




# Marine Spatial Data Infrastructures

## Orientation




Produced by  IHC TECHNOLOGIES

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# Marine Spatial Data Infrastructures

Concepts, definitions and examples



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## Why are you here?

Data engineering for reuse is really hard!

I'm lost in the buzzwords

MSDI?  
What is it?  
What do I do next?

Too much information


What are the hurdles?

National Commitment


Regional Coordination

What is data-centric?

It's Not My Job!



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## Definitions

A **“Spatial Data infrastructure (SDI)”** is:

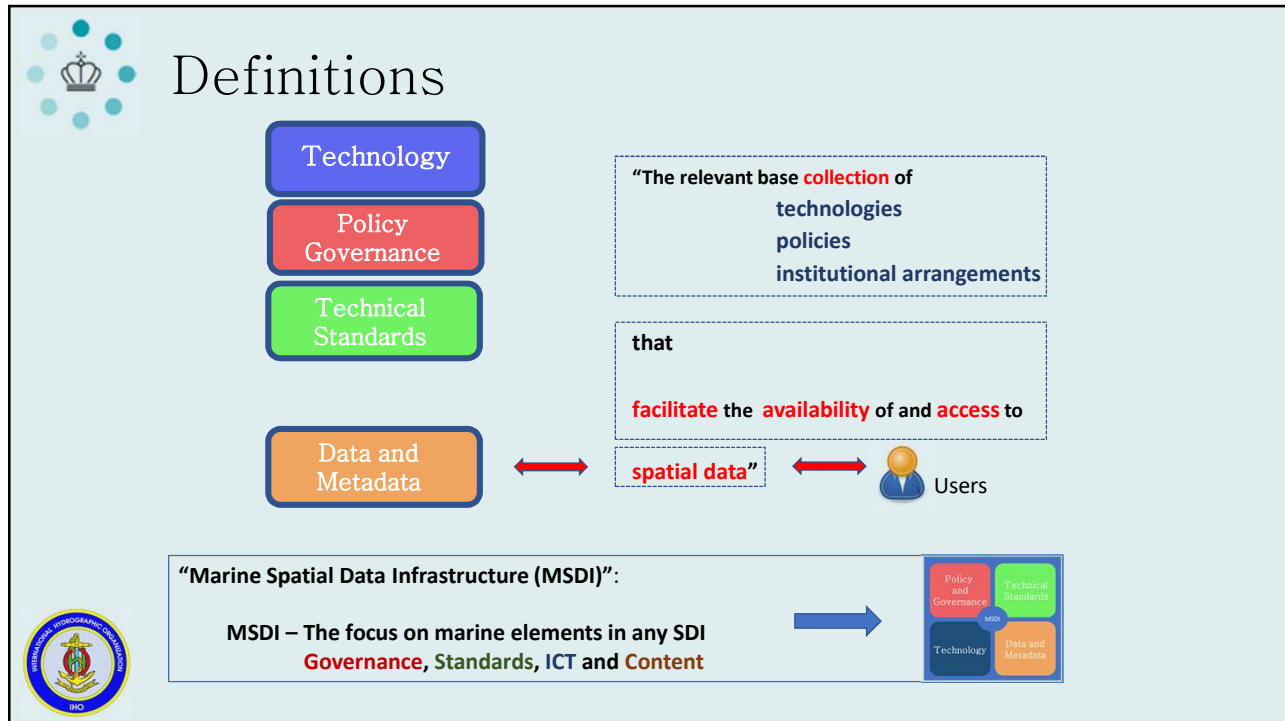
**“the relevant base collection of technologies, policies and institutional arrangements that facilitate the availability of and access to spatial data.”**

A **“Marine Spatial Data Infrastructure (MSDI)”** is:

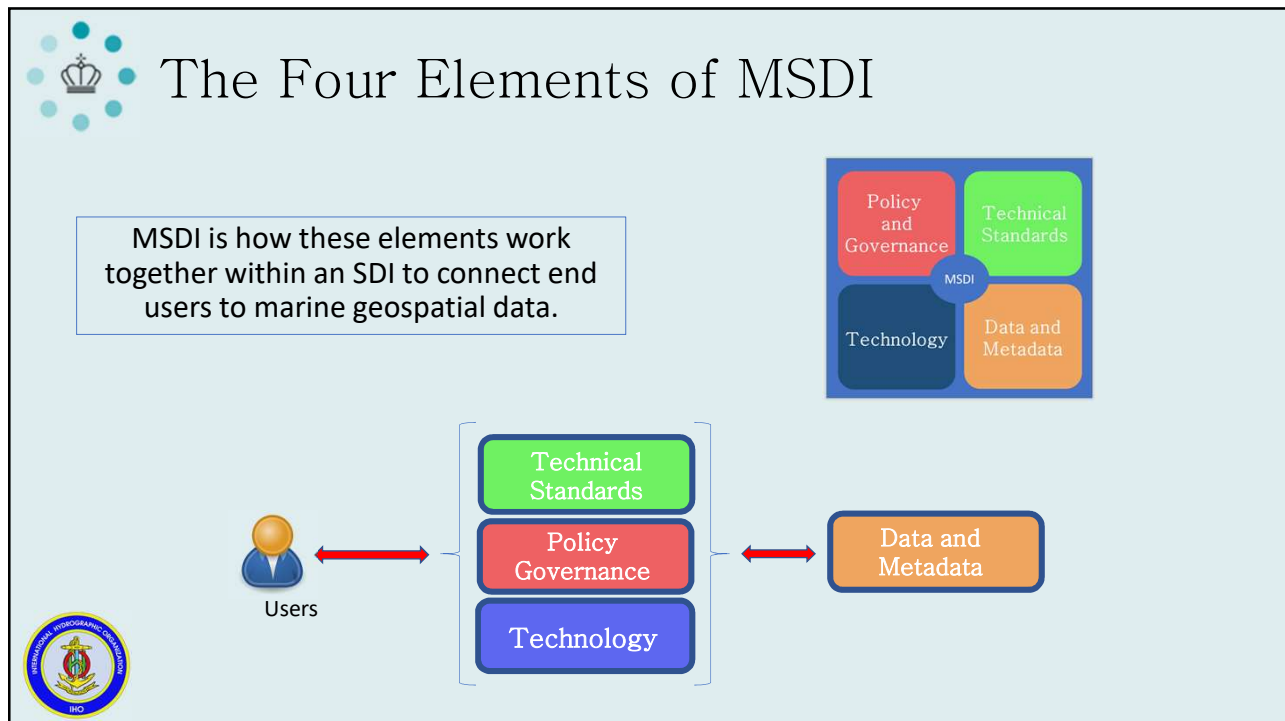
**“that element of an SDI that focuses on the marine input [to an SDI] in terms of governance, standards, ICT and content”**



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# Benefits of MSDI




- Unlock the economic and environmental power of marine geospatial data
- Provide reusable data to a broader audience for diverse uses
- Break out of a single tightly defined customer group
- Improve marine geospatial data quality and working practices



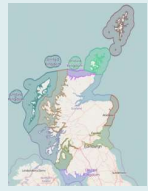
Leisure and Tourism



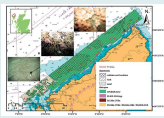
Emergency Planning and Response




Fisheries Regulation




Maritime Boundaries  
Marine Protected Areas




Coastal Zone Management




Dredging planning and beneficial reuse



Marine Spatial Planning




Site Selection



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# What is MSDI?



