



Marine Spatial Data Infrastructures

Training Material

Orientation



Danish Geodata
Agency



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Version 1.1 – June 2019

Revision History:

| | |
|--------------------------------|---|
| December 20 th 2018 | First Edition. Compiled by IIC Technologies |
| January 2019 v0.81 | Minor edits – first delivery to Danish Geodata Agency |
| February 2019 v0.9 | Edits following first presentation at DGA |
| February 2019 v1.0 | Review Edits following DGA feedback |
| June 2019 v1.1 | Updated for change of organisational logos |

Geodata Agency. It is published through the IHO and is aimed at spreading knowledge and awareness of MSDI globally. This publication is available from the IHO MSDIWG website at <https://bit.ly/2lvGGpY>

1 Introduction

This Orientation material is aimed at participants who are marine focused but who have little experience of Marine Spatial Data infrastructure (MSDI) concepts or practice.

There are two main use cases for this document in the delivery of an MSDI orientation course:

1. A participant who wants to download and self-learn from the materials provided.
2. A participant who wishes to deliver the materials in a group setting to stakeholders.

2 Structure

This material is modelled on the IHO MSDIWG Standard Orientation syllabus and is aimed at decision makers possibly at a senior level, not necessarily from a hydrographic background, who are engaged with marine geospatial data and considering involvement with marine spatial data infrastructures.

A high level structural overview of the material is set out below:

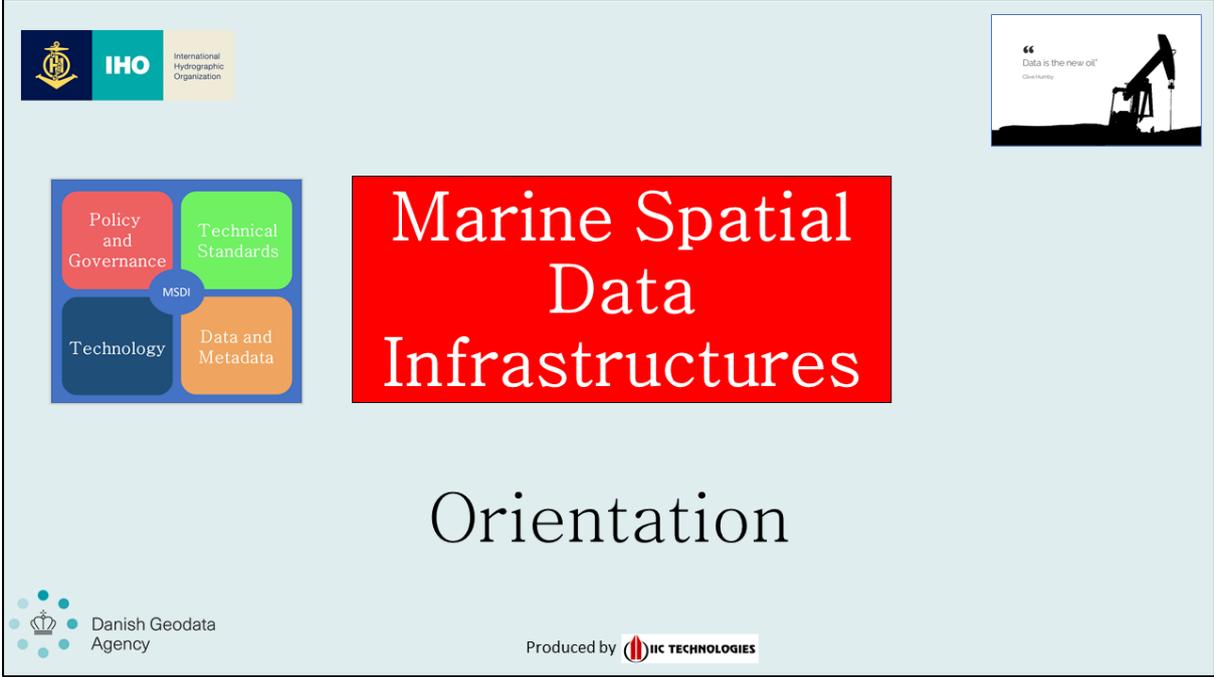
1. **Introduction**
 - a. **Orientation is explained and the layout of the material is presented. A brief overview of the sections included**
2. **What is MSDI?**
 - a. **Definitions of Spatial Data Infrastructure, Marine Spatial Data Infrastructures (MSDI) and their core elements. From this the four elements of MSDI are defined.**
 - b. **A description of typical MSDI infrastructures and the essential elements which define them.**
3. **The Elements of MSDI**
 - a. **This section describes the four elements of MSDI individually and describes their relationships together.**
 - i. **Policy And Governance**
 - ii. **Technology**
 - iii. **Technical Standards**
 - iv. **Data and Metadata**
4. **A Hydrographic Office Perspective**
 - a. **This section describes a typical hydrographic office perspective on MSDI and shows the importance of the data re-engineering which enables re-use and interoperability with data from other domains.**
 - b. **The business case for MSDI**

3 Glossary of Terms used.

The glossary contains useful definitions taken from the many sources consulted in the creation of these materials.

| | |
|--------------------------|--|
| Spatial data | Data which has a spatial component to it. A spatial thing is something that can be drawn on a map, or something that can be given in reply to a 'where?' question (ISO) |
| MSP | Maritime (or Marine) Spatial Planning |
| Hydrography | ...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 |
| SDI | Spatial Data Infrastructure - "the relevant base collection of technologies, policies and institutional arrangements that facilitate the availability of and access to spatial data." |
| Marine / Maritime | Marine and Maritime are used interchangeably. Marine tends to refer to the branch of earth science dedicated to the oceans whereas maritime refers to use and exploitation of the seas including the context of Safety of Life At Sea (SOLAS). |
| MSDI | Marine Spatial Data Infrastructure. "that element of an SDI that focuses on the marine input [to an SDI] in terms of governance, standards, ICT and content" [IHO C-17] |
| API | Application Programming Interface |
| Interoperability | a characteristic of a product or system, whose interfaces are completely understood, to work with other products or systems, at present or in the future, in either implementation or access, without any restrictions. |
| Governance | The means for achieving direction, control, and coordination of wholly or partially autonomous individuals or organizations on behalf of interests to which they jointly contribute |
| Metadata | Metadata is data "about" data. |
| Standards | Reusable agreements that make it easier for people and organisations to publish, access, share and use better-quality data [UK ODI] |
| Open Standards | A standard available for anyone to access, use or share at little or no cost. |
| ENC | Electronic Navigational Chart. The primary output of most hydrographic offices globally. A vector based data format. |
| OGC | Open Geospatial Consortium http://www.opengeospatial.org |
| IHO | International Hydrographic Organization http://www.iho.int |
| ISO | International Standard Organisation http://www.iso.org |
| UN | United Nations |
| UN-GGIM | United Nations Committee of Experts on Global Geospatial Information Management http://ggim.un.org |

4 Introductory slides



“Data is the new oil”
Gladwell

Policy and Governance
Technical Standards
MSDI
Technology
Data and Metadata

Marine Spatial Data Infrastructures

Orientation

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Produced by IIC TECHNOLOGIES

Key Messages:

- Key Messages during the course are contained in a box like this.
- In this booklet each slide is presented along with any further notes that may be useful.
- Space permitting there is room at the bottom of each page for participant's notes.

