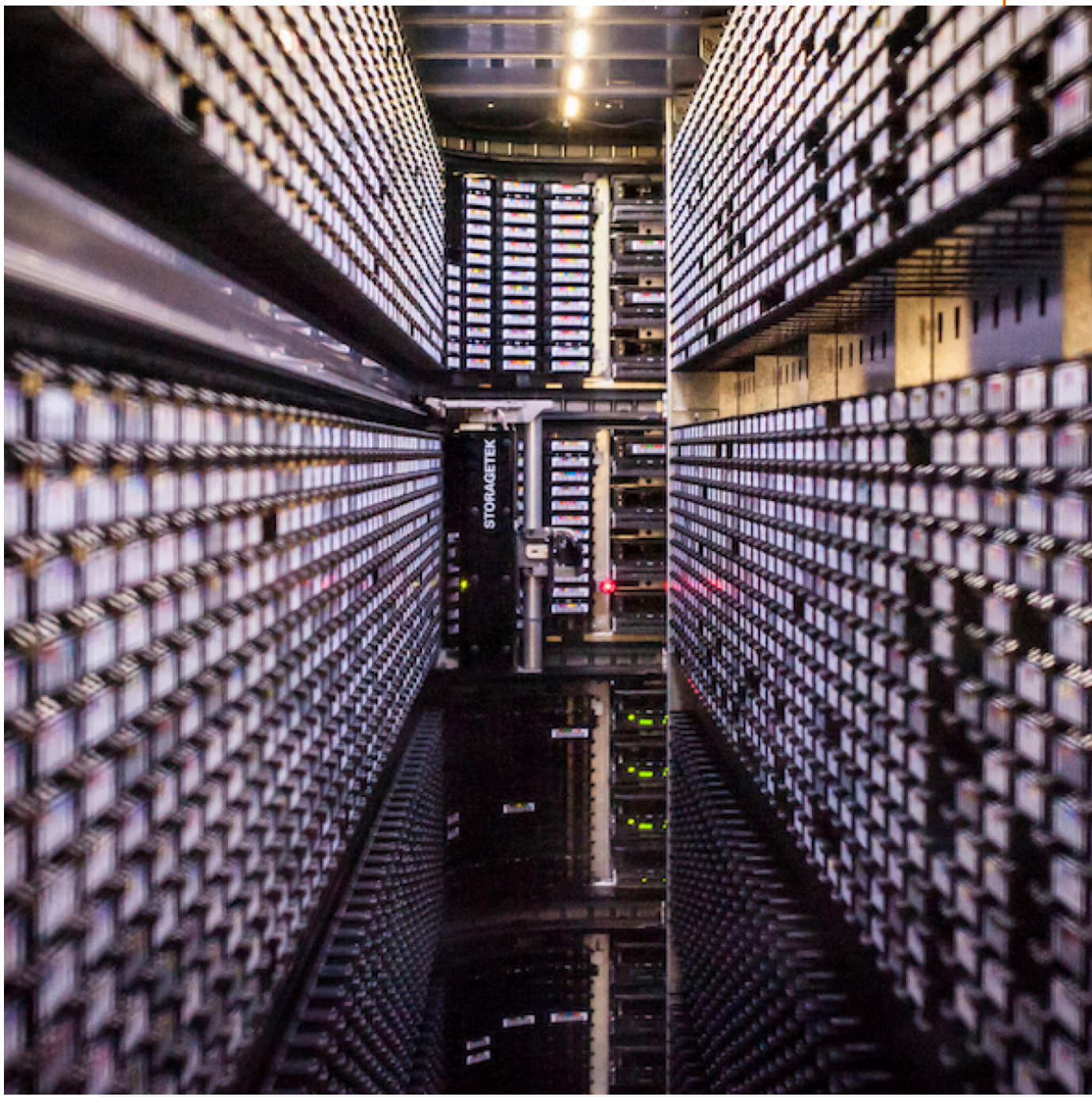
Data Management Services at SURF



Data Challenges

- Data Explosion
  - More and more data is being created
  - Navigate, transfer and share data
  - Reuse existing data

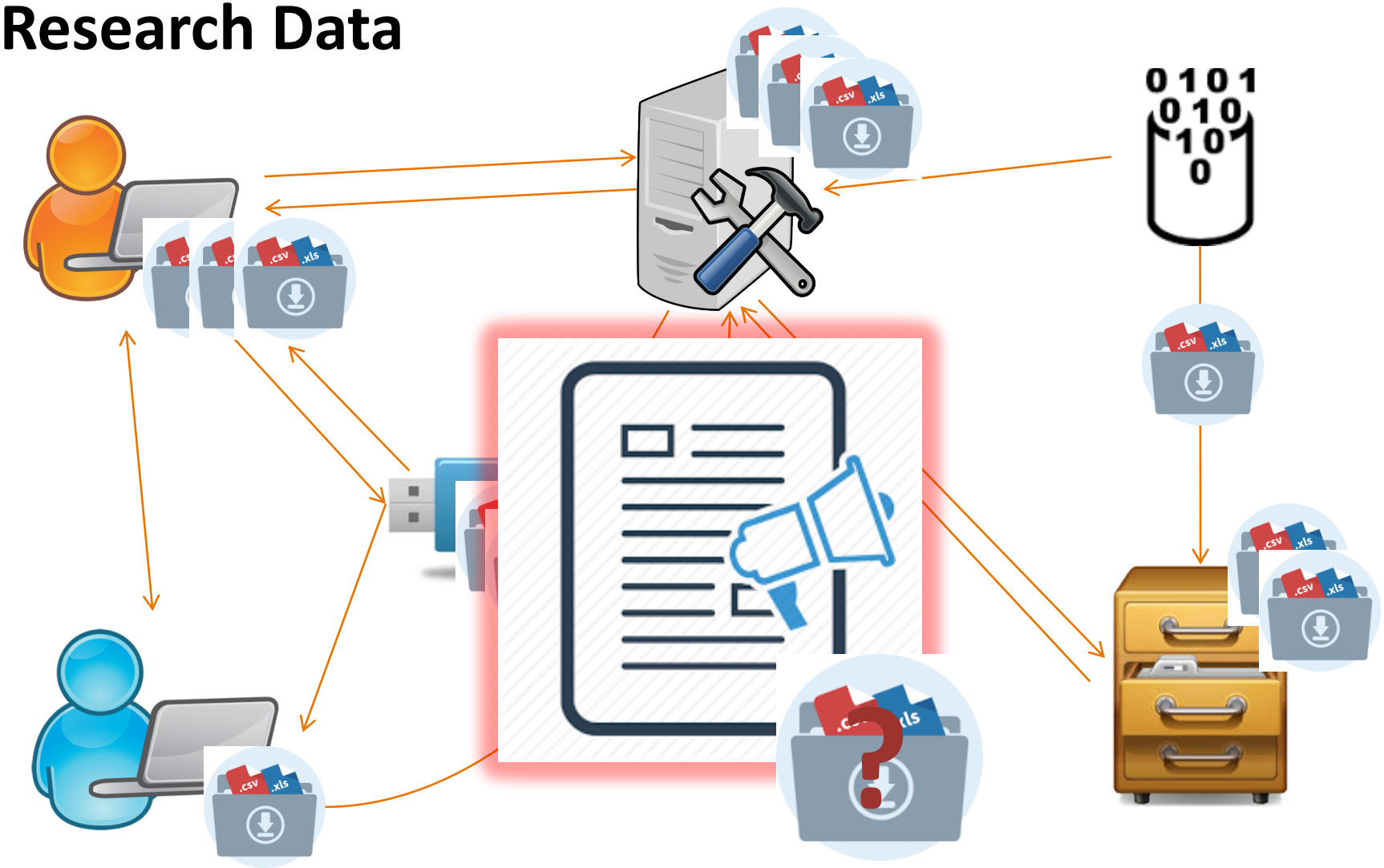
- Data Loss:
  - Natural disaster, infrastructure failure, storage failure, …
  - Application software failure, Format obsolescence,…
  - Human error, malicious attack,..

