



Marine Data Sharing and Collaboration: *The Keys for a Successful Hydrospatial Strategy Implementation*

Session 8
"Coordinated and coherent integrated marine geospatial information management"
Singapore, May 12th, 2022

*International Seminar on United Nations Global
Geospatial Information Management*



Open Vision & Geospatial Infrastructure Resources

The screenshot shows the Esri Open Vision website. The header includes the Esri logo and navigation links for Products, Solutions, Support & Services, Stores, and About. The main content area features a large blue header with the text "Esri's Open Vision" and a sub-header "Listen to Esri President Jack Dangermond describe our commitment". Below this is a "Hear about Esri's open vision" button. The main body text states: "ArcGIS is an open, interoperable system that drives efficiency and innovation. Esri is committed to an open and secure design architecture. ArcGIS enables our users to integrate more easily within their specific IT contexts to leverage the power of location and data from virtually any source. Whether you're a large enterprise systems integrator, a developer looking to build your own apps, or a user who wants to share information and collaborate with others, we support multiple pathways to get your work done. Esri's open vision supports users around the globe in their work with geospatial data, connecting people with the data and information they need to complete their mission." A QR code is overlaid on the right side of the page. At the bottom, there is a section titled "More on the open system" with two featured articles: "A conversation with Jack and Satish" and "Integrated tool for prioritizing capital projects".

<https://www.esri.com/en-us/arcgis/open-vision>

The screenshot shows the Esri Integrated Geospatial Infrastructure website. The header includes the Esri logo and navigation links for Products, Solutions, Support & Services, Stores, and About. The main content area features a large dark header with the text "Integrated Geospatial Infrastructure" and a sub-header "Address shared challenges". Below this is a "Get Started" button. The main body text states: "Interconnect organizations across borders, jurisdictions, and sectors." A QR code is overlaid on the right side of the page. The lower section features a photograph of a man walking in a modern building and the text: "Address shared challenges, integrate geospatial infrastructure. People and economies, disasters, and infrastructure must cross borders. Our location data and technology must cross borders, too. How we think of traditional spatial data infrastructure (SDI) is evolving. From local and regional data cooperatives to the National Spatial Data Infrastructure (NSDI), the internet and cloud computing are transforming the way organizations manage data and collaborate in a system of systems. Integrated geospatial infrastructure connects organizations across borders, jurisdictions, and sectors to address shared challenges—efficiently and effectively. Infrastructure for our future: New patterns for modern SDI and federated Web GIS are shifting paradigms from hierarchical to interconnected networks of collaborating partners."

<https://www.esri.com/en-us/arcgis/integrated-geospatial-infrastructure>

Collaboration is
key



What is Geospatial Infrastructure?

Geospatial infrastructure is a technology enabler of digital ecosystems

It provides:

- Security, privacy and accessibility
- Identity management
- Data sharing & Collaboration

Through:

- Open standards
- APIs
- Licenses
- Marketplaces

On-demand streaming web services & APIs

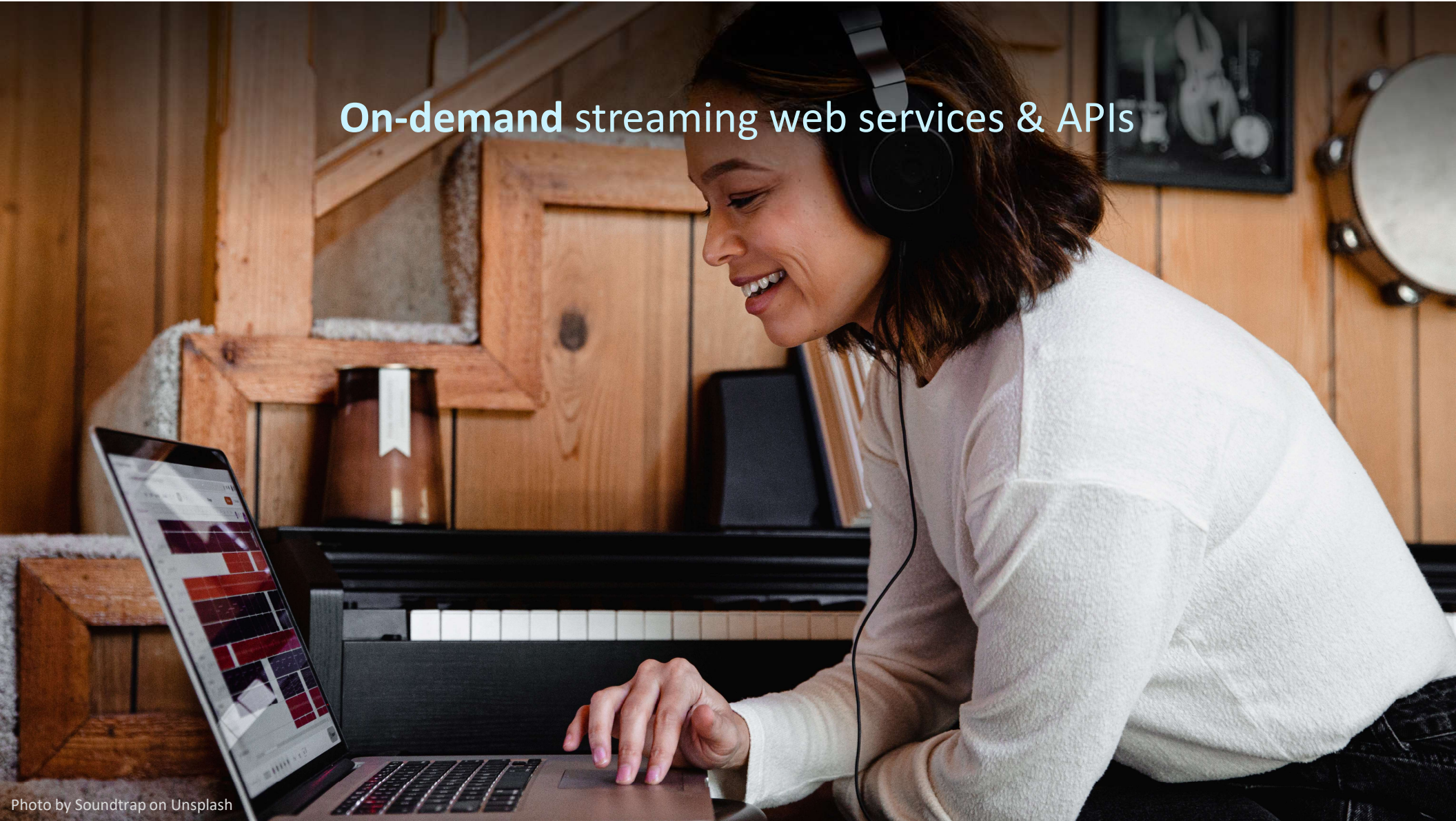


Photo by Soundtrap on Unsplash

Evolving SDI: Integrated Geospatial Infrastructure

Expanding beyond data to knowledge and understanding



Metadata catalogs



Federated portals

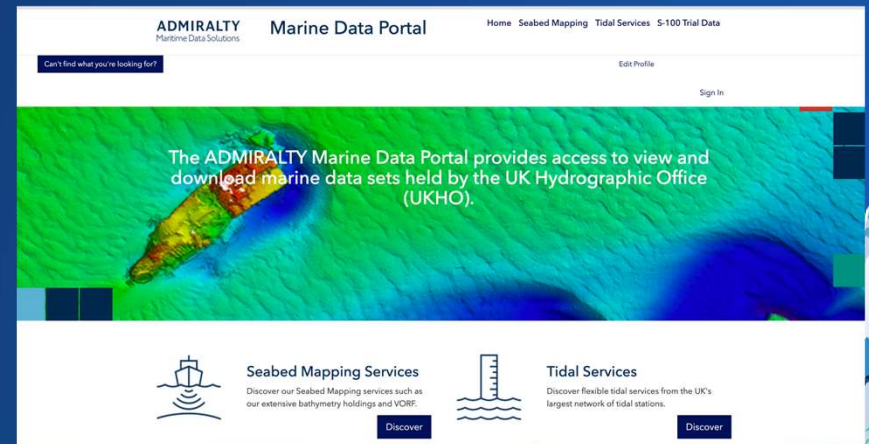


Digital ecosystems

Search & Discovery \longrightarrow Integration & Use

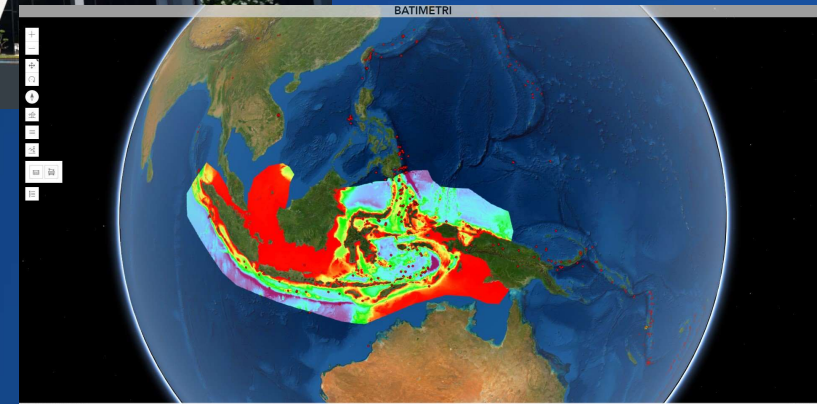
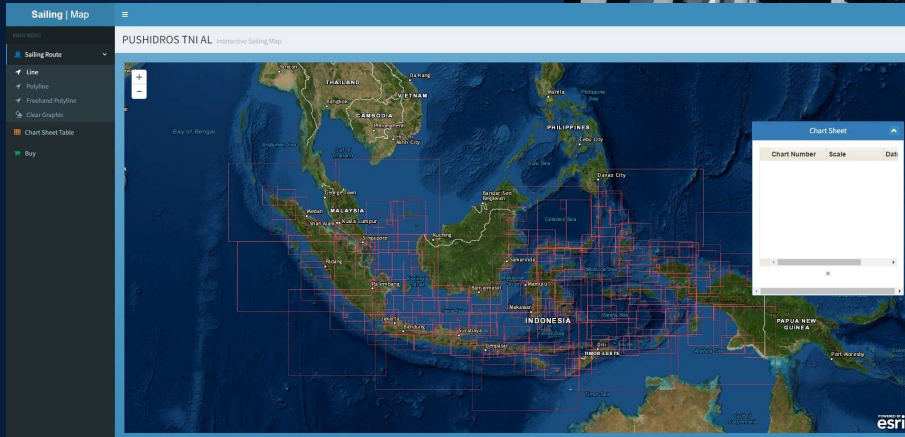
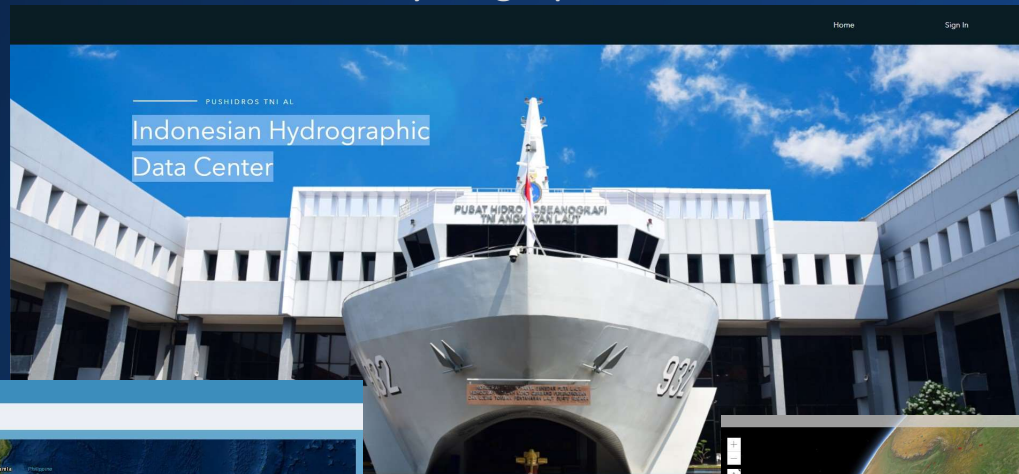
Modern SDI: Integrated Geospatial Infrastructure

