European Collaborative Data Infrastructure EUDAT

- Training on EUDAT Principles -

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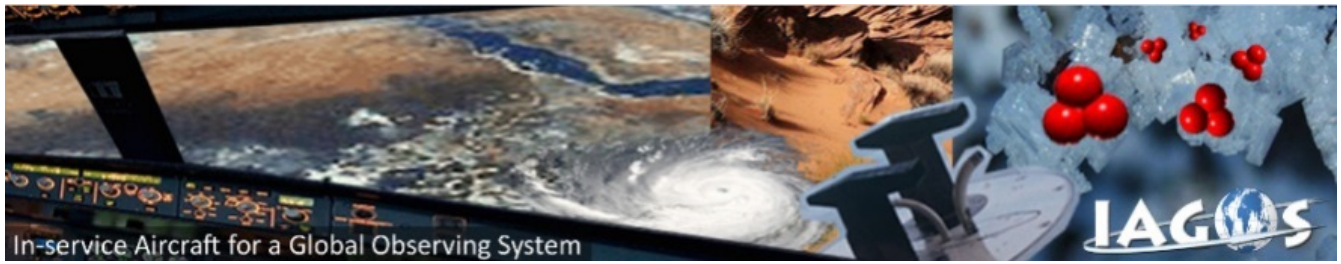
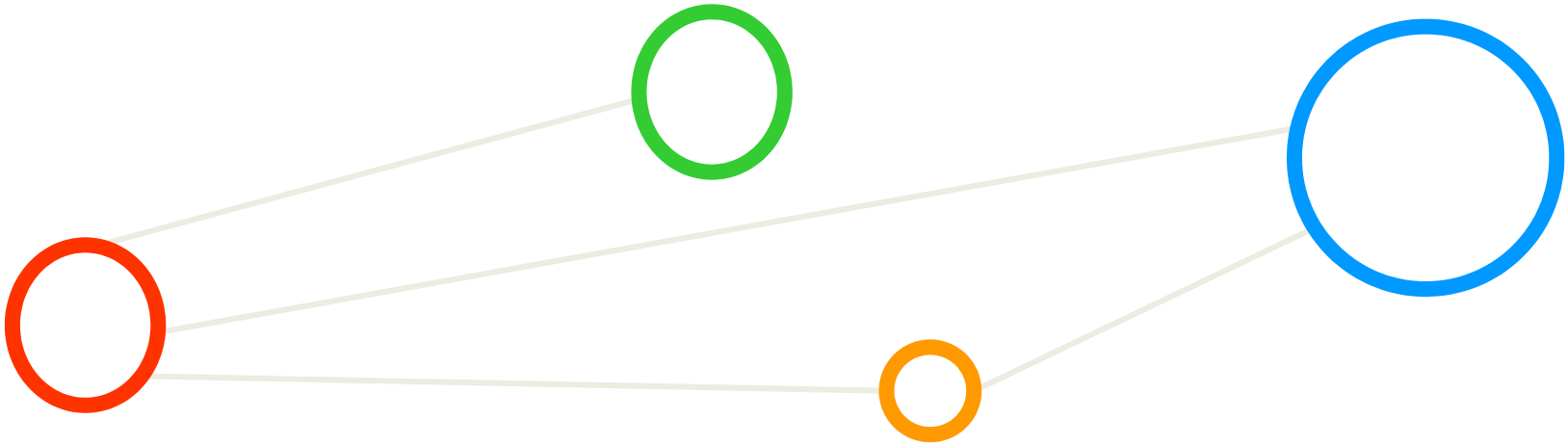


Outline

- Motivation & EUDAT & IAGOS Context
- Short Training on Key Principles
  - How to create a collaborative data infrastructure
  - How to create a registered domain of data
  - How to perform policy-based data replication
- Summary & Possible Actions
- References

Motivation & EUDAT & IAGOS Context



Big Data Waves – Surfboards – Breakwaters

How can we manage the rising tide of scientific data

High Level Expert Group on Scientific Data Report

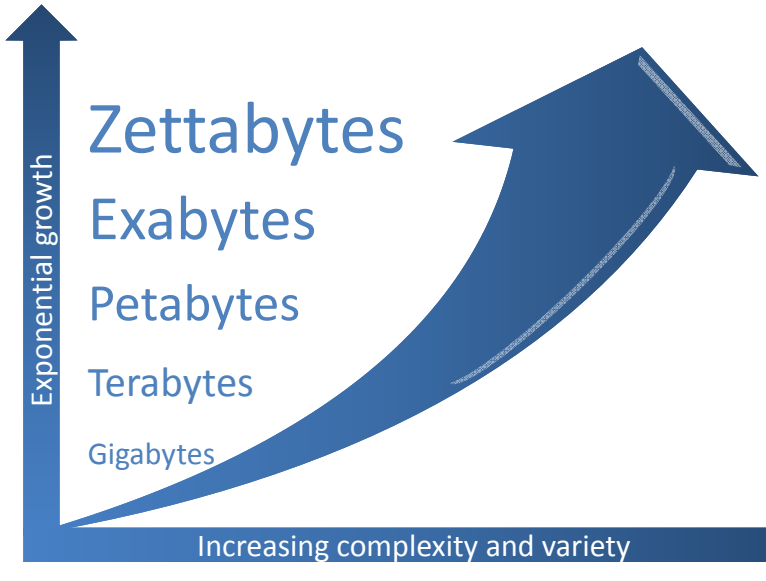
Lists unsolved questions
Outlines challenges
Provides visions

A Surfboard for Riding The Wave Report

Lists 4 key action drivers
Identifies 3 strategic goals
Clarifies Data Scientists

‘Concrete’ Next Steps → ‚Breakwaters‘

Data trends



- Where to store it?
- How to find it?
- How to make the most of it?

- How to ensure interoperability?
- How to engage in cross-disciplinary science?

In commercial environments
Big Data is all about
Volume – Variety – Velocity

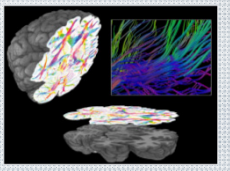
'Big Data is data that becomes large enough that it cannot be processed using conventional methods.'

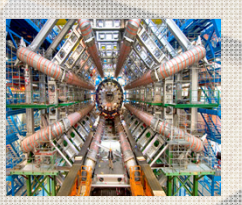
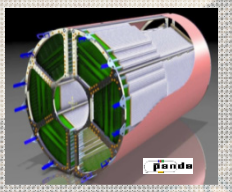
[1] O'Reilly Radar Team, 'Big Data Now: Current Perspectives from O'Reilly Radar'

xilostudios.com

The next generation radio telescope for science…

The square kilometre array
… 1 PB in 20 seconds


EUDAT – Collaborate to tackle 'big data'

[2] EUDAT Web page

Training & Working habits with Communities

Example: Persistent Identifiers for Data (PIDs)

MINDSET

Do we all think that PIDs for scientific data are important?

Do we agree that safe replication of data is important for unique scientific data sets?

SKILLSET

How do we use PIDs and what type of PID structures are relevant?

What are the techniques to perform data replication and how it relates to PIDs and metadata?

TOOLSET

Do we use (common) services and tools to work with PIDs being part of community practice?

Are there established (common) data replication services and tools available we can use daily?

Explore possibilities for IAGOS & EUDAT

MINDSET

Smooth metadata sharing *with other communities (e.g. climate communities), MOZAIC and IAGOS data policies good example in science for re-use*

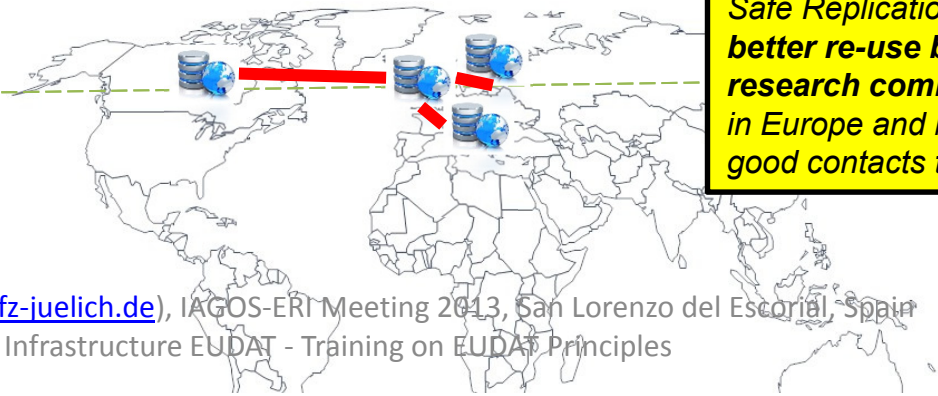
Clarify long-term relationships ***to sustain the ecosystem around the IAGOS/MOZAIC*** *database and ensure its free access for science & society*

SKILLSET

Persistent Identifier (PIDs) for ***IAGOS/MOZAIC datasets to get referenced clearly*** *in publications (example US & Owen Cooper this morning)*

IAGOS/MOZAIC database: observations (1994 – today)

