CEOS Interoperability Handbook 2.0 Status
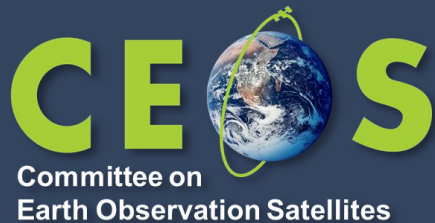
Nitant Dube
& Tom Sohre,
WGISS

Agenda Item E.1
WGISS / WGCV Joint Meeting
15 & 18 October 2024
Sioux Falls, South Dakota, USA

CEOS
Committee on
Earth Observation Satellites

CEOS Interoperability Handbook V 2.0

❖ **Objective**

▪ CEOS Interoperability Handbook Version 2.0 should provide <u>guidance to the organizations</u> for development of **Interoperable Data** and **Services** and help them in measuring their **maturity level**

Interoperability Handbook

Maturity Matrix

Interoperability Framework : Factors
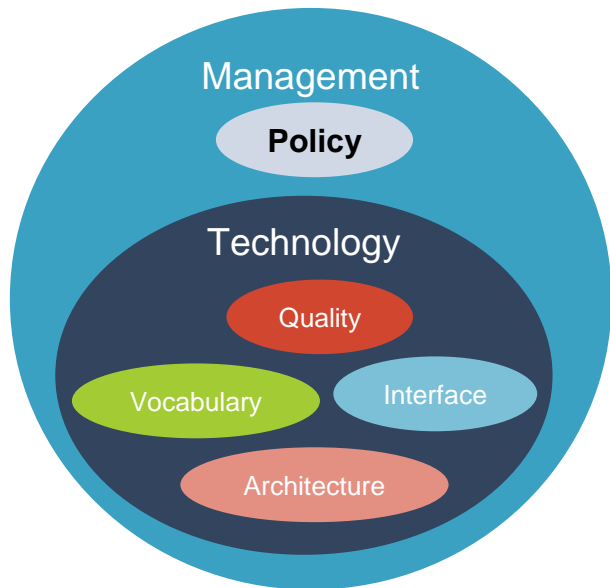
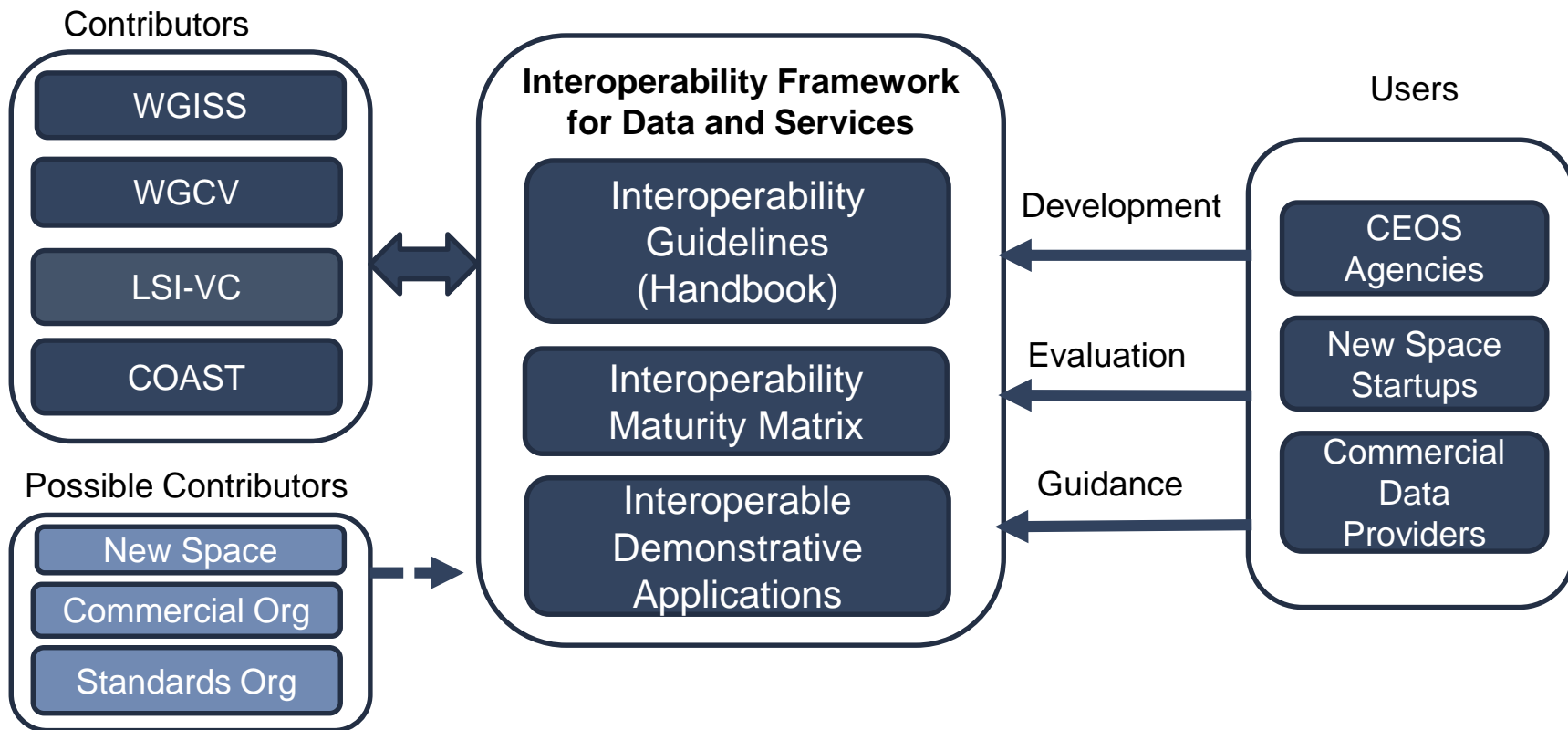|	
Vocabulary (Semantics)	The (narrow) semantic aspect refers to the naming and meaning of data elements. It includes developing, harmonising, and maintaining vocabularies and schemata supporting provision, exchange, and analysis of data, and ensures that terms and data elements are understood in the same way by all communicating parties
Architecture	Architecture describes the organisational structure of concepts, processes, and assets, including data and workflows. It comprises the structural aspects of models and standards that govern the collection, storage, arrangement, integration, and use of data.
Interface (Accessibility)	Data exchange protocols, and application interfaces. These provide the means necessary to access and exchange data.
Quality	References are data and schemes that are used as benchmarks for (observational) data comparison or analysis. This could include instances such as geographic locations, product numbers, or official (authoritative) data and statistics.
Policy	Legal frameworks, policies and strategies regulating the relation between the different stakeholders.

