Innovation for Hydrospatial Information Management - IHO and OGC
The Story so far

International Seminar on Marine Geospatial Information
11-May-2022. Singapore
What is OGC?

A hub for thought leadership, innovation, and standards for all things related to location

Our Vision
Building the future of location with community and technology for the good of society

Our Mission
Make location information Findable, Accessible, Interoperable, and Reusable (FAIR)

Our Approach
A proven collaborative and agile process combining consensus-based standards, innovation project, and partnership building
## Who Are Our Members?

### Commercial

<table>
<thead>
<tr>
<th>Business Development</th>
<th>Global: Brand Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competitive Technical Advantage</td>
<td>Funding for Innovation</td>
</tr>
</tbody>
</table>

### Government

<table>
<thead>
<tr>
<th>Innovation &amp; Market Support</th>
<th>International Partnerships</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trusted Advice</td>
<td>Operational Policy</td>
</tr>
<tr>
<td>Support &amp; Certification</td>
<td></td>
</tr>
</tbody>
</table>

### Research & Academia

<table>
<thead>
<tr>
<th>Applied Research Partners</th>
<th>International Collaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Funding for Innovation</td>
<td>Citations</td>
</tr>
</tbody>
</table>
The OGC Community

Advancing & Applying S&T

Collective Problem Solving

Driving & Enabling Integration

Innovative Solutions

Best Practices

Open Standards
Global Growth Continues – increasingly from outside the traditional Geospatial Industry

Answering the call for increased innovation, and the need for collective problem solving (e.g. Impact on Marine, Climate Resiliency, Disasters)

F.A.I.R. location data, information and knowledge is even more important – everywhere, especially across domains (e.g. Land/Water Interface)
Tech and Innovation
Many Tech Trends…

- New sensors
- Small sats
- LIDAR
- IoT
- Drones/CAVs
- ...

- GNSS
- 5G
- Global grids
- Indoor
- Underground
- ...

- Cloud
- Edge
- Streaming
- Internet
- APIs
- ...

- 3D
- AR, VR, MR
- Gaming & simulation
- Maps on the web
- Natural language
- ...

- Artificial Intelligence
- Machine Learning
- Big data analytics
- Linked data
- Analysis Ready Data
- ...

- Weather
- Disaster risk
- Pandemics
- Human activity
- Hydro/soil/air/etc
- ...

- More sources
- More data
- Location/Position Accuracy
- Computing Advancements
- Visualization and Interaction w data
- Data Science and Analytics
- Modeling and Simulation
Technologies & Innovations

Modernizing SDI: Data Interoperability for Cumulative Effects
Data & services to study cumulative effects
[link to ogc.org/mod-SDI]

Now Available: Engineering Reports documenting method for simple cloud-based EO Applications

Smarter Cities Through Use of Digital Twins
The Location Powers 2021 Report Preamble

OGC – IHO
Federated Marine SDI Demonstration Pilot
Connecting Land and Sea Across Nations
PHASE II Coming Soon!

Public Comment Requested on Proposal for Revision to I3S Community Standard

Leveraging Sensor Data and the Internet of Things

Seeking public comment on charter for Artificial Intelligence in Geoinformatics Domain Working Group
OGC APIs – Building Blocks of the Future

https://ogcapi.org/
The Innovation Program

OGC Innovation: Engineering Services: Applied research for geospatial challenges

OGC Innovation: Concept Development Studies: Applied research, market analysis, and state of art analysis

Domain Working Group (DWG): Discusses geospatial challenges, research results, and solutions for a specific domain.

Standard Working Group (SWG): Develops a single standard or series of standards.

OGC Innovation: Pilots & Testbeds: Collective problem solving & best practice generation

Compliance Program (CITE): Compliance tests for OGC Standards
Innovation Continuum

Innovation

- Create public call
- Select best members
- Executive Project
- Generate Results
- Call for Sponsors
- Identify Project

Standards Development

- DWG discussion
- SWG formation
- Standards development
- DWG/SWG Presentation
- Formulation of enhancements
- Interest gathering

IHO
Partnerships – Critical!