TOOLSET



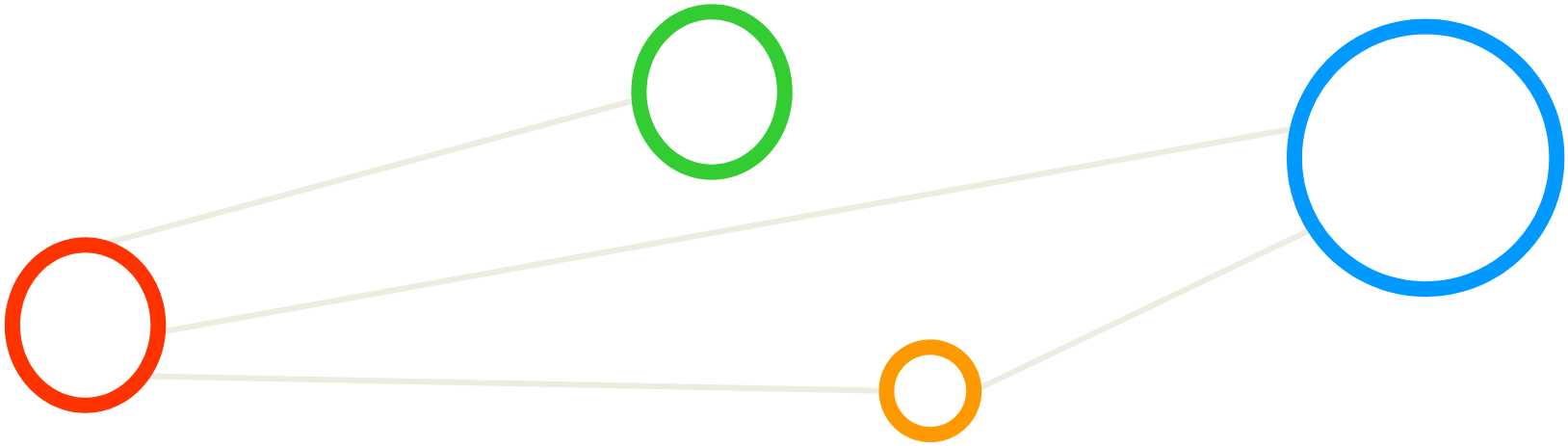
Safe Replication of Datasets for ***better re-use by scientific research communities*** *in Europe and beyond (e.g. good contacts to US)*

Possible Concrete example: Discussions over lunch Morris + Owen…

- IAGOS & EUDAT & Research Data Alliance (RDA)
  - Promote a case for world-wide scientific IAGOS research
- RDA : Share Open Research Data w/o barriers
  - Here: EU (Morris&IAGOS) & US (Owen et al.) + China?
  - Create interest group (e.g. similar as the agricultural interoperability group, but with IAGOS interests)
  - Align with RDA Big Data Analytics group that is interested to work with MOZAIC, and show interop use cases (Owen)

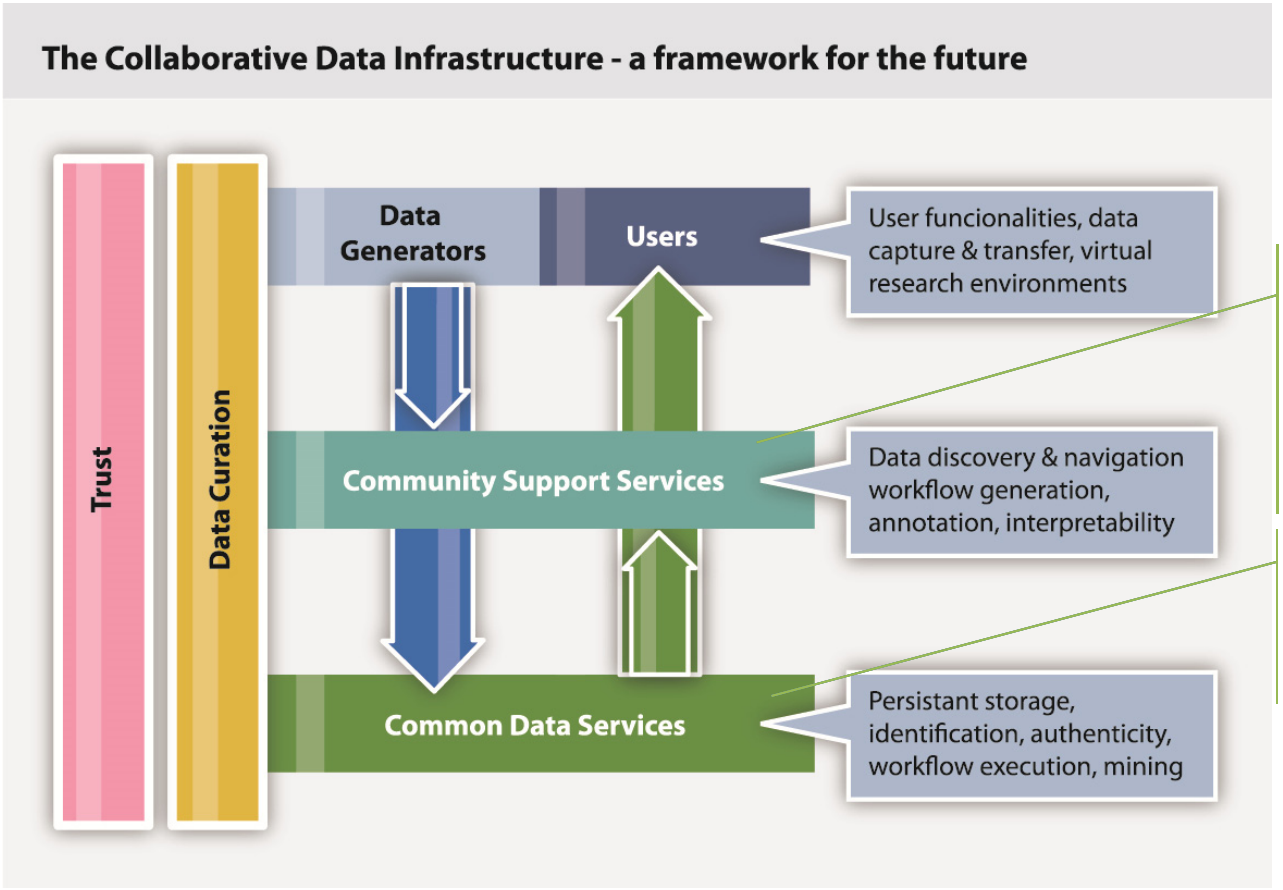
IAGOS/MOZAIC database: observations (1994 – today)

How to create a collaborative data infrastructure



Training on 'Skillset Level'

Blueprint of a Collaborative Data Infrastructure



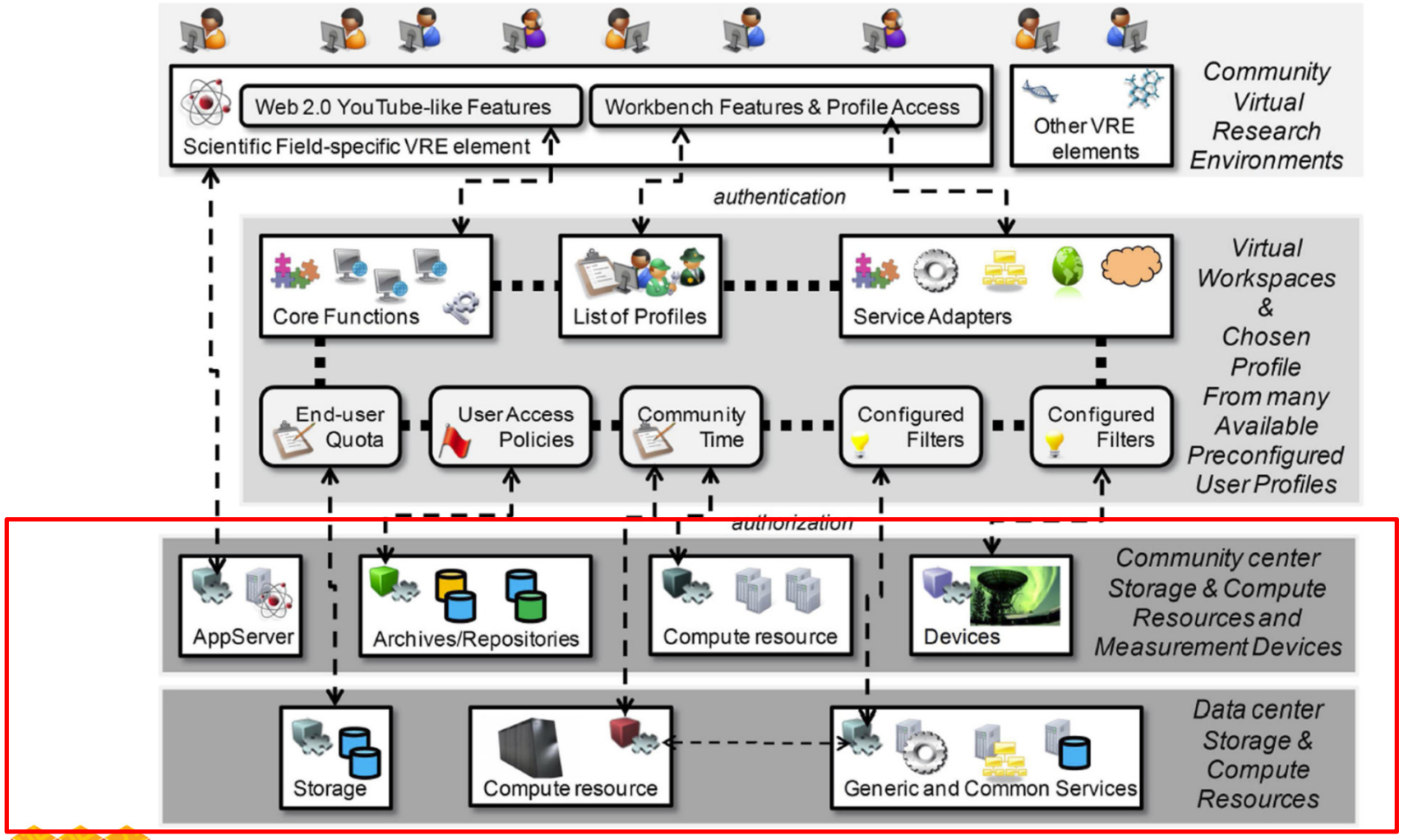
CLARIN, LifeWatch, ENES, EPOS, VPH, INCF, etc.
6 Core Infrastructures - more second round infrastructures

=> 12 EUDAT data centers

How can we link to the existing IAGOS data infrastructure to create benefits for science?

