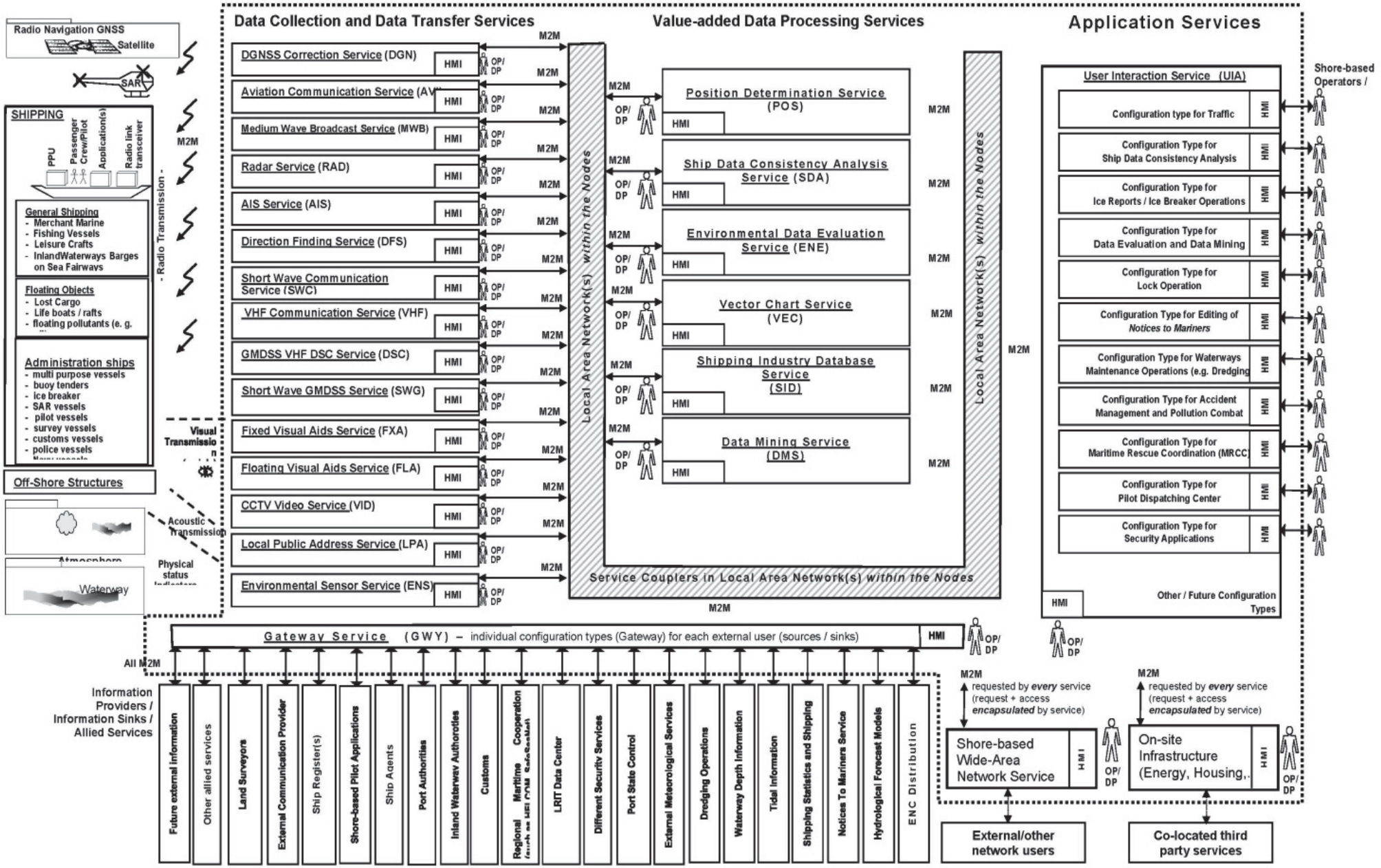

LEGEND:

HMI	Human-Machine-Interface
M2M	Machine-Machine-Interface
OP/DP	Technical *Operating* Personnel (operates and maintains technical equipment; *no* licence to change structure and/or functionality) / Technical *Development* Personnel (plans, deploys and further develops technical equipment; licence to change structure and/or functionality)

NOTE: By default, external users can request a HMI (Configuration Type to be provided by the User Interaction Service) and/or a dedicated Gateway (Machine-to-Machine-Interface; configuration type to be provided by Gateway Service), depending on individual operational requirements.

