Recommendations for Implementing Open Science

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An Open Science solution should be researcher-centric

National Academies of Sciences New Report: Open Science by Design (2018)

Researcher at the center:

- **Researcher contributes to open science**
- **Researcher takes advantage of the open science practices**
- **From data generation to validation, dissemination, and preservation**

OpenAire New White Paper: Achieving Open Science in the European Science Cloud (2019)

Researcher at the center:

- **Researcher publishes all kinds of scientific products (data, software, workflows)**
- **Open as the default**
- **Services provide technology and training for researchers**

Data Sharing is key to Open Science

Dataverse: an open-source platform for sharing and archiving research data

- Launched at Harvard in 2006
- Used in 6 continents
- 48 Dataverse sites
- 5500 dataverses (branded datasets collections)
- 120K datasets
- 10M data files downloads
- Vibrant open-source community

A National Dataverse Site: DataverseNO

DataverseNO
Dataverse Network Norway

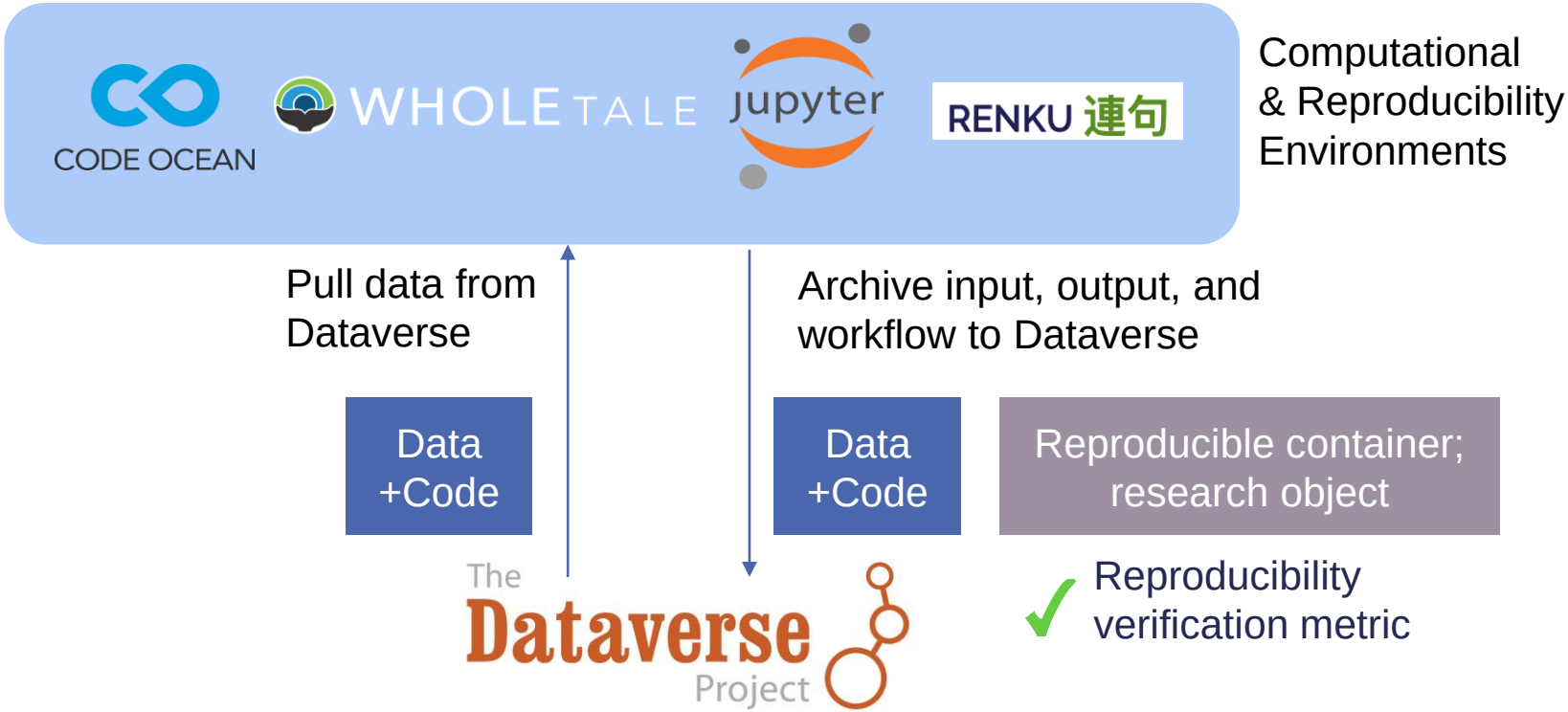
- **8 universities in Norway** as members**;** the other 3 to join soon
- **Policies and guidelines common** to all DataverseNO members
- Global and local support
- Applied for Core Trust Seal certificate
- Dataverse Europe Workshop January 2020
- https://site.uit.no/dataverseno/

But data sharing only is not sufficient for Open Science

Open Science should include sharing of:

- Code associated with data to reproduce research results
- Workflows to describe research steps and data transformations
- Research software, algorithms, and tools for reuse

Data repositories should be integrated with computational environments



Sharing data and computing together helps create a Data Commons to collaborate

"…*a data commons brings together (or co-locates) data with cloud computing infrastructure and commonly used software services, tools & applications for managing, analyzing and sharing data to create an interoperable resource for a research community*"

Robert Grossman

Data scientist at the University of Chicago; Director of the Open Commons Consortium

https://medium.com/@rgrossman1/a-proposed-end-to-end-principle-for-data-commons-5872f2fa8a47

Open Science does not always mean fully open data

Metadata should be open for discoverability;
But data restricted when needed.