[4] High Level Expert Group on Scientific Data, Riding The Wave – How Europe can gain from the rising tide of scientific data, October 2010

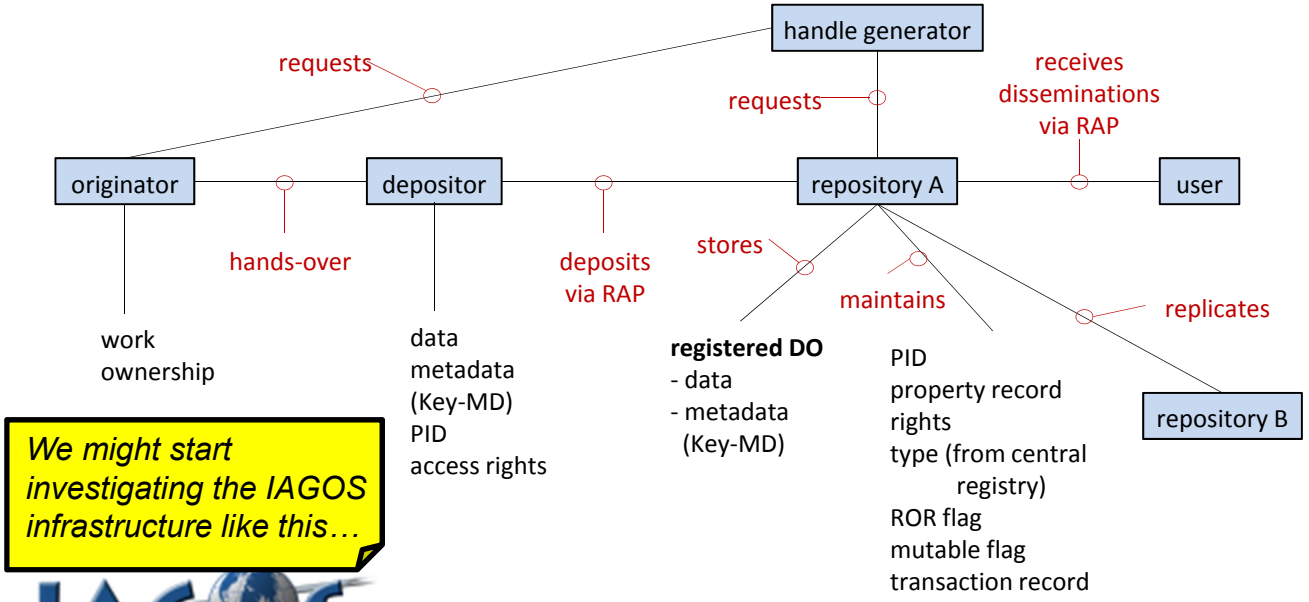
Conceptual View of a CDI



[1] M. Riedel and P. Wittenburg et al. 'A Data Infrastructure Reference Model with Applications: Towards Realization of a ScienceTube Vision with a Data Replication Service'

Analysis of existing community data infrastructure

- community interactions based on abstract model (Kahn & Wilensky, 2006)
  - 'triple': Data + Metadata + Handle (PID) – use it as 'orientation point'!
- used in many meetings and interactions - accepted quickly as reference model
- helped even in improving community organization plans



We might start investigating the IAGOS infrastructure like this…

Definitions/Entities

originator = creates digital works and is owner;
depositor = forms work into DO (incl. metadata),
digital object (DO) = instance of an abstract data type;
registered DOs are such DOs with a Handle;
repository (Rep) = network accessible storage to store DOs;
RAP (Rep access protocol) = simple access protocol
Dissemination = is the data stream a user receives
ROR (repository of record) = the repository where data was stored first;
Meta-Objects (MO) = are objects with properties
mutable DOs = some DOs can be modified
property record = contains various info about DO
type = data of DOs have a type
transaction record = all disseminations of a DO

[2] EUDAT Web page

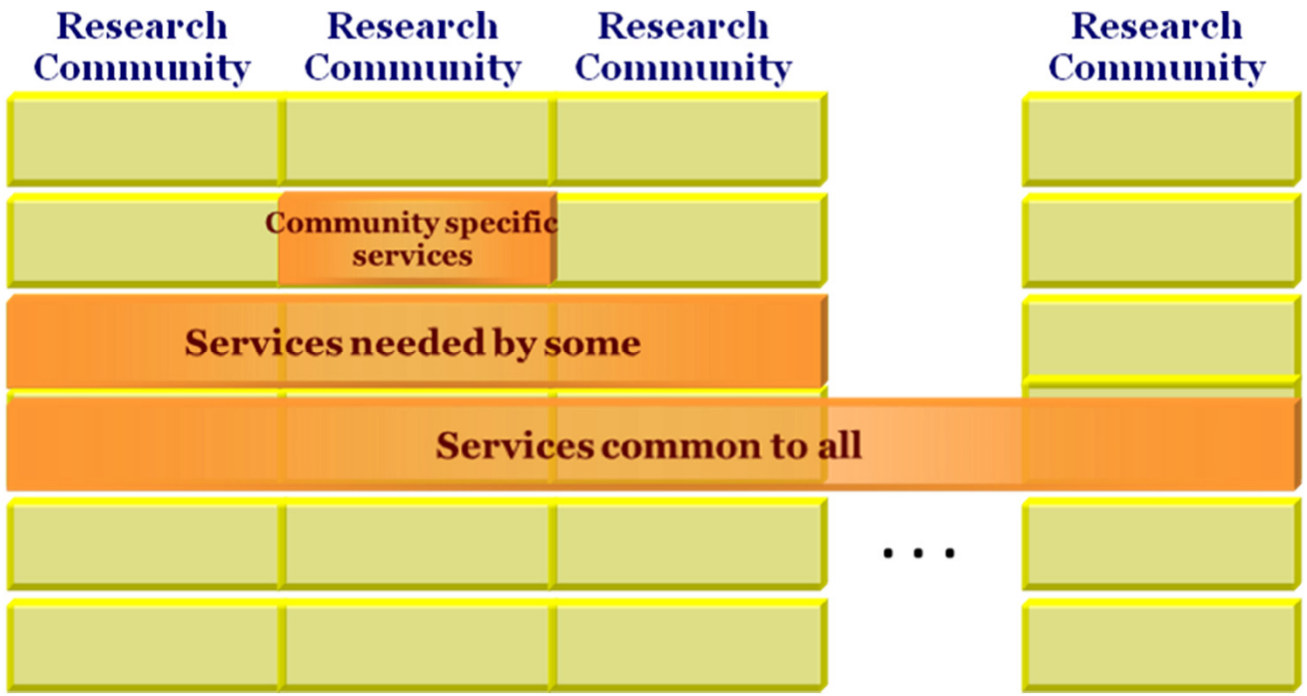
Example: EUDAT Centres

Overlap of several formal partners in IAGOS & EUDAT

Clear Task: Identify Common Services

If there are hundreds of Research Infrastructures, how many different data management systems can we sustain?

Are there services you might want to share/re-use with/from other communities?



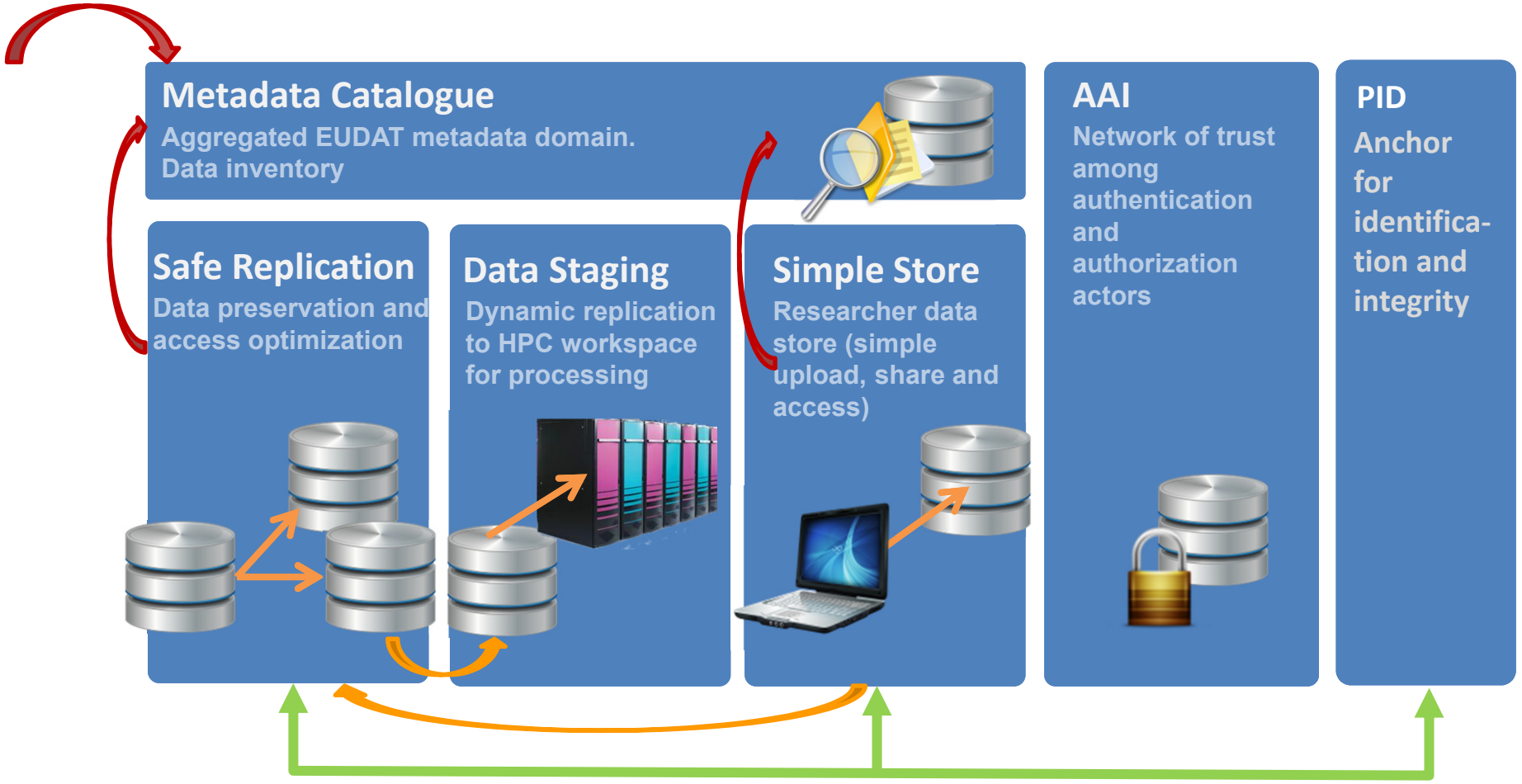
Example: Current EUDAT Services Focus

Common Services	CLARIN	LW	VPH	ENES	EPOS	INCF	ECRIN	Bio Vel	Dixa	CESSDA	DARIAH	Pan Data	BBMRI	EMSO
Safe Replication	X	o	X	X	X	X			x		x			
Data Staging	o	o	X	X	X									
Simple Store	X	X	X	X	X	X	x	x	x	x	x		x	
Metadata	X	X	o	X	x	x	x	x	x	x	x	x	x	x
Web-service platform	X	o		X	o									

