National Snow and Ice Data Center

Supporting Cryospheric Research Since 1976

Review of Polar Data Community Activities

Peter L. Pulsifer
National Snow and Ice Data Center
University of Colorado Boulder

IARPC COLLABORATIONS

ARCTICDATACOMMITTEE IASC SAON

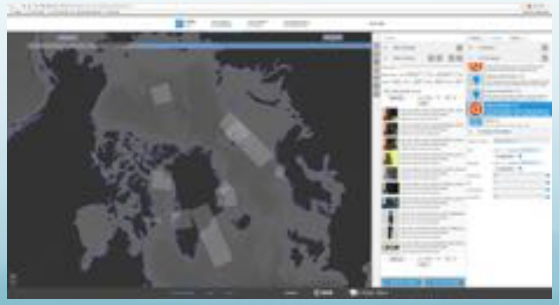
Goals and Objectives of the Polar Data Planning Summit

The Vision

http://nsidc.org/acadis/search/

- "Common access, Single Window" to discuss and access data through information technology
- High quality, ethically open data preserved over time (sustainability)
- Data as a service
- Interoperability (share data among various information systems in a useful and meaningful manner)
- Inclusive of Indigenous and local perspectives
- Access to big data and powerful analytical tools (e.g. cloud platforms)
- Cost effective!

Pulsifer xxet al. 2014



Screen capture complements of Polar View

http://eloka-arctic.org/communities/yupik/atlas/index.html

Pulsifer, P. L., Yarmey, L., Godøy, Ø. et al. (2014). Towards an International Polar Data Coordination Network. *Data Science Journal*, 13, 94–102. doi:http://dx.doi.org/10.2481/dsj.IFPDA-16

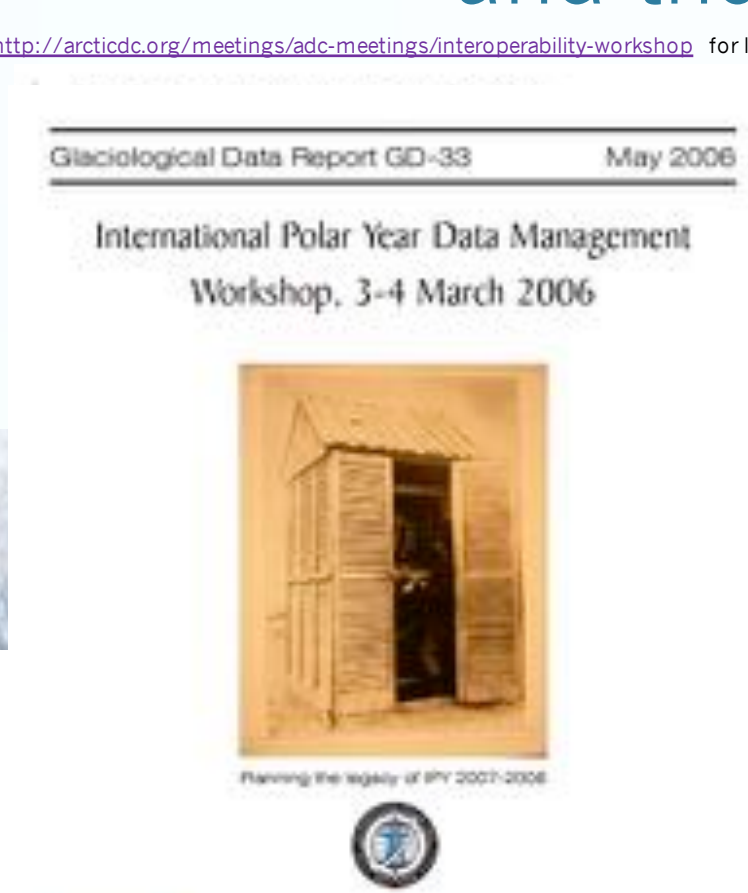
PDPS

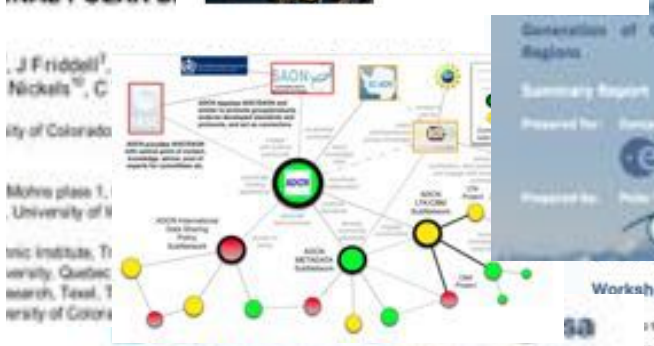
- Bring polar data coordinating bodies and other interested orgs and people together
- Provide a space for detailed technical discussion and architecture-level planning
- Establish a plan for community focus areas and future coordination

Recent History of Polar Data

Arctic Data: Opportunities, Challenges and the Way Forward

See http://arcticdc.org/meetings/adc-meetings/interoperability-workshop for links to resources





Opportunities

Data is Big

https://obamawhitehouse.archives.gov/blog/2015/02/18/white-house-names-dr-dj-patil-first-us-chief-data-scientist
https://www.openaire.eu/opendatapilot
https://www.icsu-wds.org/
https://www.rd-alliance.org/
https://envirodatagov.org/protecting-climate-data-in-times-of-political-turmoil-a-report-from-los-angeles/

Observations, Data and Societal Benefit

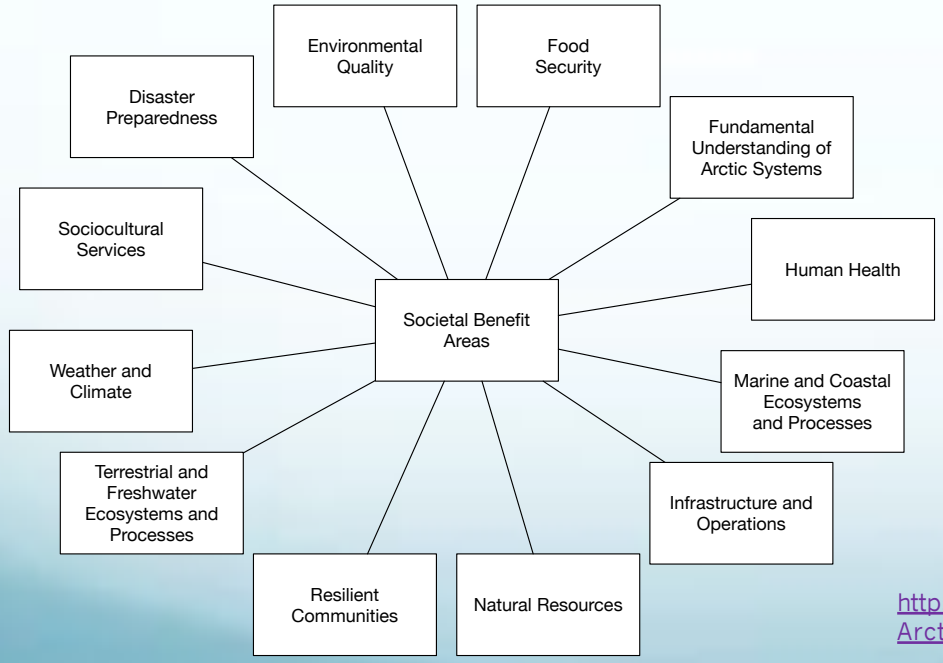
Proposal by Finland for a new project:

Arctic Observation Value project - assessment for physical atmospheric and oceanic variables

Background and Motivation

Arctic monitoring is largely not sustained for a long term. The first Arctic Science Ministerial declaration and the Arctic Councils Fairbanks declaration are calling for increased efforts to observe the Arctic. An initiative within SAON (Sustaining Arctic Observing Networks) has recently been started and is trying to clearly justify Arctic-monitoring actions by performing a comprehensive Arctic Observation Systems value tree analysis. The Assessment framework and top of the tree has been developed by a workshop in January. The corresponding report is published on the SAON web. This work has only been started and needs now the next step. Sustaining and extending the Arctic Observing system becomes easier if the value of observations can be made more explicit. It also helps to focus efforts on areas with most impact for policy goals. For this value tree to reach the lower level, it needs to be assessed from the bottom up connecting the information produced for key societal objectives to the underlying services and observation data sources.

Sustainability is a key concept



https://www.arcticobserving.org/images/pdf/misc/STPI-SAON-International-Arctic-Observations-Framework-Report-2017.pdf

After: IDA Science and Technology Policy Institute and Sustaining Arctic Observing Networks. 2017. International Arctic Observations Assessment Framework. IDA Science and Technology Policy Institute, Washington, DC, U.S.A., and Sustaining Arctic Observing Networks, Oslo, Norway, 73 pp

Arctic Science Ministerial

White House Arctic Science Ministerial: September 28, 2016

Summary: On September 28, 2016, science ministers from across the globe will gather in Washington, DC, for the first-ever White House Arctic Science Ministerial.

Second Arctic Science Ministerial

Berlin, Germany

Polar Orgs & Cyberinfrastructure

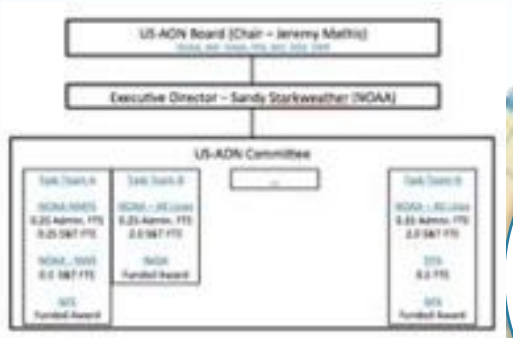
- Arctic Data Committee
- SCADM
- SOOS
- GCW
- GEOCRI
- AC WGs
- Arctic SDI
- Polar View
- …

Montreal 16-18 Sept. 2017

https://www.rd-alliance.org/plenaries/rda-tenth-plenary-meeting-montr%C3%A9al-canada

