

Marine Spatial Data Infrastructures

Orientation



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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

Too much information

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

What are the hurdles?

National Commitment

What is data-centric?

Regional Coordination

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.”

Source: The Global Spatial Infrastructure Cookbook - <https://bit.ly/2HZhGcy>

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”

Source: IHO C-17 - <https://bit.ly/2JD5NeW>



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Definitions

Technology

Policy
Governance

Technical
Standards

Data and
Metadata

“The relevant base **collection** of
technologies
policies
institutional arrangements

that

facilitate the **availability** of and **access** to

spatial data”



Users

“Marine Spatial Data Infrastructure (MSDI)”:

MSDI – The focus on marine elements in any SDI
Governance, Standards, ICT and Content



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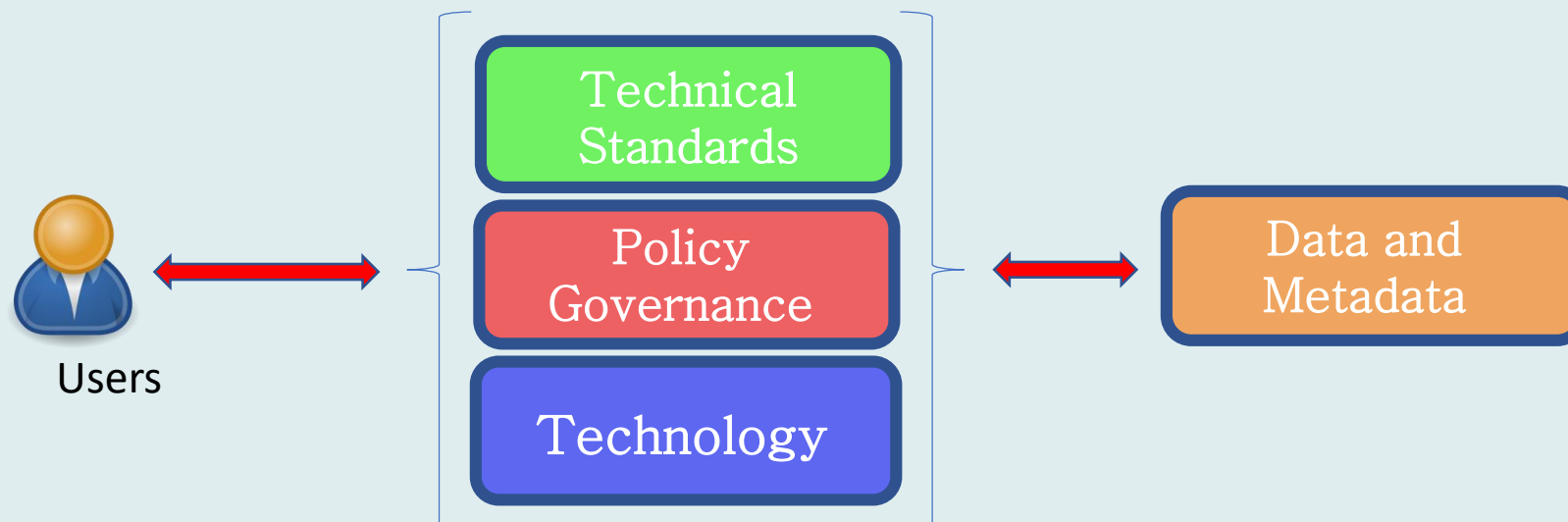
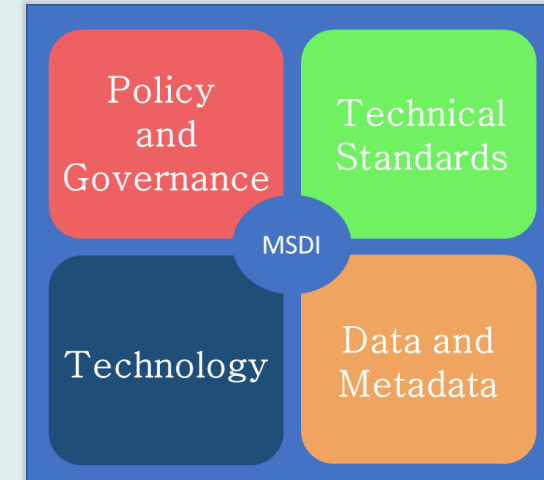


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The Four Elements of MSDI

MSDI is how these elements work together within an SDI to connect end users to marine geospatial data.