X = needed now, x = interested, o = interest, not direct priority

Are there services where IAGOS is interested in to use across Europe?

Example: EUDAT Services in Preparation

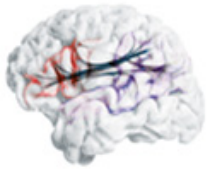


Data PID Metadata

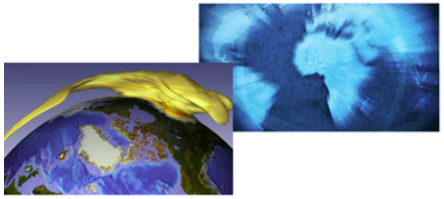
[2] EUDAT Web page

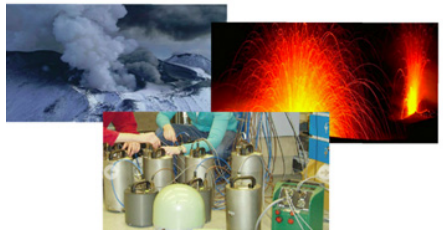
Example: EUDAT user communities

- **EPOS**: European Plate Observatory System
- **CLARIN**: Common Language Resources and Technology Infrastructure
- **ENES**: Service for Climate Modelling in Europe
- **LifeWatch**: Biodiversity Data and Observatories
- **VPH**: The Virtual Physiological Human
- **INCF:** The neuroscience community

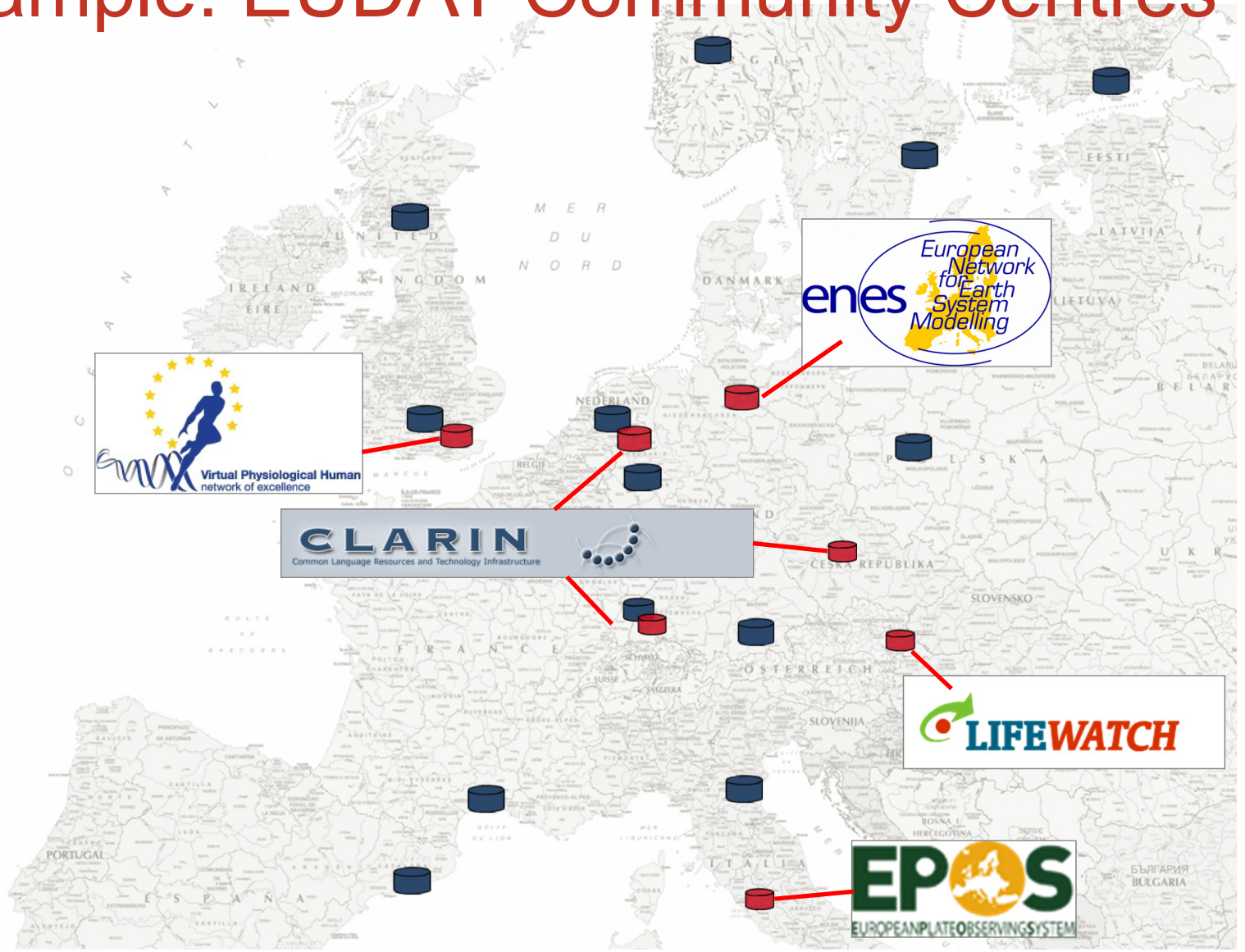


- **All share common challenges:**
  - **Reference models and architectures**
  - **Persistent data identifiers**
  - **Metadata management**
  - **Distributed data sources**
  - **Data interoperability**





Example: EUDAT Community Centres



EUDAT

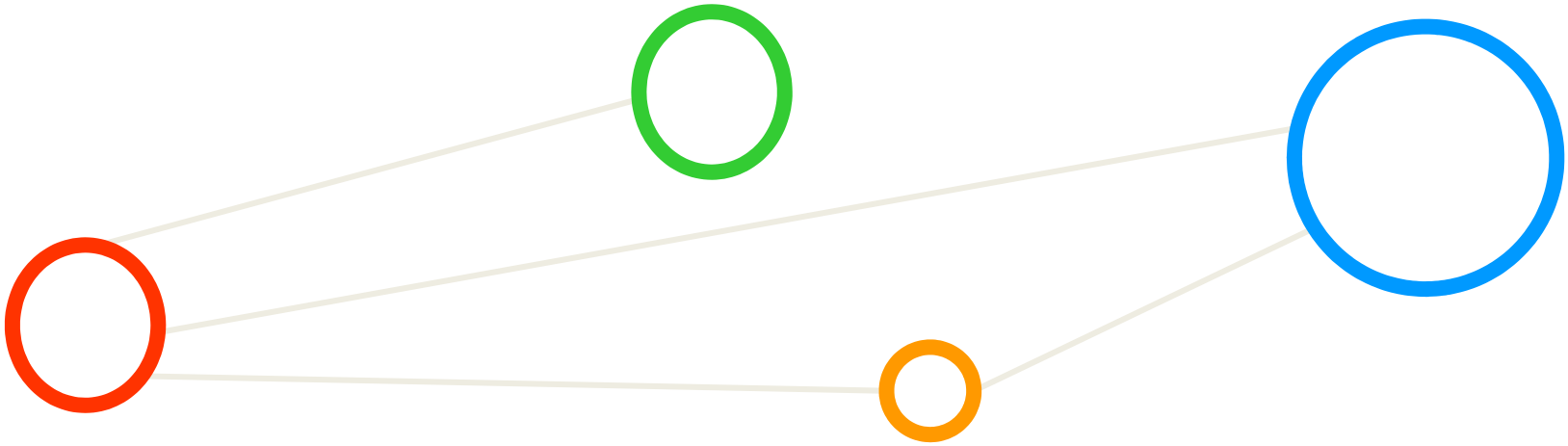
‘ScienceTube’: User perspective of CDI

[1] M. Riedel and P. Wittenburg et al. ‘A Data Infrastructure Reference Model with Applications: Towards Realization of a ScienceTube Vision with a Data Replication Service’