Approach

❖ Use the **interoperability framework** and develop a **handbook**, which will provide an overview of existing capabilities within CEOS, which could be used either by CEOS agencies or external users to develop approach for interoperability or to improve/develop interoperability for Earth Observation Data and Services

❖ Handbook will address **What to Do (Guide),** with possible links to **How to Do (Manuals)**

Overview

Contributors
- WGISS
- WGCV
- LSI-VC
- COAST

Possible Contributors
- New Space
- Commercial Org
- Standards Org

Interoperability Framework for Data and Services
- Interoperability Guidelines (Handbook)
- Interoperability Maturity Matrix
- Interoperable Demonstrative Applications

Users
- CEOS Agencies
- New Space Startups
- Commercial Data Providers

Development

Evaluation

Guidance

Handbook Chapter Layout

❖ **Chapters**

▪ **Chapter-1 : Introduction**
  O Requirements/Need, Scope, Audience

▪ **Chapter-2: Interoperability Framework**
  O Genesis of the Factors, Brief overview of the factors

▪ **Chapter-3: Vocabulary (Semantics)**

▪ **Chapter-4: Architecture**
  O **Pre-Processing, Analysis Ready Data, Data Cubes, Cloud Compatibility; Data Stewardship; Data Dissemination**

▪ **Chapter-5: Interface (Accessibility)**
  O **Discovery:** Metadata, STAC; **Access:** API, https; **Authentication**

▪ **Chapter 6: Quality**
  O **Quality Evaluation and Tags, Calibration, Validation**

▪ **Chapter 7: Policy**
  O **Open Data Policy, Open Science, Open Source Science**

▪ **Chapter 8: Conclusion and Future Scope**

▪ **Annexures**

Vocabulary

❖ Recommendations are primarily based on work done and paper published by **Peter Strobl , Woolliams and Katrin Molch**

❖ Vocabulary also termed as semantics helps in providing a **consistent terminology for communication** between different stakeholders including humans and machines for acquisition, processing, archival, dissemination and analysis of Earth Observation data.