Research Data Management

- **Research Data**: “materials generated or collected during the course of conducting research”, by The National Endowment for the Humanities.

- **Data Management**: Actions that contribute to effective **storage**, **preservation** and **reuse of data** and **documentation** throughout the **research lifecycle**.

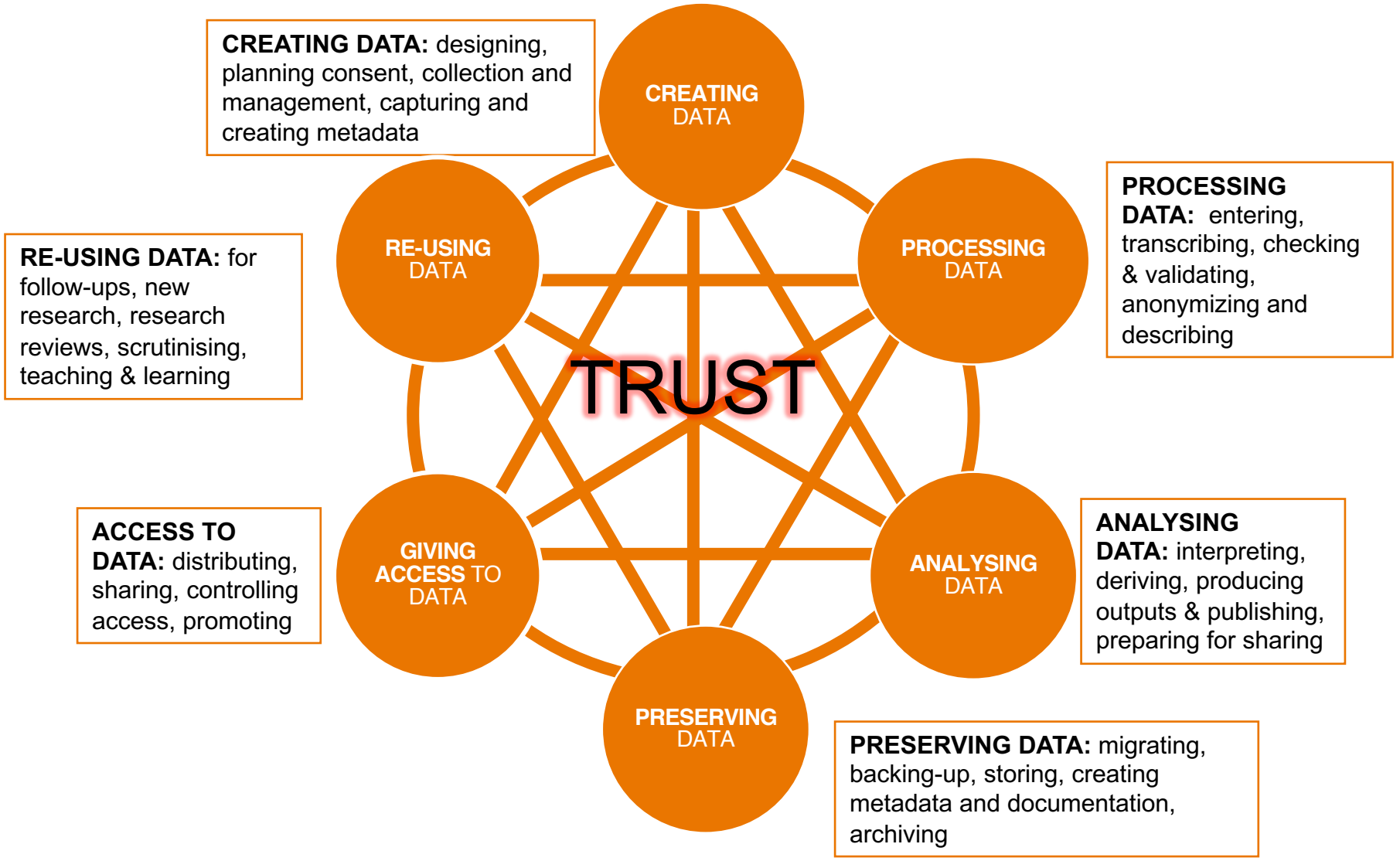
A Typical Problem in handling Research Data



Researcher’s needs

- **Store** data during research
- **Share** data during and after research
- **Synchronize** data across different locations
- **Backup** data
- **Archive** data
- **Publish** data
- **Link** publication to processed and raw data
- **Find** data and **make data findable** by others
- Data **transfer**
- Data **provenance**: what happened with the data
- …

Research Data Lifecycle



CREATING DATA: designing, planning consent, collection and management, capturing and creating metadata

PROCESSING DATA: entering, transcribing, checking & validating, anonymizing and describing

ANALYSING DATA: interpreting, deriving, producing outputs & publishing, preparing for sharing

PRESERVING DATA: migrating, backing-up, storing, creating metadata and documentation, archiving

ACCESS TO DATA: distributing, sharing, controlling access, promoting

RE-USING DATA: for follow-ups, new research, research reviews, scrutinising, teaching & learning

Ref: UK Data Archive: http://www.data-archive.ac.uk/create-manage/life-cycle

Metadata, data about data

What is metadata?