The learning objectives of this material are as follows. When complete the participant should be able to:

1. Confidently identify the definition of a spatial data infrastructure (SDI), a Marine spatial data infrastructure (MSDI) and the core elements defining them.
2. Clearly describe the interaction between the defining elements of an MSDI and how they contribute to broader use of marine geospatial data by MSDI end users – specifically re-use and interoperability
3. Understand the layout of a typical national MSDI structure
4. Describe at a high level how greater re-use of data is enabled by a migration to data-centric working in conventional marine geospatial data agencies.



Marine Spatial Data Infrastructures

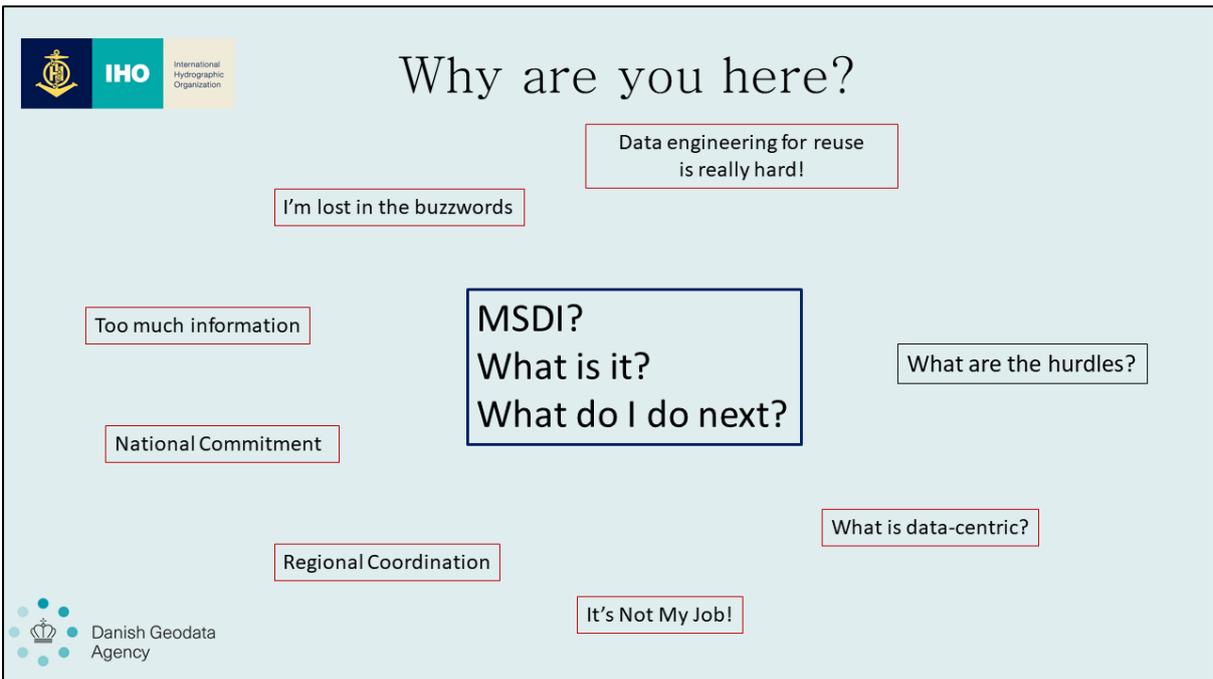
Concepts, definitions and examples



Key Messages:

- This material is an Orientation course which introduces the concepts and definitions of Marine Spatial Data infrastructures (MSDI) to participants with existing experience of marine geospatial data
- The material is aimed at decision makers and MSDI stakeholders who require an overview of the key elements which make up MSDI.
- We introduce the core concepts and explore the defining elements of MSDI.
- Further information and examples of MSDI are also supplied

Notes:



Key Messages:

- Many participants may have heard of MSDI and have seen existing promotional or media articles
- There is a lot of information about MSDI in the public domain. This material is intended to:
 - Give a solid grounding in the core MSDI concepts
 - To explain the wider value of MSDI to its users and to participants through initiatives such as data-centric working
 - Provide some guidance for steps to take towards MSDI engagement and implementation

Notes:

5 What is MSDI?



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/2ID5NeW>

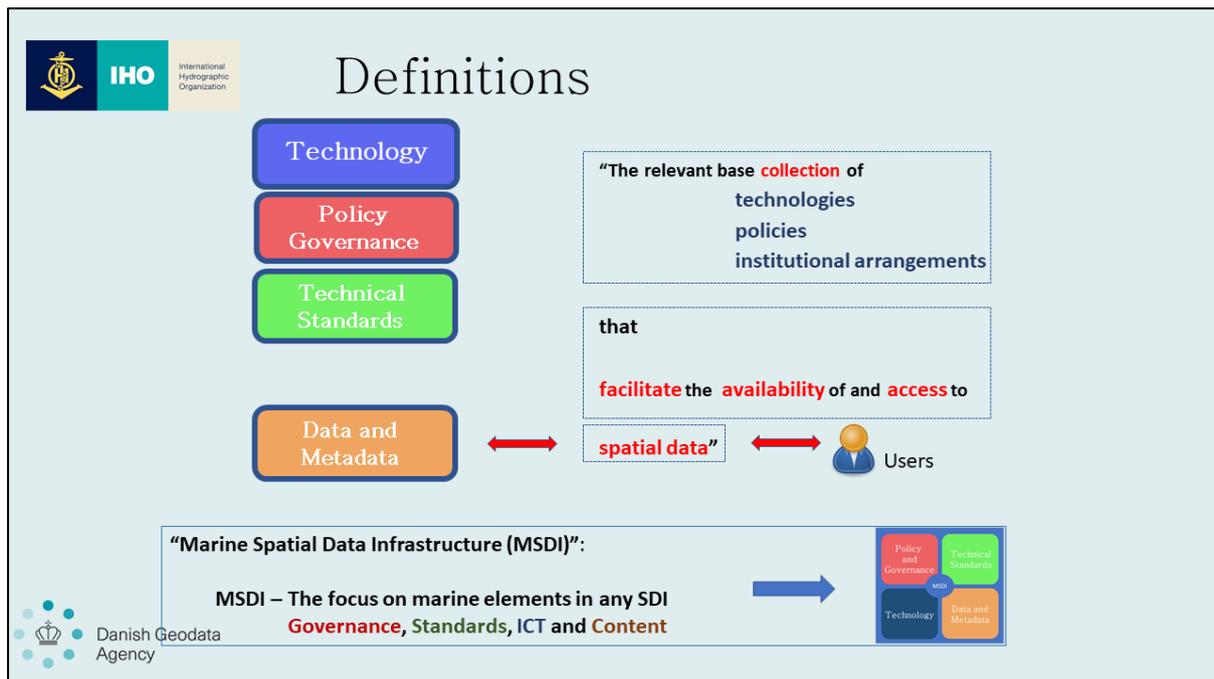


This section defines the core concepts of MSDI. Note that these definitions are quite old now (SDI – 1993, MSDI 2007) so some of the wording should be understood with some flexibility. For instance “ICT” is a (now) little used term for “Technology” (i.e. infrastructure) and the importance of global digital technical standards was not as strong when SDI was conceived. Their importance in MSDI are paramount, hence their inclusion in the MSDI definition alongside technology, governance and “content” (data)

Key Messages:

- These definitions are at the core of SDI and MSDI
- SDI is a more general term than MSDI.
- MSDI is the “marine elements” of an SDI
- MSDI is broken down into named focused components which, considered together, form the marine input to the SDI

Notes:



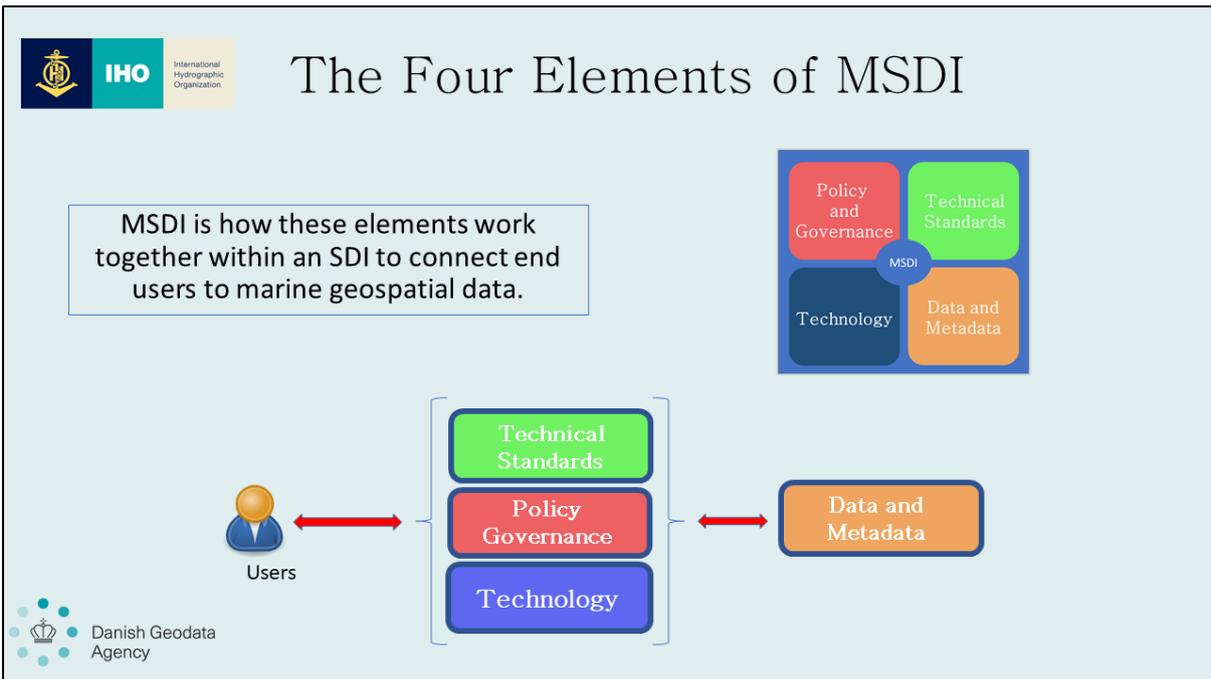
This slide shows how the core definitions of SDI are broken down and the core elements used in the explanation of MSDI are defined from them. The elements of the SDI definition have had their language modernised and encapsulated in the coloured boxes labelled “Technology”, “Policy and Governance”, “Technical Standards” and “Data and Metadata”

The object of this material is to examine these elements of MSDI and demonstrate how they are used to implement MSDI.

Key Messages:

- SDI is a more general case of the MSDI.
- MSDI is the marine input to any SDI
- The focus on marine in an SDI is broken into four elements which follow from the SDI definition.

Notes:



The four elements of MSDI which are defined within this Orientation course are

1. Policy and Governance (“Policies” in the original SDI definition)
2. Technology (“Technologies”)
3. Technical Standards
4. Data and Metadata (“Content” in the original MSDI definition)

Each of these elements are examined in the next section of the Orientation material. This slide illustrates the core definition of MSDI as the marine elements which connect Users with content, in the form of Data and Metadata.

Key Messages:

- The coloured elements are used in the material to show the MSDI elements
- The core concept of MSDI is the use of these elements to connect Users to marine geospatial data
- Users – MSDI users, here, can be anyone with a need for marine geospatial data.

Notes:



Benefits of MSDI



Leisure and Tourism

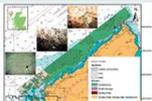


Emergency Planning and Response



Fisheries Regulation

- 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

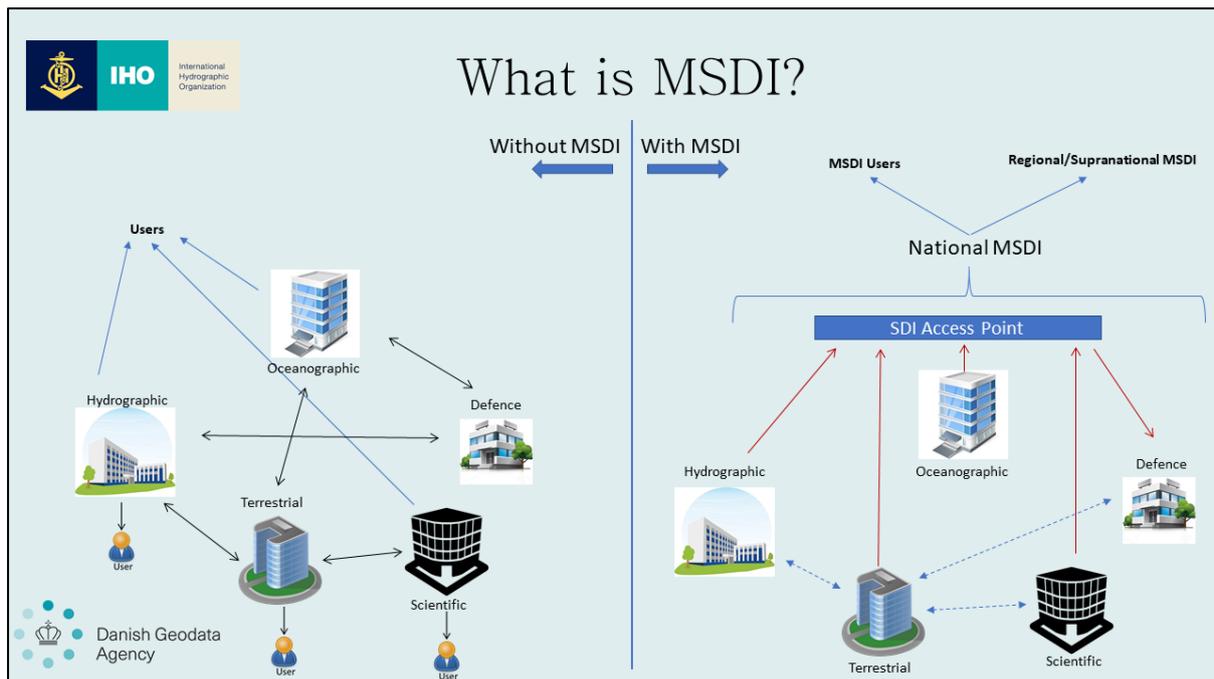


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Key Messages:

- MSDI concerns the re-use of marine geospatial data by a wide range of end users
- Marine geospatial data is used in many fields of human activity and often has uses far beyond its primary use case and traditional market boundaries
- The benefits of opening up marine data to wider uses can increase data quality and benefit working practices by placing data at the heart of the enterprise.

Notes:

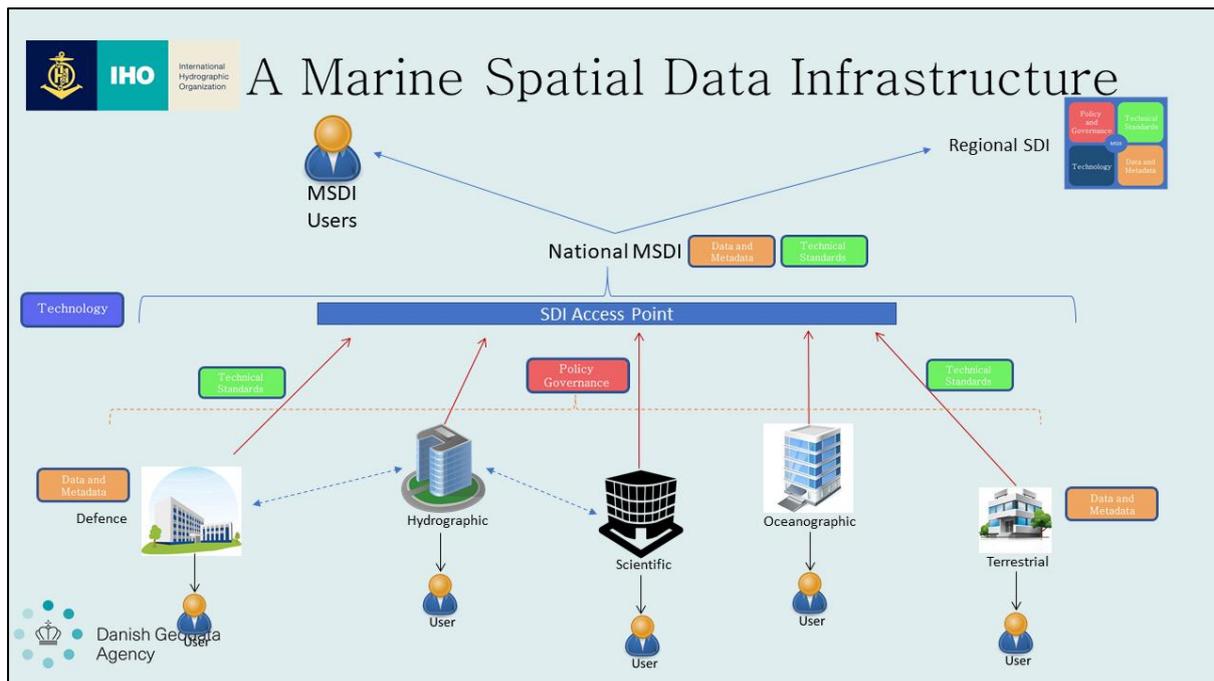


This slide shows a typical national geospatial infrastructure without any MSDI (or SDI) capabilities on the left. Each agency has a single remit and is authoritative for data within its own domain. They may have data exchange relationships with other agencies.

The right half of the slide shows how an MSDI implementation changes the relationships and communications between the participating organisations and MSDI users. The national MSDI introduces an Access Point for data and all participating agencies feed data (either through direct copies or by interface) into it. This data is then made available to MSDI users as well as, potentially, into regional MSDI implementations.

Key Messages:

- Without MSDI individual organisations act in “silos” operating within their own parameters. Inter-agency communication is complex and data users need to harmonise and integrate data themselves.
- Agencies can be “Authoritative” for data in their own domains.
- MSDI implementations collect marine geospatial data from participating institutions and make it available to a broader user community.
- Data for the MSDI is gathered and distributed via one or more access points
- A national MSDI can feed into a regional MSDI



This slide shows a more complete description of the MSDI implementation with a focus on the MSDI elements. As can be seen:

- The individual institutions supply data (and metadata) to the MSDI through the access point.
- Participating institutions work within a single policy and governance framework which gives them a remit to produce data which is suitable for reuse and which conforms to a framework of common standards. This is all supported by a common technical infrastructure
- Participating organisations continue to work between each other or they may use the MSDI infrastructure for their own use as well. They may also individually retain their primary customers
- A national MSDI can feed into a regional MSDI. This pattern of elements existing at national, regional and global level is repeated in various aspects of MSDI such as technical standards and metadata

Key Messages:

- MSDI connects MSDI users with data content provided by participating geospatial organisations.
- The MSDI elements can be identified in the layout of the MSDI implementation
- There is no set arrangement or prescribed form for an MSDI. Each may have a different layout.

