Practical information

- 15 minutes breaks between sessions
- Remember to mute when listening
- Use chat actively during sessions
- Use “raise hand” functionality during discussions or to indicate wish to ask questions
- No recording of sessions are planned
- Working groups are organised using the breakout session functionality in Zoom
  - Participants are allocated to sessions by host
- Supposed to be an interactive course!
- Picture of all participants wanted, will start with this

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Motivation:
Why do we need data management?

Øystein Godøy

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Outline

- Data Sharing and Management Snafu in 3 Short Acts
  - https://www.youtube.com/watch?v=N2zK3sAtr-4
- Why do we need data management?
- Science life cycle/Data life cycle
- How to change data sharing culture.
- What are the FAIR data principles?
  - How do they help with good data management?
- External boundary conditions by funding agencies and publishers.
- Scientific data as service.
- Data management plan.

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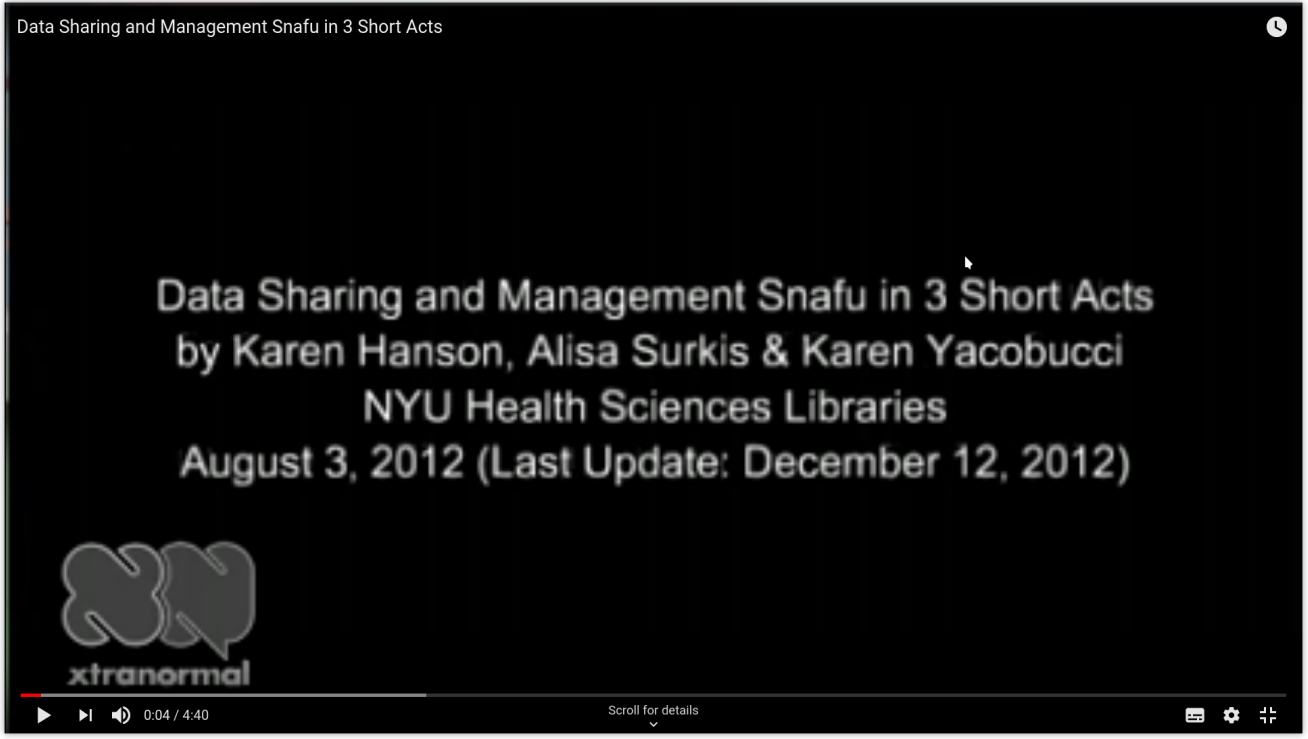
Data Sharing and Management Snafu in 3 Short Acts



https://www.youtube.com/watch?v=N2zK3sAtr-4

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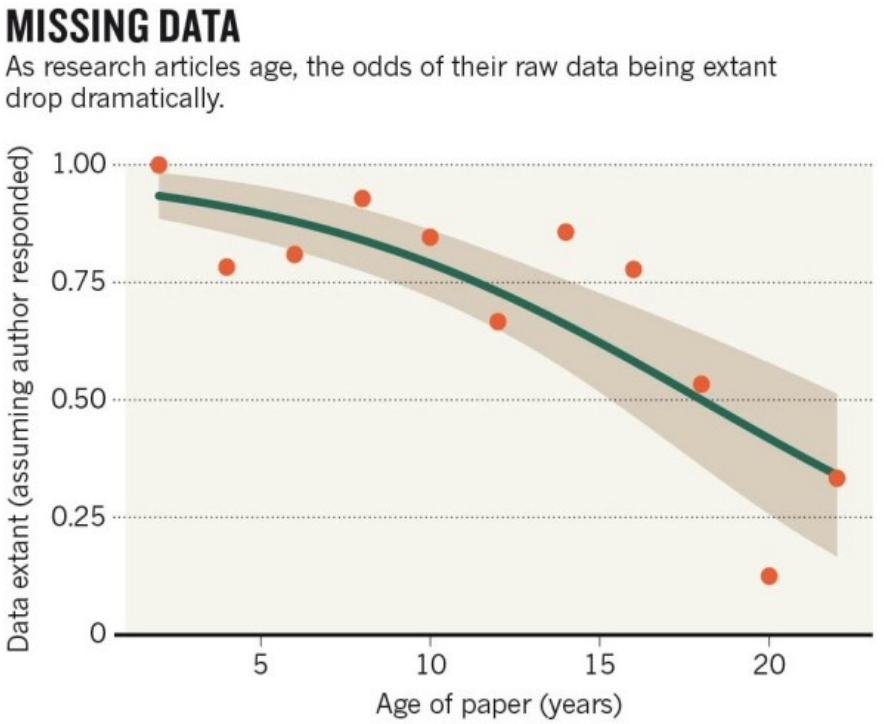
Why do we need data management?