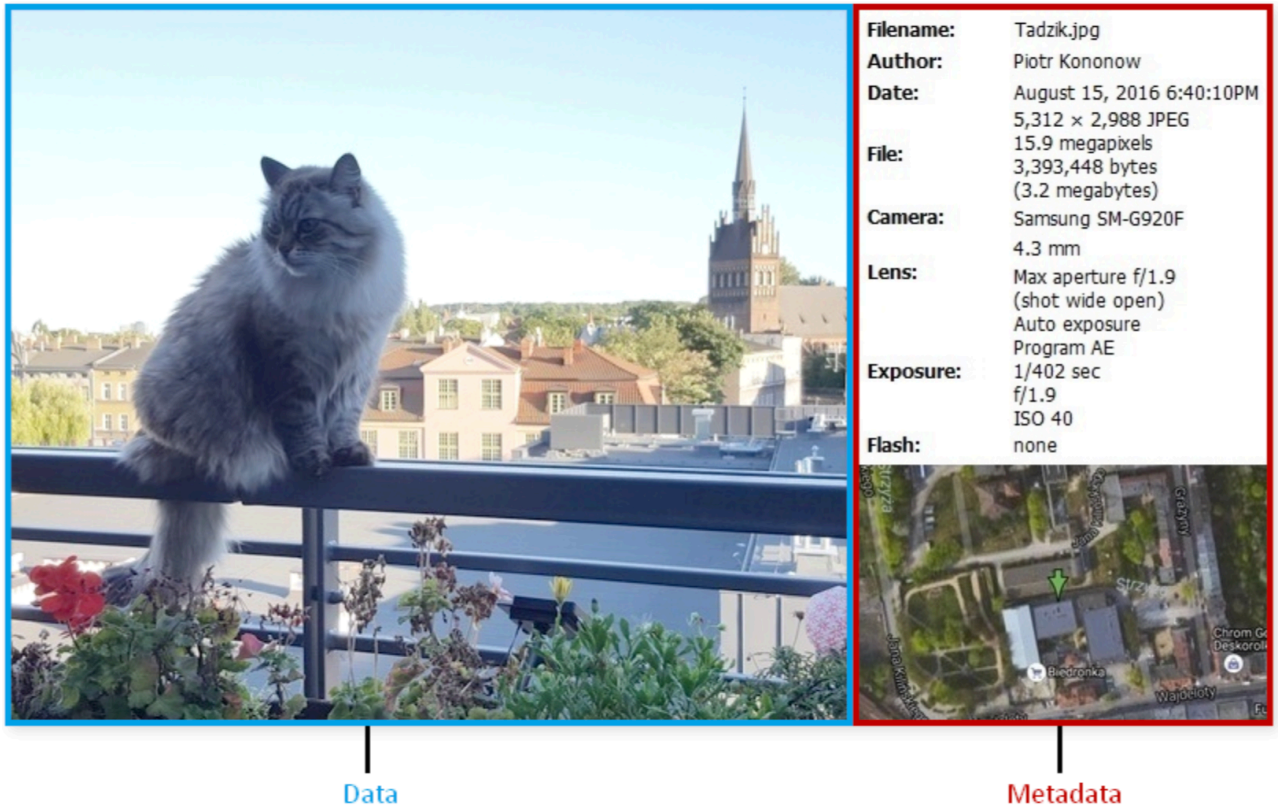
- Metadata is ‘data about data’, which helps to make data findable and understandable

Why using metadata?

- Facilitate data discovery
- Help users determine the applicability of the data
- Enable interpretation and reuse of data
- Allow any limitations to be understood
- Clarify ownership and restrictions on reuse

Types of metadata:

- **Descriptive**: information about the content and context of the data
- **Structural**: information about the structure of the data
- **Administrative**: information about the file type, rights management and preservation processes



Ref: https://dataedo.com/kb/data-glossary/what-is-metadata

FAIR Data

EUDAT

What is… FAIR ?

Findable:

F1. (meta)data are assigned a globally unique and persistent identifier;

F2. data are described with rich metadata;

F3. metadata clearly and explicitly include the identifier of the data it describes;

F4. (meta)data are registered or indexed in a searchable resource;

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;

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;

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;

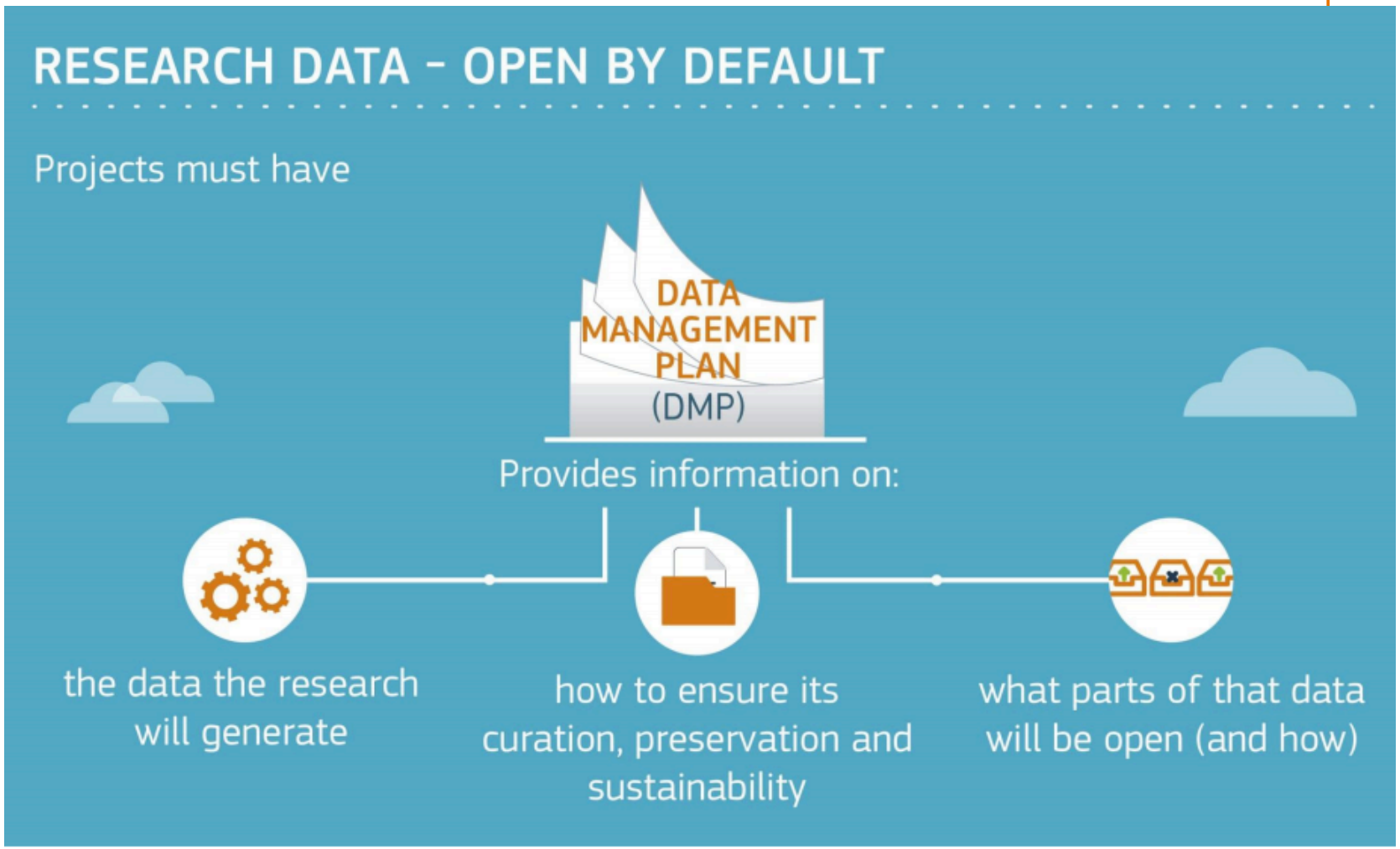
R1.2. (meta)data are associated with detailed provenance;