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Benefits of MSDI



Fisheries Regulation

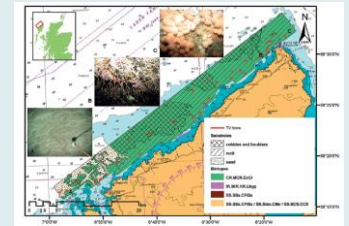


Leisure and Tourism

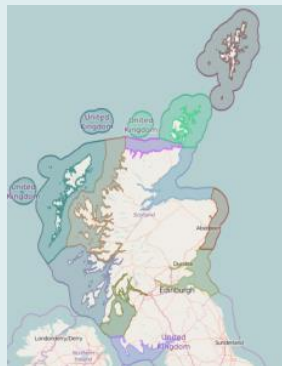


Emergency Planning
and Response

- 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



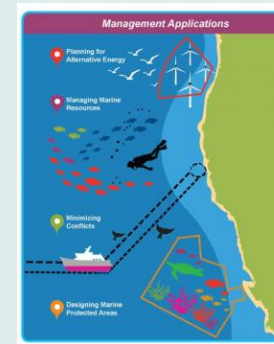
Coastal Zone
Management



Maritime Boundaries
Marine Protected Areas



Dredging planning
and beneficial reuse



Marine
Spatial Planning



Site
Selection



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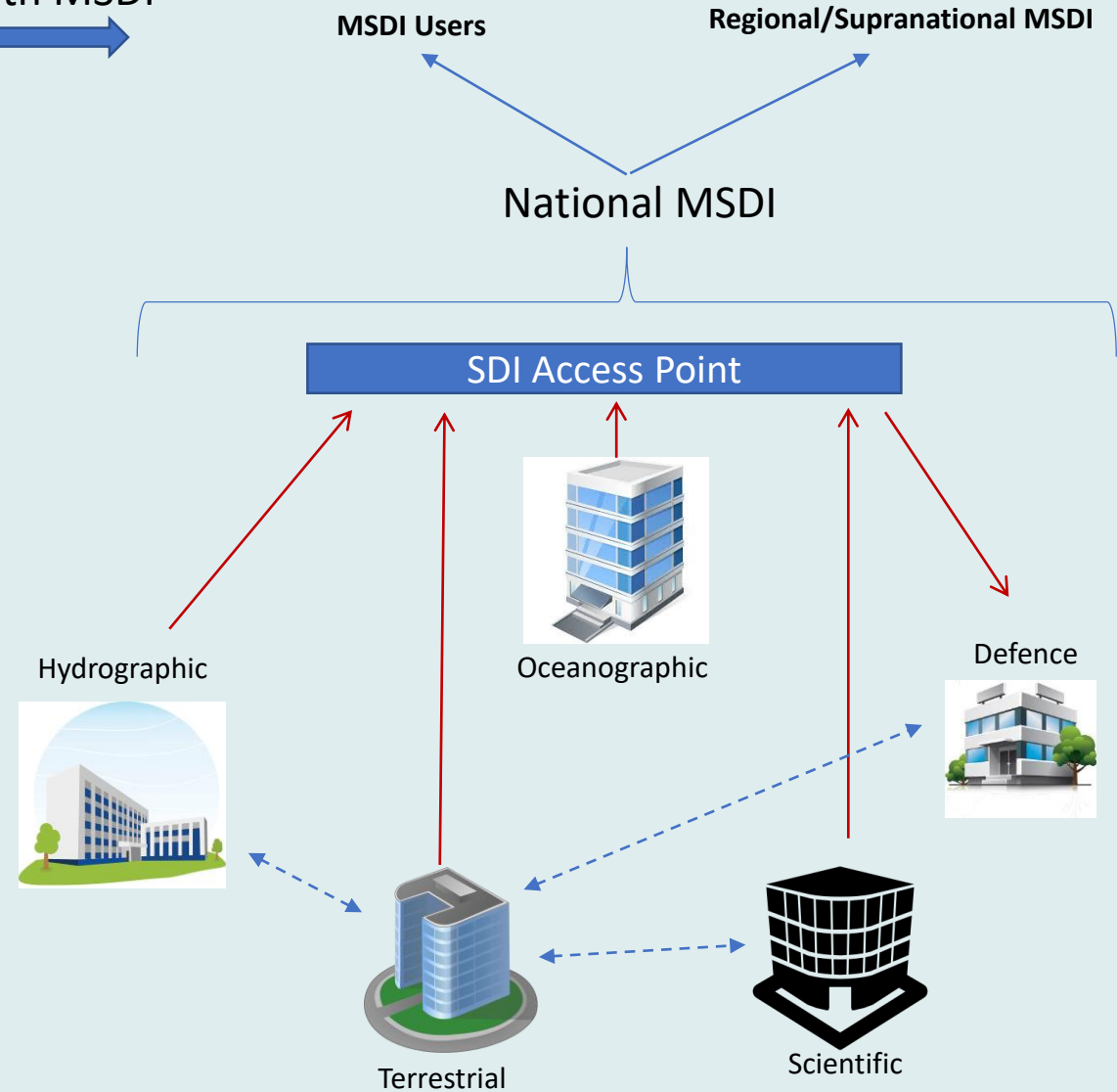
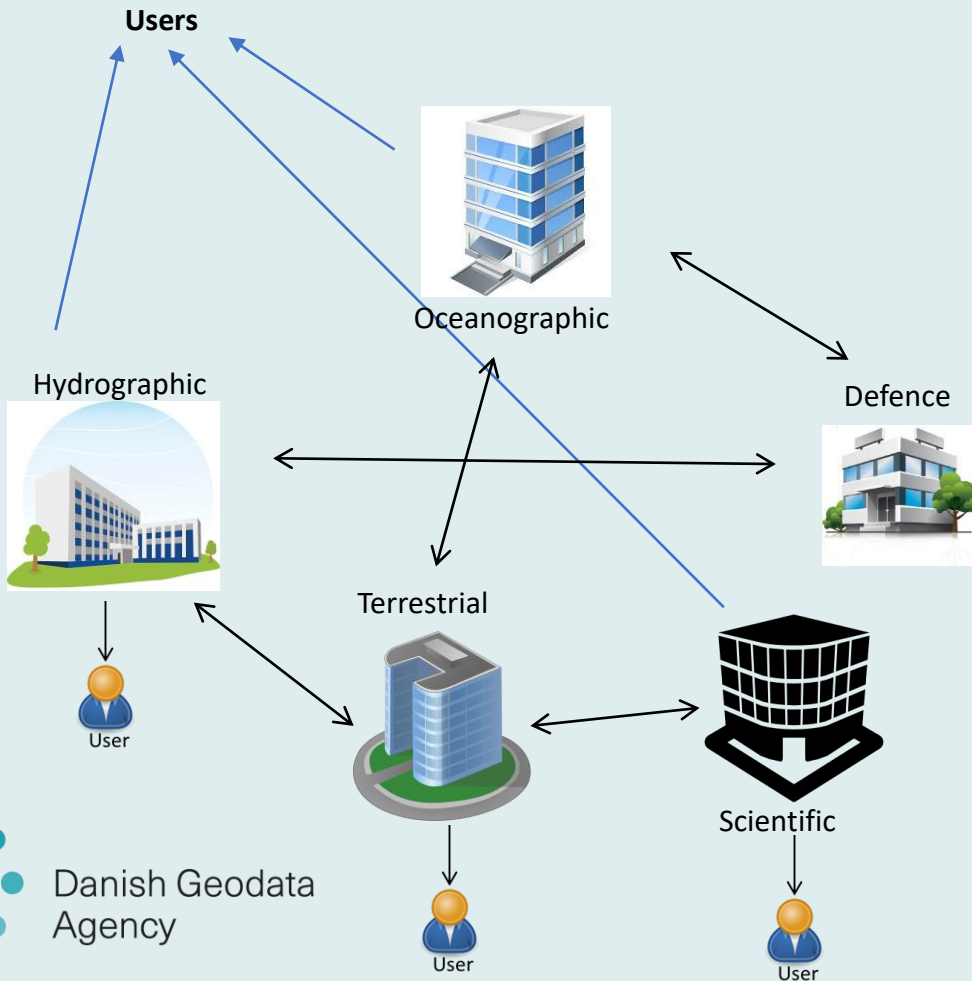
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What is MSDI?

Without MSDI

With MSDI



A Marine Spatial Data Infrastructure



Regional SDI

National MSDI



Technology

SDI Access Point

Technical Standards

Policy Governance

Technical Standards

Data and Metadata

Defence



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Hydrographic



Scientific



Oceanographic



Terrestrial



Data and Metadata





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Example: New Zealand Geoportals

Technology

Technical
Standards

Data and
Metadata

Policy
and
Governance

The screenshot displays the LINZ DATA SERVICE interface. The main content area shows metadata for a 'Depth area polygon (Hydro, 1:90k - 1:350k)'. The metadata includes a description, S-57 Object Class, S-57 Acronym, a license (Creative Commons Attribution 4.0 International), and technical details like Layer ID (50447) and Data type (Vector multipolygon). The interface also features a search bar, navigation controls, and a map of New Zealand.

Depth area polygon (Hydro, 1:90k - 1:350k)
LINZ / New Zealand Hydrographic Authority

Licence 2508 352 Updated 19 Dec 2018

About Metadata Data Table History Services Comments (0)

A depth area is a water area whose depth is within a defined range of values.
S-57 Object Class: Depth area
S-57 Acronym: DEPARE
This data was compiled for the use in the scale range 1:90,000 to 1:350,000.
THIS DATA DOES NOT REPLACE NAUTICAL CHARTS AND MUST NOT BE USED FOR NAVIGATION.
This data is based on the S-57 data format used in Electronic Navigational Charts (ENCs) published and maintained by the New Zealand Hydrographic Authority at Land Information New Zealand (LINZ). Refer to the following link for information about S-57 data: www.linz.govt.nz/hydro/regulation/

Licence
Creative Commons Attribution 4.0 International
 You may use this work for commercial purposes.
 You must attribute the creator in your own works.

Information

Category	Hydrographic & Maritime > Coastal Charts (1:90k - 1:350k) > Marine Features
Tags	New Zealand
Regions	Oceania
Metadata	ISO 19115/19139, Dublin Core

Technical Details

Layer ID	50447
Data type	Vector multipolygon



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What SDI and MSDI “isn’t”



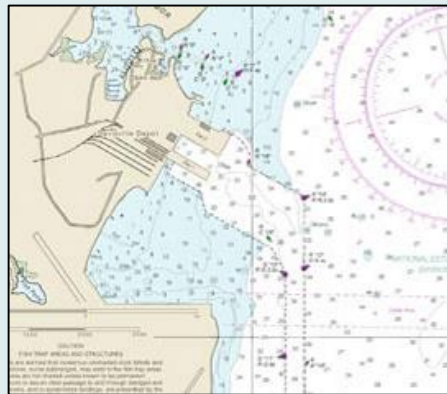
Not an IHO initiative



This site can't be reached

www.msdi.com took too long to respond.

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



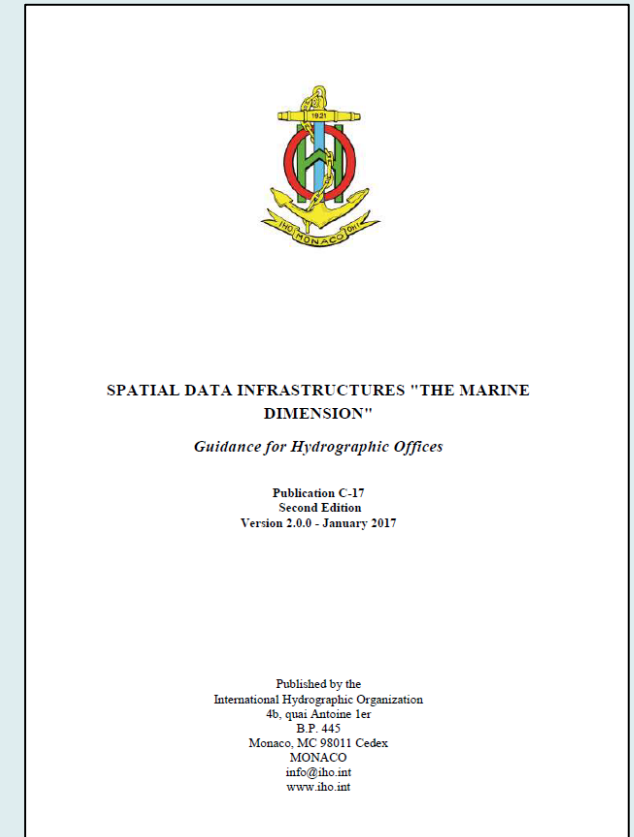
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- MSDIWG - The IHO's working group with the objective of supporting activities relating to SDI and MSDI.
- Also links to OGC Marine domain working group (MDWG)
- Publishes IHO C-17, "a guide to establishing the role of the national hydrographic authority 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

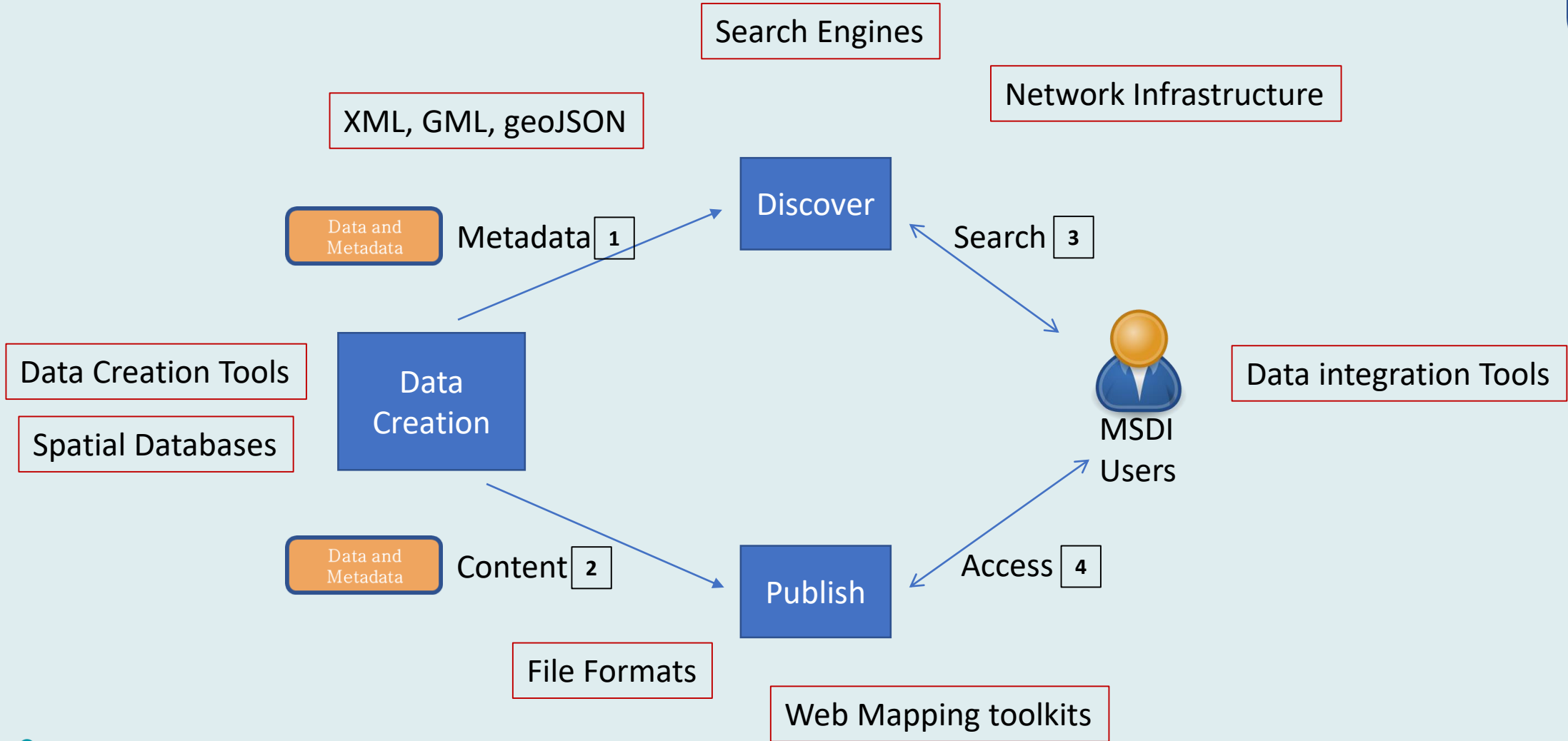
Technical
Standards

Data and
Metadata

Technology



Technologies for MSDI





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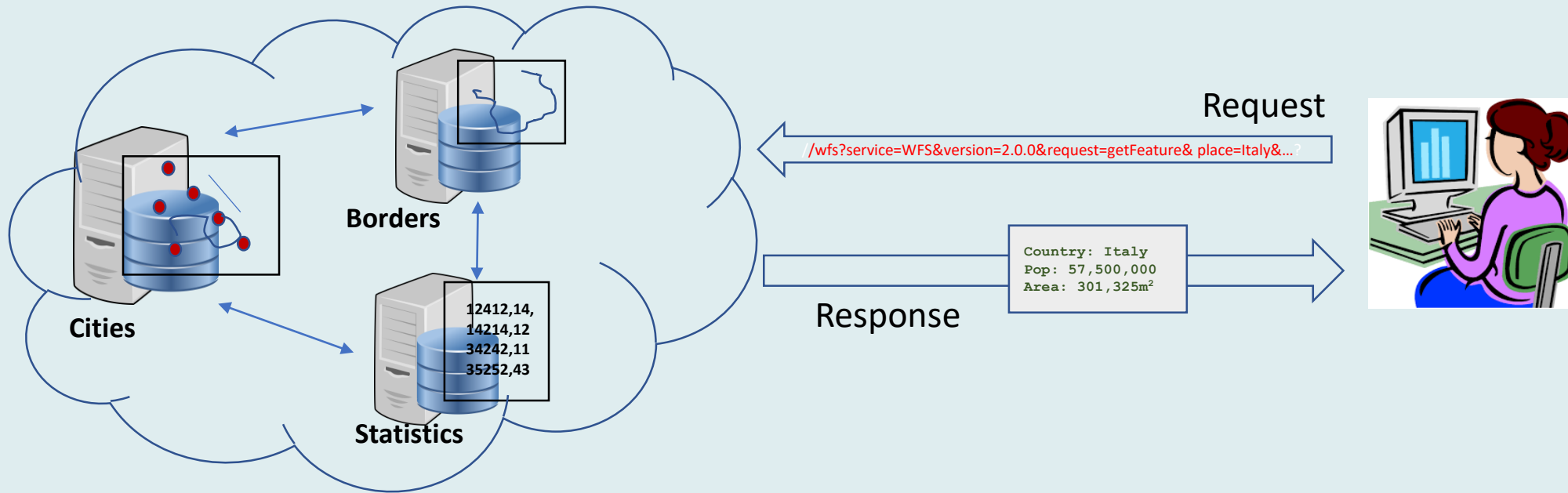
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Web Services for MSDI

Technology

Data and
Metadata

Technical
Standards





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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