Notes:

In this slide an example of an MSDI access point is shown, generally these are web portals with an interface which allows data to be searched and accessed. In this slide we have highlighted the defined MSDI elements (which we will consider in detail later). All MSDI access points are different and the existence of all the elements can sometimes be hard to establish.

Key Messages:

- It is possible to identify the elements of MSDI in existing national and regional implementations.
- MSDI elements are not always obvious from an inspection of an MSDI access point

Notes:

What SDI and MSDI “isn’t”

Not an IHO initiative

Not a website

Not a “product”

Not a Format

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When we talk about MSDI there can be many misconceptions and here we try to use the previous slides to clarify what MSDI “isn’t”. MSDI is not an IHO initiative. The IHO is one of the foremost organisations promoting it, MSDI is embedded firmly within the fabric of many member states’ institutions and governmental policies. MSDI is more of an observation of a global phenomenon – the rise of geospatial information, within communities of all sizes, local, national, regional and global and the observation that there are common factors which contribute to its success in effecting economic and environmental change.

MSDI is not a website – there’s no <http://www.msdi.com> – it is not a single global “thing” which is accessed by all stakeholders. It is the sum total of all the MSDI activities of the individual participants globally, some of which act within a regional or national infrastructure and some of which act in isolation. It’s certainly not a product which can be purchased (although tools and technologies can be purchased to assist). It’s not just a case of saving data in an MSDI “format” and putting it on a website!

Key Messages:

- There are many misconceptions about the definition of MSDI and many participants have difficulty understanding the wide range of concepts involved.
- This is because MSDI is not just a technical implementation and spans many different areas of an organisation’s activities.

Notes:

6 The elements of MSDI



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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The first of the MSDI elements to be defined is “policy and governance” . This is a collection of policy and governance instruments which together enable the various MSDI participants to create the necessary content data, in the appropriate standards, to input to the MSDI. There are many aspects to policy formulation identified in the slide and, like many other elements, they can exist at different levels i.e. at a national, regional and global level.

Key Messages:

- Policy and Governance tell participating data providers what to do and establishes the remit for the MSDI.
- Policy and Governance is of key importance, affects all aspects of MSDI and is a critical success factor in making an MSDI implementation successful.
- Policy and Governance differ more than any other element of MSDI between states and regions.

Notes:

IHO
International Hydrographic Organization

IHO MSDIWG

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

Geomatics 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 "

As part of the IHO's commitment to capacity building an MSDIWG has been established since 2007 to assist member states in aspects of MSDI and formulation of appropriate policy and governance within the hydrographic community is a key area.

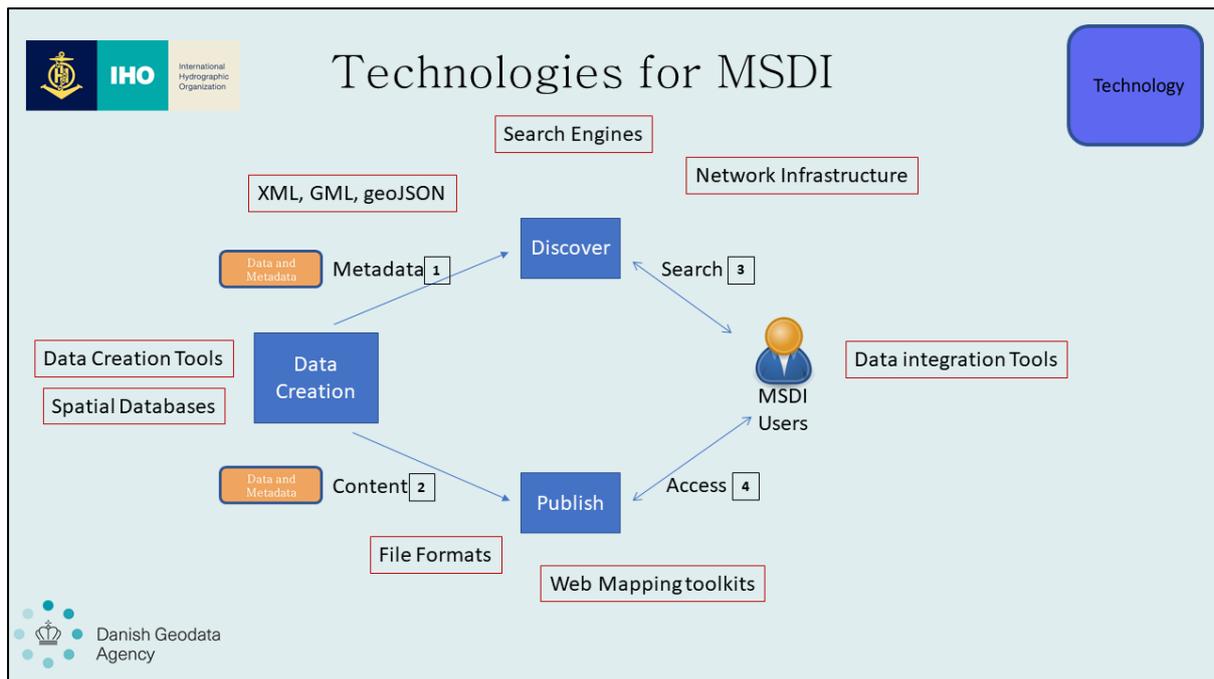
The MSDIWG web pages, hosted by the IHO are at the following link: <https://bit.ly/2lvGGpY>

The MSDIWG publishes a model policy for MSDI implementation on its website.

Key Messages:

- The IHO has a long standing commitment to assist member states in establishing their MSDI capabilities through the MSDI Working group (MSDIWG)
- This helps with policy and governance as well as advice on the other MSDI elements.
- The IHO publication C-17 summarises guidance to member states. Additionally MSDIWG has its own global meetings and many regional Hydrographic Commissions have their own MSDI groups for exchange of best practice and implementation plans.