- Loosing scientific data
  - Decline can mean 80% of data are unavailable after 20 years.
    - Gibney and Van Noorden (2013), Nature



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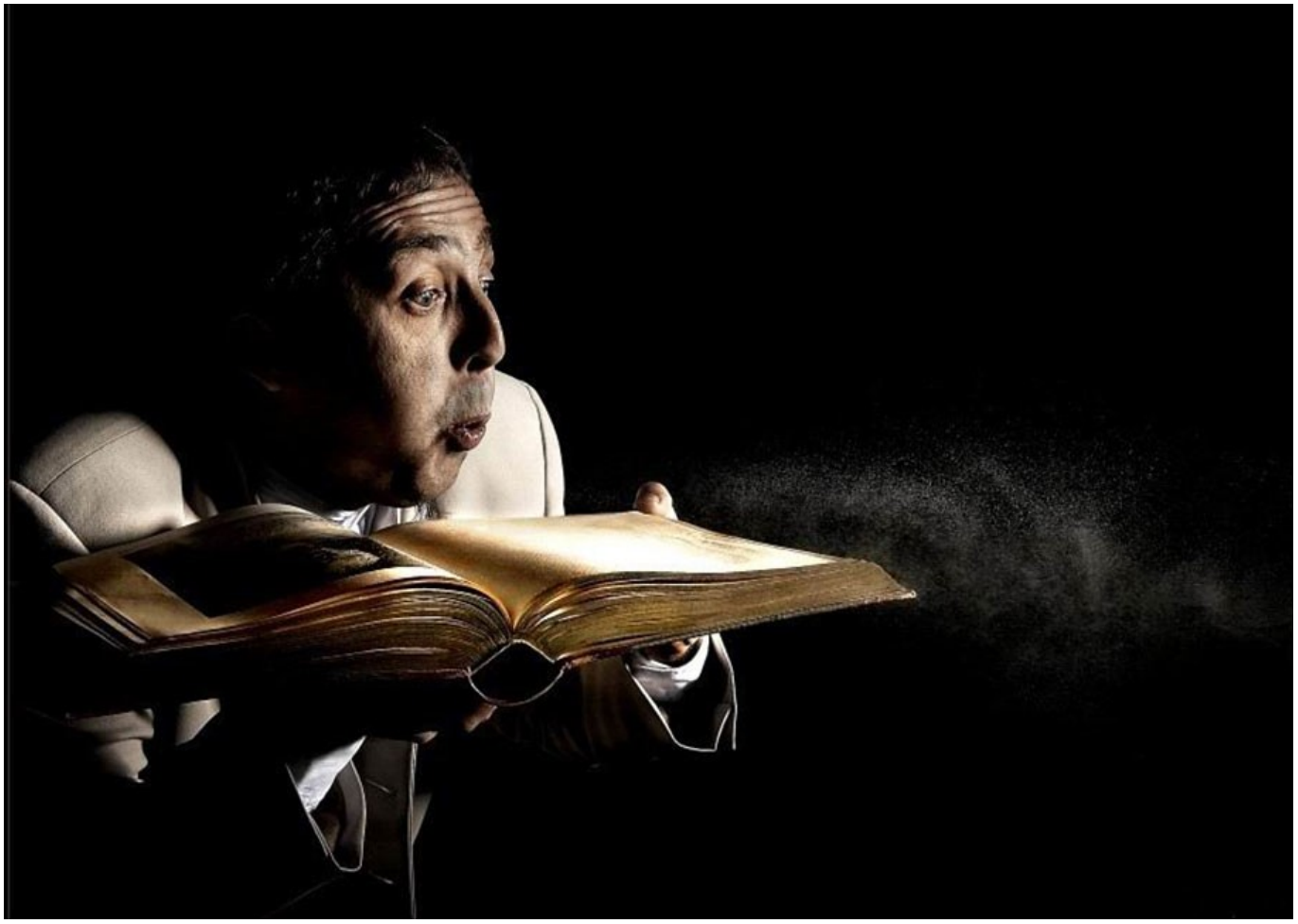

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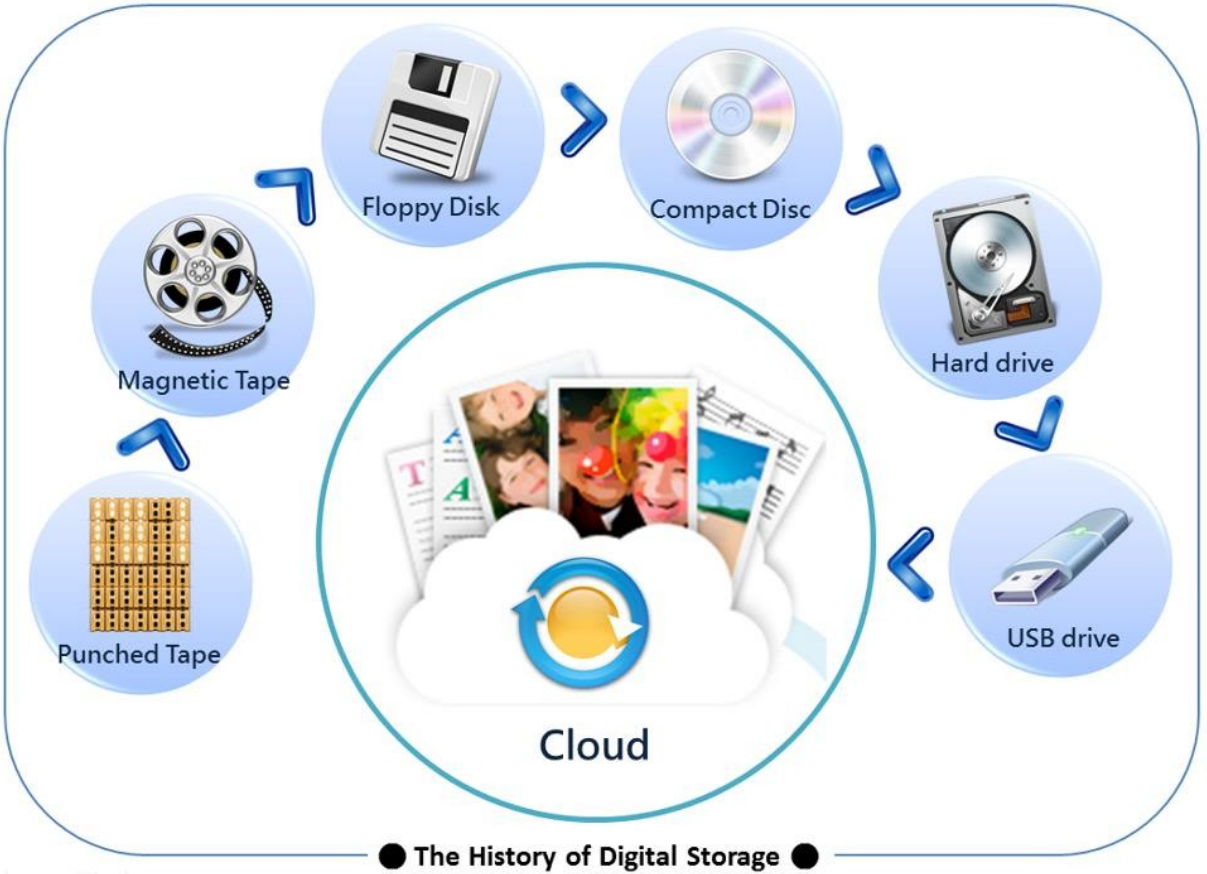