Lessons Learned in this Training Section

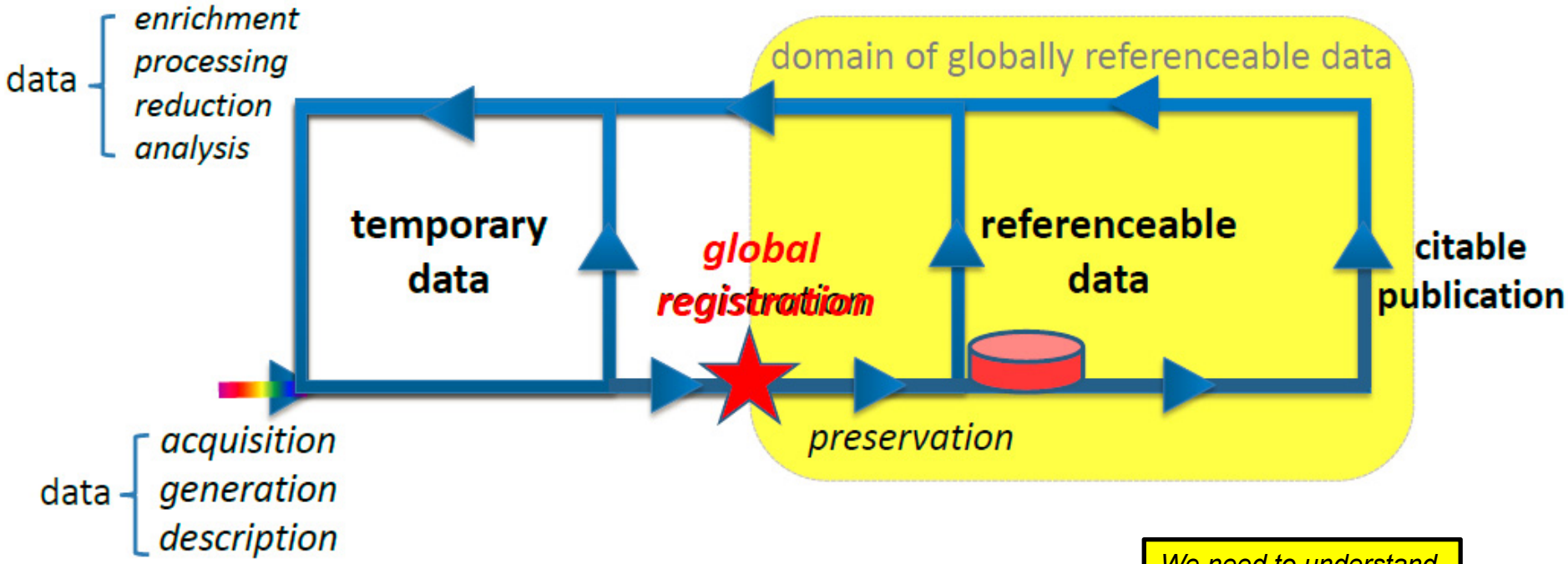
- ✓ **Accept that many communities have already a data infrastructure, so we need to connect it**
- ✓ **Knowing triple to organize/understand data plans**
- ✓ **Understand the major blueprint of a Collaborative Data Infrastructure (CDI)**
- ✓ **Capable of identifying common data services**
- ✓ **Knowing the difference between mono-thematic community center and multi-disciplinary centers**

How to create a registered domain of data

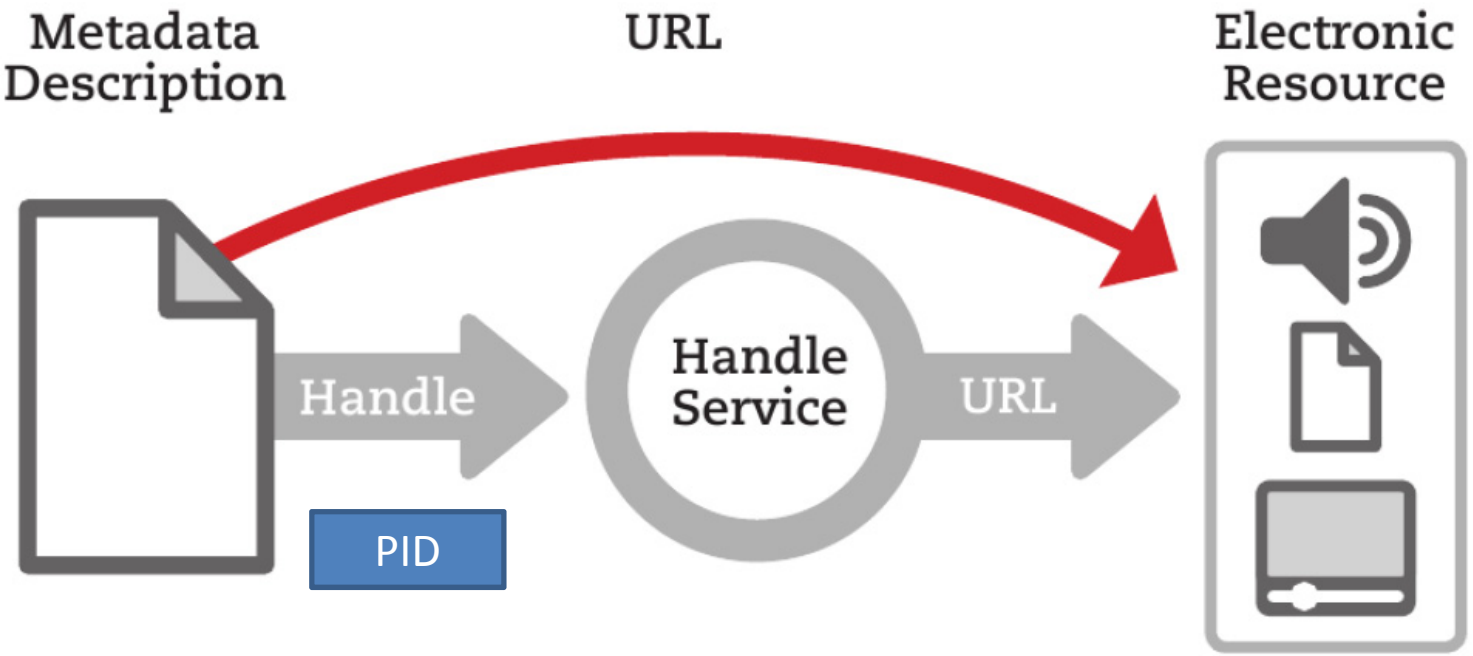


Training on 'Skillset Level'

Blueprint for a registered domain of data

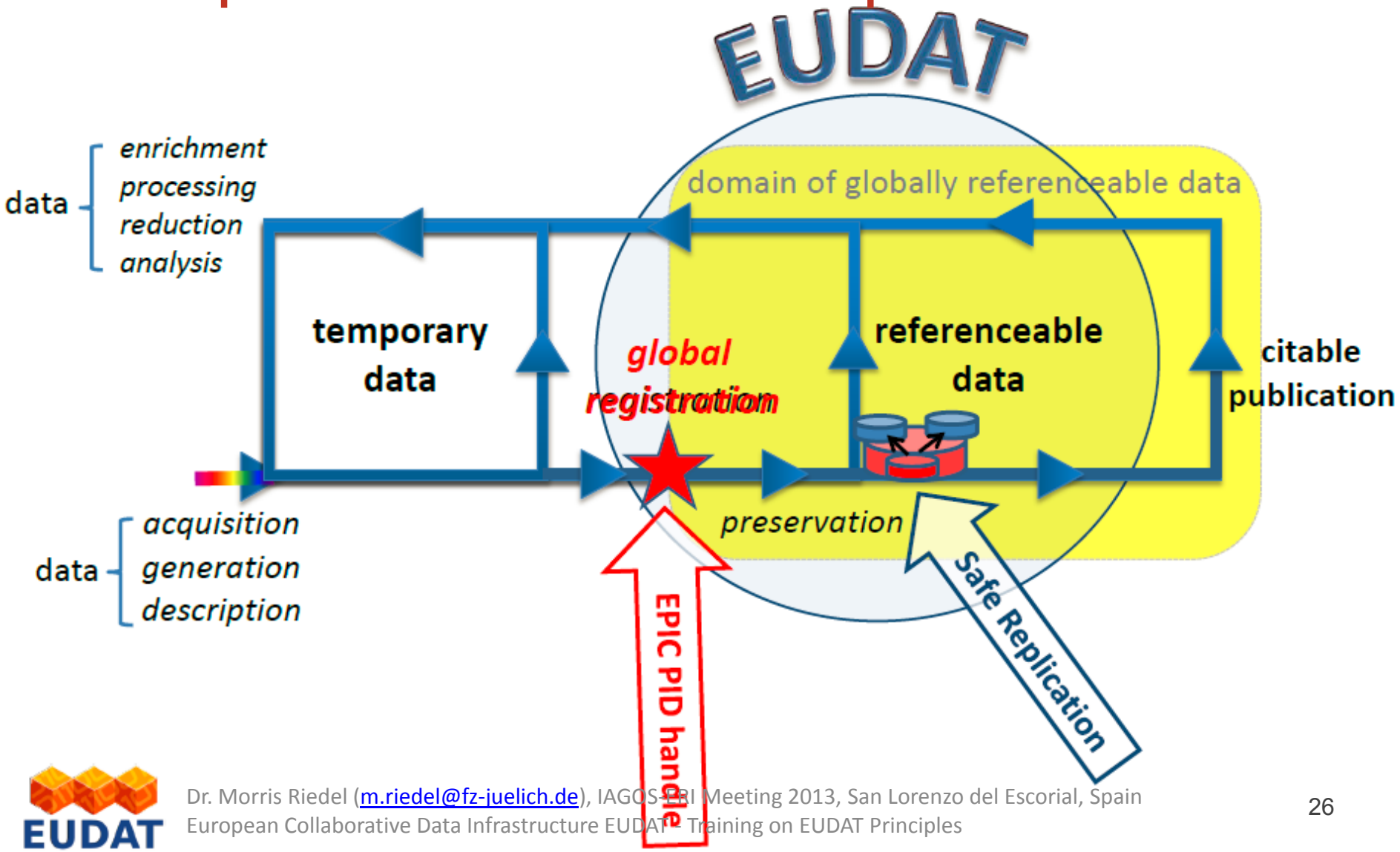


Key Principle of Handle System



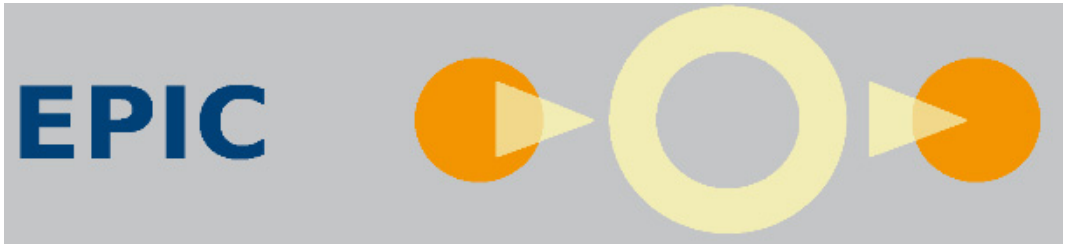
- URN, ARK, Handle, DOI, PURL (by HTTP-redirect)
- Critical: Resolution