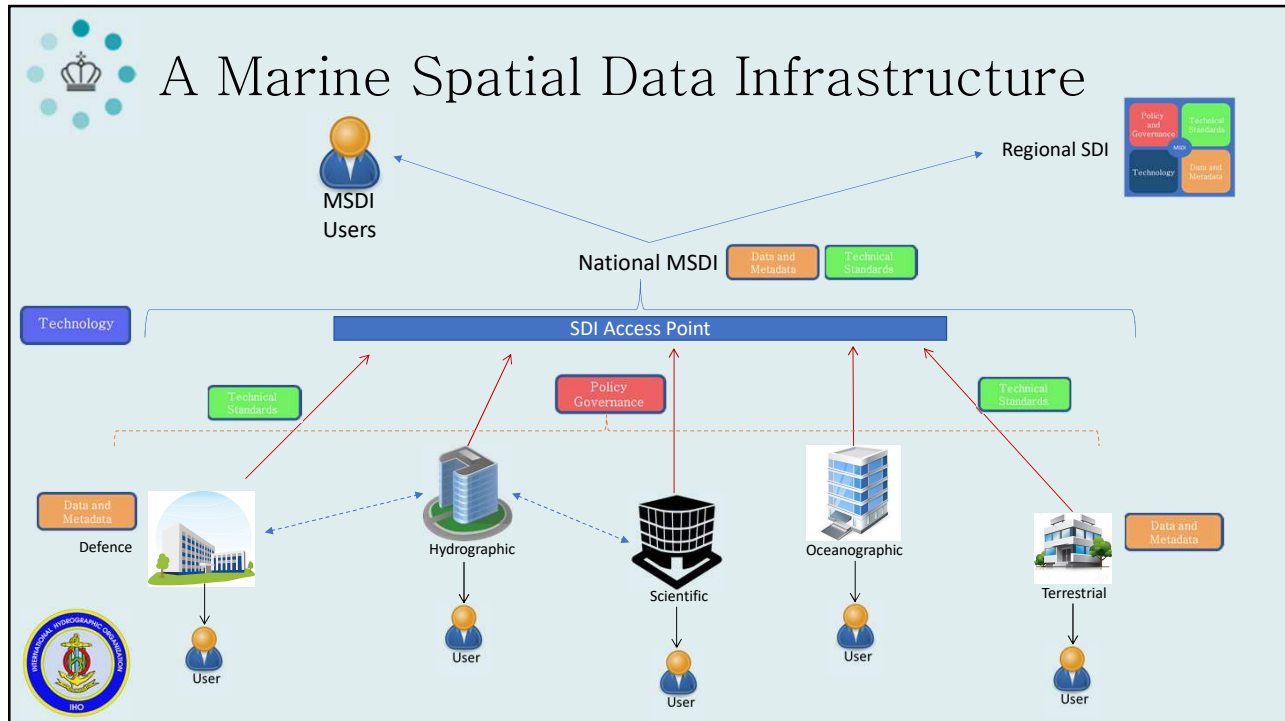
Without MSDI
With MSDI

**Without MSDI:** A fragmented network where various users (Hydrographic, Oceanographic, Defence, Terrestrial, Scientific) interact with their own data silos. Each silo has its own user interface and data flow.

**With MSDI:** A unified system where all data silos (Hydrographic, Oceanographic, Defence, Terrestrial, Scientific) connect to a central **SDI Access Point**. This point provides access to **National MSDI**, which is then accessible to **MSDI Users** and **Regional MSDI**.




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# Example: New Zealand Geoportal

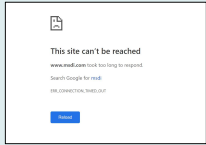
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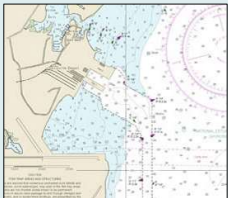
## What SDI and MSDI “isn’t”




Not an IHO initiative




Not a website




Not a “product”



Not a Format



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## MSDI policy development

Policy  
and  
Governance


- To establish MSDI a policy and governance framework should define the need to create information that is interoperable
- Policy and Governance should:
  - Sets the vision and goals of the MSDI and
  - Define the responsibilities of participating institutions
  - Resource the work necessary to establish and maintain the MSDI
  - Define which institution is authoritative for each domain
- Policy is often linked to a regional, national or organizational strategies
- Policies can vary significantly between different states
  - Often the most difficult hurdle to establishing MSDI
  - No fixed format, standard or process for policy development
  - IHO publication C-17 contains best practice guidelines for Hydrographic Offices