❖ **Recommendations**

- Thesaurus should be the preferred way of implementing vocabulary in an organization. Use **ISO 25964-1, 2011** for developing Thesaurus and **ISO 25964-2, 2013** to ensure Interoperability with other vocabularies

- **CEOS Common Online Dictionary** can be used as a reference for Vocabulary implementation

- Use existing vocabulary and enrich it by involving a wider community with a balance of **centralized and distributed control.**

- The terms used in vocabulary should be Consistent and divided into classes such as **Base, Core, Controversial and High Impact**

Vocabulary

❖ **Recommendations cont..**

- **Active web links** to the standard centralized definition of terms should be used as against the documentary standards providing their own list of references.

- Vocabulary should have **version control and change management** at the individual term level and historical and alternative definitions should be linked to current term definition.

- The terms used in the vocabulary should be Interrelated with **clear relationships between other terms** (parent, sibling, child) avoiding, in particular, circular (child becomes parent) relations. Overlaps between terms that are supposed to delineate more generic concepts (siblings) should be avoided or minimized

- The vocabulary should have capability to record **public comment and discussion** and should provide options for adding new terms.
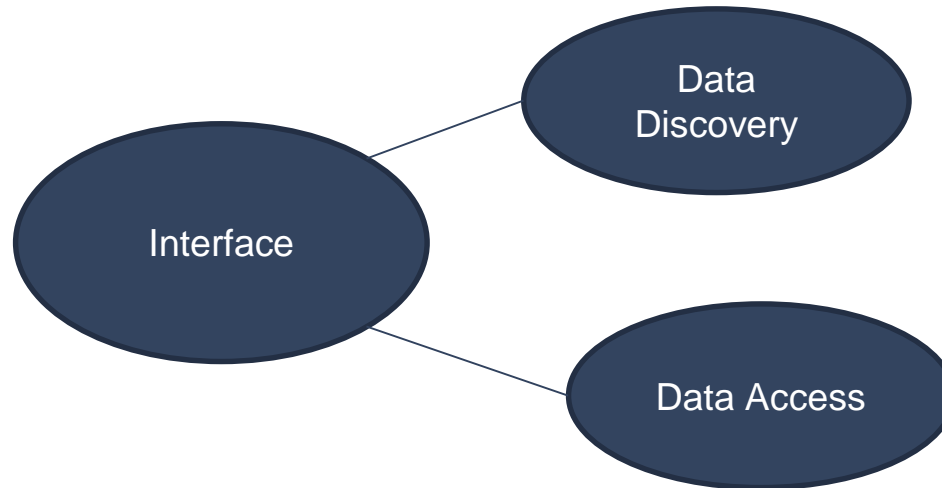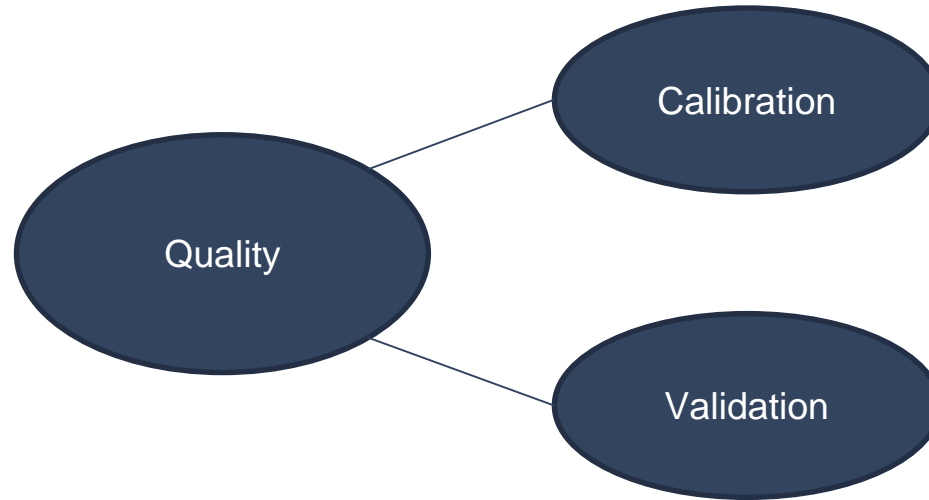
Analysis Ready Data (ARD)
(For discussion)
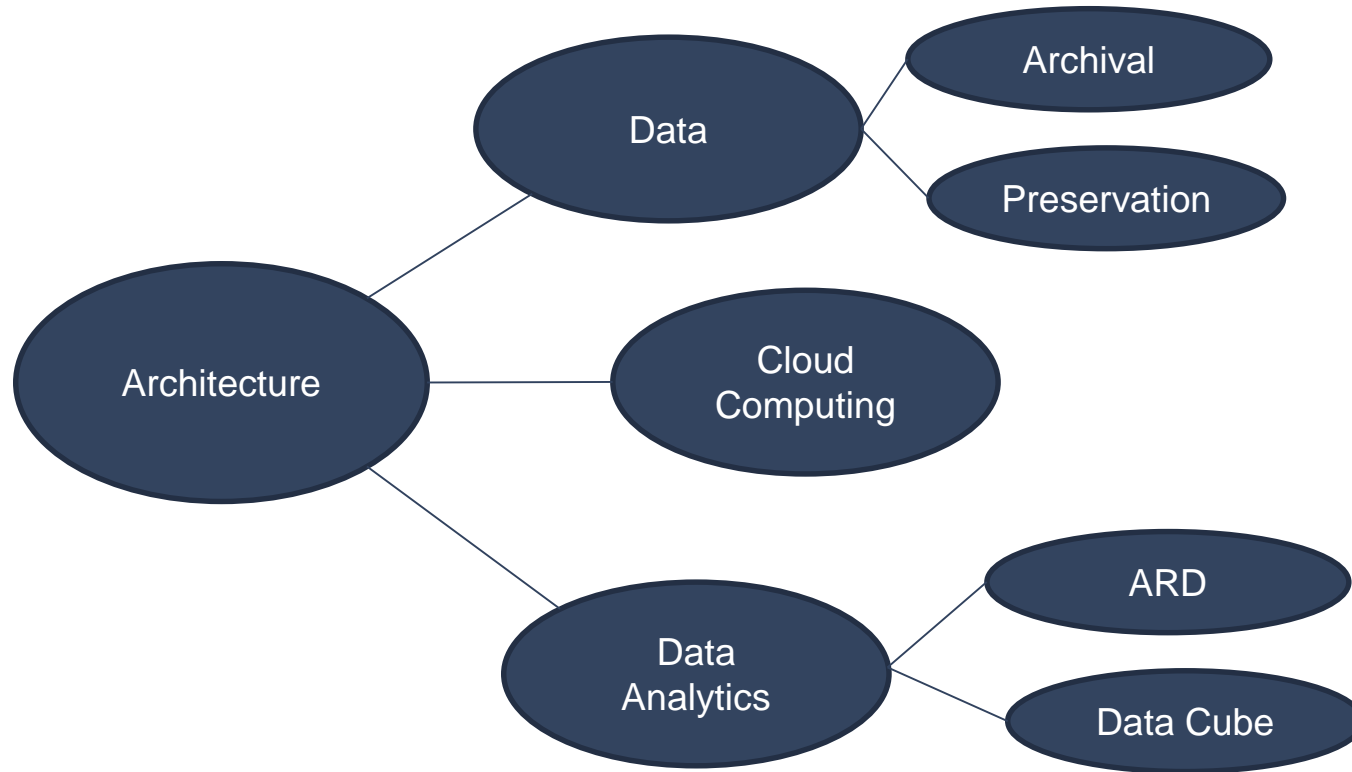
❖ **Analysis Ready Data (ARD) are starting point for interoperability in analysis and hence Data Providers are encouraged to develop ARD.**

- **Recommendations**
  - **CEOS ARD Framework** should be used as a starting point for development of Analysis Ready Data
  - CEOS **Product Family Specifications (PFS)** should be used for development of ARD products. In case if a new ARD is to be developed, use PFS template and submit to CEOS for approval
  - CEOS ARD compliance of the product requires two level of assessments, first is self assessment (**CEOS ARD Self Assessment Guide**) and second is peer review by CEOS Experts
  - ....