CSSA-compliant Shore-system Infrastructure

<table>
<tr><td colspan="8">HMI Devices</td></tr>
<tr><td colspan="8">Secure connection to Applications</td></tr>
<tr><td>Applications</td><td colspan="3">• Traffic Information
• Ship Data Consistency Analysis
• Ice Reports / Ice Breaker Operations
• Data Evaluation and Data Mining
• Lock Operation
• Editing of Notices to Mariners</td><td colspan="4">• Waterways Maintenance Operations (e.g. Dredging)
• Accident Management and Pollution Combatting
• Maritime Rescue Coordination (MRCC)
• Pilot Dispatching Center
• Security Applications
• OP/DP Applications</td></tr>
<tr><td rowspan="2">Application Services</td><td colspan="4">Data Collection and Data Transfer Services</td><td colspan="2">Value-added Data Processing Services</td><td>IT Infrastructure Services</td></tr>
<tr><td>• DGN
• AV
• MWS
• RAD</td><td>• AIS
• DFS
• SWC
• VHF</td><td>• DSC
• SWG
• FXA
• FLA</td><td>• VID
• LPA
• ENS</td><td>• POS
• SDA
• ENE
• VEC</td><td>• SID
• DMS</td><td>• DBMS
• Security
• Network Mgt
• Back-up Mgt</td></tr>
<tr><td colspan="8">Operating System</td></tr>
<tr><td rowspan="3">Hardware</td><td colspan="7">Servers and Data Storage Device</td></tr>
<tr><td colspan="7">Networking & Firewalling, Physical Connections to Sensors, video cameras, Radio Communications Equipment, User Devices and other equipment</td></tr>
<tr><td colspan="7">Data Center Mechanical & Uninterruptable Power Supply (UPS)</td></tr>
</table>

CSS and component requirement categories

- Scalability
- Interoperability
- Flexibility
- Modularity
- Reliability/continuity/availability
- Latency
- Maintainability
- Security
- Integrity
- Survivability/robustness
- Safety
- Seamlessness
- Verifiable/validatable
- Usability
- Extensibility
- Inclusivity
- Consistency

Proposed Specific CSS infrastructure requirements

- High Availability
  - Redundancy with Automatic Fail-Over for all Components in all layers of the stack
  - Remote maintenance of Components
- Security
- Use Existing Computing Infrastructure/Technology where possible
- Modular & scalable at all layers

Modularity is a very important requirement because:

- **It avoids vendor lock-in**
- **It allows Mixing-N-Matching of components from different vendors**
- **It makes the CSS future proof**
- **It allows Re-Use of Components**
- **It Shifts Market Balance of Power**
- **It Increases Component Market Potential**

Open Source Maritime Reference System Architecture (MARSSA)