Areas considered within policy
 

- Privacy
- Licensing
- Intellectual Property
- Authenticity
- Data Security
- Data quality
- Data integration
- Data Archiving
- Open Data
- Copyright and Licencing



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# IHO MSDI WG

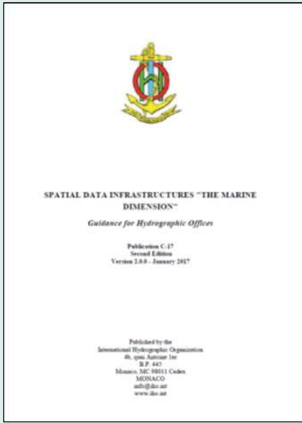
Policy and Governance

- MSDIWG - The IHO's working group with the objective of supporting activities relating to SDI and MSDI.
- Also links to OGC Marine domain working group (MDWG)
- Publishes IHO C-17, "a guide to establishing the role of the national hydrographic authority in MSDI"
- Contains much advice on formulating policy, governance and implementation of MSDI
- IHO C-17 also contains much information on the other MSDI elements

Technical Standards


Data and Metadata

Technology



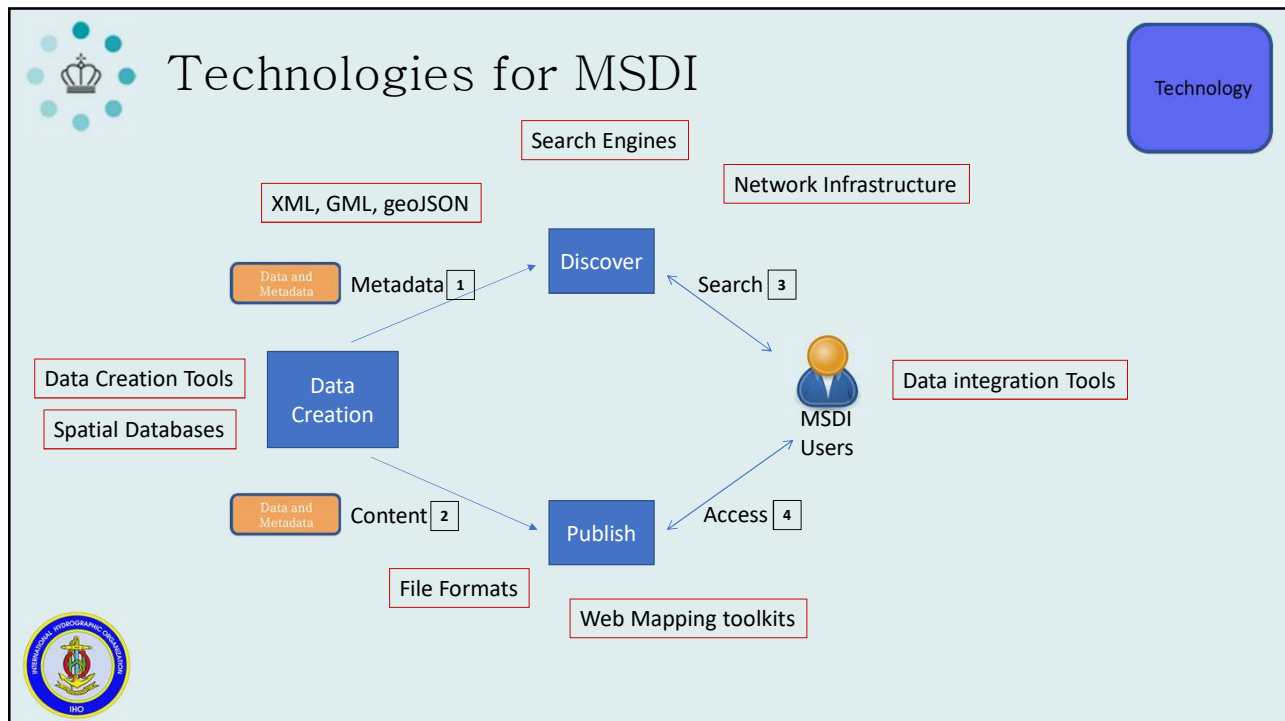
SPATIAL DATA INFRASTRUCTURES "THE MARINE DIMENSION"  
Guidance for Hydrographic Offices  
Publication C-17  
Second Edition  
Version 2.0.0 - January 2007