- Collective Problem Solving – Innovation
- Multiplier effect + reduce redundant work
- Maximize Investments
- Long History on collaboration – which is accelerating

Slide Courtesy of UKHO – Maturity Work Item example
The Story so far....
The IHO-OGC Federated MSDI Pilot
The FMSDI Pilot

• Built on multi-stakeholder IHO-OGC MSDI Concept Development study

• Demonstrate aspects of multi-country/region, Federated Marine Spatial Data Infrastructure (SDI) to:
  • **Stakeholders** - inclusivity!
  • **Delivery** - Demonstrate how federated Marine SDI can provide simple, secure access using Modern Standards based approaches (OGC APIS, IHO S-1XX)
  • **Areas of interest** - Baltic and North Sea (potentially Arctic, South East Asia, others)

OGC- IHO collaborative Pilots work extremely well – Example : IHO-OGC **Maritime Limits and Boundaries** Pilot

Thanks to our founding Sponsors!

[Images of logos for Danish Geodata Agency and UK Hydrographic Office]
Scope

- Marine Data Availability and Accessibility Study (MDAAS) via Stakeholder Consultations
- Examine S-122 data availability, how to better utilize S-122, and what appropriate governance considerations should be taken
- Explore where the S-1XX product specifications provides sufficient, good quality data and how to incorporate additional domain data (land content standards, meteorological, oceanography, etc.)
- Demonstrations of use cases leveraging the S-122 framework that is developed and a demonstration bringing together the additional data domains – OGC APIs!
- Guided by the UN-GGIM Integrated Geospatial Information Framework (IGIF) to develop a roadmap for MSDI maturity, defining when, where, and how the S-1XX product specifications are integrated

Supports UN-GGIM
Outcomes

- **“Show me” Demonstration** - technology demonstration from global community experts showcasing federated Marine SDI for selected Land/Sea use cases across domains and jurisdictions – forward looking (OGC API)

- **Impact on OGC Standards** - Lessons learned, gaps, and the need for changes to the OGC Standards Baseline that will inform the OGC Standards Program.

- **Impact on IHO Standards** - Practical testing of relevant S-100 based IHO standards will accelerate the process for adoption and implementation of IHO standards to help to inform the work of the IHO HSSC Working Group

- **Impact on Next Steps** – what is next (demonstrating creation and delivery of IHO S.1XX product specs using OGC standards? Data Management – data cubes, Discrete Global Grids?)

- Advancing FAIR (and increasingly FAIR+) approaches

  How do we unlock the ability to share the wealth of non-navigational marine data collected by the international community?
FMSDI initiative

Phase I consists of an RFI on resource collection with a primary focus on Marine Protected Areas (MPA).

**Phase II which is currently running includes:**

**Task 1**- Developing a federation of S-122 Standard MPA data sets;

**Task 2**- Developing various data services Exploring the data fidelity, mobility, and versatility of S-1XX Product Specification as well as other marine standards and data;

**Task 3**- Designing a [UNGGIM-IGIF](https://www.unggim.org) derived Marine SDI maturity model which provides a roadmap for MSDI development.

The third phase, which is expected to start later in Summer 2022, will primarily extend the use cases developed in the second phase and add the **Arctic region** as a new location to the demonstration scenarios.
### Phase I: RFI Data Resources