Connects organizations across borders, sectors, and jurisdictions



Modern SDI: Integrated Geospatial Infrastructure

Indonesian Hydrographic Data Center



<https://tinyurl.com/4fmyub2m>

Modern MSDI: Integrated Geospatial Infrastructure

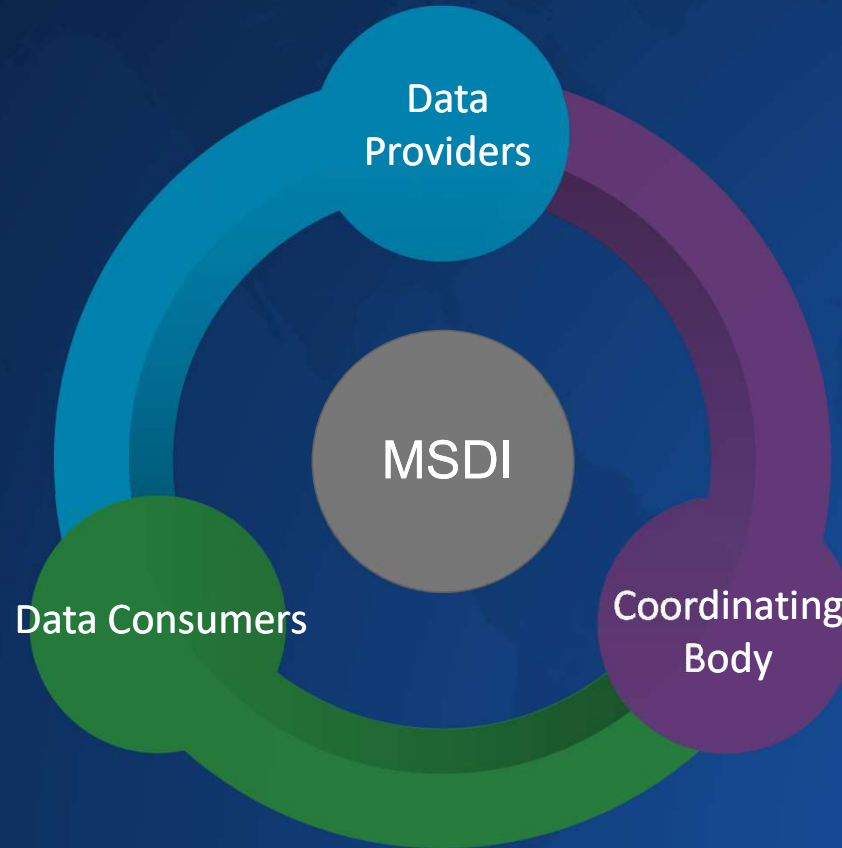
Whether we call it SDI, Open Data, Digital Twin, or otherwise...

- Key characteristics:

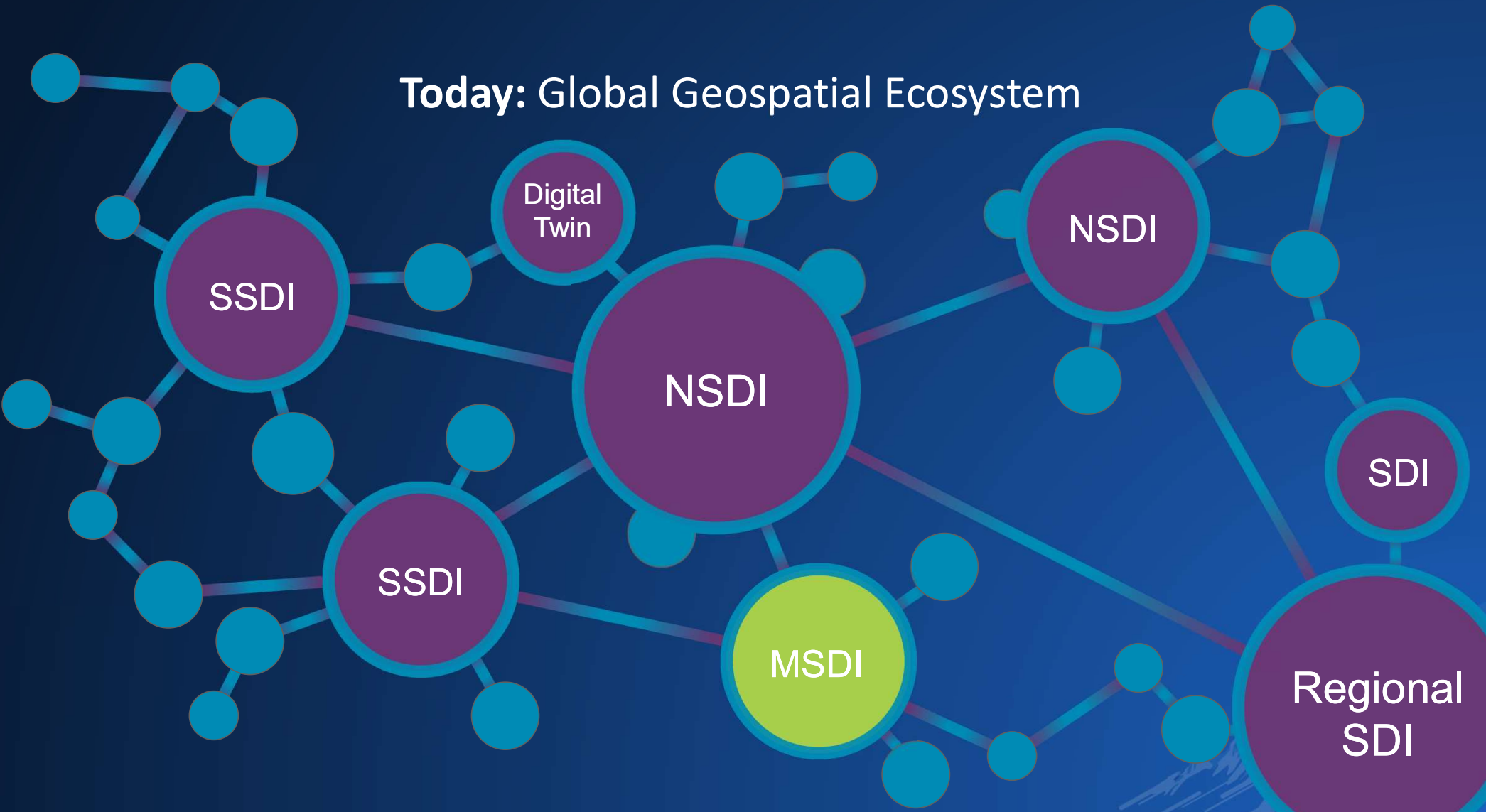
- Multi-organizational
- Integrated Fundamental & Operational Data
- Interoperable (standards)
- Collaborative
- Digital Ecosystem
- Focus on End Users / Putting Data to Use



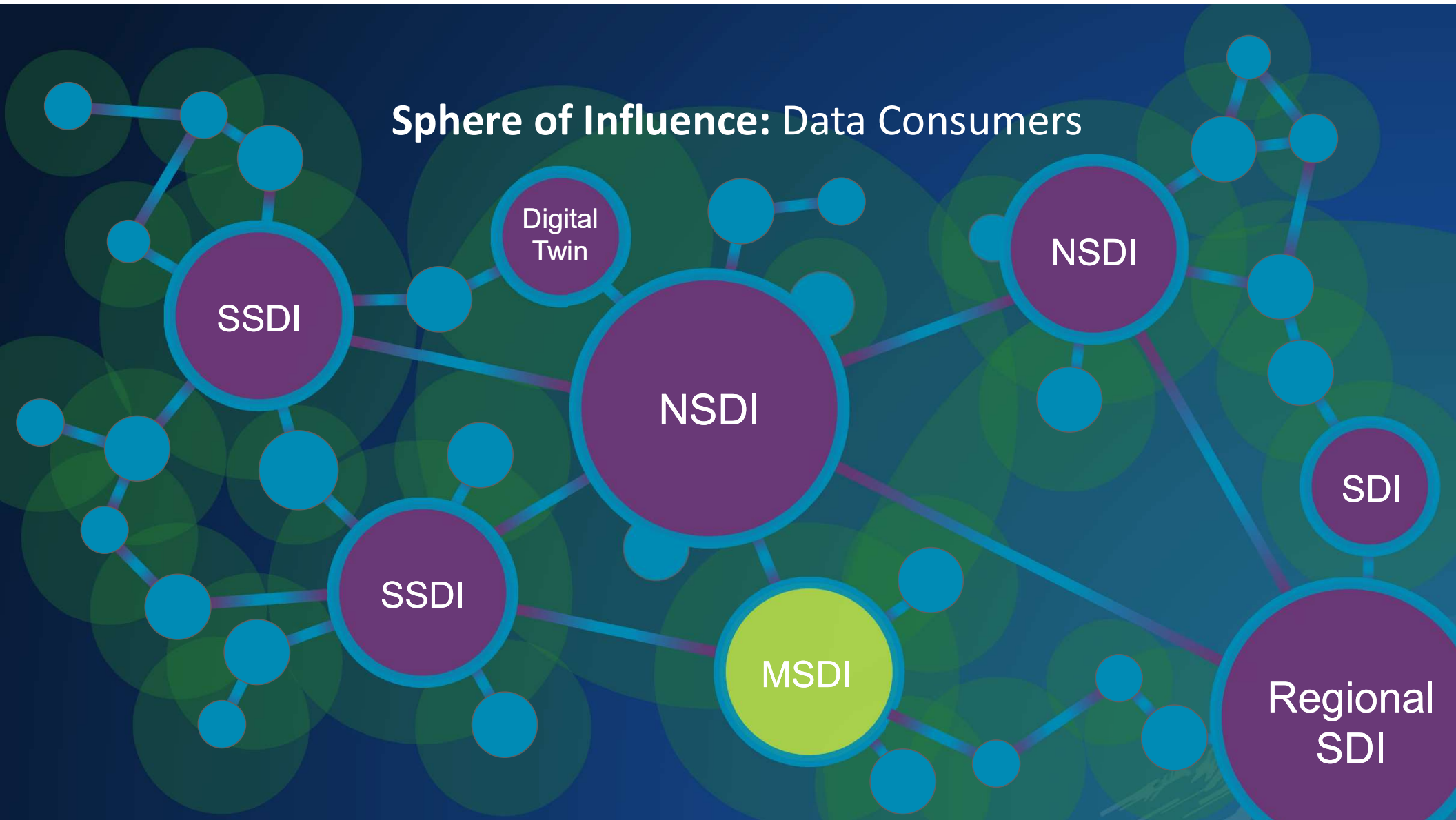
Digital Ecosystem: SDI Community of Practice