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"Hydrography is the branch of applied sciences which deals with the measurement and description of the physical features of oceans, seas, coastal areas, lakes and rivers, as well as with the prediction of their change over time, for the primary purpose of safety of navigation and in support of all other marine activities, including economic development, security and defence, scientific research, and environmental protection"

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# Web Services for MSDI

Technology

Data and Metadata

Technical Standards

**Request**

```
/wfs?service=WFS&version=2.0.0&request=getFeature& place=Italy&...
```

**Response**

```
Country: Italy
Pop: 57,500,000
Area: 301,325m²
```

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# Marine Technology Advances

Technology

**Sensors:**

- Increase in power, decrease in price
- Scale of sensors for marine survey
- LIDAR, AIS, Satellite imagery
- Handheld positioning

**Crowdsourcing:**

- Volunteered geographic information now realistic, reliable and usable by many agencies
- Changes role of some agencies.
- Tools have revolutionised the concept. OpenStreetmap, Waze, Google Maps

**Big Data, Data Science and Machine Learning:**


- Emerging in geospatial technologies
- Could have tremendous impact on data manipulation, compilation and search/retrieval
- Data science will enable "information" exchange rather than just data.

**Computing Power:**

- Computing Power and connectivity have dramatically increased
- Cheap access to high powered, cloud based databases and mainstream geospatial technology
- Convergence of hydrography with GIS

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Technical Standards

Standards are technical documents that detail interfaces or encodings (OGC).


Software developers, cartographers and data engineers use these documents to build their products and services.

Standards span the collection, management, publication and use of geospatial data

Key to MSDI are open standards and standards interoperability

Open Standards can be used by anyone at little or no cost

Interoperability is being able to combine data and services from different sources without requiring specific efforts of humans or machines



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Data and Metadata

Technical Standards

Policy and Governance



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LIFE BELOW WATER




**SDG 14 TARGETS:**

- 14.1** By 2025, prevent and significantly reduce marine pollution of all kinds
- 14.2** By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts
- 14.3** Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels
- 14.4:** By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices
- 14.5:** By 2020, conserve at least 10 per cent of coastal and marine areas
- 14.6** By 2020, prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, eliminate subsidies that contribute to illegal, unreported and unregulated fishing
- 14.7** By 2030, increase the economic benefits to Small Island developing States and least developed countries from the sustainable use of marine resources



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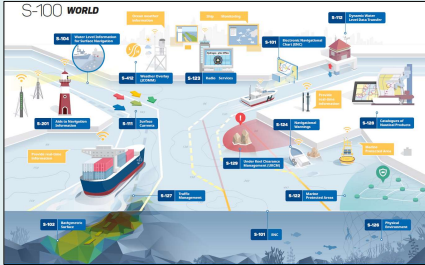



# MSDI and the role of IHO S-100

Technical Standards


S-100 is a fundamental standard for MSDI:

- A universal framework for encoding marine geospatial data
- Derived from ISO19100 standards
- Open – free for all to use and implement
- Extensible – all marine domains can represent their data
- IHO Geospatial Registry of defined features






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# Marine geospatial data content

Data and Metadata

Vector Data: "Things"




```

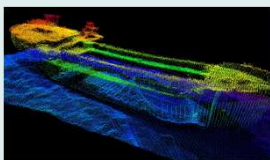
LIGHTS:
{
  CATLIT = 6
  COLOUR = 3
  INFORM = More than one
  SCAMIN = 59999
}
geometry:
{
  id = 6E42010000 [-40.5,36.2]
  ornt = null
}
                    
```

A collection of **features** with **attributes** and **geometry**.