Example: EUDAT Safe Replication Service

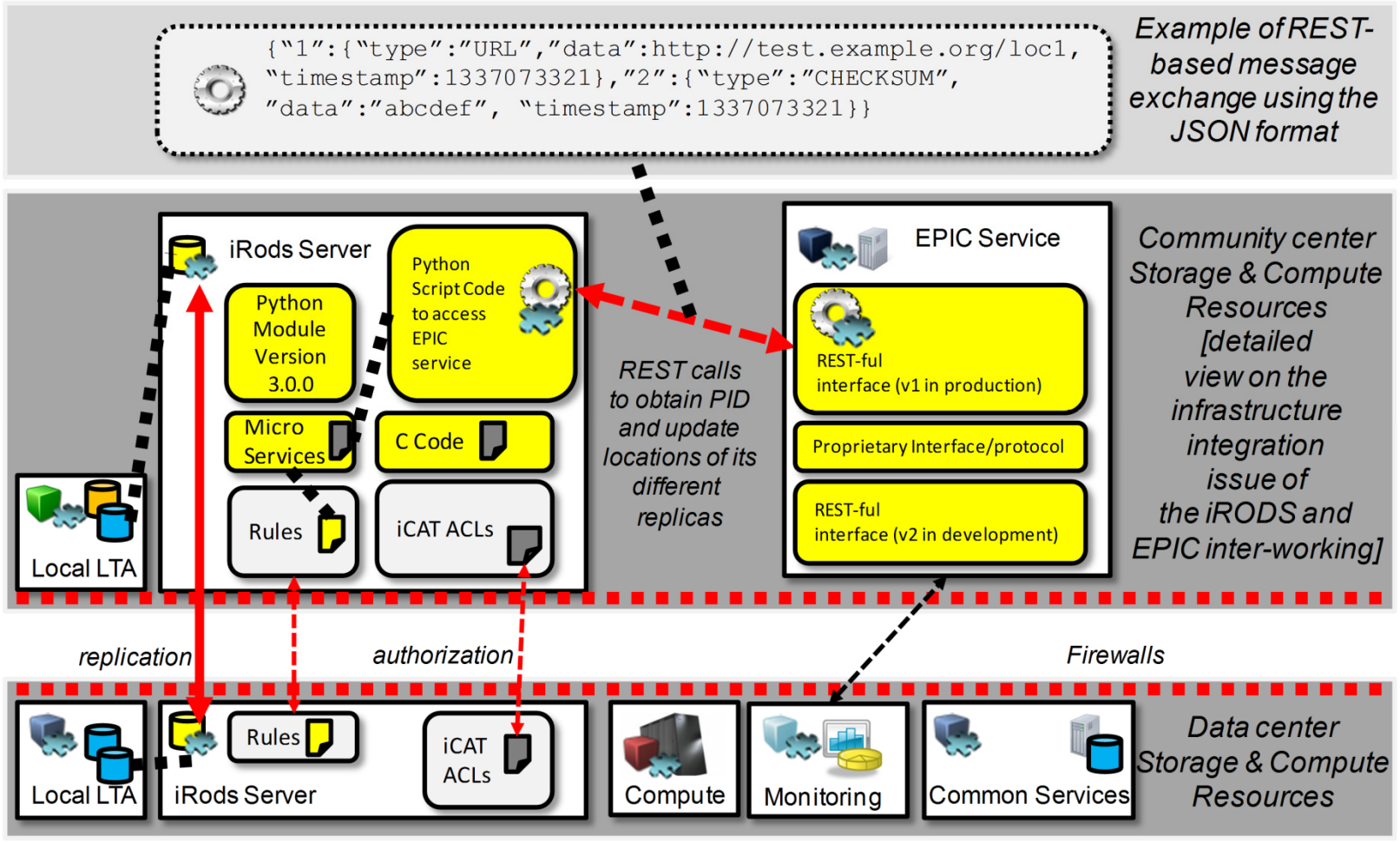


Use Persistent Identifiers to Identify Data

- Use Persistent Identifiers (PIDs)
  - Based on the Handle System
  - Used to reference data, including different locations
- Requires a PID Service
  - One example is the EPIC PID service
  - E.g. register a PID specifying a URI
  - EPIC = European Persistent Identifier Consortium



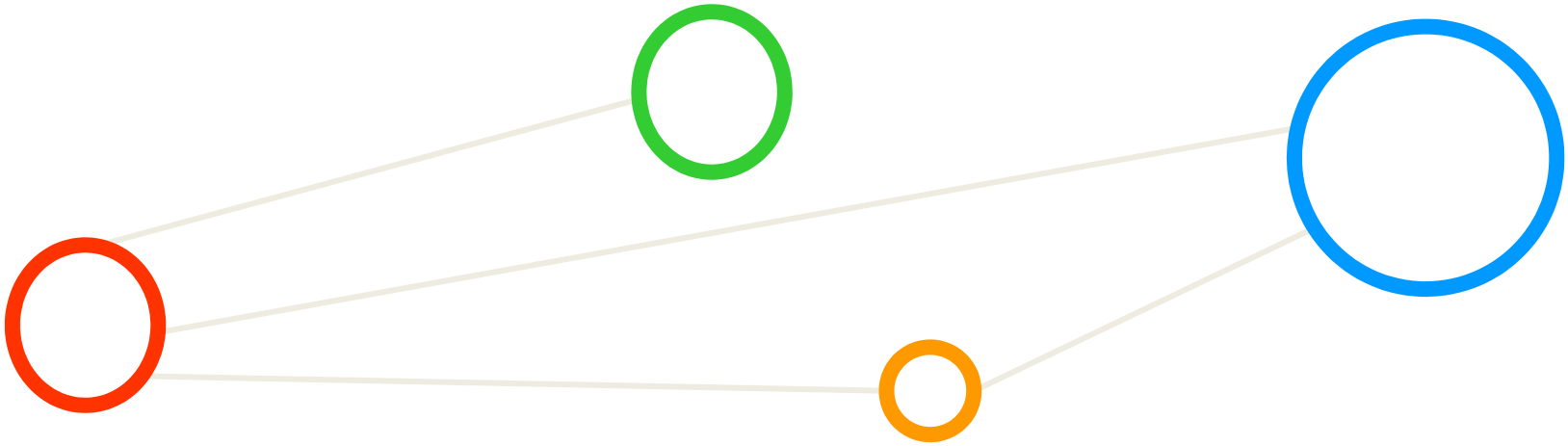
Example: EUDAT Use of EPIC Service



Lessons Learned in this Training Section

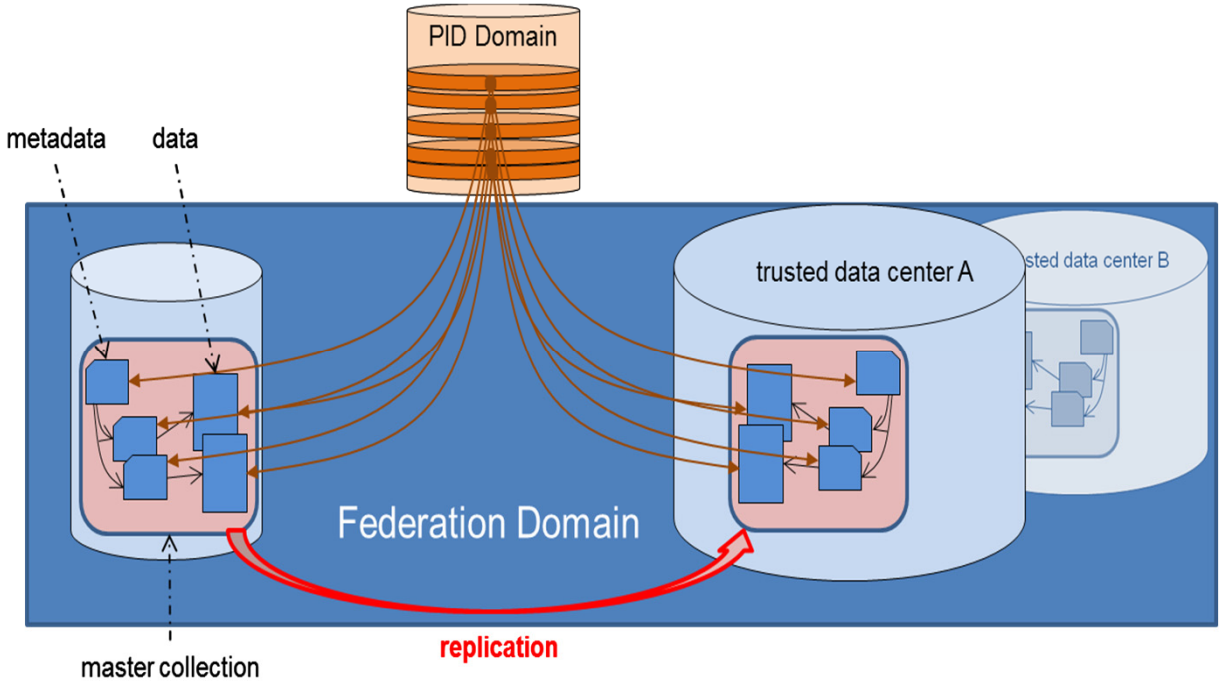
- ✓ **Understand the structure of one possible registered domain of (scientific) data**
- ✓ **Accept that the handle system is a pragmatic way to identify data not bound to location**
- ✓ **Knowing that you need Persistent Identifier (PIDs) as reference to digital objects (data)**
- ✓ **Capable of creating a theoretical use case that is using PIDs and an associated PID service (EPIC)**