R1.3. (meta)data meet domain-relevant community standards;

doi: 10.1038/sdata.2016.18

Data Management Plan

- **Data Management Plan (DMP):** A document that outlines how data are to be handled both during and after a research project
  - research funders mandate writing a DMP
  - Type of data
  - Data & metadata standards
  - Data storage, sharing, & preserving
  - Budget & finance
  - …



SURF's Role in Research

- Vision: Driving ICT innovation in education and research together

Focus of services:

- High Performance Computing (Lisa, Cartesius, HPC Cloud)
- Distributed computing (Grid)
- Big Data
- ...

- → Larges infrastructure for (storing & processing) large data

SURF Data Services

SURF REPOSITORY

RESEARCH DRIVE

SURF FILESENDER

SURF DRIVE

Handle.Net®

ePIC Persistent Identifiers for eResearch

SURF object storage

Data Archive

SURF SARA

Data ingest service

SURF SARA

SURF

HPC and Data Management

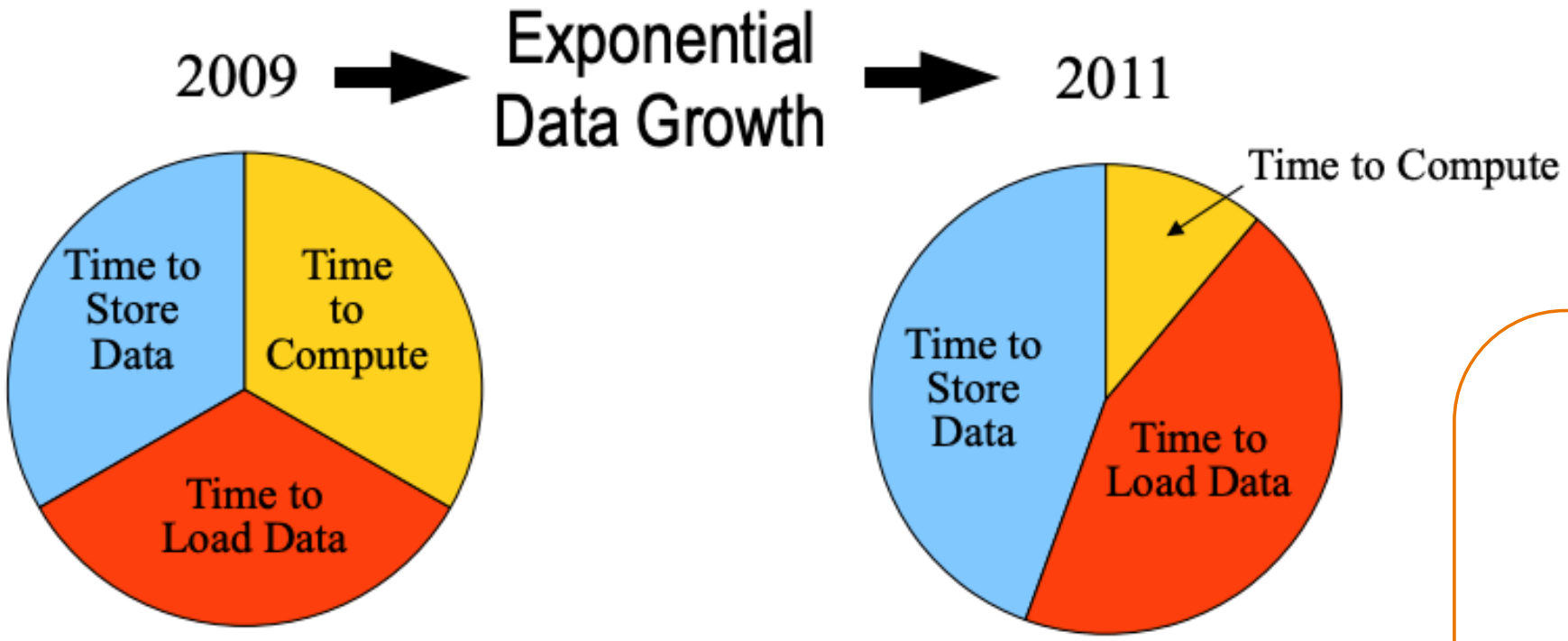
Importance of HPC

- Computationally intensive applications
- Need to analyze more and more data
- Reduce costs and increase efficiency

Challenges/Barriers to HPC

- Data access/sharing
- Complexity of use
- I/O bottlenecks
  - Leads to poor overall application performance
  - Prevent applications from scaling

HPC and Data Access



You can only compute as fast as you can move the data

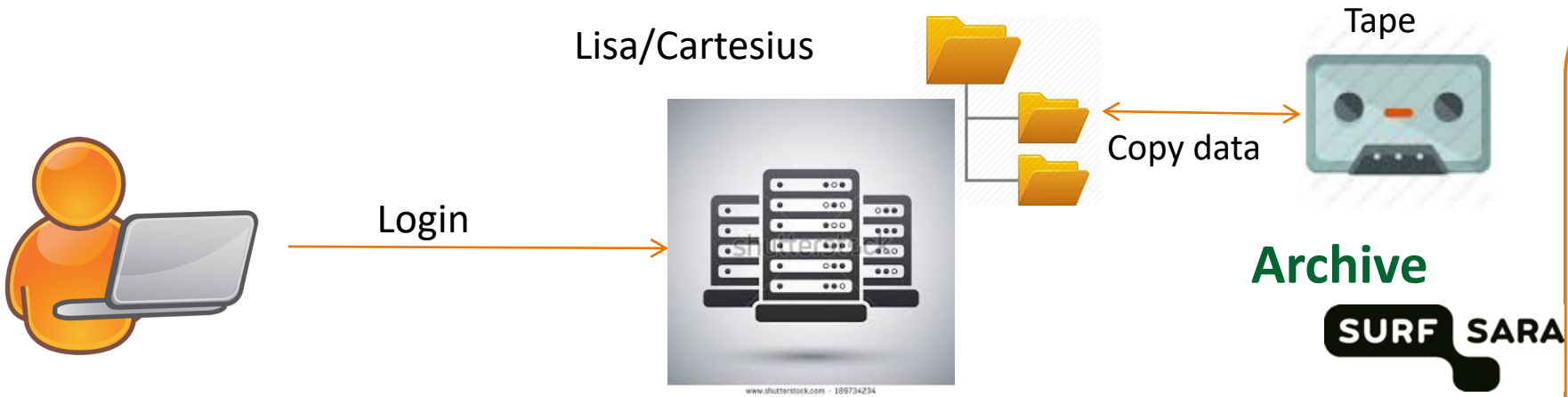
Ref: High Performance Computing Data Management A European Perspective:
http://web.stanford.edu/group/dlss/pasig/PASIG_October2009/Day1/PASIG_Oct09_PhT_V1.0.pdf

Archiving Data in HPC: Data Archive Service

- Long-term storage of big data
- Storage medium: Tape → high latency

- Powerful transfer protocols:

  - gridFTP, rsync, scp,…



- Easy access from HPC services Lisa and Cartesius via NFS mounts
  → use archive as yet another directory

Data growth in the Data Archive: 10s of Petabyte of data

Figure 4: Usage overview: average file size per domain (in GB)

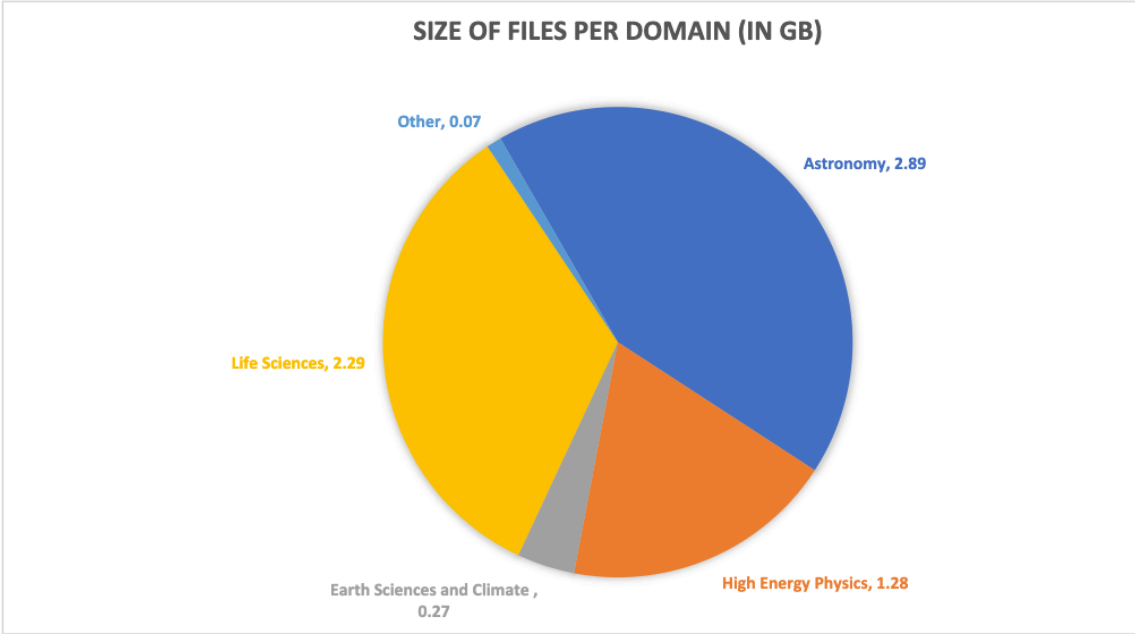
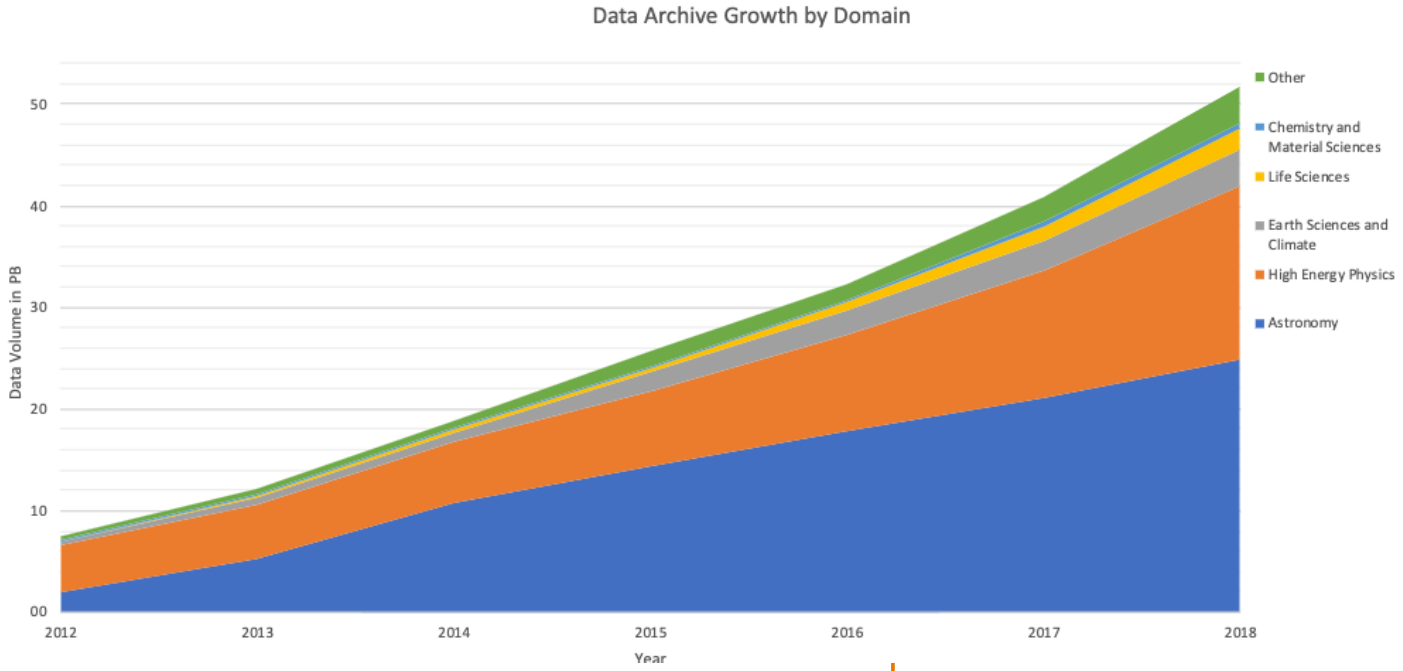


Figure 5: Data on the Archive over time per scientific domain (in PB)

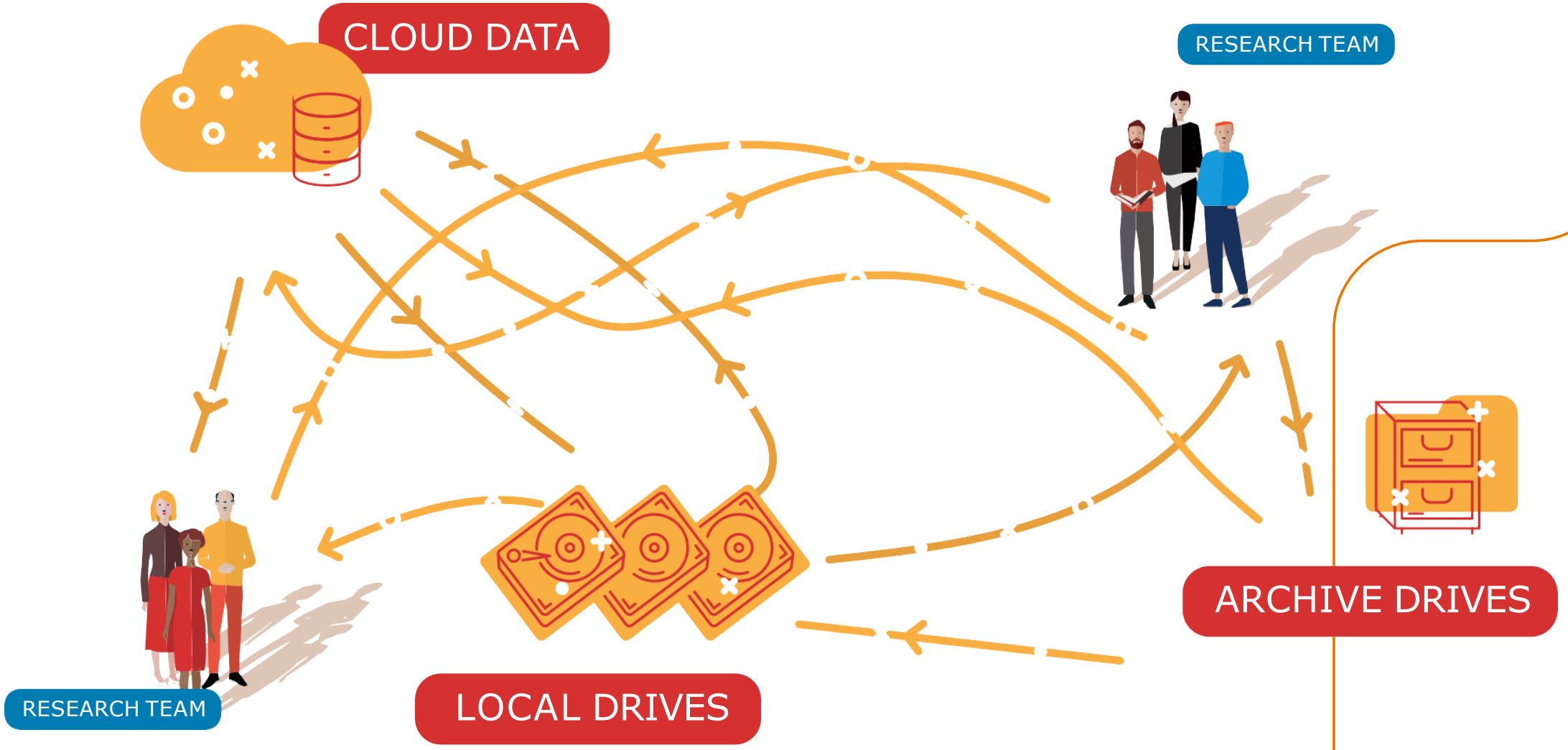


Data Ingest Service

- Data often resides on external storage media, USB sticks, external hard drives
- Slow or no internet connection
- Easy way to upload large data from disk to SURFsara facilities
- Upload data from 45 disks in parallel

SURF SARA

Difficulty in Sharing Data



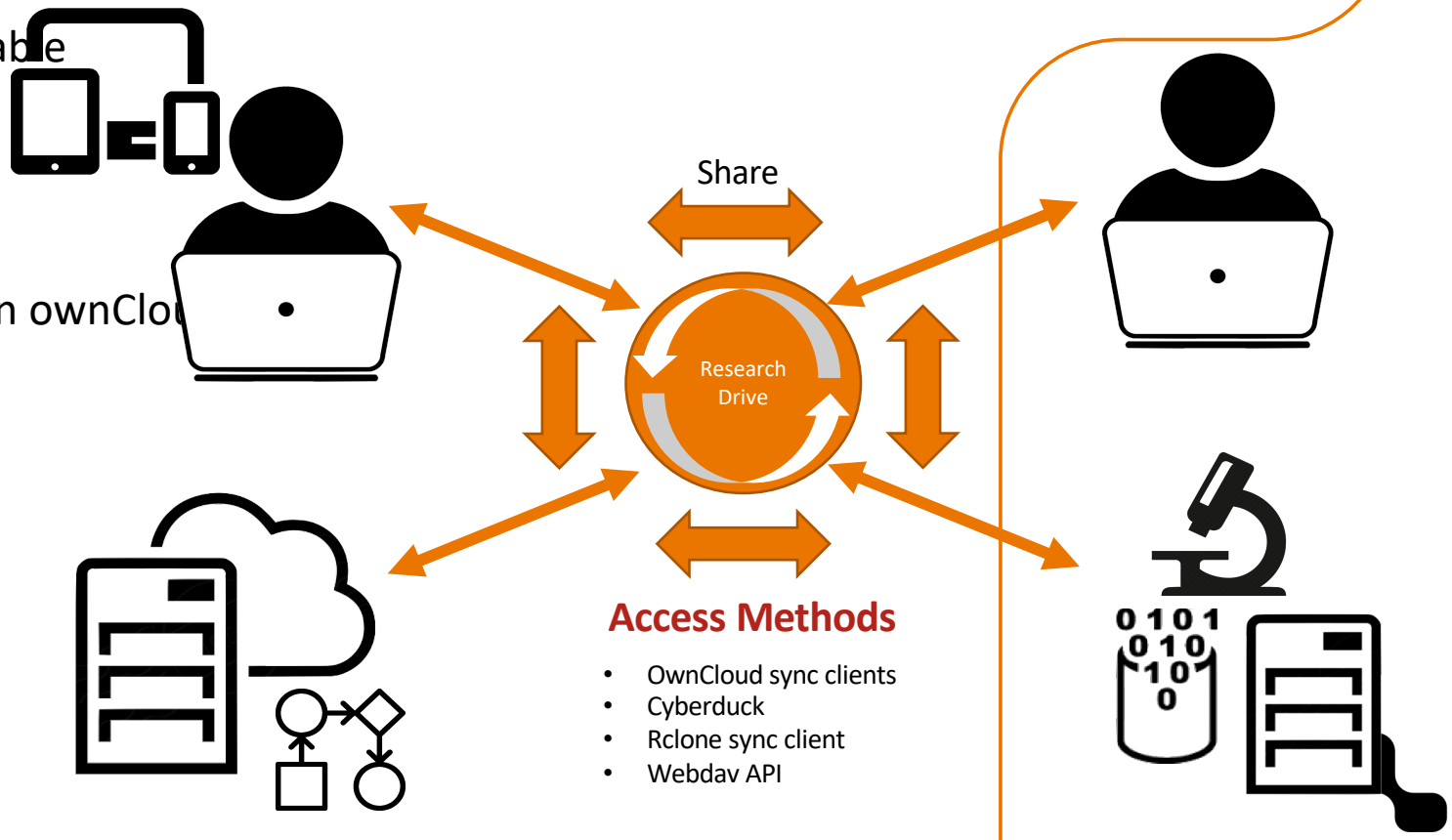
Data Sharing and personal storage: SURFdrive

- Trusted community cloud for personal storage
- Collaboration between SURFsara, SURFnet and Dutch universities
- Specifications and service determined by end-users (universities)
- Sharing smaller data files, documents,…
- 250 GB storage capacity per user
- Privacy and security: Data in the Netherlands
- Based on ownCloud,
- Synchronizes with local storage,…
- Access through: surfdrive.nl

Data Sharing and Team storage: ResearchDrive

COLLABORATIVE WORKING AND SHARING OF DATA FOR RESEARCH COLLABORATIONS

- ✓ Trusted cloud storage for research teams
- ✓ Facilitates collaborative research between teams
- ✓ High quota's (>250 GB) per user/group available
- ✓ Sharing across similar cloud storage services
- ✓ Based on ownCloud
- ✓ Synchronization with local storages, Based on ownClou
- ✓ Data stewardship



Publishing Research Data: SURF Data Repository

- Data repository service to deposit and publish data
- Long-term preservation of research data
- Connected to tape and Data Archive in the backend
- Provides quality to data sets via metadata descriptions
- Makes data citable and findable via Persistent Identifiers
- Status: Pre-production phase

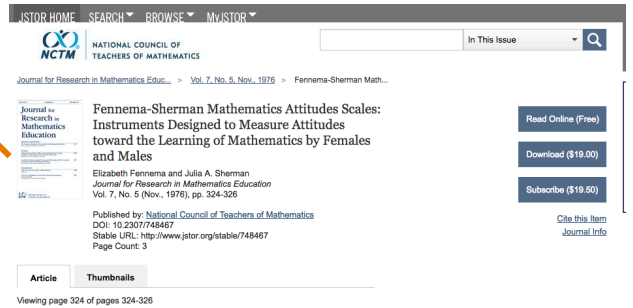
PID Service

PIDs (Persistent Identifiers) ensures the findability of your data

- Pointers to resources like files, folders, webpages, real world objects
- Globally unique and resolvable via http
- Comparable to ISBN numbers assigned to books

10.2307/748467

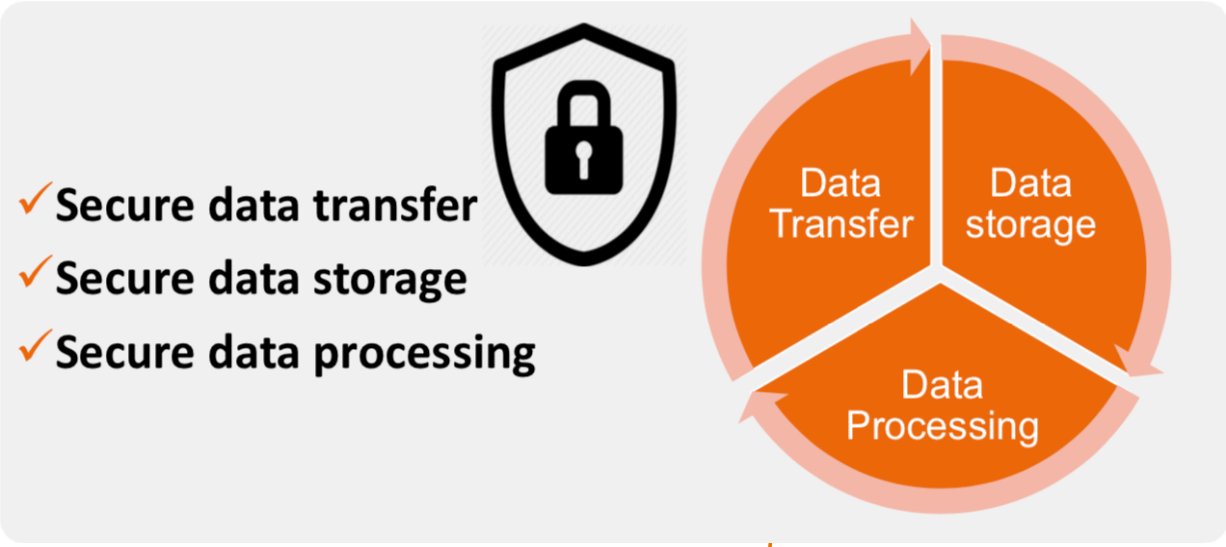
Handle.Net®



- Example resolvers: https://dx.doi.org/ and http://hdl.handle.net/
- A PID consists of a prefix and a postfix (11304/2e873bd8-b988-11e3-8cd7-14feb57d12b9)

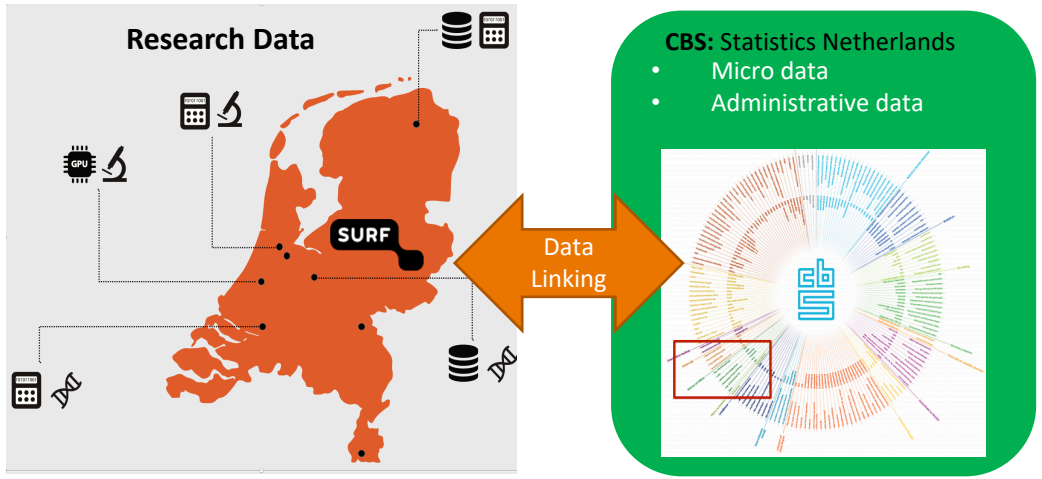
Sensitive Data and HPC

- Sensitive data is data that must be protected against unwanted disclosure
  - Clinical Data, DNA sequences,…
  - Patient data, personal Data
- Provide a secure environment on HPC for sensitive data
- Comply with all legal and ethical requirements
- GDPR, WGBO (Act on the Medical Treatment Agreement), CBS law

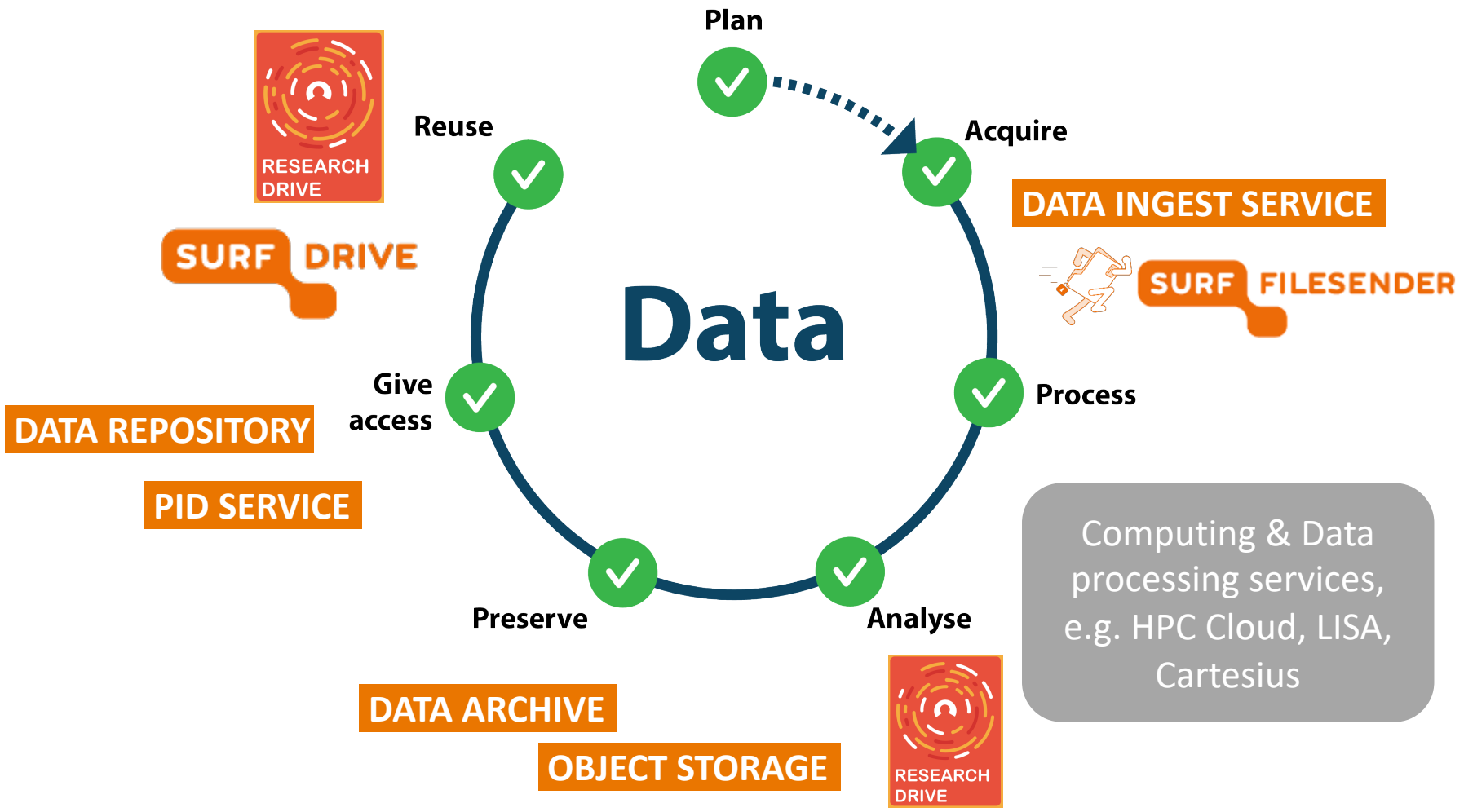


The ODISSEI Data Facility

- A High-Performance Computer environment with secure access to sensitive data
- **Secure sandbox for processing and storing data**



SURF Data Services



For more detail, please see https://www.surf.nl/diensten-en-producten/categorie/datadiensten

Thank you!

Thanks to SURFsara's …

- … Data Preservation team
- … Data Management team
- … Online Data Services team