<table>
<thead>
<tr>
<th>Organization</th>
<th>Notes</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>HELCOM - Baltic Marine Environment Protection Commission</td>
<td>Reported tabular data is collected and made available via HELCOM MPA database</td>
<td><a href="http://mpas.helcom.fi">http://mpas.helcom.fi</a></td>
</tr>
<tr>
<td></td>
<td>Spatial data on MPA areas is also available as spatial dataset (shapefile). The spatial data can be accessed via web service</td>
<td><a href="https://maps.helcom.fi/website/mapservice/?datasetID=d27df8c0-de86-4d13-a06d-35a8f50b16fa">https://maps.helcom.fi/website/mapservice/?datasetID=d27df8c0-de86-4d13-a06d-35a8f50b16fa</a></td>
</tr>
<tr>
<td></td>
<td>Metadata record for the above shapefile</td>
<td><a href="http://metadata.helcom.fi/geonetwork/srv/eng/catalog.search#/metadata/d27df8c0-de86-4d13-a06d-35a8f50b16fa">http://metadata.helcom.fi/geonetwork/srv/eng/catalog.search#/metadata/d27df8c0-de86-4d13-a06d-35a8f50b16fa</a></td>
</tr>
<tr>
<td></td>
<td>OGC WMS</td>
<td><a href="https://maps.helcom.fi/arcgis/services/MADS/Biodiversity/MapServer/WMSServer?request=GetCapabilities&amp;service=WMS">https://maps.helcom.fi/arcgis/services/MADS/Biodiversity/MapServer/WMSServer?request=GetCapabilities&amp;service=WMS</a></td>
</tr>
<tr>
<td></td>
<td>ArcGIS REST</td>
<td><a href="https://maps.helcom.fi/arcgis/rest/services/MADS/Biodiversity/MapServer/54">https://maps.helcom.fi/arcgis/rest/services/MADS/Biodiversity/MapServer/54</a></td>
</tr>
<tr>
<td>UK Hydrographic Office</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Danish Agency for Culture and Palaces</td>
<td>Data can be downloaded through 2 locations</td>
<td><a href="https://www.kulturarv.dk/ffreg/">https://www.kulturarv.dk/ffreg/</a></td>
</tr>
<tr>
<td></td>
<td>The data can also be accessed via webservice</td>
<td><a href="https://www.kulturarv.dk/ffpublic/wms?service=wms&amp;version=1.1.0&amp;request=GetCapabilities">https://www.kulturarv.dk/ffpublic/wms?service=wms&amp;version=1.1.0&amp;request=GetCapabilities</a></td>
</tr>
</tbody>
</table>
## Phase I: RFI Data Resources

<table>
<thead>
<tr>
<th>Organization</th>
<th>Notes</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Geodata info</td>
<td><a href="http://www.geodata-info.dk">www.geodata-info.dk</a></td>
</tr>
<tr>
<td></td>
<td>Additional resources</td>
<td><a href="https://dataforsyningen.dk/">https://dataforsyningen.dk/</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td><a href="https://datafordeler.dk/">https://datafordeler.dk/</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td>mim.dk</td>
</tr>
<tr>
<td>Finland Traficom</td>
<td>All Traficom data sets can be found from our geoportal</td>
<td><a href="https://julkinen.traficom.fi/oskari/">https://julkinen.traficom.fi/oskari/</a></td>
</tr>
<tr>
<td></td>
<td>Additional resources</td>
<td><a href="https://kartta.paikkatietoikkuna.fi/?lang=en">https://kartta.paikkatietoikkuna.fi/?lang=en</a></td>
</tr>
<tr>
<td>Lithuanian Transport Safety Administration</td>
<td>We use public data from national spatial data center</td>
<td><a href="http://www.geoportal.lt">www.geoportal.lt</a></td>
</tr>
<tr>
<td>German Federal Maritime and Hydrographic Agency</td>
<td>The GeoSeaPortal is part of the integrated German and European MSDI network</td>
<td><a href="https://www.geoseaportal.de/mapapps/?lang=en">https://www.geoseaportal.de/mapapps/?lang=en</a></td>
</tr>
<tr>
<td>Swedish Hydrographic Organization</td>
<td>Many GIS stakeholders rely on the national SDI for data discovery</td>
<td><a href="http://www.geodata.se/geodataportalen">www.geodata.se/geodataportalen</a></td>
</tr>
</tbody>
</table>
## Phase I: RFI Data Resources