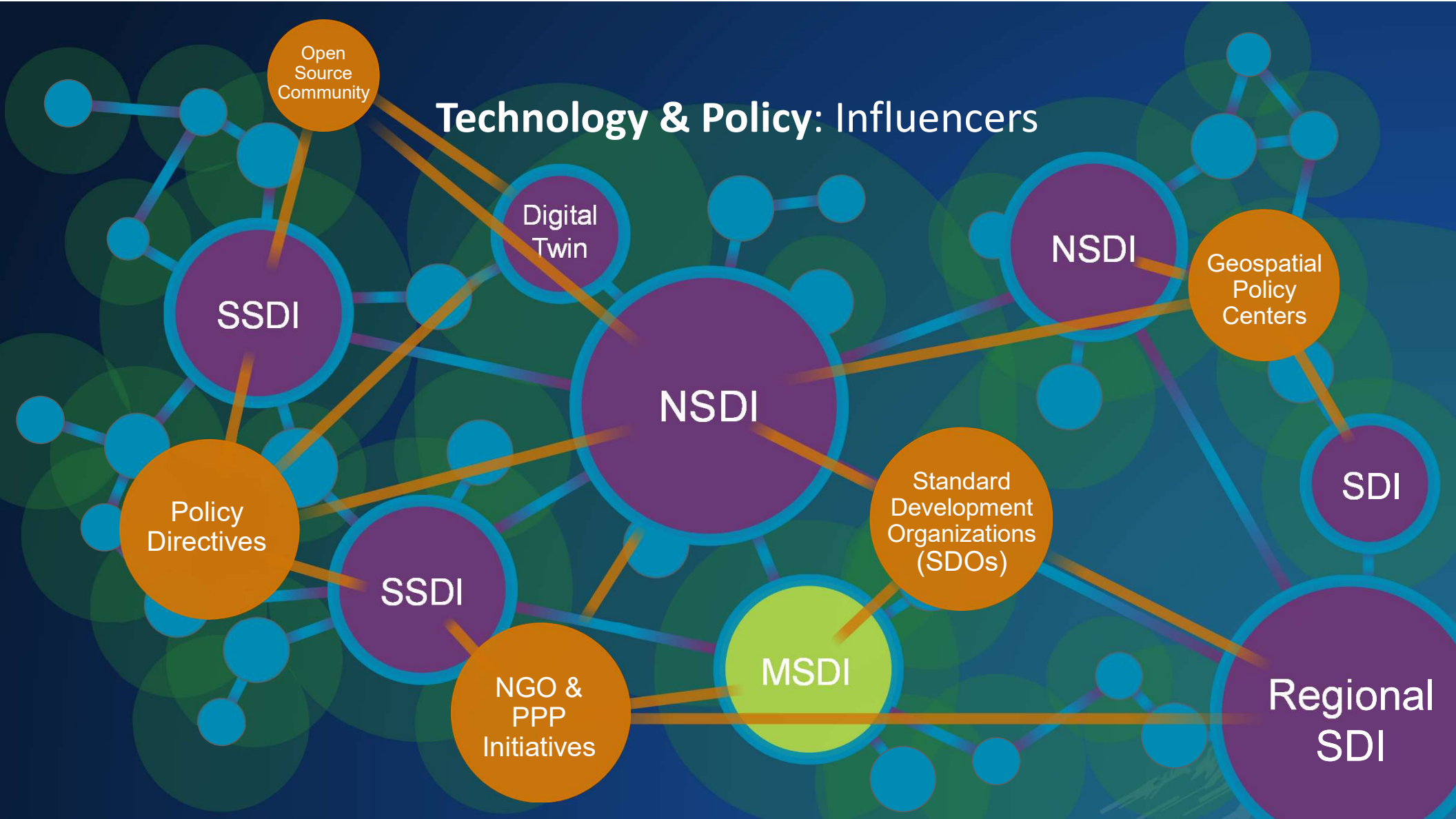
Today: Global Geospatial Ecosystem



Sphere of Influence: Data Consumers



Technology & Policy: Influencers

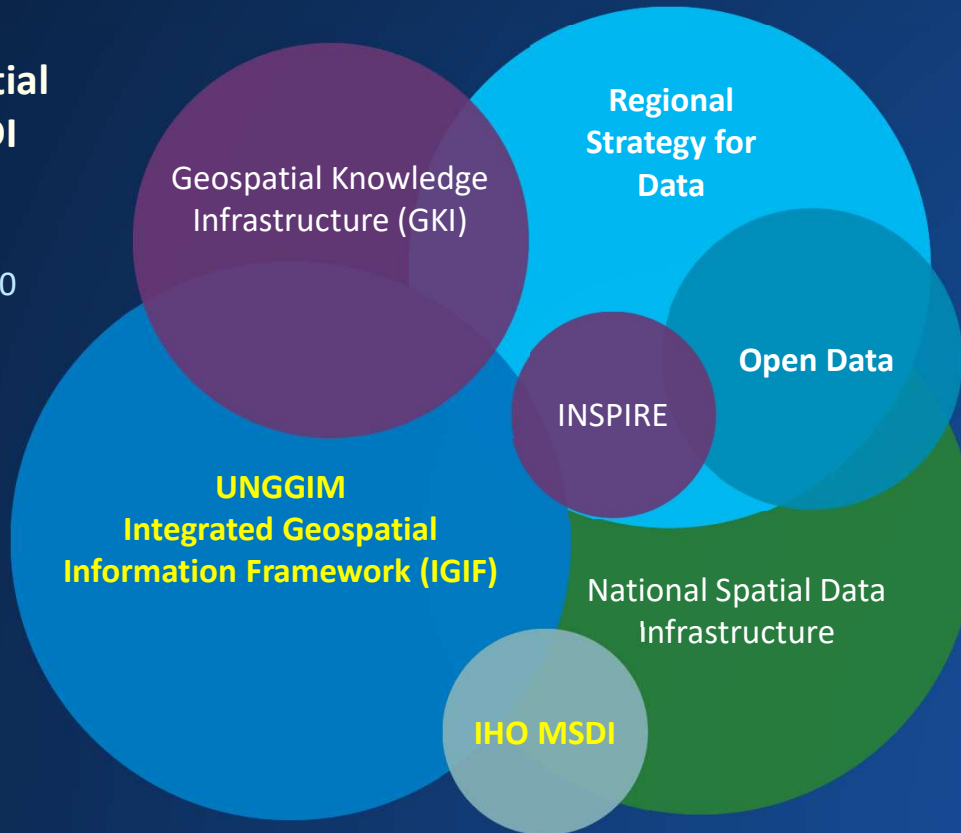


An open platform is essential

evolving, expanding, energizing the community

Integrated Geospatial Infrastructure & SDI

- Green Deal
- Horizon 2020
- Open Data Directive
- High value datasets
- GEO / GEOSS
- GAIA-X
- Data Spaces*
- Digital Twins
- SDGs



Standards Support

- OGC
- IHO
- ISO
- OGC APIs
- Web Services
- INSPIRE
- DCAT-AP
- Domain/Industry Standards
- Federated services
- Federated catalogs

FAIR data principles

- Open Data
- Open Science
- Metadata & Search

An abstract digital landscape with a dark blue background. In the foreground, there are stylized mountains in shades of green and blue. A bright yellow sun is visible in the upper right, surrounded by several smaller yellow circles of varying sizes. The overall style is modern and digital.

Standards & Interoperability

Working in heterogeneous environments

Standards Development Organizations

Open Geospatial Consortium

ABOUT ▾ MEMBERSHIP ▾ STANDARDS & RESOURCES ▾ INNOVATION ▾ NEWS & EVENTS ▾

Climate Change Service Pilot

Enabling FAIR Standards

The Home of Location Tech Collaboration

Your Global Resource for Geospatial

Welcome to OGC, a worldwide community of location information. We connect people, co challenges and address everyday needs. The government agencies, research organization location information FAIR – Findable, Accessible, Interoperable, Reusable

OGC Standards and Resources

OGC Standards and Resources:
Made by our Member Community for use by the Global Community

<p>Standards</p> <p>International standards that detail conceptual models, interfaces, or encodings to enable interoperability. View all OGC Standards</p>	<p>Registries</p> <p>Web accessible sources of information about things ("Concepts") the OGC defines or that communities ask that we host on their behalf. Applies FAIR principles for interoperability in systems. Visit the OGC Definition Server</p>	<p>Best Practices</p> <p>Member-agreed and -approved documents describing the use of one or more OGC standards to address a domain-specific topic or provide a solution to an interoperability challenge. Read More on Best Practices</p>	<p>Community Practices</p> <p>Documents describing implemented standards, specifications, or technologies that originate outside of OGC, but also address interoperability requirements in geospatial and related communities. Read More on Community Practices</p>
<p>Engineering Reports</p> <p>Developed in the OGC Innovation Program to highlight the initiatives completed by OGC members. They document the partners involved, the</p>	<p>Discussion Papers</p> <p>Technology issues being considered in the Working Groups of the OGC Technical Committee. They create discussion in the geospatial</p>	<p>White Papers</p> <p>Technology issues of interest to OGC Members and the geospatial community at large. They provide necessary background to highlight</p>	<p>OGC Reference Model</p> <p>The OGC Reference Model (ORM) describes the OGC Standards Baseline and the relationships between the baseline documents</p>

<https://www.ogc.org/standards>

Standards Listing : <https://www.ogc.org/docs/is>

ISO ISO/TC 211

Geographic information/Geomatics

<https://committee.iso.org/home/tc211>

88 : published ISO standards

24 : ISO standards under development

IHO

ABOUT IHO INTER-REGIONAL COORDINATION SERVICES & STANDARDS PUBLICATIONS EVENTS & NEWS

International Hydrographic Organization

Hydrography provides the basis for all activities which involve the sea. The International Hydrographic Organization works to ensure that all the world's seas, oceans and inland waters are surveyed and charted, thereby supporting safety of navigation and the protection of the marine environment. It coordinates the activities of national hydrographic offices and sets standards in order to promote uniformity in nautical charts and documents. It issues survey best practices and provides guidelines to maximize the use of hydrographic information.

→ READ MORE

<https://iho.int/>

The New S-100 series

The IHO S-100 “Universal Hydrographic Data Model



How can these new series of standards help?

S-100 Derived Product Specifications | Types and domains



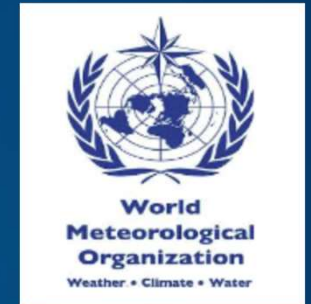
Electronic Navigational Charts
Nautical Publications
Surface Currents
Bathymetry
Tides



AIS
VTS
Aids to Navigation
Port Calls



E-Navigation
CMDS
MSP



Ice Coverage
Weather layer



Route planning
ECDIS



Domain	Responsible
IHO Hydro	IHO
WMO ICE	WMO ETSI
WMO Weather	WMO ETMSS
Inland ENC	IEHG
Port ENC	
IALA AIS	IALA
IALA AtoNs	IALA
IALA VTS	IALA
AML	NATO GMWG
IEC	IEC

Best Practices: Spatial data on the Web



Spatial Data on the Web Best Practices

W3C Working Group Note 28 September 2017



OGC and W3C joint initiative

<https://www.w3.org/TR/sdw-bp/#toc>

Where to start?

- Identify key stakeholders and their requirements
 - Identify National and/or regional initiatives/legislation that support MSDI
 - Identify appropriate IHO Committees and WGs to be involved with and participation at the RHC
 - Consider participation at the IHO MSDI WG
- Identify data providers
 - Who they are and what is their data
 - How does that data complement that of the HO
 - Who are the key people in each organization to engage with
 - What do they expect from the MSDI
 - How will they interact with other organizations in the MSDI
 - What are their data sharing and exchange protocols



What datasets the National HO and related agencies could provide?

- **Bathymetry** (e.g. Digital Elevation Model, Triangulated Irregular Network, Grid, points);
- **Coastline**;
- **Tidal data** (heights and streams);
- **Oceanographic data** (e.g. sound velocity, salinity, temperature, currents);
- **Aids to Navigation** (e.g. lights, landmarks, buoys);
- **Maritime information and regulations** (e.g. administrative limits, traffic separation schemes);
- **Obstructions and wrecks**;
- **Geographical names** (e.g. sea names, undersea feature names, charted coastal names);
- **Seafloor type** (e.g. sand, rocks, mud);
- **Constructions/infrastructure at sea** (e.g. wind farms, oil platforms, submarine cables, pipelines);
- **Shoreline constructions/infrastructures** (e.g. tide gauges, jetties) and
- **Practice and Exercise and /or Restricted areas.**



An abstract digital landscape with a dark blue background. In the foreground, there are stylized mountains in shades of blue, green, and purple. A bright yellow sun is positioned in the upper right, surrounded by numerous smaller, glowing circles of varying sizes. The overall aesthetic is modern and digital.

Modern SDI Patterns

Produce, **Publish**, Collaborate, Share, Use

Geospatial Infrastructure is emerging rapidly

Connecting organizations across borders, jurisdictions, and sectors

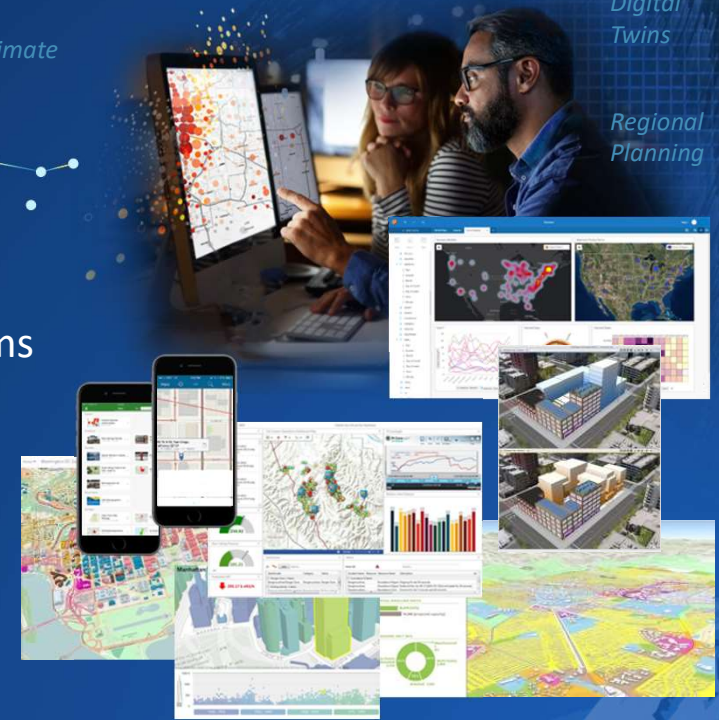
- Authoritative Content
- Distributed / Federated
- Open & Secure
- Easily Discoverable
- Directly Usable



Standards
Metadata
APIs

Supporting FAIR principles
Findable Accessible Interoperable & Reusable

Resilience
Green Infrastructure
Disasters
Biodiversity
Economy
Mobility
Climate
Digital Twins
Regional Planning



*Dynamically integrating content...
...enabling decision-ready information products*

Hydrospatial Infrastructure Integrates Distributed Services

Making Available All Types of Data

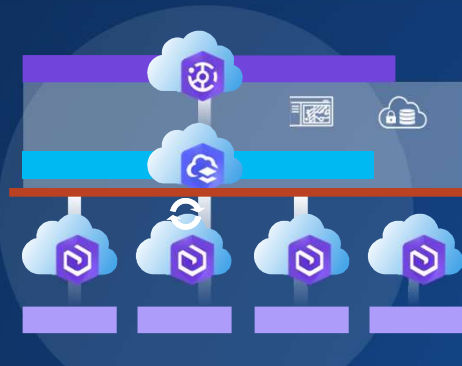


Produce, Publish, Collaborate, Share & Use

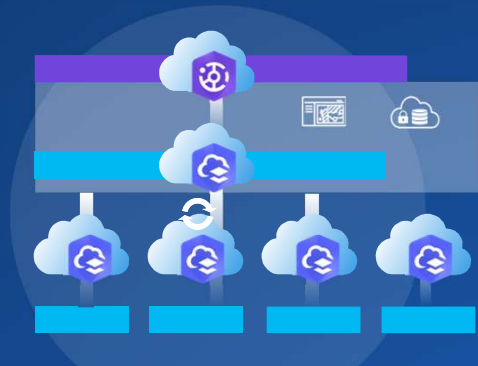
Hybrid



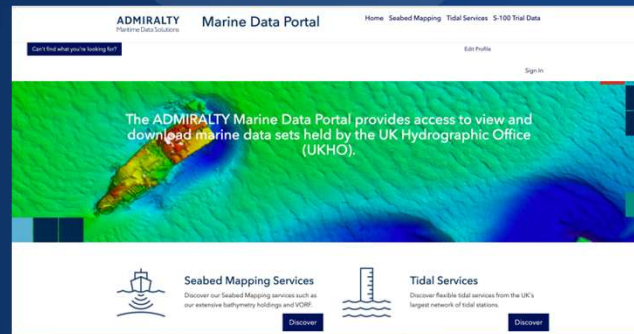
Registered/Referenced



Hosted



<https://www.caribbeangeoportal.com/>



<https://data.admiralty.co.uk/portal/apps/sites/#/marine-data-portal>



<https://geoadriatic.hhi.hr/en/>

The Big Picture



So what? What does this enable?

Ease of Sharing and Integration: US Marine Cadastre



<https://marinecadastre.gov/>

Regional and Multi-state Collaboration



The screenshot shows the homepage of the Caribbean GeoPortal. At the top, there is a navigation bar with a hamburger menu icon on the left, followed by the text "GeoPortal" and a list of menu items: "Data", "Tools", "Learn", "Community", and "About Us". On the right side of the navigation bar, there is a search icon and the text "Sign In". Below the navigation bar is a large hero image featuring a map of the Caribbean region in the background. Overlaid on the map are three people: a man on the left wearing a straw hat, a young boy in the center, and a woman on the right. The text "The Caribbean GeoPortal" is prominently displayed in the center of the hero image, with the tagline "Inspiring communities through geography" below it. Below the hero image is a yellow horizontal bar. Underneath the bar, the text "What inspires you?" is followed by a paragraph: "Your neighborhood, your school, your community? Perhaps a people or place whose story needs to be told? Maybe it's an app to help collect some type of data for your community?". Below this paragraph is another paragraph: "The #YourCaribbeanStory competition allows students like you to tell your story while encouraging spatial thinking and promoting research across the region. And for winners of the competition... A chance to secure an intern/externship." At the bottom left, there is a small line of text: "Your Caribbean Story Student Competition opens on Jan 24th". To the right of this text is a rectangular image showing a tropical beach scene with a blue sky, mountains, and a body of water. Overlaid on this image is the text "YOUR CARIBBEAN STORY" in large, bold, white letters, and below it, in smaller white text, "We are pleased to announce the inaugural 2022 CARIGEO Student Competition".

GeoPortal Data Tools Learn Community About Us

Search Sign In

The Caribbean GeoPortal

Inspiring communities through geography

What inspires you?

Your neighborhood, your school, your community? Perhaps a people or place whose story needs to be told? Maybe it's an app to help collect some type of data for your community?

The #YourCaribbeanStory competition allows students like you to tell your story while encouraging spatial thinking and promoting research across the region. And for winners of the competition... A chance to secure an intern/externship.

Your Caribbean Story Student Competition opens on Jan 24th

YOUR CARIBBEAN STORY

We are pleased to announce the inaugural 2022 CARIGEO Student Competition

Let's Recap

- The **main take-aways** we want you to leave with:
 - Geospatial (Hydrospatial) Infrastructure powering modern MSDI
 - The future is bright: Technology enables the creation of a system-of-systems supporting modern MSDI
 - Supported by an open platform
 - Interoperability through open standards and specifications
 - Enabling new things!
 - These patterns support organizations and their local-to-global key initiatives



Thank you for your kind attention!

Speaker and Co-Author

- **Rafael Ponce** – Esri Principal Maritime Consultant and Practice Lead
- *Co-Author*
- **Chris Fowler** – Esri Asia Pacific, National Government BD Manager – Geospatial Authorities

Additional Expert contributors

- **Jill Saligoe-Simmel** – Product Manager, Geospatial Infrastructure, SDI & INSPIRE
- **Satish Sankaran** – Product Manager, Open Platform Team
- **Adam Martin** – Integration & Knowledge
- **Bruce Harold** – ArcGIS Data Interoperability

Connect with us and additional resources
<https://www.esri.com/en-us/arcgis/open-vision/resources>





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THE
SCIENCE
OF
WHERE®