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Why bother with structured data management?

- Benefits
  - Maximise public investment in data collection and production
  - Promote scientific collaboration
  - Promote interdisciplinary science
  - Promote scientific transparency
  - Leave a legacy
- Science paradigms
  - according to Jim Gray
  - empirical science
  - theoretical science
  - computational science
  - data exploration science

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Why share data?

- Research sponsor require it
  - recognition as an authoritative source and wise investment
- Quality control
  - improved data quality due to expanded use, field checks, and feedback
- Improved visibility
  - improved connections to scientific network, peers, and potential collaborators
- Journals require it
  - Reproducible research
- Far upstream sponsors require it

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Making Your Research Easier and Cheaper

The 5 P's matter!

Prior
Planning
Prevents
Poor
Performance!

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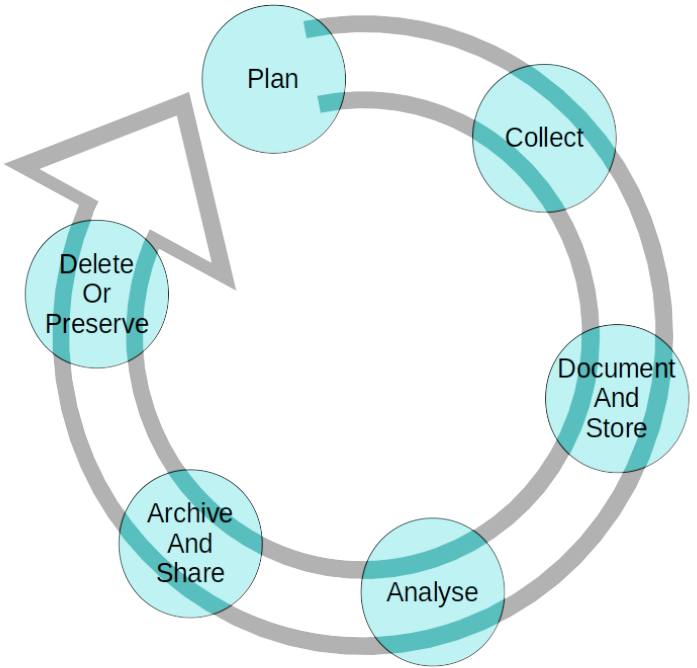
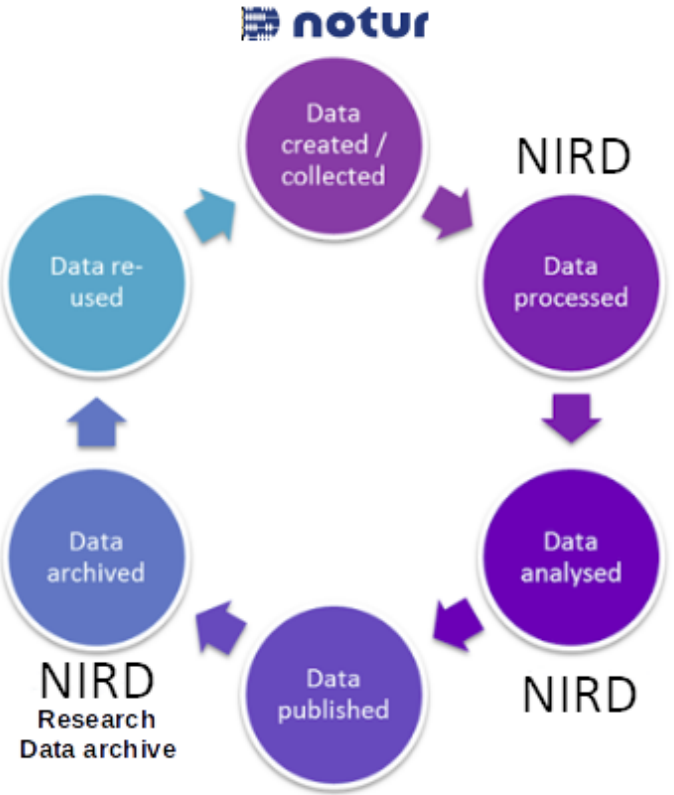
Ruth Duerr, NSIDC, 2013 ESIP Material

ESIP

Science life cycle/Data life cycle





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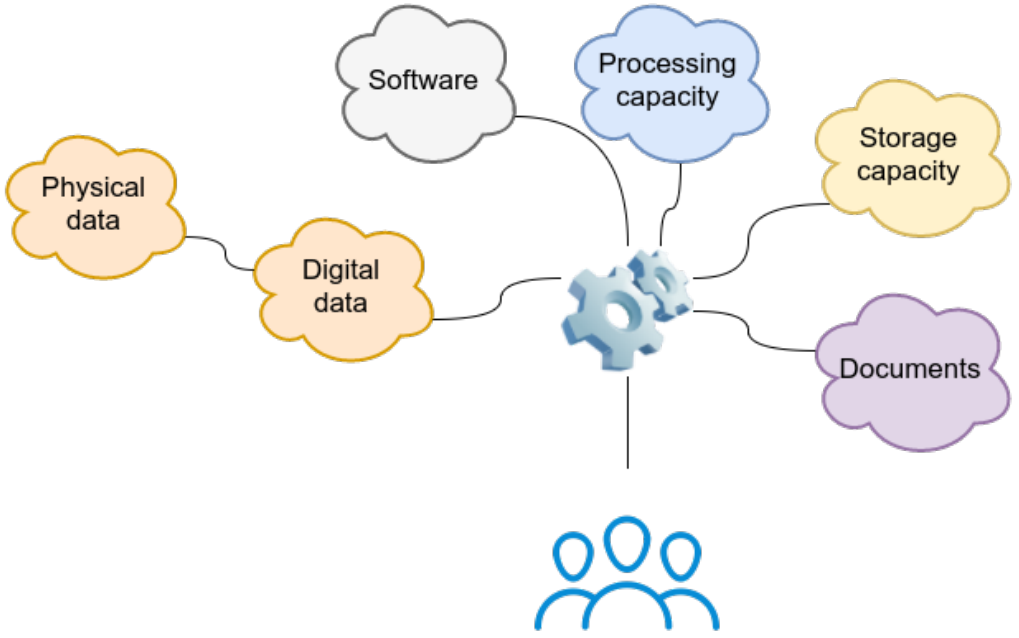
https://codemeta.github.io/