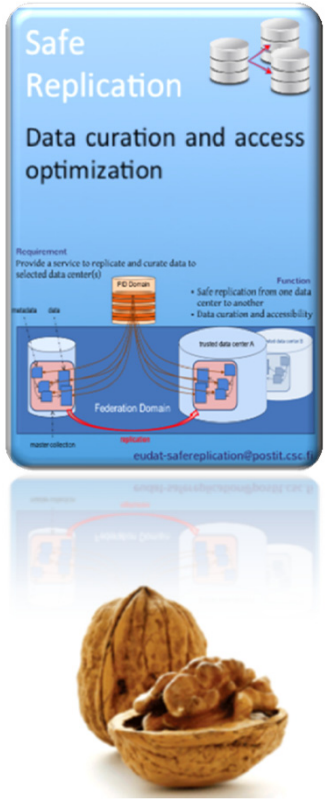
How to perform policy-based data replication



Training on 'Skillset Level'

Blueprint for safe data replication





Better accessibility of scientific data

Make data referencable

High degrees of reliability and trust

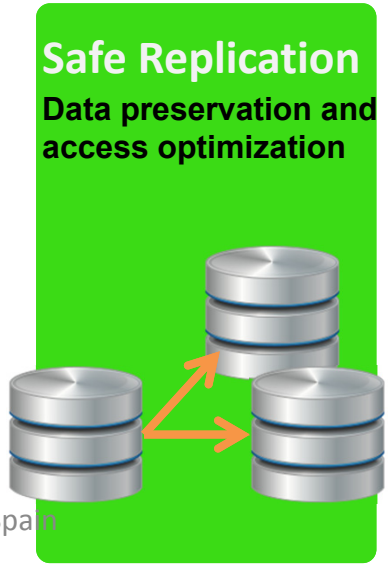
More optimal data curation

Safe Data Replication Approach

- Idea: Safe replication between 1 scientific community center and N data centers
  - Replication within a ‚registered domain of data' (i.e. PID assigment)

- Flexibility, scalability and management require policy-based data management (i.e. rule engine)
  - With local policies at centers and global policies for infrastructure(s)

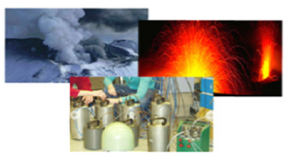
- Islands (community + data centers) in parallel & close interaction → merge?
  - Enabling community as process for acknowledging existing data management plans of communities



Example EUDAT: Forming strong relationships

EPOS - European Plate Observatory System

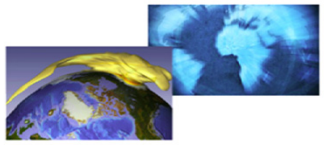
- Distributed data sensors
- Large scale statistics
- Metadata schema
- Reference architecture



Research Infrastructure and E-Science for Data and Observatories on Earthquakes, Volcanoes, Surface Dynamics and Tectonics

ENES - Service for Climate Modeling in Europe

- About 20 centers in EU
- CIM data model
- Using CDI @ German Climate Center
- Using DOIs and EPIC
- Metadata based on ISO 11179



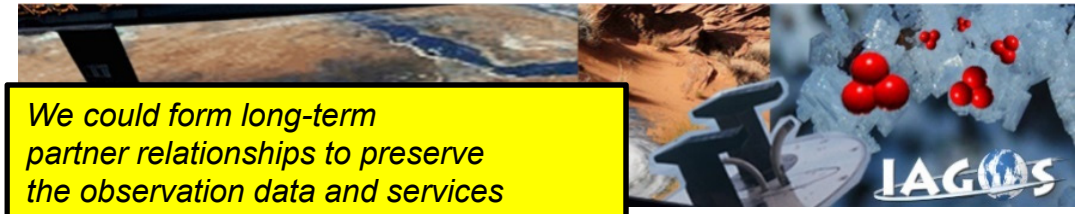
ENES provides information and services to foster intricate simulations of the climate system using high performance computers as well as the distributions and dissemination of data produced by such simulations

CLARIN - Common Language Resources and Technology Infrastructure

- About 200 centers in EU
- Require PIDs, CMDI
- ISOcat, SCHEMcat
- Virtual Language Obs.

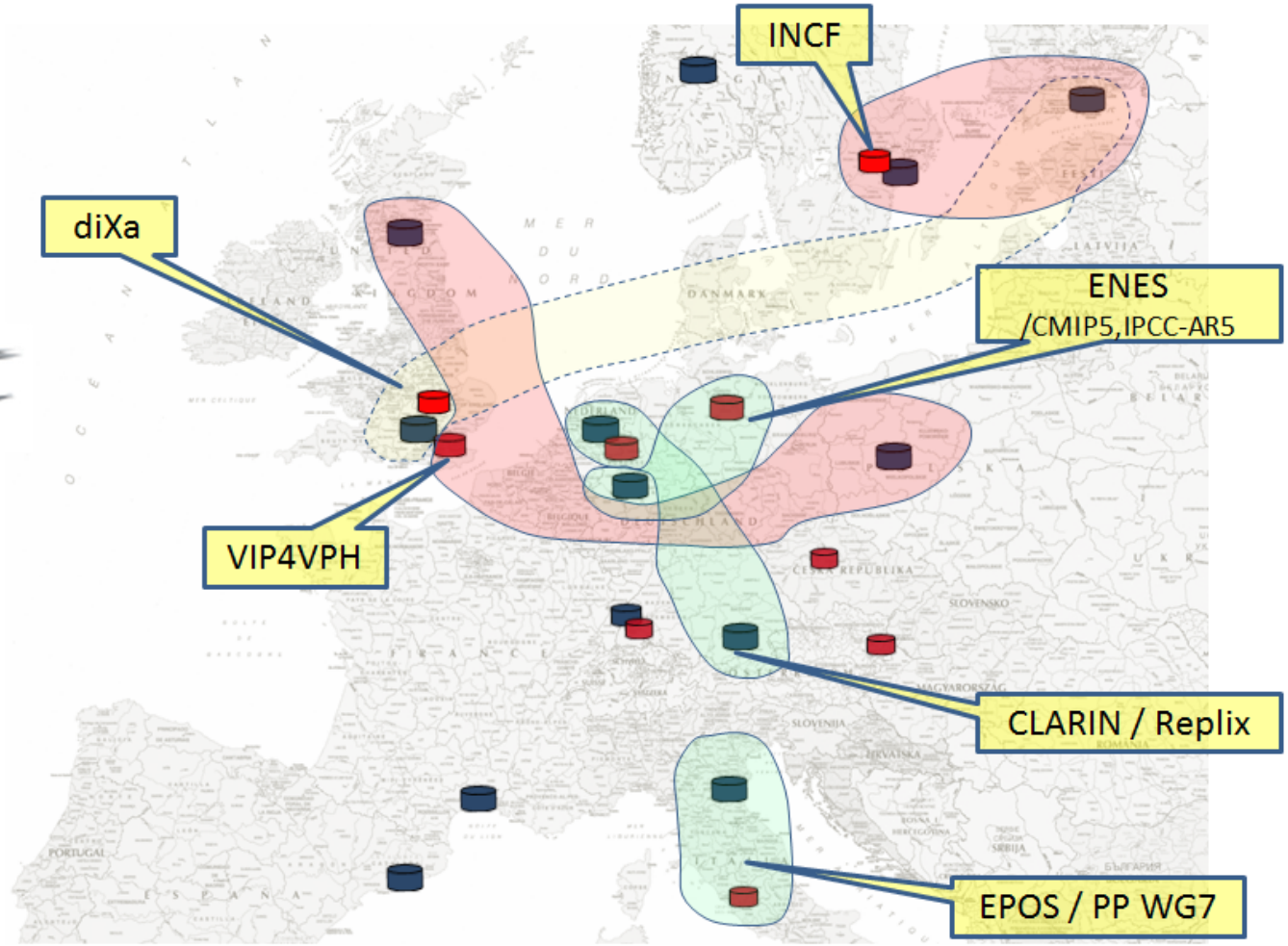
http://www.clarin.eu/vlo/

The CLARIN project is a large-scale pan-European collaborative effort to create, coordinate and make language resources and technology available and readily usable