Raster Data and Imagery




Bathymetry: Point Clouds and Surveys




Technical Standards

Standards for data format  
 Vector: IHO S-57, S-100  
 Raster: geoTIFF, PNG, HCRF  
 Bathymetry: LAS, IHO S-102



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# Metadata

Data and Metadata


- Metadata is Information about datasets
- Published “discovery” metadata is how MSDI users “find” the data they are searching for and establish its authenticity
- For the MSDI community standardized, populated, comprehensive metadata is crucial to success.
- Collection of metadata facilitates good data management and has benefits beyond MSDI applications

Technical Standards


Metadata content is Standardised

Standards exist at different levels, e.g.


- International
- Regional
- National




UK Marine Standard: MEDIN




UK Standard: GEMINI2




European Standard: INSPIRE (Directive)

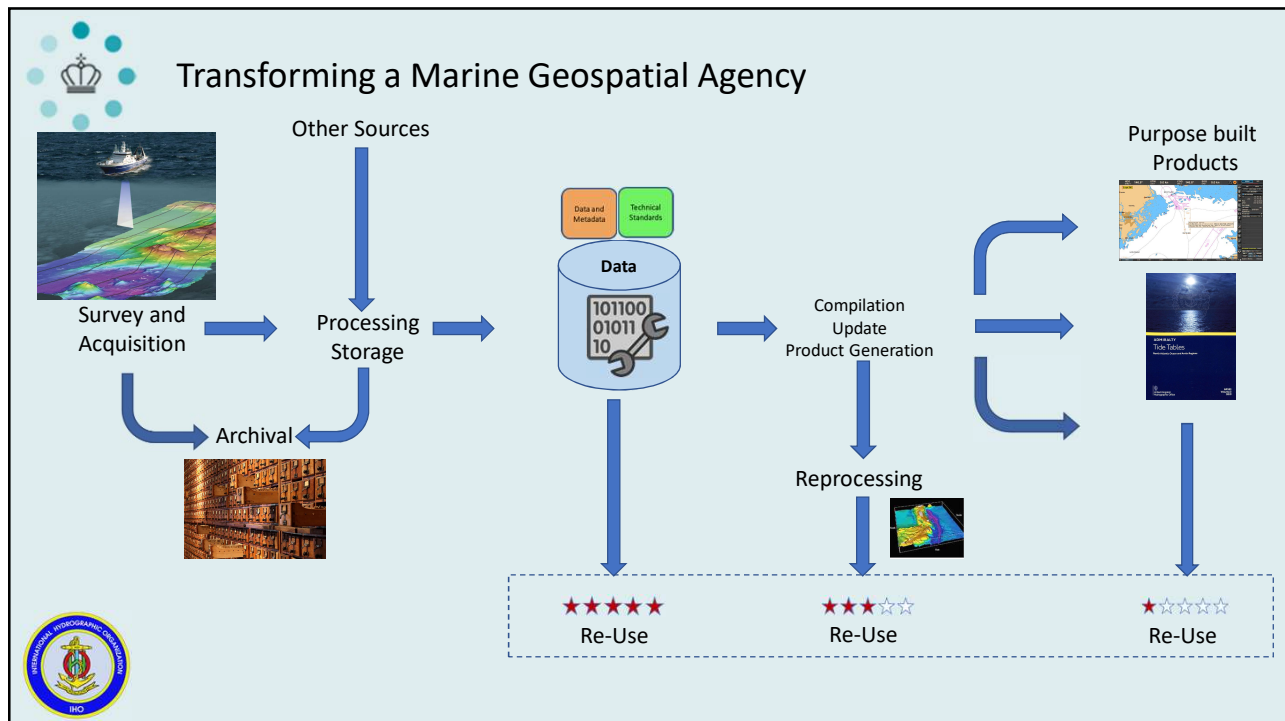


International Standard: ISO19115






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## What now? An example plan for MSDI

**Policy and Governance**

- Define policies for technology, standards and content to promote interoperability and reuse.
- Ensure the right team are in place to deliver MSDI
- Define business model so that MSDI can be delivered as part of organisation's mission
- Define and promote the organisation's part in the national, regional and global infrastructure.