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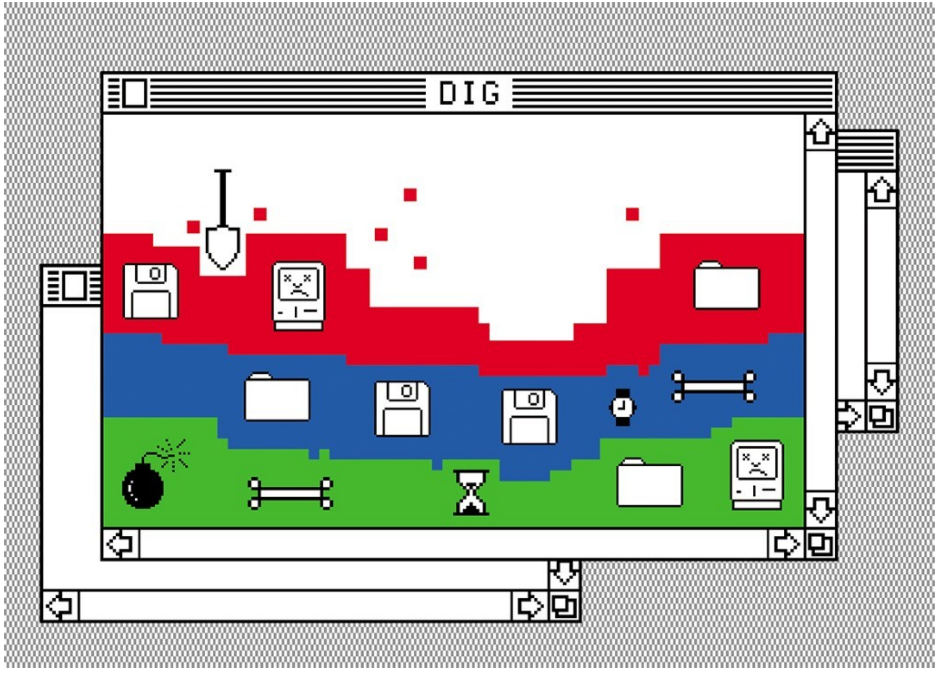
Challenge to scientists: does your ten-year-old code still run?

https://www.nature.com/articles/d41586-020-02462-7



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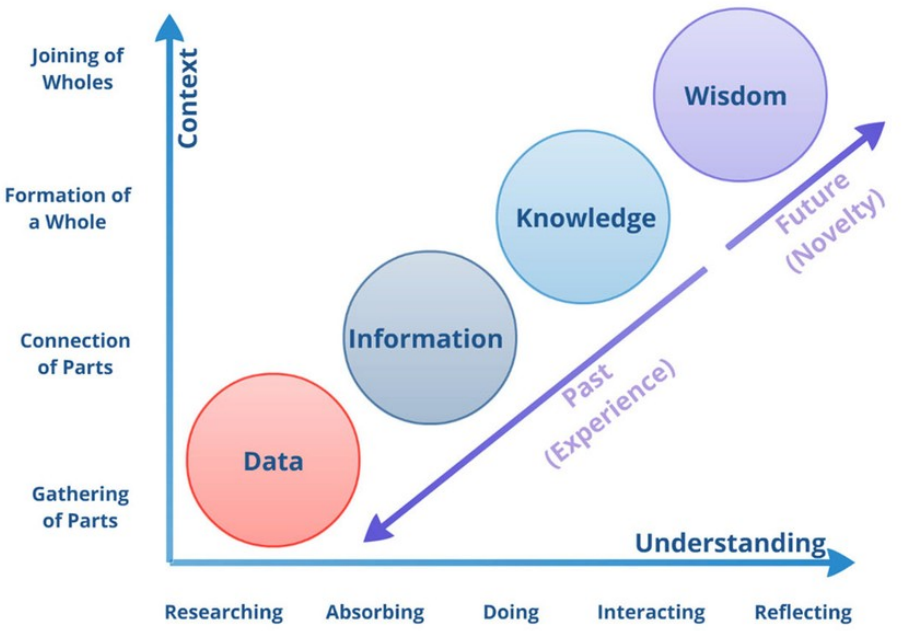
DIKW chain

- How to transition from data to knowledge and understanding...
  - The illustration is a common redrawing of Russ Ackoff “From Data to Wisdom”
    - Journal of Applied Systems Analysis, Volume 16, 1989 p 3-9
- DIKW is necessary to
  - Take care of data for the future
  - Ensure data is the basis for knowledge
    - Now and in the future
  - Knowledge based management depends on national, regional and global interaction



http://www.easterbrook.ca/steve/2012/09/what-is-climate-informatics/

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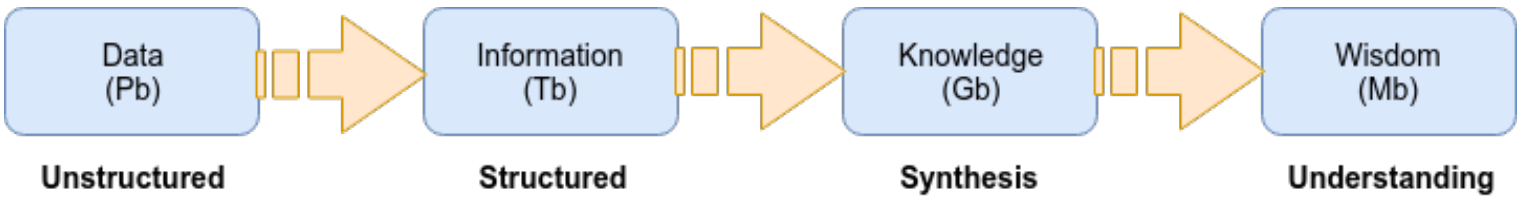
DIKW chain



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The reality today

Recreated from Klump et al. 2006

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How to change data sharing culture?