<table>
<thead>
<tr>
<th>Organization</th>
<th>Notes</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flemish Hydrography</td>
<td>Data custodian for various relevant datasets as they are included on navigational charts. It concerns the 6 MPA’s described in the Marine Spatial Plan.</td>
<td><a href="https://www.geopunt.be/catalogus/webservicefolder/688b3a9c-025b-4872-b1c6-06126a821e25">https://www.geopunt.be/catalogus/webservicefolder/688b3a9c-025b-4872-b1c6-06126a821e25</a></td>
</tr>
<tr>
<td>Geoscience Australia</td>
<td>A whole-of-government data access and visualisation application. WCS harvester compiles web services into a common framework</td>
<td><a href="https://nationalmap.gov.au/">https://nationalmap.gov.au/</a></td>
</tr>
<tr>
<td></td>
<td>Maritime boundaries thematic mapping applications. Internal curated datasets are made available with analysis tools</td>
<td><a href="http://maps.ga.gov.au/interactive-maps/#/theme/amsis">http://maps.ga.gov.au/interactive-maps/#/theme/amsis</a></td>
</tr>
<tr>
<td></td>
<td>Seafloor thematic mapping application. Internal curated datasets are made available with analysis tools</td>
<td><a href="https://portal.ga.gov.au/persona/marine">https://portal.ga.gov.au/persona/marine</a></td>
</tr>
<tr>
<td></td>
<td>Location Index (Loc-I) is a framework that provides a consistent way to seamlessly integrate data on people, business, and the environment. Open datasets are converted to linked data for research and development</td>
<td><a href="http://www.locationindex.org/">http://www.locationindex.org/</a></td>
</tr>
</tbody>
</table>
## Updated Phase II: Scheduling

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>M05</td>
<td>January 5 - 7, 2021</td>
<td>Kick-off Workshop</td>
</tr>
<tr>
<td>M06</td>
<td>January 8 - 20, 2022</td>
<td>Scenario Development</td>
</tr>
<tr>
<td>M07</td>
<td>January 10 - 27, 2022</td>
<td>Phase 1 TIE (Technology Integration Experiment) Testing</td>
</tr>
<tr>
<td>M08</td>
<td>January 24 - 28, 2022</td>
<td>Phase 1 Documentation Completion</td>
</tr>
<tr>
<td>M09</td>
<td>March 31, 2022 -&gt; April 15, 2022</td>
<td>Phase 2 TIE Testing</td>
</tr>
<tr>
<td>M10</td>
<td>March 31, 2022 -&gt; April 29, 2022</td>
<td>Draft ER: Thread 2 &amp; 3 Documentation Completion</td>
</tr>
<tr>
<td>M11</td>
<td>May 15, 2022</td>
<td>Submitting Final ER before June TC deadline</td>
</tr>
<tr>
<td>M12</td>
<td>June 13-17, 2022</td>
<td>Demonstration of Results at the OGC member meeting</td>
</tr>
</tbody>
</table>
Phase II - Task 1: BNS

Baltic Sea / North Sea – S122: Federated Marine Protected Area Data

Demonstrate improved access to Baltic/North Sea MPA data for a wider variety of end users outside of the traditional MSDI domain.
Phase II - Task 1: BNS

- **Use Case(s)**
  - Location-based analytics and support for loosely connected clients for the Baltic/North Sea region

- **Outcomes**
  - Identification of S-122 data, who produces it, where is it held, how it is accessed
  - UML Models for S122
  - Technology demonstration for the usage of a Federated MSDI framework actively being informed by S-122 data – forward-looking – e.g. OGC APIs
Phase II - Task 2: Fusion

Fusion Service: Data Fidelity, Mobility and Versatility

To have a greater fidelity, mobility, and versatility, participants will go beyond MPA data and examine a broader set of data and standards. These include other data sets and standards to develop a firmer more holistic view of a region: terrestrial data, meteorological data, earth observation data, online sensors, etc.
Outcomes

- Demonstrating how the various data can be brought together to enhance data analysis and understanding
- Documenting where S-1XX product specifications excel, where supporting data is needed, and how these data are being combined and used.