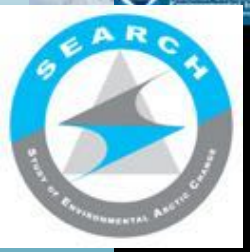
Photo credits: Marten Tacoma

National/Regional Hubs

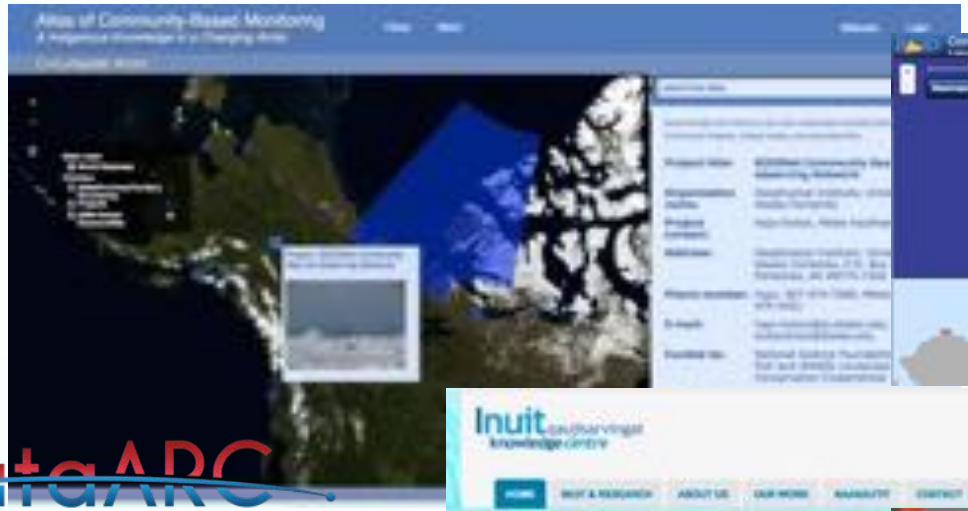


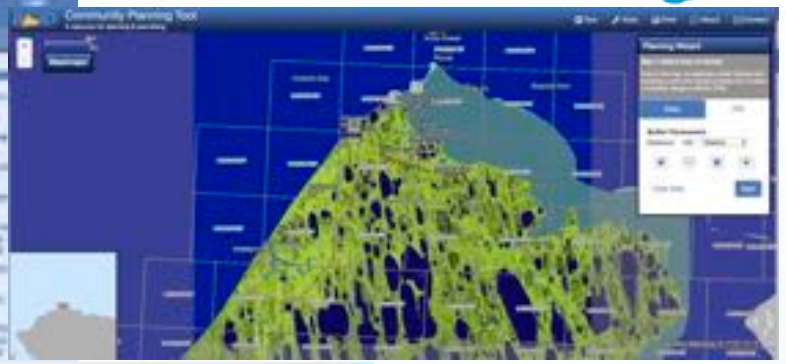
CCADI

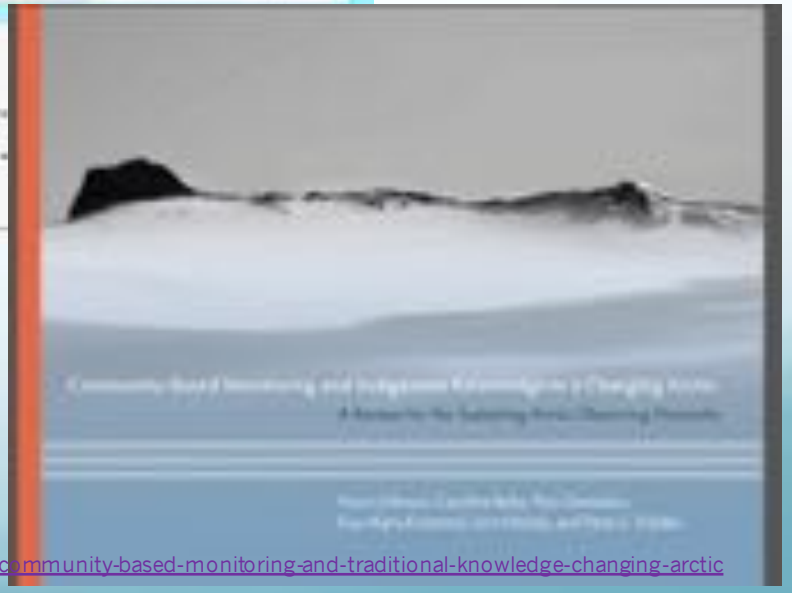
The Canadian Consortium for Arctic Data Interoperability



Local Community Hubs and Nodes







http://www.arcticcbm.org/index.html
http://www.inuitknowledge.ca/
https://toolkit.climate.gov/tool/atlas-community-based-monitoring-and-traditional-knowledge-changing-arctic
http://ittaq.ca/
http://prodgis02.utep.edu/BaidCommunityPlanning1001
http://www.inuitcircumpolar.com/community-based-monitoring.html

Community Driven Monitoring Workshop, Québec

- Interest in building bottom-up networks
- Investment in community capacity and infrastructure needed
- Interoperability across technical platforms
- Major issues around data sharing are social/ political rather than technical

Workshop on Community Based Monitoring held at Arctic Change, 11,12 December

INTAROS

ELOKA

ONE PEOPLE-ONE RIVER
Yukon River Inter-Tribal Watershed Council

Indigenous and Community-Based Data/Information Platforms

http://eloka-arctic.org/

Nunaliit

Nunaliit Atlas Framework

http://nunaliit.org/

SMARTICE

https://www.smartice.org/

LEO NETWORK

https://www.leonetwork.org

https://arcticeider.com/siku

Trailmark

http://trailmarksys.com/

eNuk

on the land | on the web

https://enuk.eco/

http://ittaq.ca/

Global Cyberinfrastructure & Orgs

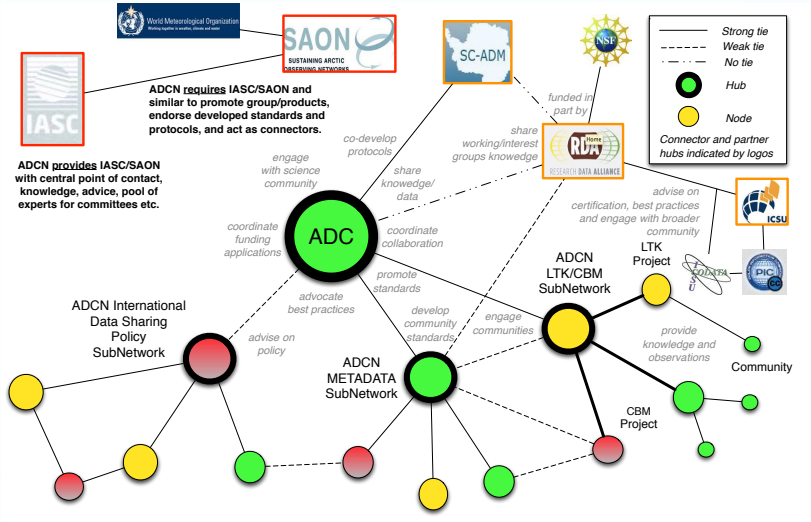
- **WMO**
- **GEO**
- **GOOS**. **IODE**
- …
- RDA
- WDS
- CODATA
- IODE (SeaData(Net)CI

Selected Recent Developments

Mapping the Data Ecosystem

Network Systems Science and the Need for a Distributed System

- Need to guide the design of a robust network that achieves the Vision – pragmatic, Agile
- Robust networks include **multiple** ***hubs*** and less connected nodes – "loose ties" + "hub and spoke



Pulsifer, P. L., Yarmey, L., Godøy, Ø. et al. (2014). Towards an International Polar Data Coordination Network. *Data Science Journal*, 13, 94–102. doi:http://dx.doi.org/10.2481/dsj.IFPDA-16

Mapping and Understanding the Data Ecosystem

Title: Postdoctoral Fellow (*Arctic Data e-Coosystem Scientist*)
Reports To: Professor Paul Arthur Berkman and Dr. Peter Pulsifer
Location: Fletcher School of Law and Diplomacy, Tufts University
FTE: 3d Months (with possible extension)

POSTDOCTORAL FELLOW
Arctic Data e-Coosystem Scientist

BACKGROUND OF FLETCHER SCHOOL OF LAW AND DIPLOMACY AT TUFTS UNIVERSITY

The Fletcher School is committed to educating in an inclusive and supportive environment that welcomes students regardless of national origin, religion or citizenship status. At The Fletcher School, for more than 80 years, we have tried to "know the world." Our job is to prepare our graduates to be practitioners in every dimension of international relations: economics, finance, diplomatic history, politics, culture, security and many other disciplines. The challenges we face in this turbulent 21st century quite literally transcend borders – we must be ready to connect in every sense

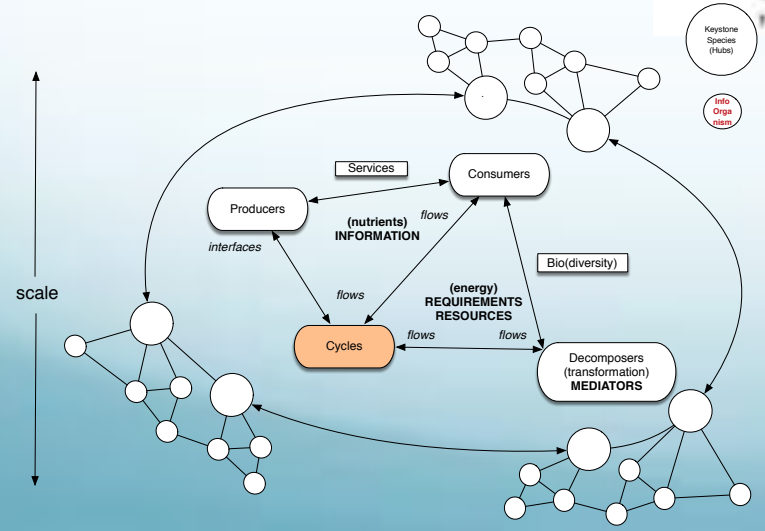
Dr. Katia Kontar

Information Ecology to Map the Arctic Information Landscape

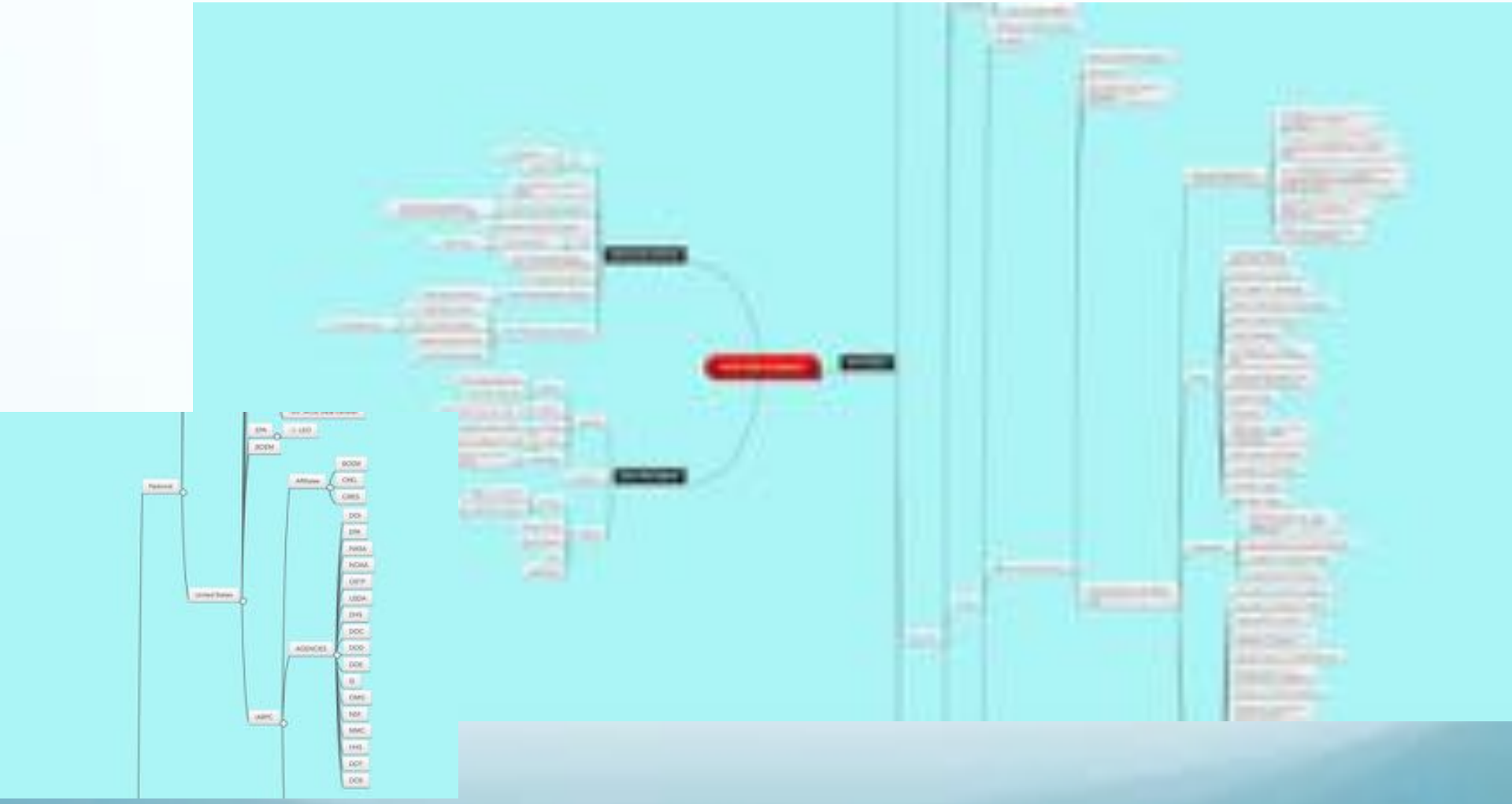
Peter L. Pulsifer, Yekaterina Kontar, Paul Arthur Berkman, D.R. Fraser Taylor

12.1 Introduction

Governance involves processes of interaction, dialogue, negotiation and decision-making among many actors involved in the development of social norms and institutions. Understanding and addressing the values, key priorities, and common interests of actors is critical to effective governance that balances societal well-being, environmental protection and economic prosperity across generations. This is particularly challenging in the Arctic region due to the complexity of the region in the face of significant environmental, economic



Preliminary Map



A group like IARPC in the U.S. has its own data ecosystem

From Map to Model

Underlying Database - LOD

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## NASA
<4547a1d0-1d00-4216-abcb-ef5cb1cc8783>
   rdfs:type org:OrganizationalUnit ;
   rdfs:label "NASA" ;
   rdfs:comment "National Aeronautics and Space Administration (NASA)";
   foaf:homepage <https://www.nasa.gov/> ;
   org:hasPrimarySite <4547a1d0-1d00-4216-abcb-ef5cb1cc8783.site> ;
   org:classification pdesclassification:governmentAgency
   org:unitOf <378aac00-aee2-4cd7-a027-b8a62ff88f1e> ;
   pdes:fundedBy <378aac00-aee2-4cd7-a027-b8a62ff88f1e> .

<4547a1d0-1d00-4216-abcb-ef5cb1cc8783.site>
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<4547a1d0-1d00-4216-abcb-ef5cb1cc8783.site.card>
   a vcard:Address ;
   vcard:country-name "United States" ;
   vcard:postal-code "20546" ;
   vcard:region "District of Columbia" ;
   vcard:locality "Washington" ;
   vcard:street-address "300 E. Street SW, Suite 5R30" .

## NSIDC
<d346e52c-3a64-43cc-9cc2-6b1e55df2304>
   rdfs:type org:Organization ;
   rdfs:label "NSIDC" ;
   rdfs:comment "National Snow and Ice Data Center (NSIDC)
   foaf:homepage <https://nsidc.org/> ;
   org:classification pdesclassification:dataCenter ;
   org:hasPrimarySite <d346e52c-3a64-43cc-9cc2-6b1e55df230
   pdes:fundedBy <4547a1d0-1d00-4216-abcb-ef5cb1cc8783> ;
   org:memberOf <b121225c-cbfd-4db0-bfbc-e6f8927723b5> ;
   pdes:fundedBy <2da7d57b-0afe-47ce-b829-3204a43a4c52> .
```

```
pdes:fundedBy owl:inverseOf pdes:funds .
pdes:funds owl:inverseOf  pdes:fundedBy .

#Start definition of organization classification schema
<http://example.org/pdes-organization-classifications#>
  a skos:ConceptScheme;
    rdfs:isDefinedBy <http://example.org/pdes-organization-classifications#>;
    rdfs:label """Polar Data Ecosystem Organization Classification Schema""";
    oci:hasVersion """0.0.1""" .

pdesclassification:networkOfNetworks
  a skos:Concept;
    skos:inScheme <http://example.org/pdes-organization-classifications#>;
    rdfs:label """Network of Networks"""@en.

pdesclassification:systemOfSystems
  a skos:Concept;
    skos:inScheme <http://example.org/pdes-organization-classifications#>;
    rdfs:label """System of Systems"""@en.

pdesclassification:network
  a skos:Concept;
    skos:inScheme <http://example.org/pdes-organization-classifications#>;
    rdfs:label """Network"""@en.

pdesclassification:infrastructure
  a skos:Concept;
    skos:inScheme <http://example.org/pdes-organization-classifications#>;
    rdfs:label """Infrastructure"""@en.

pdesclassification:dataCenter
  a skos:Concept;
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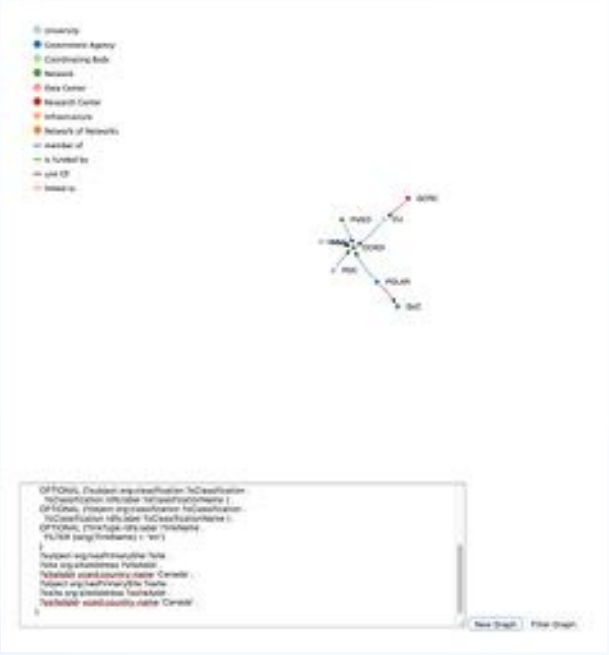
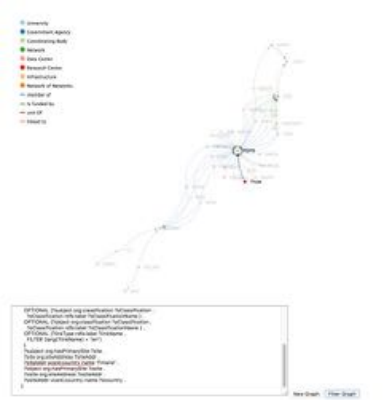
    rdfs:label """Data Center"""@en.
```

Dynamic Queries

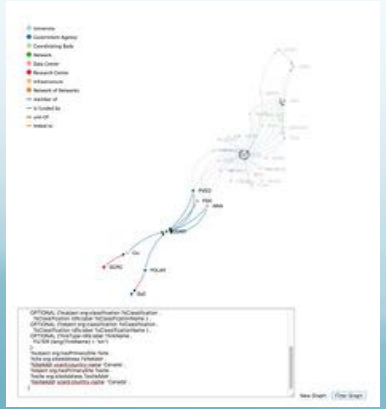


Canada



Finland

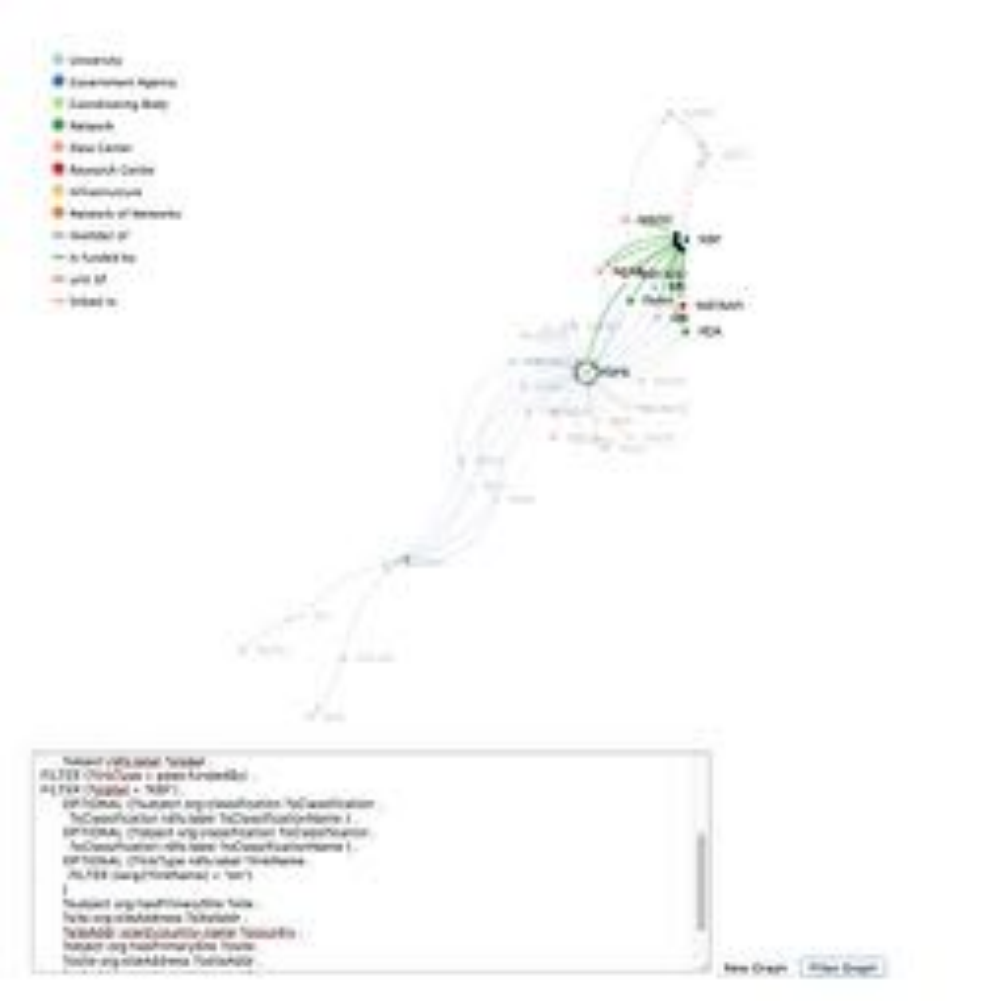
Belgium



By Country

USA

Funding Ecosystem



POLDER

Polar Federated Search Working Group

- Joint SOOS, ADC, SCADM, SOOS effort
- Major support from Arctic Portal, SOOS, RBINS, NSIDC/ELOKA and all partners
- Concrete products under development
- Early use of products by community
- Chaired by Bricher, Smirnov, De Bruin

Polar Federated Search Working Group
Draft Terms of Reference

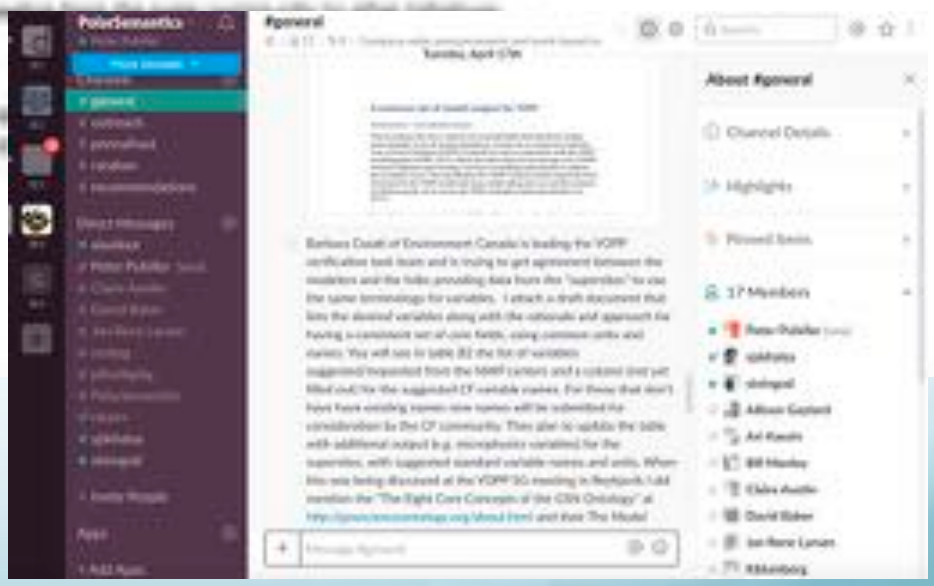
Mission Statement:
The Polar Federated Search Working Group (PFSWG) is a collaboration between the Arctic Data Committee(ADC), Standing Committee on Antarctic Data Management (SCADM), and Southern Ocean Observing System (SOOS), to develop the tools and resources to support metadata aggregation and federated search tools to improve the discoverability of polar science data.

Objectives:

- PFSWG will investigate the needs of the polar research community and opportunities for developing metadata aggregation and federated search
- PFSWG will advise ADC, SCADM, and SOOS on the best approaches to metadata aggregation federated search
- PFSWG will pursue funding and resource opportunities with other related groups to support metadata aggregation federated search
- Once funding/resources are found, PFSWG will act as a scientific advisory group for the developers
- PFSWG will maintain contact with the broader data management community to ensure that polar metadata aggregation and federated search is linked with other global initiatives and minimises duplication of efforts

Vocabularies and Semantics Working Group

Chaired by Godøy & Duerr



https://arcticdc.org/activities/core-projects/vocabularies-and-semantics-wg

Indigenous Data

National Inuit Strategy On Research

Figure 1: *Respectful and beneficial research for all Inuit*

Meetings

XXXV SCAR Biennial Meetings

Arctic Science Summit Week 2018 & IASC Business Meetings

Arctic Observing Summit 2018
The Business Case of a pan-Arctic Observing System
Davos, Switzerland
24 - 26 June 2018

The Arctic Observing Summit (AOS) is a biennial summit that aims to provide community-driven guidance for the design, implementation, coordination and sustained operation of an international network of Arctic observing systems. The AOS provides a platform to address urgent and broadly recognized needs of Arctic observing across all components of the Arctic system. It fosters international communication on and coordination of long-term observations aimed at improving understanding of and response and adaptation to system-scale Arctic change. It is an international forum for optimizing resource allocation through coordination of and exchange among researchers, Indigenous organizations, the public, private and not-for-profit sectors, and all others involved or interested in the Arctic. The AOS is a contribution to the Sustaining Arctic Observing Networks (SAON) initiative of IASC and AMAP.

Arctic Data Committee Annual Meeting:

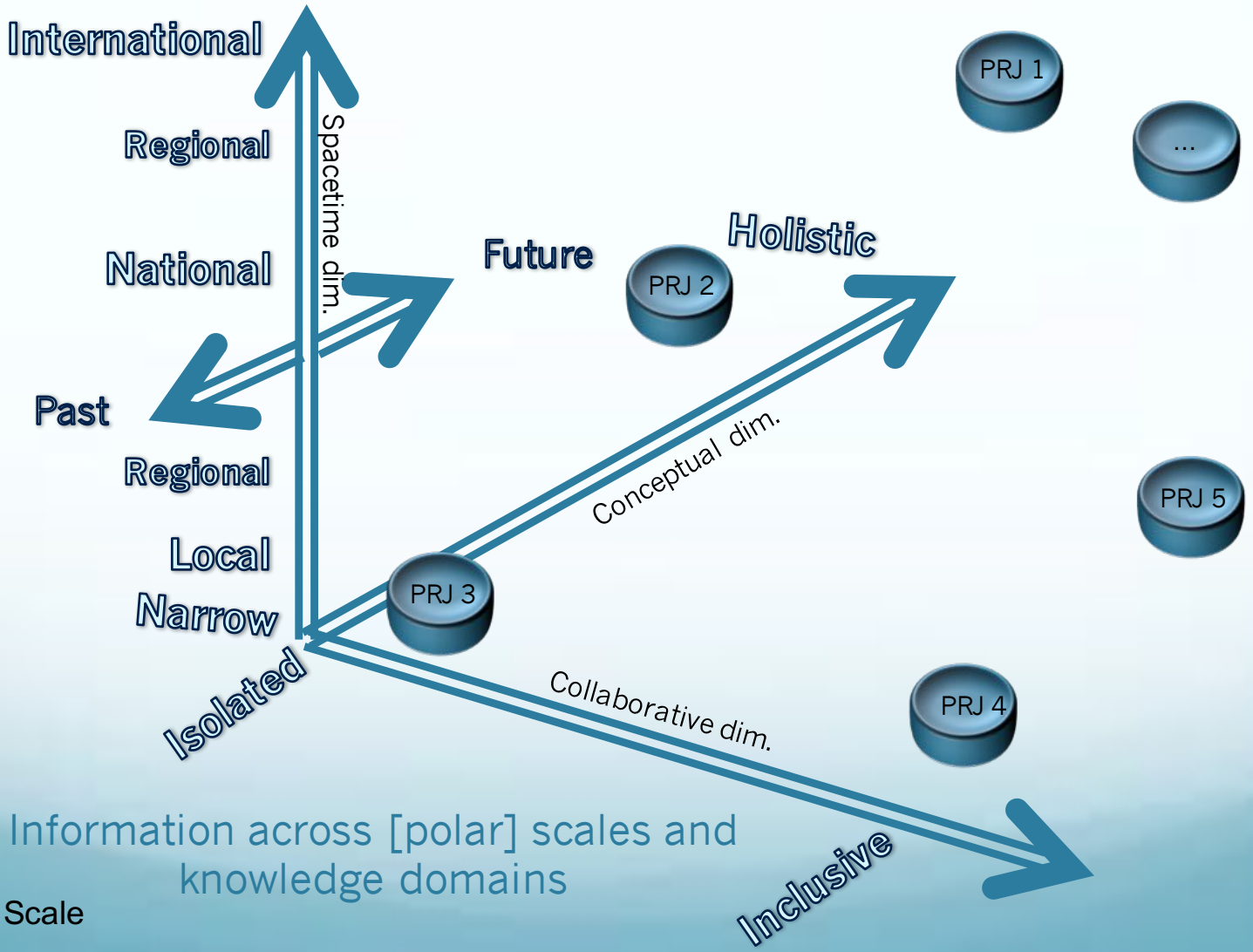
Geneva, Switzerland, November 2018

Gaborone, Botswana | 5-8 November 2018
INTERNATIONAL DATA WEEK
IDW 2018

Arctic Science Ministerial

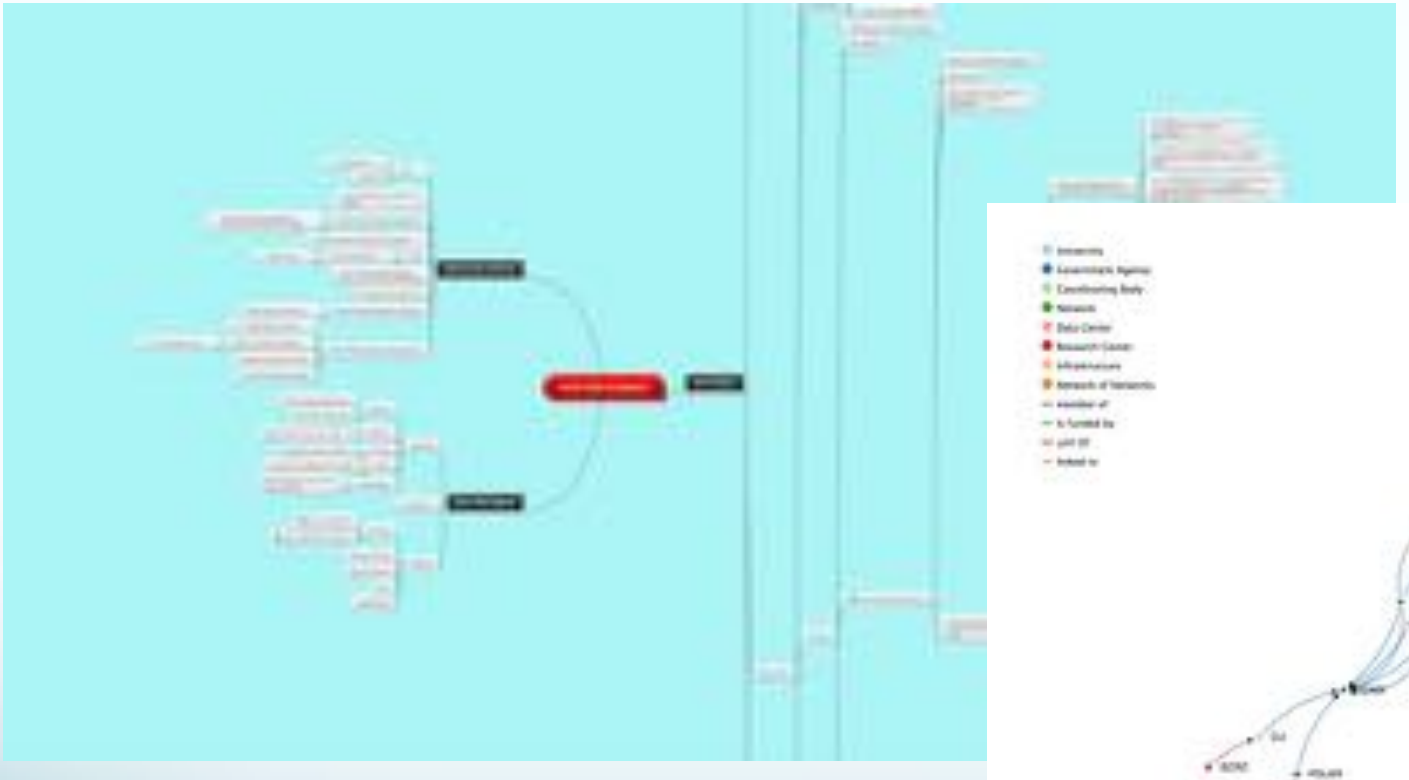
Challenges

Domain Complexity

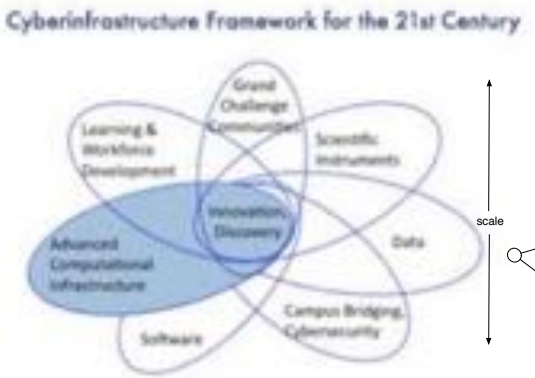


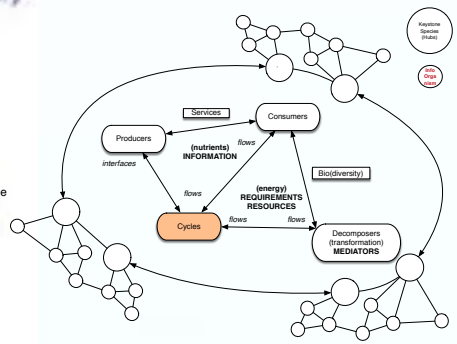
Information across [polar] scales and knowledge domains

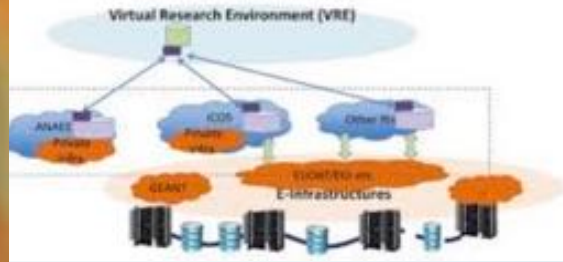
Community Complexity

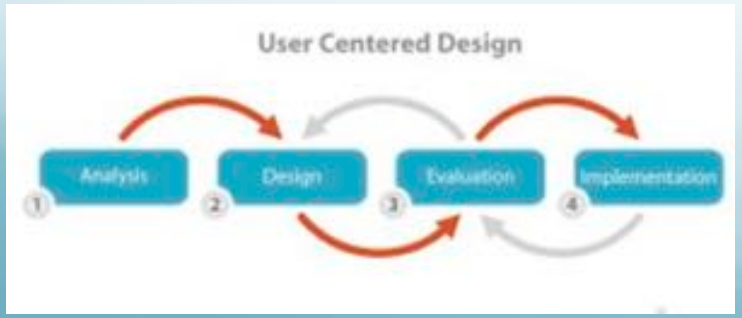


Socio-Technical Model Complexity

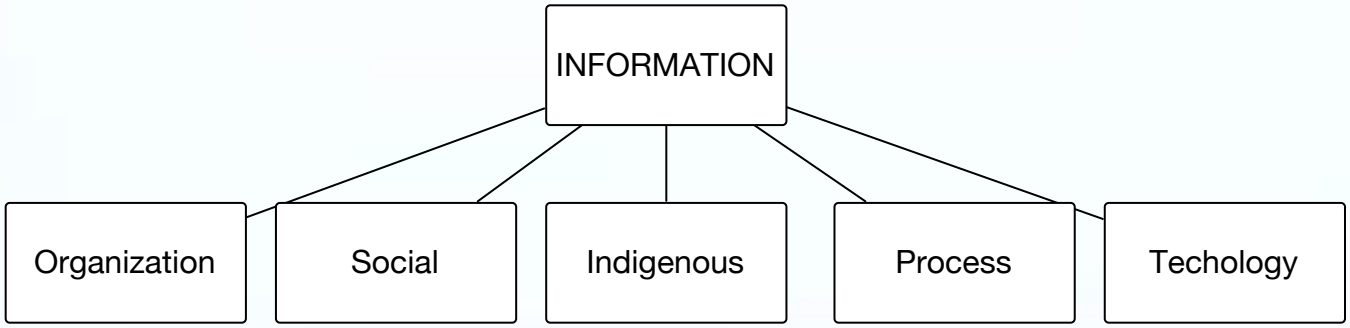


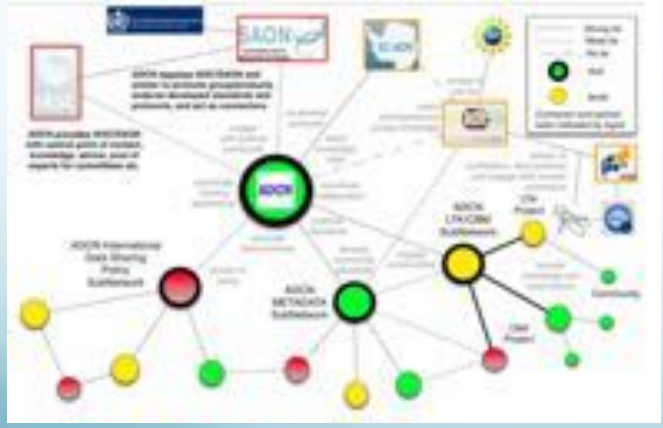






Frames


INFORMATION
Organization
Social
Indigenous
Process
Techology



DATA SCIENCE JOURNAL
Proceedings Papers
Is Data Publication the Right Metaphor?
Authors: M A Parsons, P A Fox
Abstract

Coordination Capacity

- Limited number of people in the community who are able, resourced, willing or qualified to lead or assist with coordination and management of complexity at a community scale

The Way Forward

Establishing Frames and Working Models

Learning from Robotics

Structure, Agency and Identity

Agency
”freedom”

Constrained
Freedom

Structure
“constraint”

Individual
identity

Funding

Collective
identity

"if all you have is a hammer, everything looks like a nail"

Abraham Maslow's *The Psychology of Science*, published in 1966.

Attention

PDPS

- Priorities?
- Bottom Up vs. Top Down?
- Individual vs. Collective?
- Connection to other scales and “non-polar” organizations?
- Sustainability?

Day 1

- Examples of Cyberinfrastructures and Initiatives
- Setting the Context and Introduction to Use Cases
- Lightning talks