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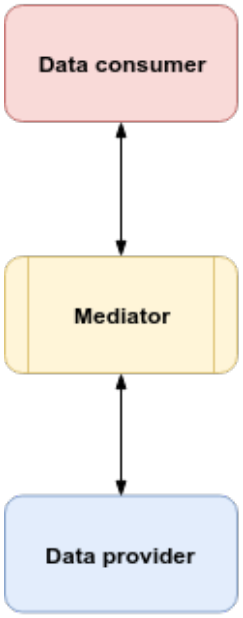
Bridging between data management actors



Unwilling

- Do not want to change behaviour, existing tools have worked well.
- Want to continue as before.
- Does not see the benefit of standardisation, until explicitly explained/demonstrated or through new

Willing

- Wants to translate between provider and consumer.
- Still relies on some sort of standardisation in order to be cost effective.
- Must know dimensions, structures, content, missing values, units, aggregation levels, ...

Unwilling and skeptical to potential users

- Do not want to change behaviour, legacy system(s).
- Want to continue as before.
- Understands own requirements (knows the data well).

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- A prerequisite for efficient data sharing across communities is application of proper metadata and standards
- Although standards exist, they are often not used by data providers who doesn't see the benefit
- Lacking understanding for the importance of use metadata
  - Enabling reuse across communities and generations
  - Lacking understanding for the importance of semantic standardisation
- Need a business model crediting all involved parties
  - Scientists, institutions, data centres, ….
- It is about leaving a legacy

The FAIR Guiding Principles for scientific data management and stewardship

- To be **Findable**:
  - F1. (meta)data are assigned a *globally unique and persistent identifier*
  - F2. data are described with *rich metadata* (defined by R1 below)
  - F3. metadata clearly and explicitly include the identifier of the data it describes
  - F4. (meta)data are *registered or indexed in a searchable resource*
- To be **Accessible**:
  - A1. (meta)data are retrievable by their identifier using a *standardized communications protocol*
  - A1.1 the protocol is open, free, and universally implementable
  - A1.2 the protocol allows for an authentication and authorization procedure, where necessary
  - A2. metadata are accessible, even when the data are no longer available
- To be **Interoperable**:
  - I1. (meta)data *use a formal, accessible, shared, and broadly applicable language for knowledge representation*
  - I2. (meta)data *use vocabularies* that follow FAIR principles
  - I3. (meta)data *include qualified references* to other (meta)data
- To be **Reusable**:
  - R1. meta(data) are richly described with a plurality of accurate and relevant attributes
  - R1.1. (meta)data are released with a clear and accessible *data usage license*
  - R1.2. (meta)data are associated with detailed provenance
  - R1.3. (meta)data *meet domain-relevant community standards*

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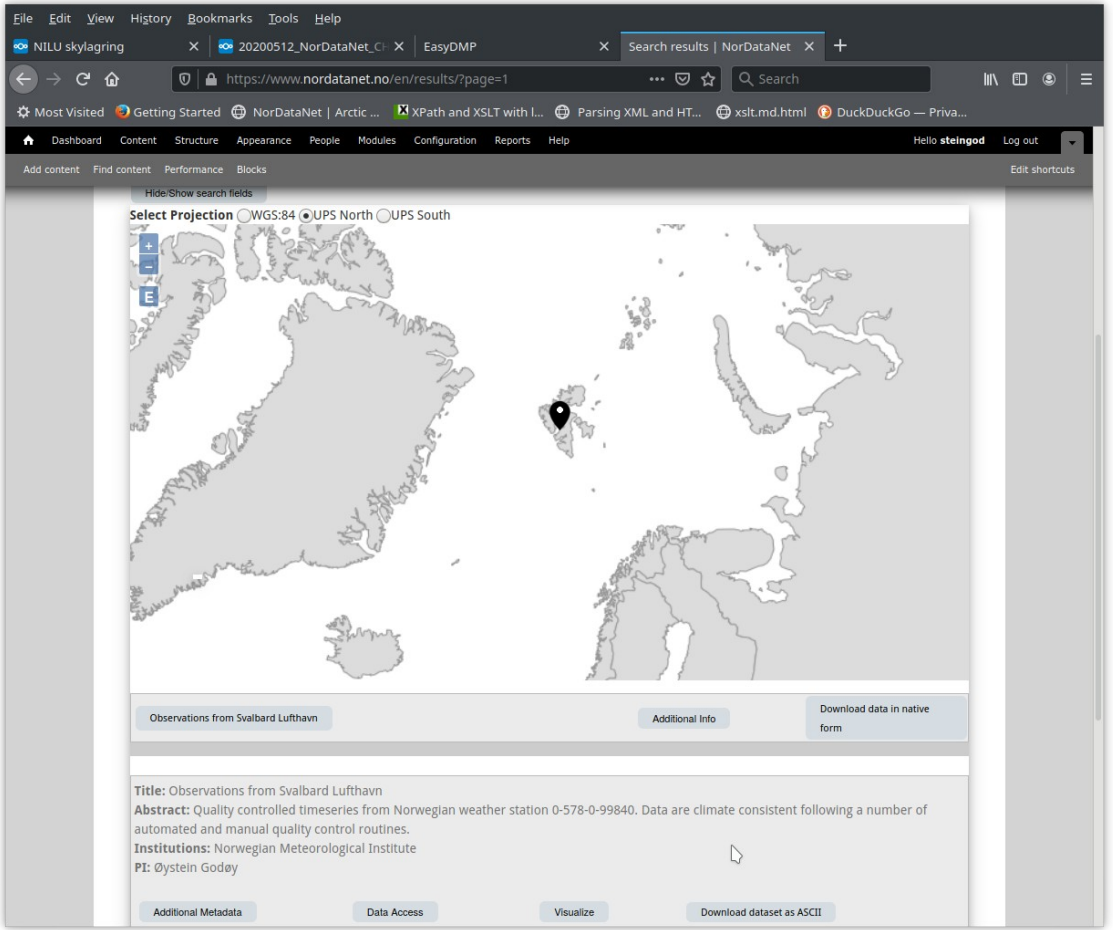
Wilkinson, M., Dumontier, M., Aalbersberg, I. et al. The FAIR Guiding Principles for scientific data management and stewardship. Sci Data 3, 160018 (2016). https://doi.org/10.1038/sdata.2016.18

Scientific data as service

- From science to service
  - Goddard, Science 23 Sep 2016: Vol. 353, Issue 6306, pp. 1366-1367 DOI: 10.1126/science.aag3087



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Data management plans

A data management plan (DMP) is a written document that describes the data you expect to acquire or generate during the course of a research project, how you will manage, describe, analyze, and store those data, and what mechanisms you will use at the end of your project to share and preserve your data.