Data Cubes
(For discussion)

❖ **Data Cubes provide capability to pack a collection of data and provide capability for fast access and analysis**

- **Recommendations**
  - The CEOS supported **Open Data Cube** can be taken as a reference for Data cube implementation
  - Data cubes should support **spatial and/or temporal dimensions** and capability for publishing available variables/properties as metadata.
  - Data cubes should **abstract the underlying data storage architecture** to support hybrid data cubes and interoperability among different types of data cubes.
  - Data cube may contain raw sensor data, analysis ready data or decision ready information. **Analysis Reay Data should be preferred** to avoid pre-processing overheads and fast analysis
  - Data cubes should be able **to publish the supported pre-built analysis functions**
  - Data Cubes should provide **REST API and OGC web services** based access for easy integration of end user applications

Interface

```
           ┌──────────────┐
           │     Data     │
           │  Discovery   │
           └──────────────┘
   ┌──────────────┐
   │  Interface   │
   └──────────────┘
                   ┌──────────────┐
                   │ Data Access  │
                   └──────────────┘
```

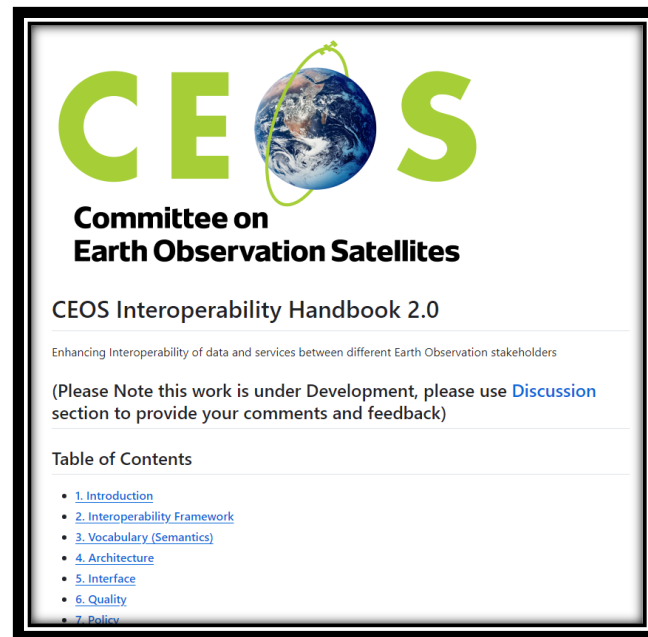# Quality

Calibration and Validation
(For discussion)

❖ **Calibration** helps in quantitatively defining a sensor response to known and controlled signal inputs. **Validation** is the process of assessing the quality of the data

❖ Recommendations

  o CEOS CAL/VAL portal can be used as a reference site for insuring interoperability for calibration and validation

  o CEOS/WGCV developed Data Quality Assurance Strategy should be followed for ensuring interoperability

  o CEOS endorsed Cal/Val sites should be used for satellite cross-comparison

Policy
(For discussion)

❖ Policy is one of the most important factors and forms the basis of interoperability.

❖ **Recommendations**

- O Identify policies in your organization/country related to data and services and conduct periodic check/audit for compliance to these policies. Identify policies which may be barriers to interoperability of data and services and flag them for resolution.

- O **CEOS MIM Database:** Publish and periodically update Information about present and planned Earth observation Satellites in [CEOS MIM Database](#) .This will help in planning and overall coordination among different EO stake holdeers

- O **Open Standards:** Ensure your organization comply to the required Open Standards for data and services

- O **Open Data :** Organizations should ensure that the non-commercial Earth Observation data is proactively made freely available for use, reuse and redistribute to users along with its guide in human and machine readable form

- O **Open Source Software:** Provide users with Open Source Software, which demonstrates use of standards to access your data and services.

- O **Open Science:** Promote concept of open science for collaborative development. Open Science ensures availability of the state-of-the-art algorithms and software providing consistent products from different data providers.

Handbook on github

❖ **Interoperability Handbook is available on github**

❖ [**Discussion**](#) **section can be used to provide comments/feedback**

❖ **Actions can be generated using [Issues](#)**

❖ **You can contribute by**

- **Forking** the repository in your account
- Make necessary modifications
- Submit the modifications/change for merging in main repository by creating the **Pull request.**

https://github.com/ceos-org/interoperability-handbook

CEOS
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CEOS Interoperability Handbook 2.0

Enhancing Interoperability of data and services between different Earth Observation stakeholders

(Please Note this work is under Development, please use Discussion section to provide your comments and feedback)

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- 1. Introduction
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- 3. Vocabulary (Semantics)
- 4. Architecture
- 5. Interface
- 6. Quality
- 7. Policy

Thanks
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