Use Case(s): Shipping routes through the Baltic/North sea with enhanced awareness of S-122 MPAs (builds on Phase I)

Demonstration of a use case for an online/on-demand vessel planned “route” (so, known) submitted for analysis using S-1xx data and fused data which is included in one or more OGC API endpoints on the server.

Datasets available from the server denote MPAs and areas of environmental protection from various providers. The aim of the analytics process is to produce basic results and demonstrate the ability to feed into the downstream analysis. Suggestions for demonstration:

- Proximity to various areas/regions
- Whether vessels (of particular types) avoid or evade certain areas
- Whether behaviour changes in any statistically significant way around certain areas
- Showing a list of data/properties which is available - e.g., surface temperature, precipitation, wind speed, direction, elevation
- Providing back statistical summaries (counts, min, max, medium).
Phase II - Fusion Servers

Discrete Global Grid System – D121 EDR Server to DGGS Client. Note the Client is querying/selecting the Protected Area and the response is shown in the legend...
Phase II - Task 3: IGIF-MSDI Maturity Roadmap

• **Use Case(s): IGIF-MSDI Maturity Roadmap**
  - Scoring a new MSDI and tenured MSDI along the roadmap to reveal potential MSDI enhancement or areas of focus
  - *Opportunity for additional sponsors (separate call coming)*

• **Outcomes**
  - A well-defined roadmap following the IGIF domains of focus with indicators for areas of improvement and areas of focus for enhancing a new of existing MSDI
## Phase III: Scheduling

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>M01</td>
<td>May 16, 2022</td>
<td>Release of Call for Participation</td>
</tr>
<tr>
<td>M02</td>
<td>May 31, 2022</td>
<td>Close of Call for Participation</td>
</tr>
<tr>
<td>M03</td>
<td>Jul 5-6, 2022</td>
<td>Kick-off Workshop</td>
</tr>
<tr>
<td>M04</td>
<td>Aug 1, 2022</td>
<td>Engineering Report Draft</td>
</tr>
<tr>
<td>M05</td>
<td>Jul-Oct, 2021</td>
<td>Deliverable Development</td>
</tr>
<tr>
<td>M06</td>
<td>Oct-Nov, 2022</td>
<td>Technology Integration Experiment (TIE) Testing</td>
</tr>
<tr>
<td>M07</td>
<td>Nov 15, 2022</td>
<td>Final Engineering Report Due</td>
</tr>
<tr>
<td>M08</td>
<td>Dec, 2022</td>
<td>Demonstration of Results at the OGC Member meeting</td>
</tr>
</tbody>
</table>

**PHASE IV in Planning stage (likely to be in the fall)**
Phase V (2023 +) ?

Building on progress to date – what should the focus be ?

Policy Drivers ?
• Climate Change,
• Disasters,
• Environment,
• Open Science

Potential Themes ?
• Sea level Rise,
• Coastal Erosion,
• Species tracking, Continued Cross Boundary / Domain sharing ( e.g. Arctic)

Related Technology and Standards ?
• Discrete Global Grid
• 3D Visualisation and Data Management –
• Simulation and Modelling
• Cloud Native
• S 1.XXX ?
Outreach and Consultation – Next Events

Join the location community at the
123rd OGC Member Meeting
At the Hotel Meliá Barajas
In Madrid, Spain
June 13th – June 17th, 2022
Thank You

Community
500+ International Members
110+ Member Meetings
60+ Alliance and Liaison partners
50+ Standards Working Groups
45+ Domain Working Groups
25+ Years of Not for Profit Work
10+ Regional and Country Forums

Innovation
120+ Innovation Initiatives
380+ Technical reports
Quarterly Tech Trends monitoring

Standards
65+ Adopted Standards
300+ products with 1000+ certified implementations
1,700,000+ Operational Data Sets
Using OGC Standards

Questions?
Trevor Taylor,
Senior Director
ttaylor@ogc.org