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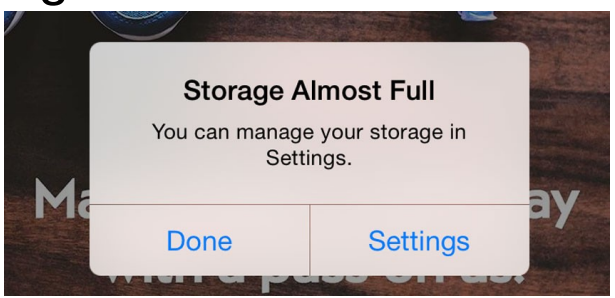
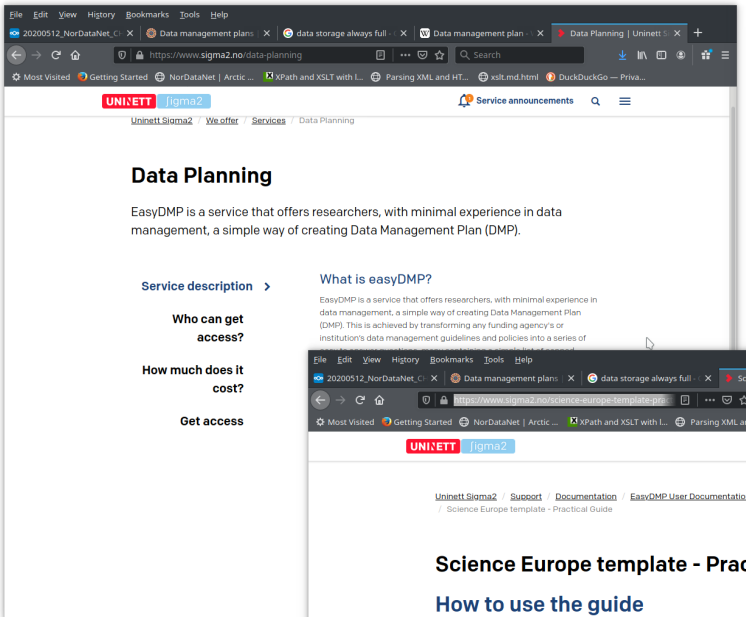
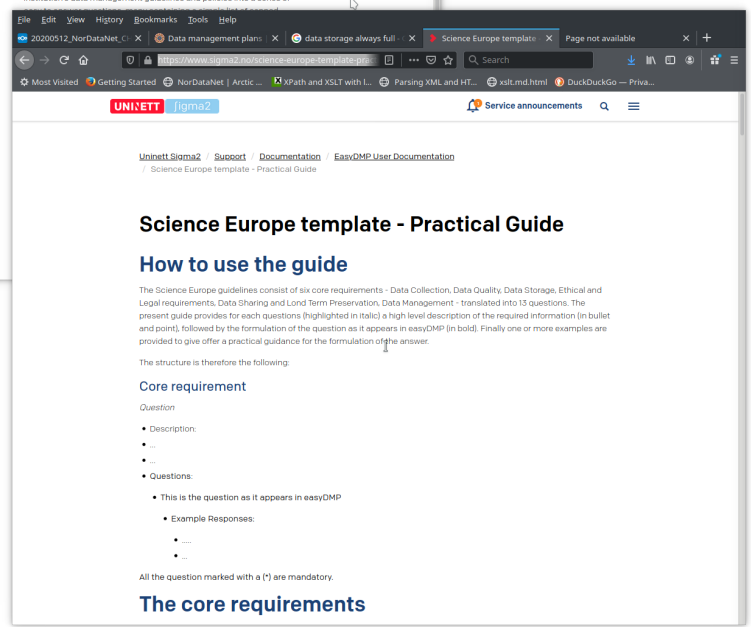
Stanford Libraries definition

Data management plans

- Are increasingly being required by funding agencies
  - e.g. RCN, EU
- And by e-infrastructure providers
  - e.g. Sigma2







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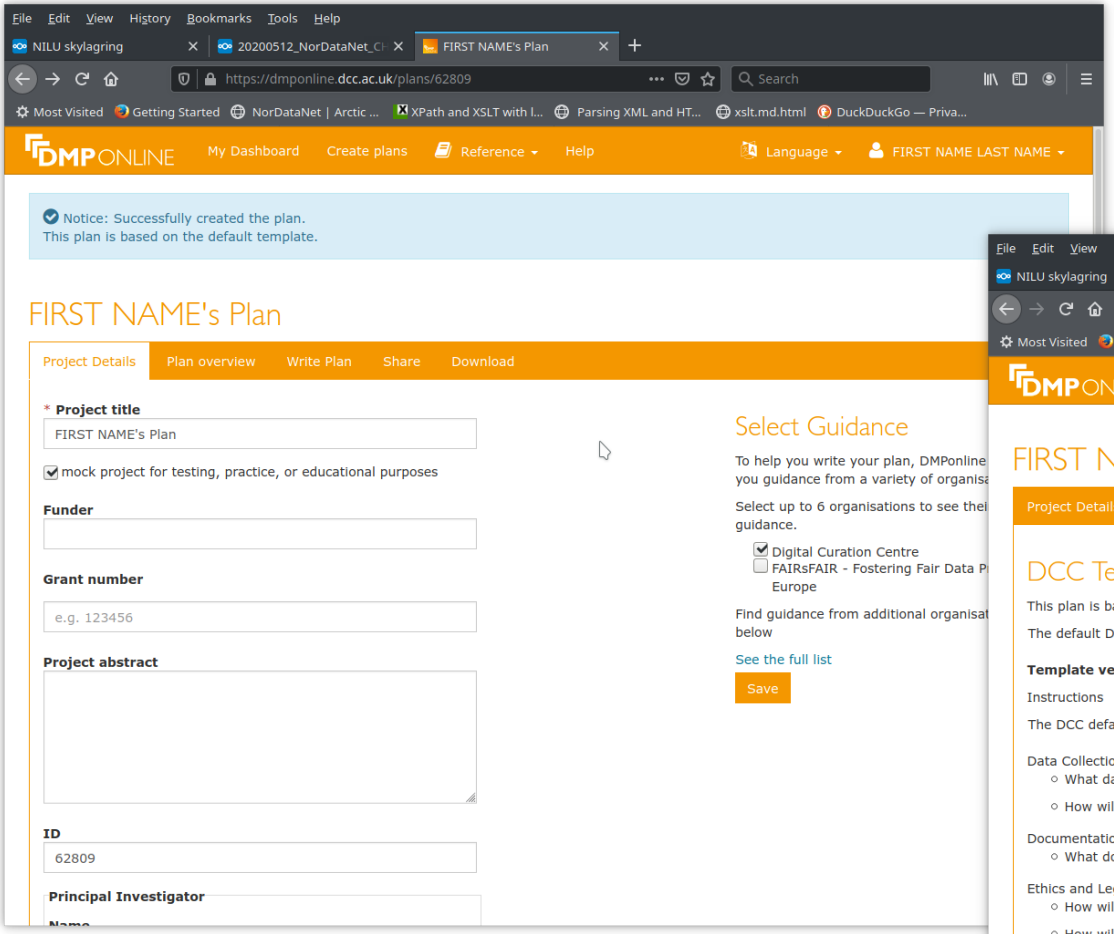