Notes:



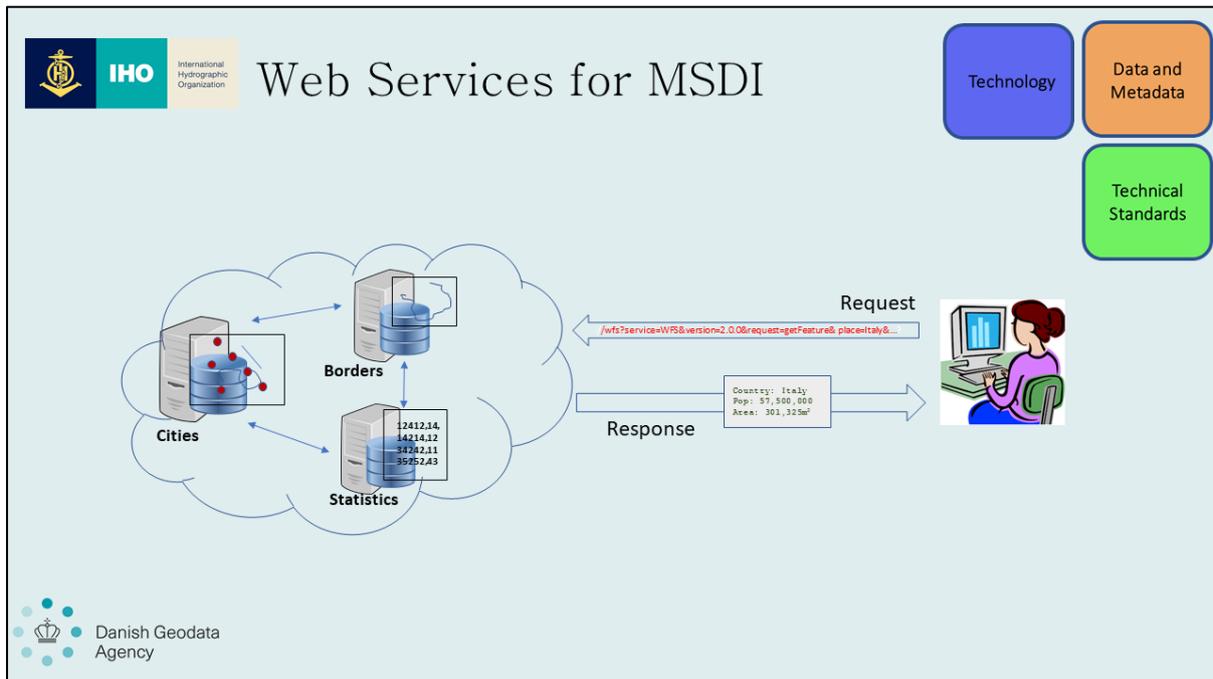
The technology element consists of all the technology and tools specific to MSDI. The slide shows a typical user interacting with an MSDI:

1. Metadata is published which advertises the available content
2. Data is created and published.
3. Metadata is searched to establish the right content
4. The data itself is accessed

This process describes most interactions with MSDI systems and there are many technology components required to work together to make this happen. Some key examples of technology underpinning MSDI systems are shown. Some may be familiar and others may not but the idea is to understand the large variety of specific technologies required to implement MSDI and the important role it has.

Key Messages:

- A large variety of technology components are required to establish and maintain MSDI systems and infrastructure
- Some of these components are generic technology, some are specific to geospatial data and some are specific to marine geospatial data.
- Technical standards have a great bearing on the types of technology adopted. Policy and Governance also can set standards for MSDI infrastructure



One of the fundamental technologies for MSDI interaction with users, and one which blends technology with content and a variety of technical standards is web services. This technology enables users (whether they are human or computer) to access data held in a structured store (such as a spatial database hosted by an MSDI access point). These interactions are standardised by a family of technical standards, most notably from the Open Geospatial Consortium (OGC) so that users are able to use a common toolset to interact with many different MSDI infrastructures (and so that the individual participants making up the MSDI can speak a “common language” when contributing their data.

Web Services are “request and response” process where the MSDI user submits a request for data (or metadata) through a standardised API and receives a structured response which can be processed automatically. OGC standards provide the ability to return either structured XML data or images rendered from MSDI data according to flexible portrayal rules.

These technologies are fundamental for MSDI because they allow data to be interoperable – they ensure that MSDI users and participants speak a common language across the whole MSDI infrastructure and bespoke tools and system do not have to be written by participants as the MSDI evolves.

Key Messages:

- Web Services are a key technology component for MSDI, providing a common mode of communication for all MSDI participants. Web Services have their own family of technical standards.
- Web Services provide a common model driving all interactions between entities in an MSDI and ensuring a base level of interoperability. This is vital for re-use of data by MSDI end users who may come from diverse domains.

IHO
International Hydrographic Organization

Marine Technology Advances

Technology

Sensors:

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

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.

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

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

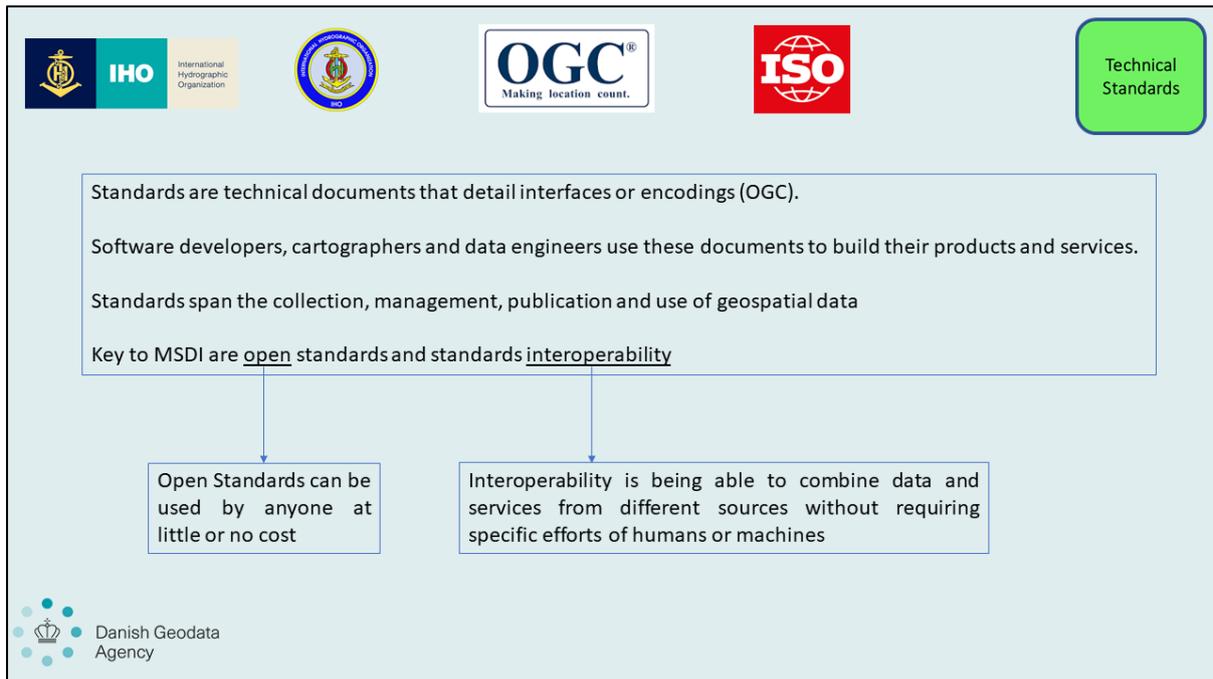
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It is of vital importance when implementing MSDI to keep the technology components up to date and to stay abreast of new developments. Four examples of key technology innovations specific to marine geospatial data are listed in the slide

Key Messages:

- Just like any other technology infrastructure advances can be rapid and any MSDI implementation should make sure the ability to upgrade and maintain infrastructure are in place. MSDI policy and governance should provide a process for "technology watch".
- Some examples of cutting edge technology in the marine geospatial field are listed. These are not exhaustive.
- Many innovations may require parallel developments in policy and governance and technical standards.