DataTags: Standardized Data Policies

DataTag	Data Access	Authorization	Data Use Agreement	Encryption
Blue	Public			
Green	Public	+ Register		
Yellow	Restricted	+ Approval Needed	+ Click-thru DUA	+ Encrypted transit
Orange	Restricted	+ Approval Needed	+ Signed DUA	+ Encrypted transit + Encrypted storage
Red	Restricted	+ Approval Needed	+ Signed DUA + Two-factor Auth	+ Encrypted transit + Encrypted storage
Crimson	Restricted	+ Approval Needed	+ Signed DUA + Two-factor Auth	+ Encrypted transit + Multi-encrypted storage

Sweeney, Crosas, Bar-Sinai, 2015. Sharing Sensitive Data with Confidence: The DataTags System, Technology Science

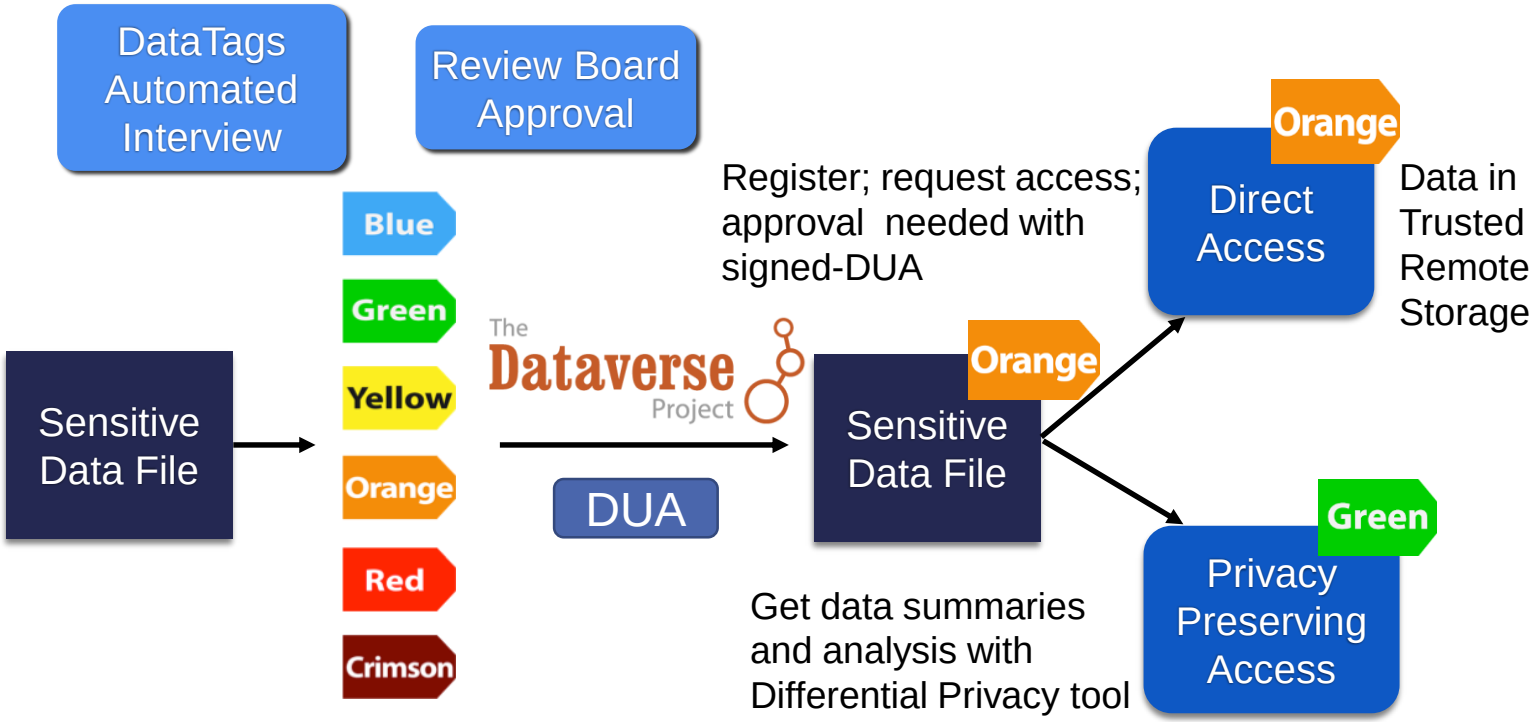
OpenDP: A New Project for Sensitive Data

A **community effort** to build a **trustworthy** and **open-source** suite of **differential privacy** tools that can be **easily adopted** by custodians of sensitive data to make it available for statistical research.

- To be launched in **2020** with Sloan Foundation funding
- Initially led by **Harvard Privacy Tools** project (PIs: Vadhan, Honaker, King, Crosas)

*A tool (algorithm) is **differentially private** if its output cannot reveal whether any individual's data was included in the original dataset or not*.

Dataverse + DataTags + OpenDP: Sharing and analyzing sensitive data



In conclusion, an Open Science implementation should include:

- Incentives to share data, software/code, and other research outputs
- Metadata and format standards for discovery and reuse
- Machine-readable data for management and usage by computers
- Sufficient information to reuse the data, software, workflows (all research outputs)
- Support for software licenses and data use agreements
- **Public metadata (at a minimum for citation) even when data are restricted**
- **Integration of archival repositories with computational environments**
- **Solutions for collaborations that access sensitive, private data**

Thanks

The Dataverse® Project

IQSS
The Institute for Quantitative Social Science

HARVARD UNIVERSITY

GDCC
The Global Dataverse Community Consortium
Supporting Dataverse repositories around the world.

Harvard University
Privacy Tools Project

dataverse.org | dataversecommunity.global/ | scholar.harvard.edu/mercecrosas