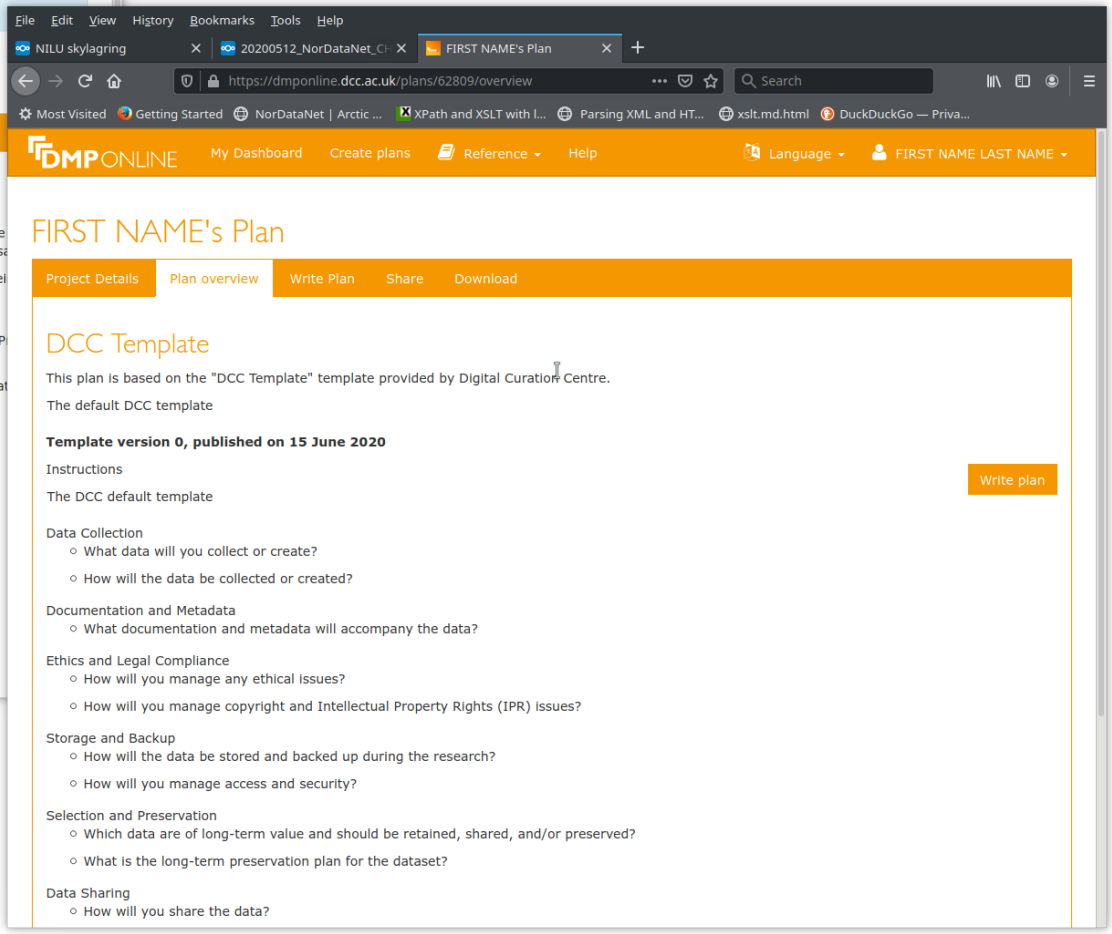

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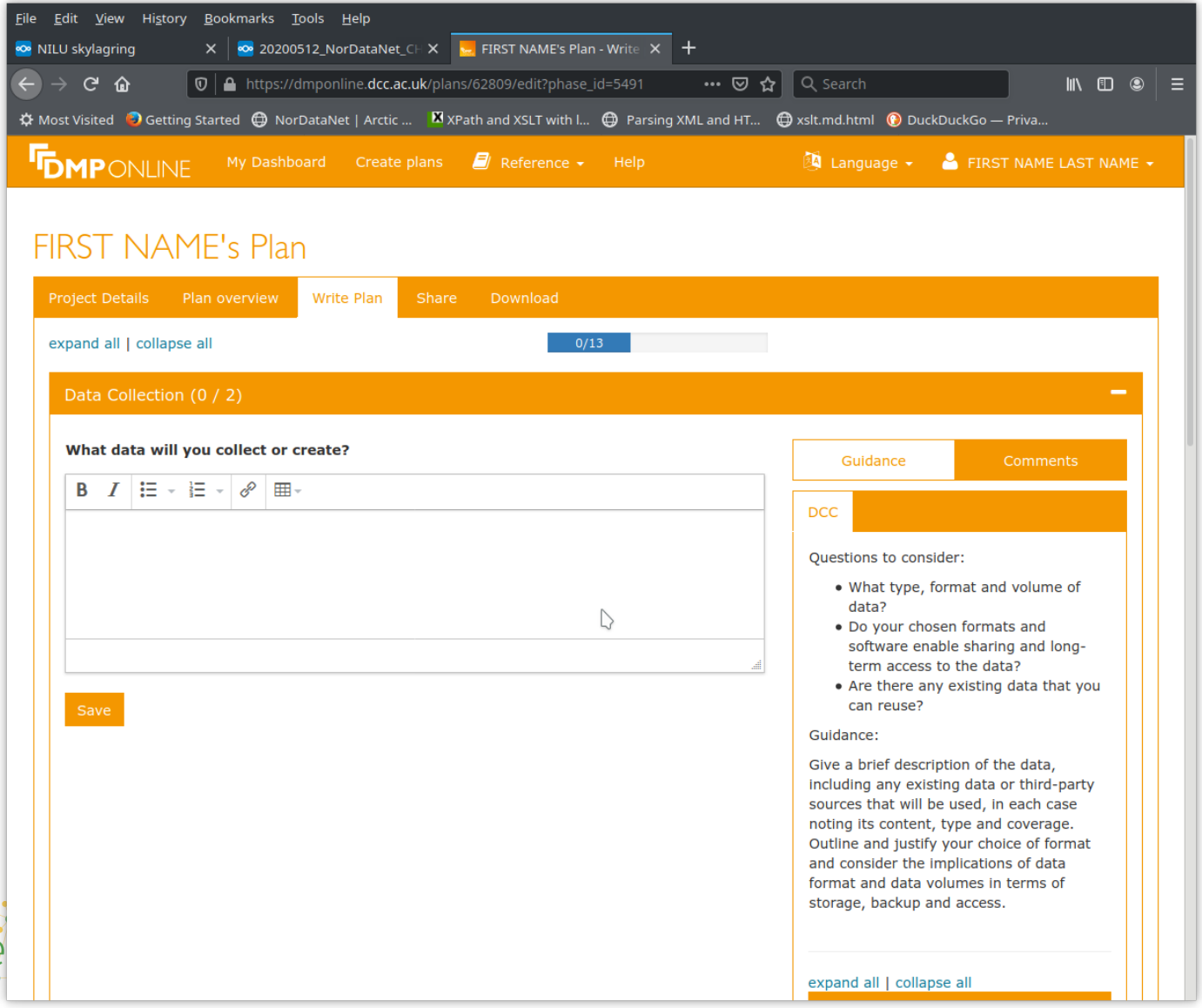