Notes:



Technical Standards are the next MSDI component to focus on. Technical Standards standardise many things, geospatial content, format, structure, terms and definitions and there are many global, regional and national standards bodies which exist to set out these common structures so that participants can build MSDI structures which are interoperable with each other.

The three main standards bodies important for MSDI are:

1. The IHO who define and implement standards for marine domain content, metadata and key encodings for primary and secondary uses of marine geospatial data.
2. ISO who provide a set of standards with a global reach covering all aspects of geospatial data definitions under the ISO19100 set of standards
3. OGC who assist MSDI development by developing and defining a set of standards for interaction via web services across many different domains

Key Messages:

- Standards enable MSDI by giving all participants a common language to describe content, structure and encoding of marine geospatial content.
- Common standards are crucial for success in MSDI implementations
- Standards are most often defined by global standards bodies which encourage adoption by as wide a number of implementers as possible.
- Key to MSDI is the concept of open standards and the definition of interoperability. These two ideas underpin standards development for MSDI and allow data to be spread widely for little or no cost

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

One of the most significant global movements globally which promote MSDI activities is the UNs Global Geospatial Information Management (UN-GGIM) and their sustainable development goals (SDG). UN-GGIM aims to be the global inter-governmental organisation “...making joint decisions and setting directions with regard to the production, availability and use of geospatial information within national, regional and global policy frameworks”. UN-GGIM has specific goals relating to the ocean (under SDG14) and have marine elements in many other of its SDGs. UN-GGIM have recently established a working group on marine geospatial information. Its remit covers all elements of MSDI including use of technical standards, fundamental datasets and metadata, and the underpinning legal and policy frameworks.

Key Messages:

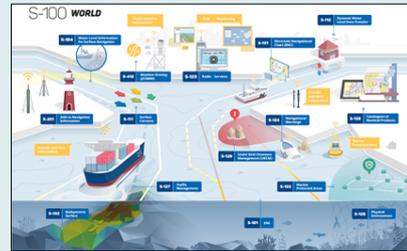
- UN-GGIM is providing a focal point for intergovernmental efforts in pursuit of a number of sustainable development goals aimed at long term sustainability
- UN-GGIM has a number of SDGs, one of which, SDG14 is devoted to the ocean “Life Below Water”. Other SDGs have marine/maritime elements
- UN-GGIM has established a marine geospatial information group which has many common areas of interest with MSDI and its associated bodies under IHO and OGC.



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



Key Messages:

- IHO S-100 is a central standard for MSDI because it provides an overall framework specifically for marine geospatial data and which is derived from the global ISO19100 series of standards which ensures interoperability with geospatial data from many other domains, e.g. terrestrial and 3D
- IHO S-100 is also open, free to use and extensible – any marine content can be expressed using its framework. It provides comprehensive structures for cataloguing of content and metadata descriptions of datasets.
- The IHO registry contains a repository of all concepts, terms and definitions for entities within the marine domain, providing a reference for MSDI users from other domains to assist with interoperability.

Notes:

IHO
International Hydrographic Organization

Marine geospatial data content

Data and Metadata

Vector Data: "Things"

```

LIGHTS:
{
  CAPLIT = 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

- Key Messages:**
- "Data and Metadata" is the last of the four MSDI elements
 - Marine geospatial content data comes in different fundamental types. Important types for marine geospatial data are vector, raster and point cloud types. Each data type has its own family of standards defining content and encoding
 - Point Clouds are very important for holding bathymetric data, one of the fundamental data marine data types.
 - Many other geospatial datasets are "vector" in nature where each geospatial feature is defined separately.
 - Electronic Navigational Chart (ENC) is the most frequently seen marine vector geospatial data type. Its content is composed of individual features which have attributes and associated geometry.

Notes:



Metadata



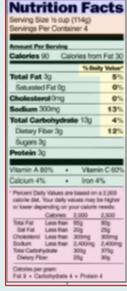
- Metadata is Information about datasets
- Published “discovery” metadata is how MSDI users “find” the data they are searching for and establish its authenticity
- For the MSDI community standardized, populated, comprehensive metadata is crucial to success.
- Collection of metadata facilitates good data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

Technical Standards

Metadata content is Standardised

Standards exist at different levels, e.g.

- International
- Regional
- National





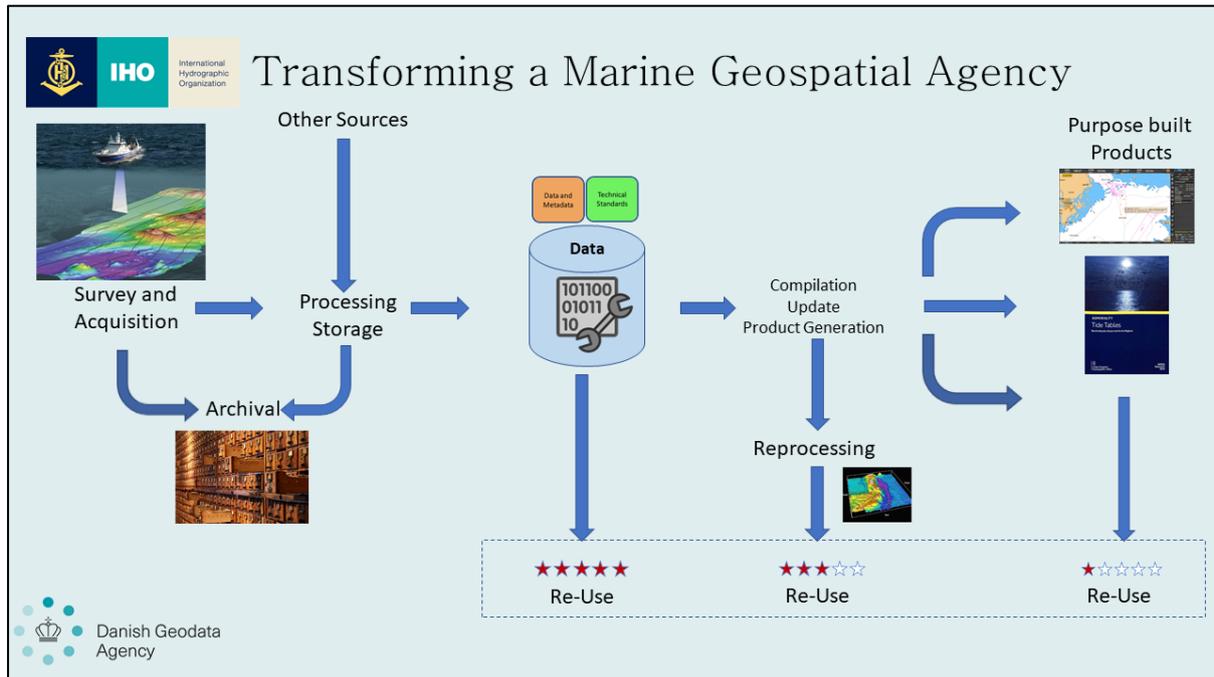

Metadata is key to successful MSDI operation because, with a much broader user base, the ability to search and retrieve data is critical for success of the MSDI infrastructure. There are many methods of storing, managing and processing metadata and many technology solutions which can be used to make search and retrieval more effective and connect MSDI users with the right data. Often, metadata management can pose huge challenges for geospatial agencies in terms of correctness, completeness and standardisation. An additional factor is attributing datasets with appropriate provenance so that end users know where it has come from and that it is complete and consistent.

Key Messages:

- Metadata describes the information within a dataset and is published to allow MSDI users to “find” the data they are searching for. It can encompass information about coverage, scale, content, source, age, provenance and many other factors
- Metadata can also contain data authenticity information to establish the originator of a dataset. For many datasets the concept of an authoritative body for the content is incredibly important.

Notes:

7 A Hydrographic Office Perspective



This slide shows an example from the Hydrographic community of a hydrographic office ingesting data, managing and producing products. In tailoring data for specific products though, its broader use may be constrained – examples such as shoal bias, chart borders, navigation-specific encodings and a lack of seamlessness or data continuity may have an adverse effect on data use outside its primary customer base.

Re-using the core assessed and processed data prior to the addition of the product elements increases its potential for re-use because the data is not specific to any single group of end users. This is illustrated by the star ratings at each stage of the process. Placing data at the centre of the agency and creating data specifically designed for re-use by a broader community of stakeholders is a long-term and significant challenge for many organisations. This transformation is referred to as “data-centric working”

Key Messages:

- Traditional Hydrographic Offices produce “products” for use by a single customer base where the use of data is fairly well defined. MSDI changes this fundamentally by exposing data to many different users for a much broader range of purposes.
- Issuing “product” data to MSDI users diminishes its usefulness because the process of compilation may suppress useful information and introduce much product-specific content which has less value to non-SOLAS users.
- Distributing product-neutral information for MSDI purposes from the central data store of an organisation places the data at the heart of the enterprise and is key to the concept of “data centric” working.
- Working in a data-centric way is not just good practice for MSDI working but can have many positive improvements for primary customers of data too.



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?



Danish Geodata Agency

Some examples are given in this slide of possible next steps in creating a plan for MSDI engagement and implementation. These have been partitioned according to the four MSDI elements. Additionally IHO C-17 provides much useful guidance for potential MSDI participants.

Key Messages:

- The example plan for MSDI shows how each element could be approached by organisations wishing to engage in MSDI.
- It emphasises that all of the MSDI elements must be considered for a balanced and successful implementation.
- IHO C-17 also provides many suggestions, best practice guidelines and references to further information.

Notes:



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

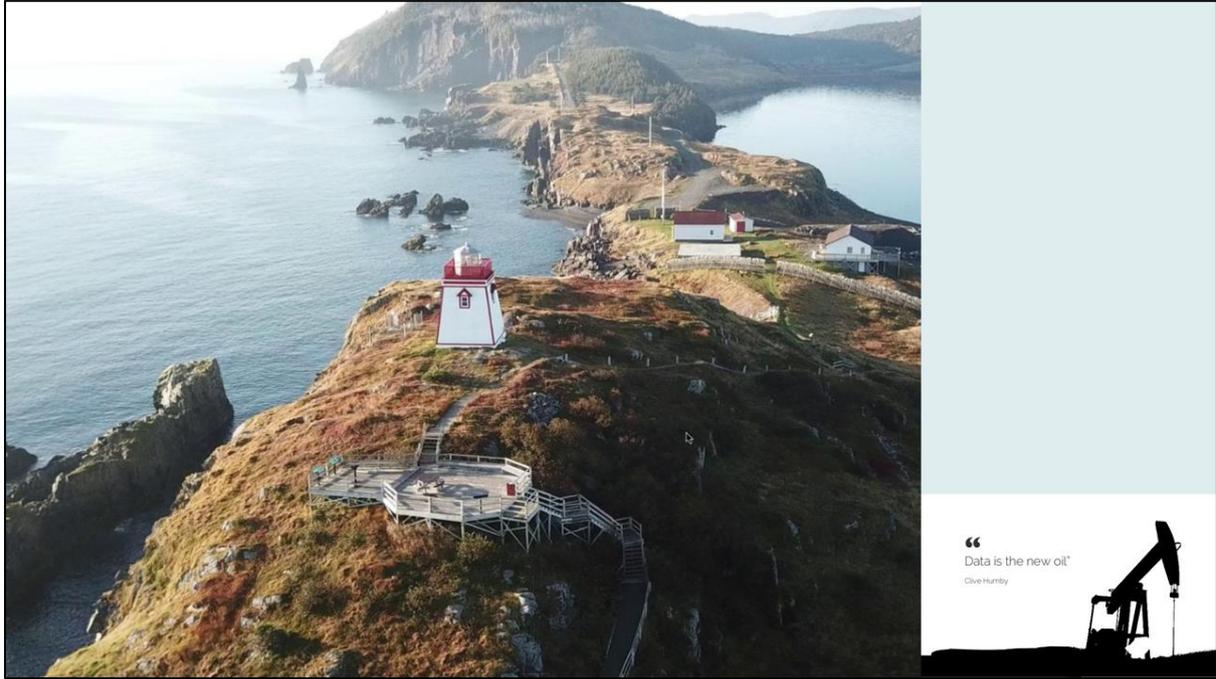
To conclude the Orientation course some suggestions are given for further areas for study

Key Messages:

- Potential routes for future study and suggestions for increasing MSDI knowledge are given.
- These broaden the knowledge around the global structures supporting and driving MSDI development.
- There are many different areas to understand and most useful information is already in the public domain.

Notes:

8 Conclusions



Notes:
