Enabling interoperability across cloud-based EO platforms: Open standards and protocols

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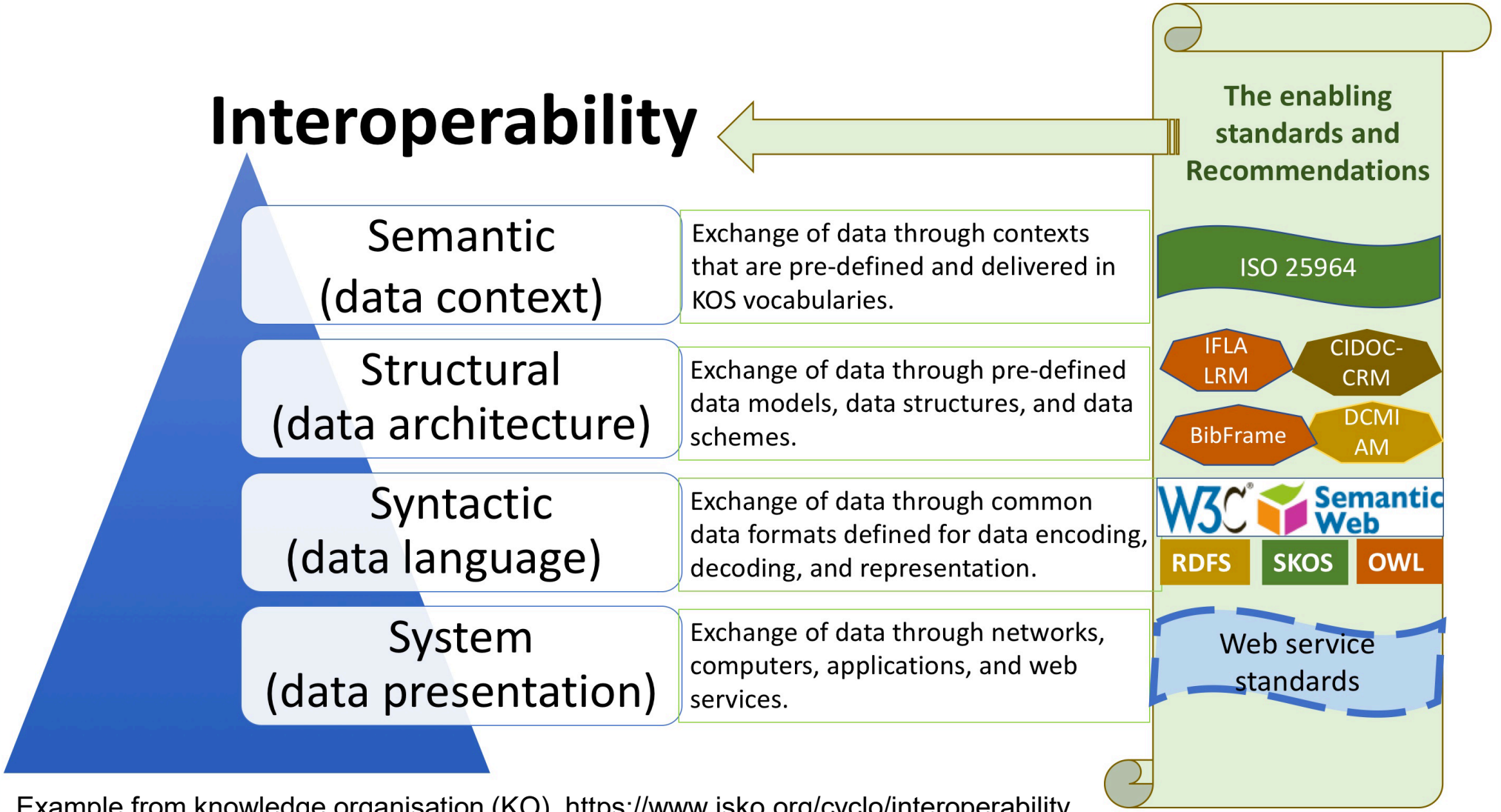
Definition

Interoperability is the
"*ability of two or more systems or components to exchange information and to use the information that has been exchanged.*"

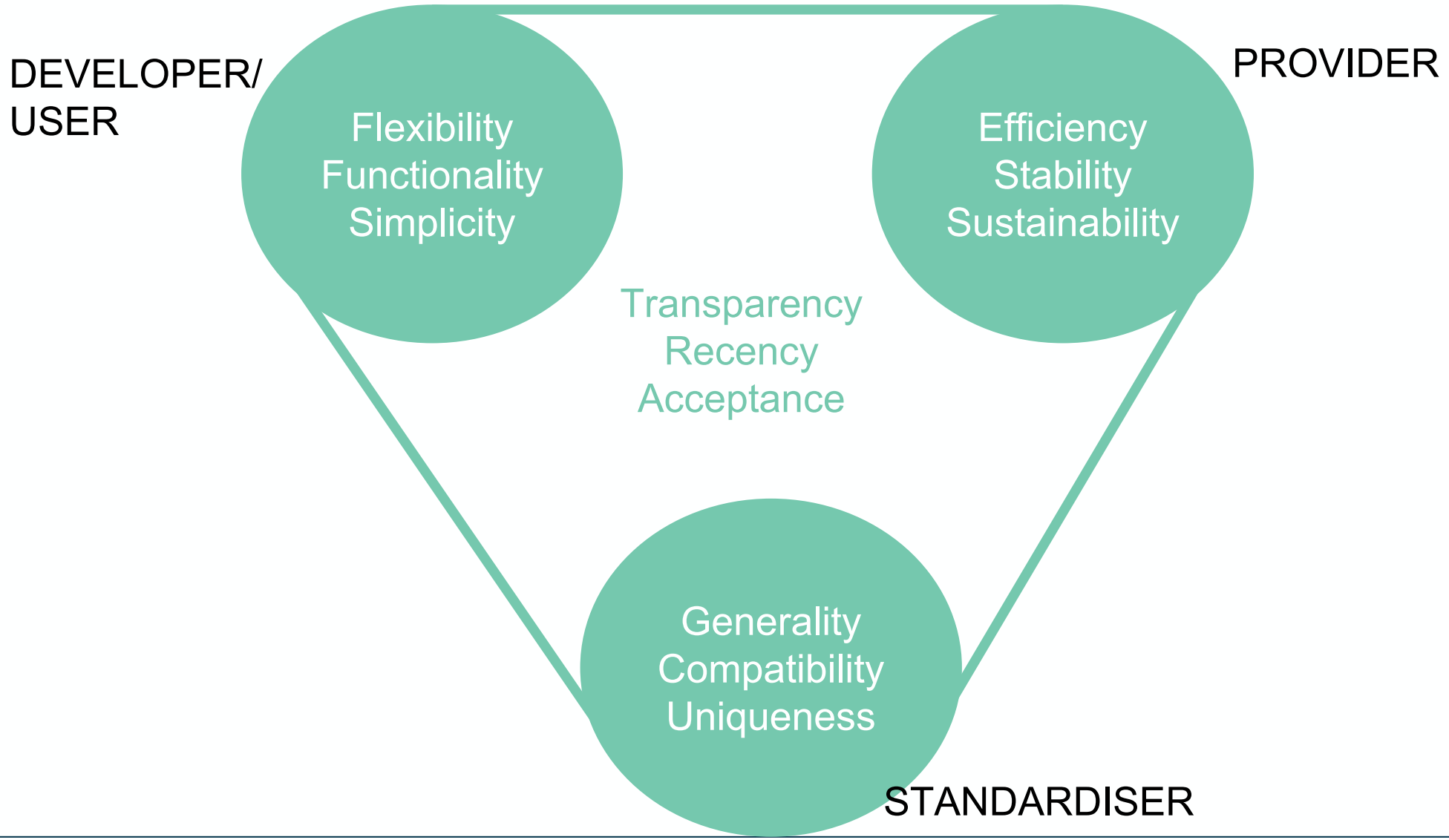
ISO 25964 *Thesauri and Interoperability with other Vocabularies* (ISO 25964-2:2013)

Types of Interoperability



Example from knowledge organisation (KO), https://www.isko.org/cyclo/interoperability

Interoperability concerns and expectations



Questions and reflections

- How did you get into interoperability of EO data and platforms? Which issues did you encounter first?
- How would you break down interoperability into different types/aspects?
- Which types of interoperability issues have you dealt with over time?
- Can you give examples of where you:
  - helped overcoming interoperability between specific (EO) platforms?
  - contributed to techniques and methods to build standards enabling generic interoperability?
- Which types of interoperability would you consider today as resolved or least challenging? Why?
- Which types of interoperability do you now perceive as most challenging? Why?
- What do you propose to address them?
- What are your main expectations in terms of benefits that result from increased interoperability of Earth Observation Data and Platforms?

Famous last words

“choice is the enemy of interoperability”

Josh Lieberman, OGC

… or in other words: less is more!

Backup slides

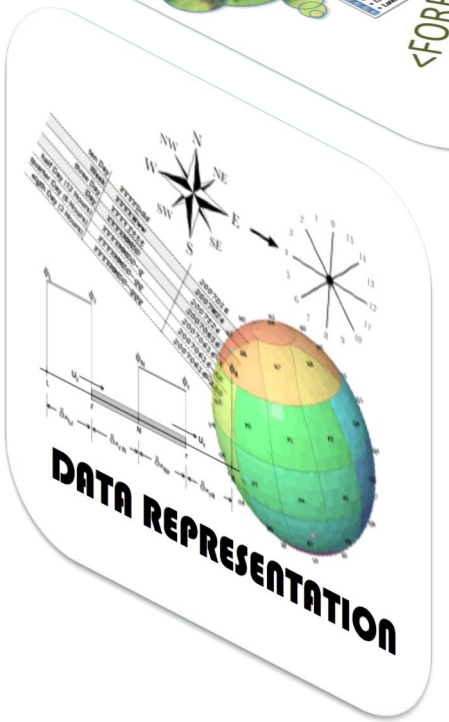
Benefits of interoperability

- Effectiveness
- Efficiency
- Operationality
- Reproducibility
- Re-usability
- Scalability
- Independence (Overcome ‘lock-in’)

EO Data Cube / Platform perspectives I

- *Parametrisation*
- *Semantics*

- *Quality metrics*
- *Metadata*



- *Discretisation*
- *Digitisation*
- *Binning (1D)*
- *Gridding (2D)*
- *Encoding*

- *Formats*
- *File systems*
- *Databases*
- *Tiling*
- *Organisation*

[some illustrations courtesy: *R. Gibb; P. Baumann/rasdaman*]

EO Data Cube / Platform perspectives II

- *IT Hardware (storage, proc. network)*
- *Facilities (buildings, power, …)*

- *Functionality:*
  - *Querying*
  - *I/O*
  - *Manipulation*
  - *Analysis*
  - *Visualisation*
- *APIs*

- *Standards*
- *Connectivity*
- *Scalability*

P. Strobl, P. Baumann, A. Lewis, Z. Szantoi, B. Killough, M. Purss,
M. Craglia, S. Nativi, A. Held and T. Dhu, (2017), "The Six Faces of the Data Cube"
BiDS'17, Toulouse (France), https://publications.europa.eu/en/publication-detail/-/publication/78a7f64a-d3ee-11e7-a5b9-01aa75ed71a1/language-en

Processing Levels re-consideration

Processing Levels were so far defined as a more or less generic chain of refinement regarding the radiometry (or more general the 'measurand') and the geometry of the (satellite) observation data.

If one considers these two types of refinements separate, a matrix could be built in which classical Processing Levels would (roughly) appear as below:

Measurand / Geometry	M/0 - raw	M/1 - sensor calibrated	M/2 - target calibrated	M/3 - harmonised	M/4 - derived
G/A - raw	L0	L1A			
G/B - geolocated		L1B			
G/C - orthorectified		L1C	L2(A)		
G/D - resampled1				L3	
G/E - resampled2					L4

Processing Levels re-consideration

For the discussion of 'Analysis Readiness' of data, a clearer separation of these two 'dimensions' of processing yields a chance to obtain a transparent scheme in which also recommendations about best possible paths (processing sequences) are feasible. This would be advantageous for defining 'Analysis Ready Data' standards at different processing Levels and for their respective interoperability.

Measurand / Geometry	M/0 - raw	M/1 - sensor calibrated	M/2 - target calibrated	M/3 - harmonised	M/4 - derived
G/A - raw	L0	L1A			
G/B - geolocated		L1B	L2B	?	??
G/C - orthorectified		L1C	L2C	L3C	L4C
G/D - resampled1		L1D	L2D	L3D	L4D
G/E - resampled2				L3F	L4F

ideal tolerable critical