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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

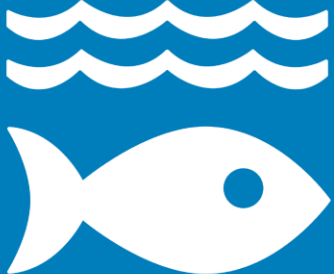
Key to MSDI are open standards and standards interoperability

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





14 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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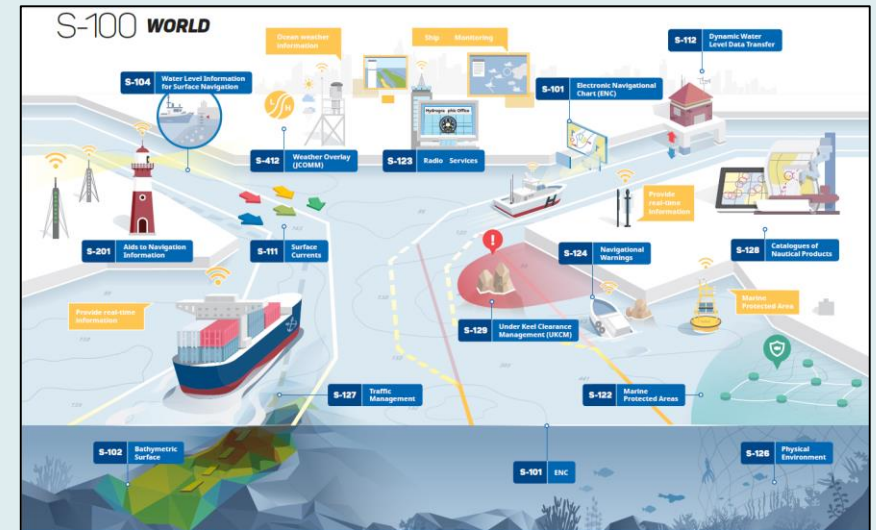
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MSDI and the role of IHO S-100