FWP Version 1.19, September 9th , 2013

<table>
<tr><td colspan="8">Any User Device with intuitive Human Machine Interface including Audio (i.e. Workstation, Heads Up Display, Tablet, etc.)</td><td rowspan="8">Security</td></tr>
<tr><td colspan="8">Secure local or remote connection to Applications running on the Private Computing Cloud</td></tr>
<tr><td colspan="2">Certified Applications from any vendor</td><td colspan="6">• Traffic Information
• Ship Data Consistency Analysis
• Ice Reports / Ice Breaker Operations
• Data Evaluation and Data Mining
• Lock Operation
• Editing of Notices to Mariners
• Waterways Maintenance Operations (e.g. Dredging)
• Accident Management and Pollution Combatting
• Maritime Rescue Coordination (MRCC)
• Pilot Dispatching Center
• Security Applications
• OP/DP Applications</td></tr>
<tr><td rowspan="5">Private Shore-System Computing Cloud</td><td rowspan="4">Any Certified MARSSA Instance</td><td rowspan="2">Certified Application Services</td><td colspan="4">Data Collection and Data Transfer Services</td><td>Value-added Data Processing Services</td><td>IT Infrastructure Services</td></tr>
<tr><td>• DGN
• AV
• MWS
• RAD</td><td>• AIS
• DFS
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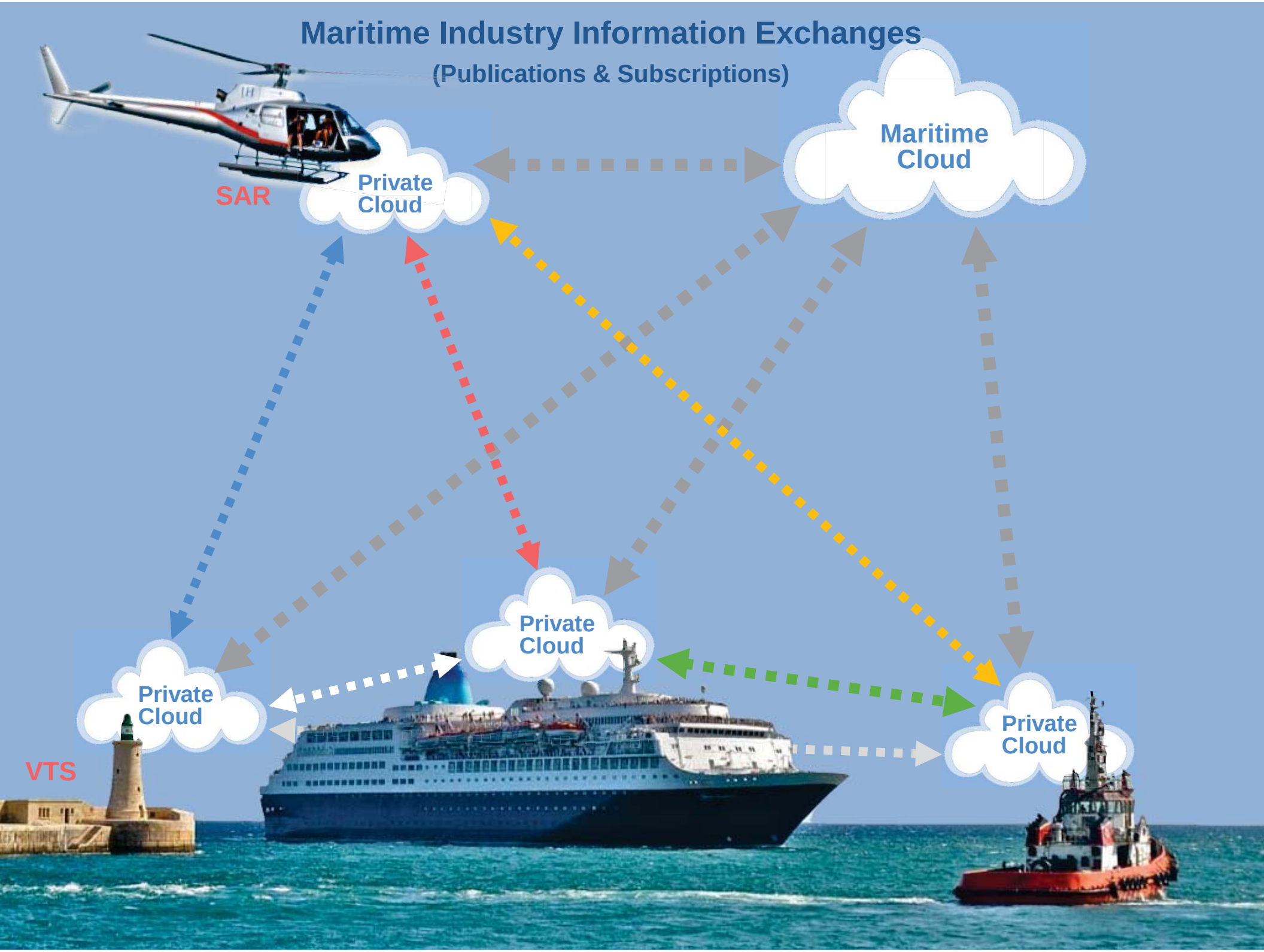
• DMS</td><td>• DBMS
• Security
• Network Mgt
• Back-up Mgt</td></tr>
<tr><td colspan="8">Engine (Service Broker, Port, Context, Hardware Abstraction Layer, UI Framework)</td></tr>
<tr><td colspan="8">Middleware (Any Operating System, Containers, Discovery & Peering, Communications, Load Balancing, other generic services)</td></tr>
<tr><td colspan="9">Virtualization Layer</td></tr>
<tr><td rowspan="3">Hardware</td><td colspan="8">Redundant Physical Servers (Any CPU, Any Data Storage Hardware or Device)</td></tr>
<tr><td colspan="8">Networking & Firewalling, Connections to local Sensors, Radar, Radio Communications Equipment, User Devices and other equipment, using any network protocol (i.e. TCP/IP, all versions of IEC 61162 and all proprietary protocols).</td></tr>
<tr><td colspan="8">Data Center Mechanical & Uninterruptable Power Supply (UPS)</td></tr>
</table>

Add Layers to make CSS MARSSA Compliant

- Virtualization Layer
- Middleware
- Engine
- Instance of MARSSA
- Security
- Private Shore-System Computing Cloud


Maritime Industry Information Exchanges
(Publications & Subscriptions)
SAR
Private Cloud
Maritime Cloud
Private Cloud
Private Cloud
Private Cloud
VTS

Conclusion

If we can agree that a Common Shore-based System should:

- Have High Availability
- Be secure
- Use Existing Computing Infrastructure/Technology where possible
- Be modular & scalable at all layers

then we should recommend that a common shore-side system (CSS) not only complies with the Common Shore-Side Architecture (CSSA) reference framework but also with the Open Source Maritime Reference System Architecture (MARSSA).

Where can I find more about MARSSA?

- marssa.org
- MARSSA is hosted by the Not-For-Profit MARSEC-XL Foundation (MARSEC-XL.org)
- MARSEC-XL is a full partner in the Mona Lisa 2.0 project.

Questions?

Thank you!

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