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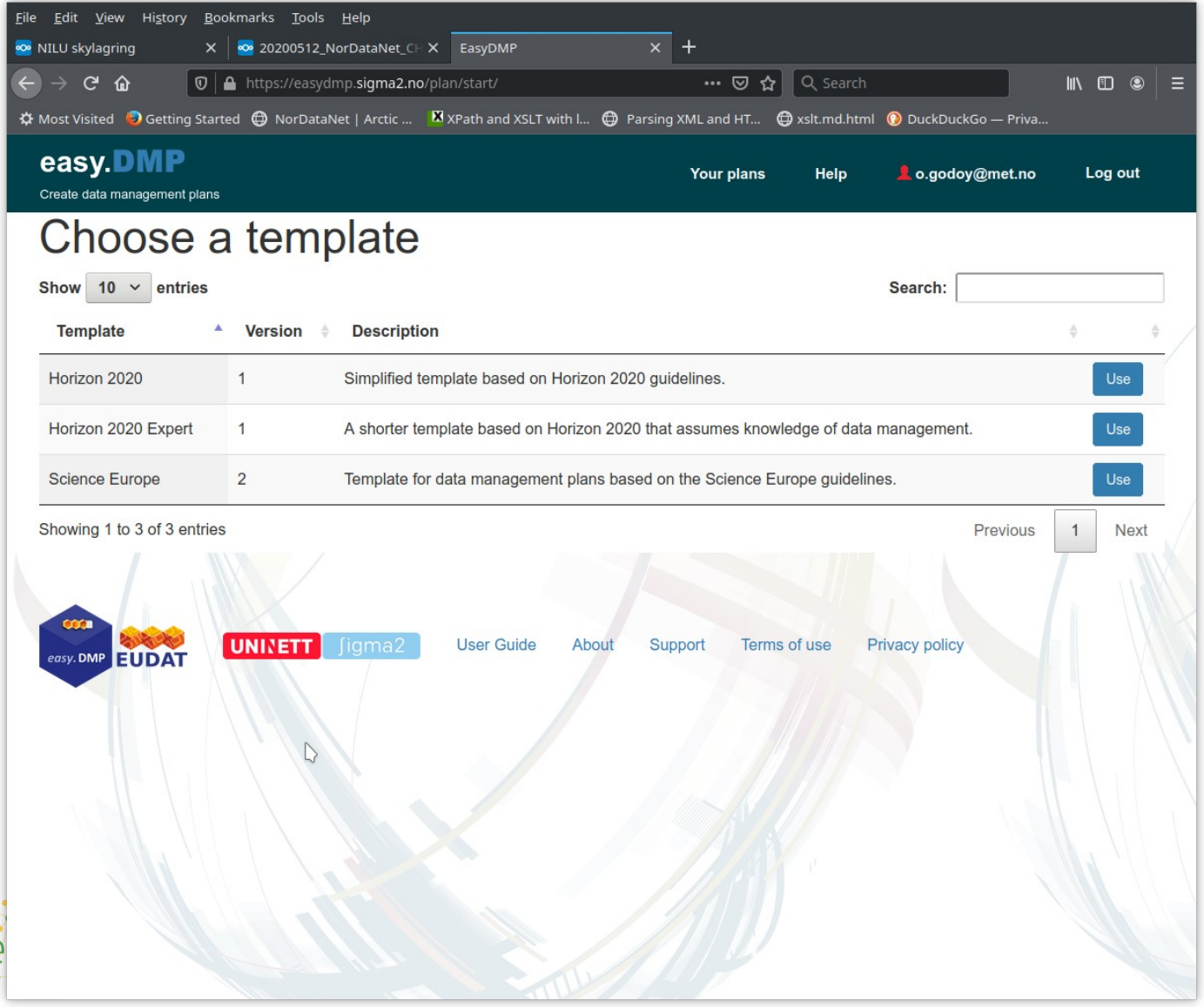

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