**Technical Standards**


- Audit current standards in use
- Assess standards within the technical infrastructure
- Assessment of standards with closest partners and likely MSDI users
- Define a roadmap for interoperability and reuse using best practice standards.
- Define upgrade plan where required

**Technology**

- Define a technical architecture for the delivery of data to all users
- Make sure MSDI best practices are followed. Use national and regional best practices
- Design infrastructure that can be updated and upgraded as the MSDI evolves

**Data**

- Data Audit - What data is held? Evaluate completeness, consistency and metadata.
- Overlaps/duplication with other stakeholders?
- How ready for re-use is the data? What needs to be done. Compile action plan for data content.
- Is the organisation data-centric? What steps should be taken?



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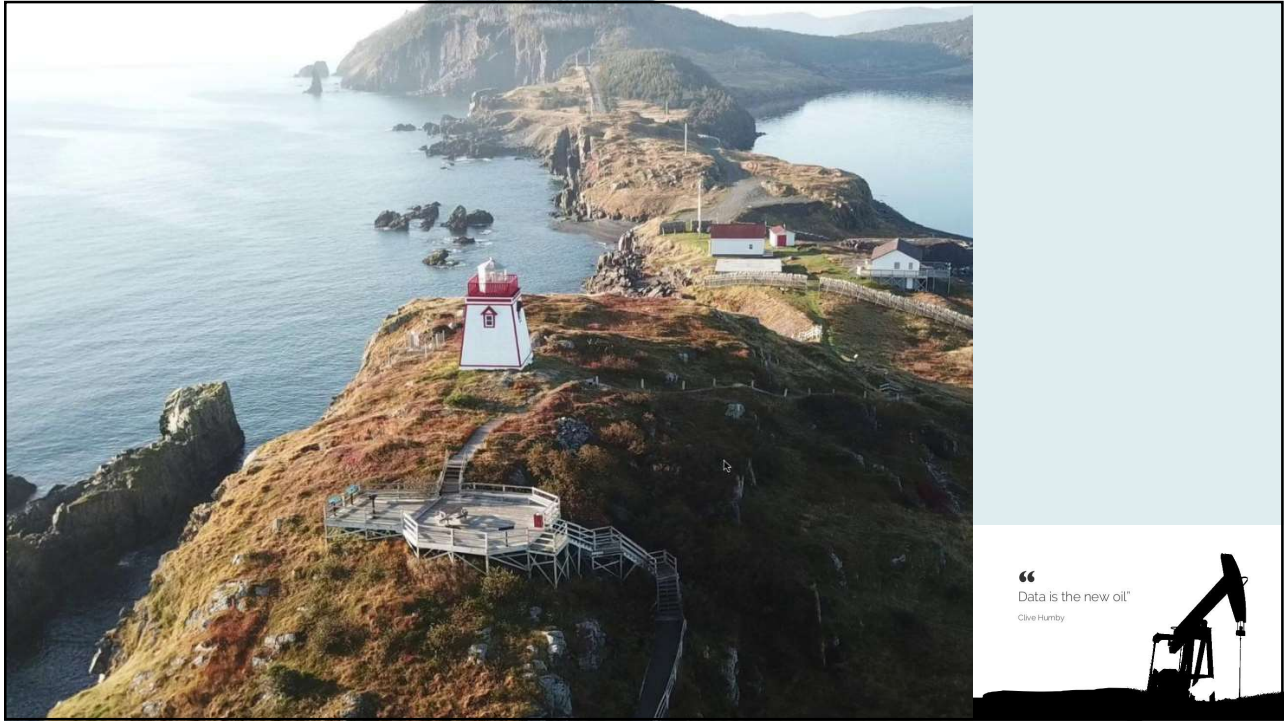


## Where Next? Some Suggestions

- MSDI examples
  - IHO MSDI world map
  - MSDIWG resources
- Broader uses of Marine geospatial data
  - Marine Spatial Planning
- Technology and Standards
  - S-100
  - Metadata
  - OGC resources
- Global Drivers
  - UN-GGIM and the UN Sustainable Development Goals
  - INSPIRE



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