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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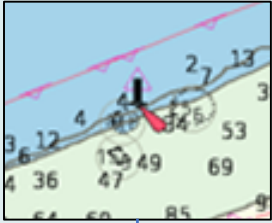
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Marine geospatial data content

Data and Metadata

Vector Data: "Things"



```

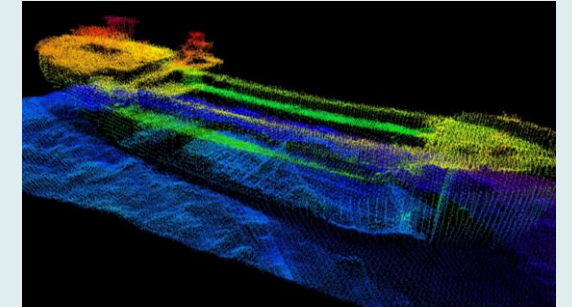
LIGHTS:
{
  CATLIT = 6
  COLOUR = 3
  INFORM = More than one
  SCAMIN = 59999
}
geometry:
{
  id = 6E42010000 [-40.5,36.2]
  ornt = null
}

```

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

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

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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

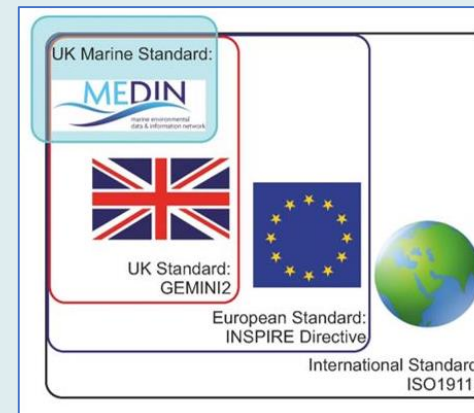
Nutrition Facts	
Serving Size ½ cup (114g)	
Servings Per Container 4	
Amount Per Serving	
Calories 90	Calories from Fat 30
% Daily Value*	
Total Fat 3g	5%
Saturated Fat 0g	0%
Cholesterol 0mg	0%
Sodium 300mg	13%
Total Carbohydrate 13g	4%
Dietary Fiber 3g	12%
Sugars 3g	
Protein 3g	
Vitamin A 80%	Vitamin C 60%
Calcium 4%	Iron 4%
* Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:	
Calories: 2,000 2,500	
Total Fat	Less than 65g 80g
Sat Fat	Less than 20g 25g
Cholesterol	Less than 300mg 300mg
Sodium	Less than 2,400mg 2,400mg
Total Carbohydrate	300g 375g
Dietary Fiber	25g 30g
Calories per gram:	
Fat 9 • Carbohydrate 4 • Protein 4	

Technical
Standards

Metadata content is Standardised

Standards exist at different levels, e.g.

- International
- Regional
- National



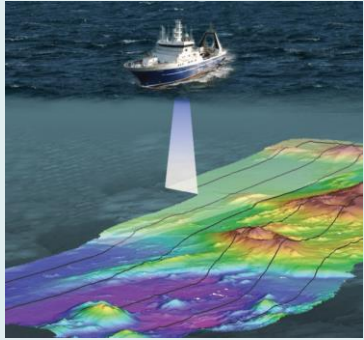
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Transforming a Marine Geospatial Agency

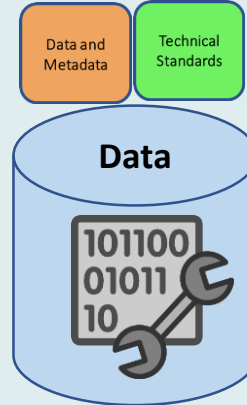


Survey and Acquisition

Other Sources

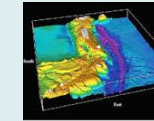
Processing Storage

Archival

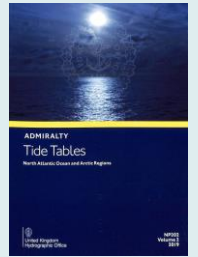


Compilation Update Product Generation

Reprocessing



Purpose built Products



★★★★★
Re-Use

★★★☆☆
Re-Use

★☆☆☆☆
Re-Use



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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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“

Data is the new oil”

Clive Humby