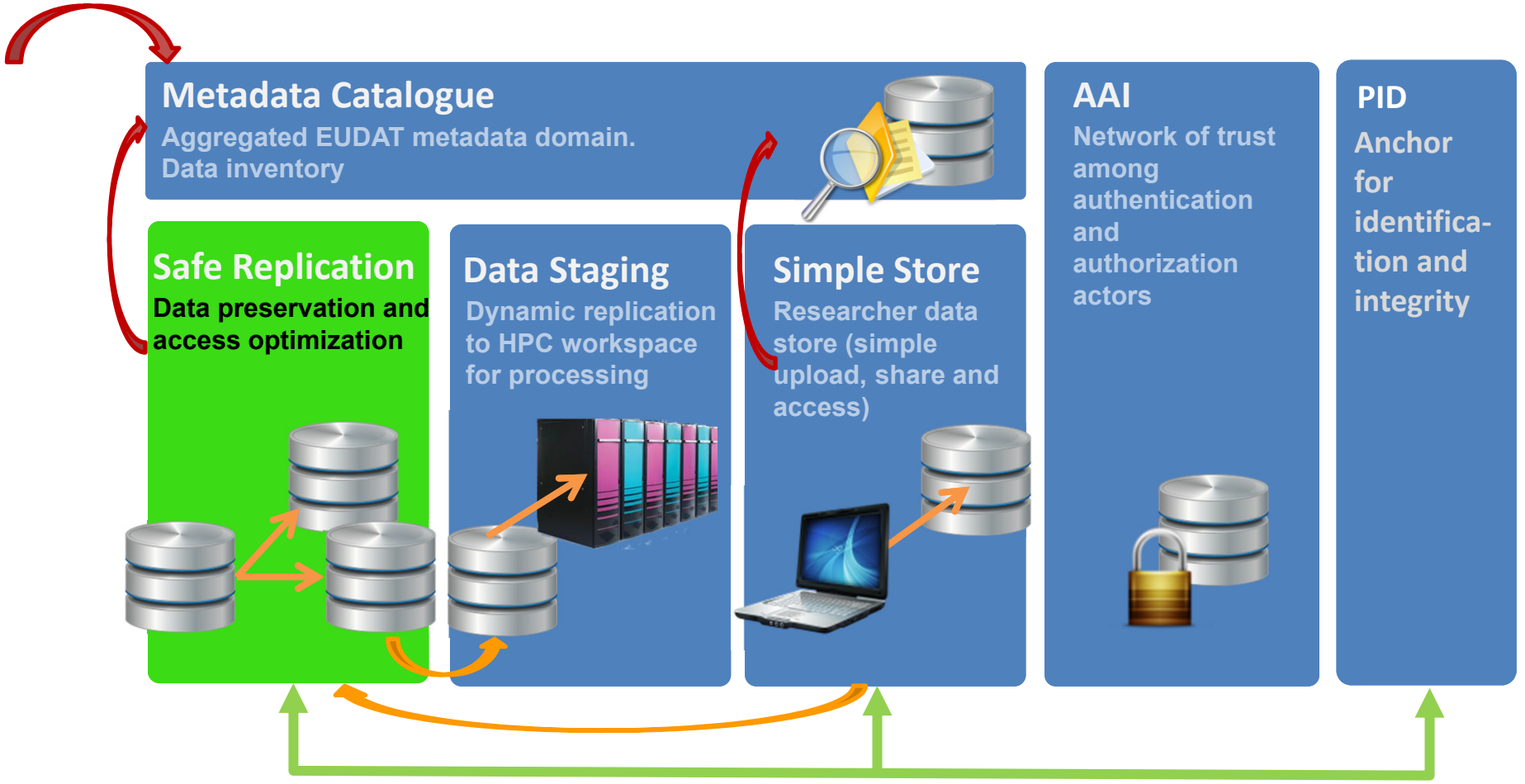
We could form long-term partner relationships to preserve the observation data and services and to make it largely available

Example: EUDAT Science Relationships



Are there scientific relationships across EU (or US) we could support?

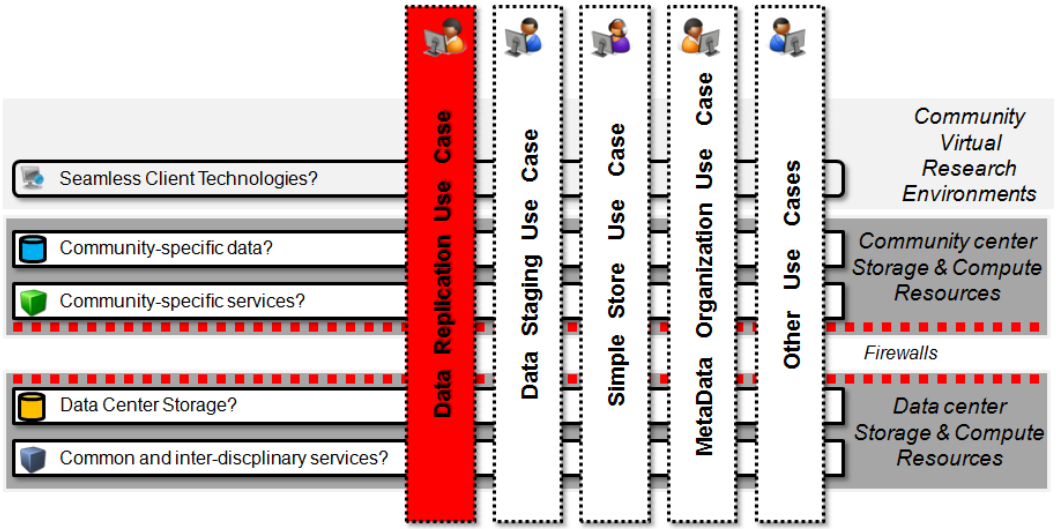
Example: EUDAT Safe Replication Service

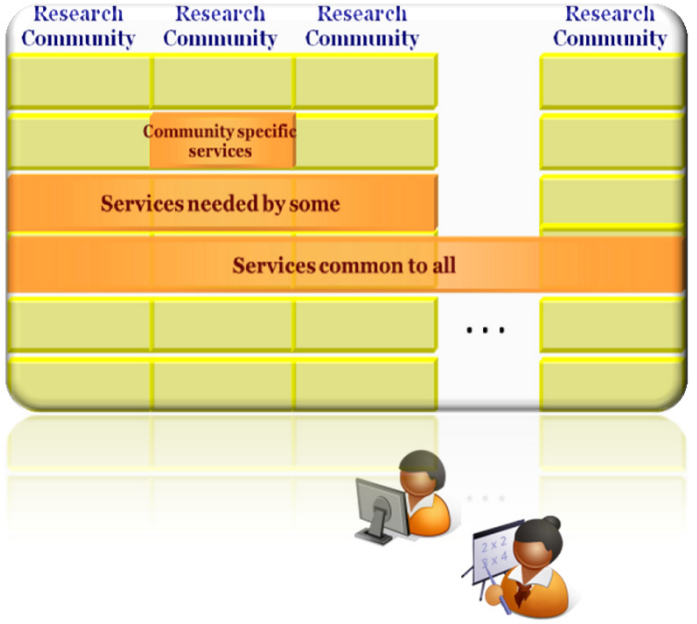


EUDAT

Data PID Metadata

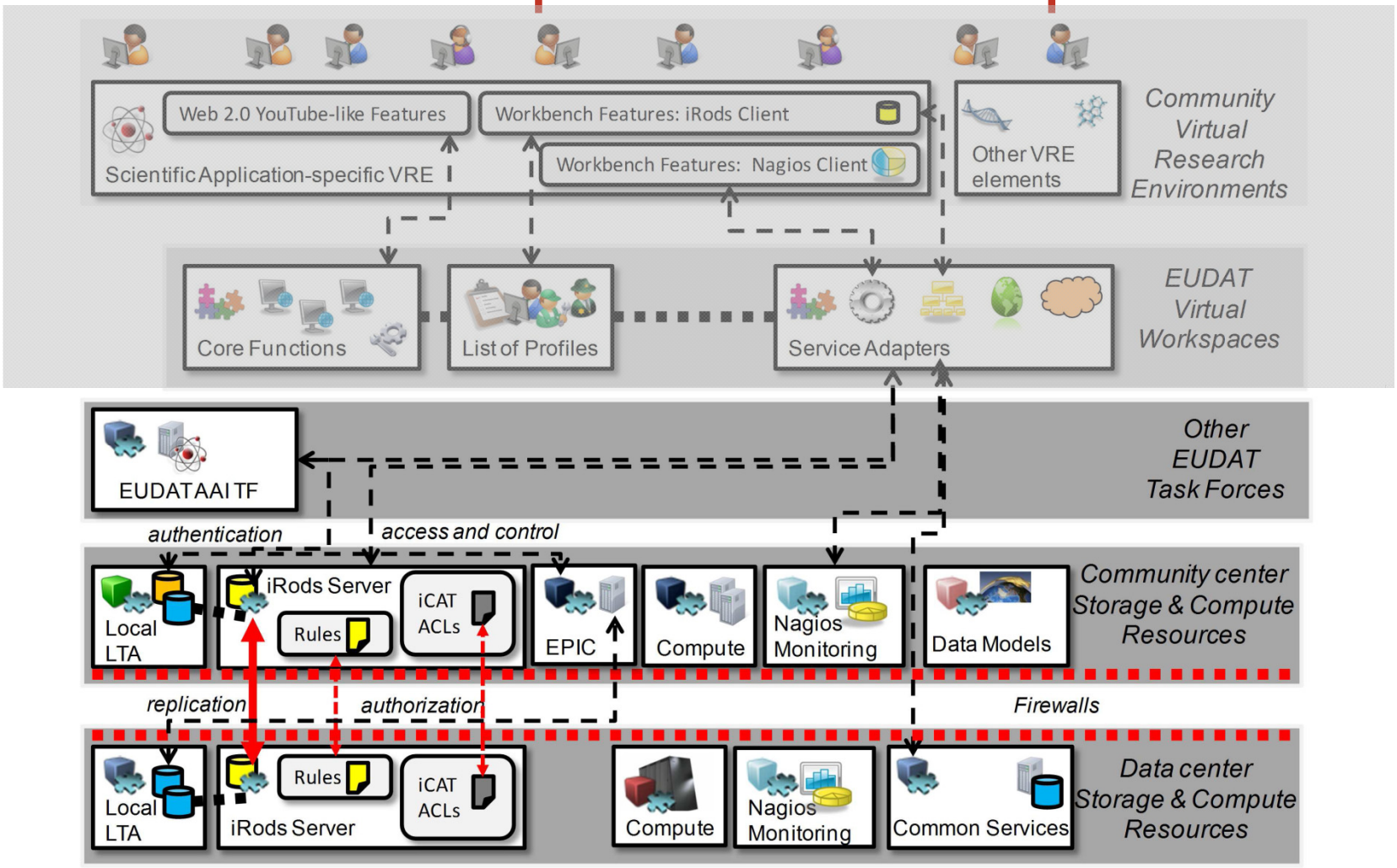
Federated Approach for Use Cases





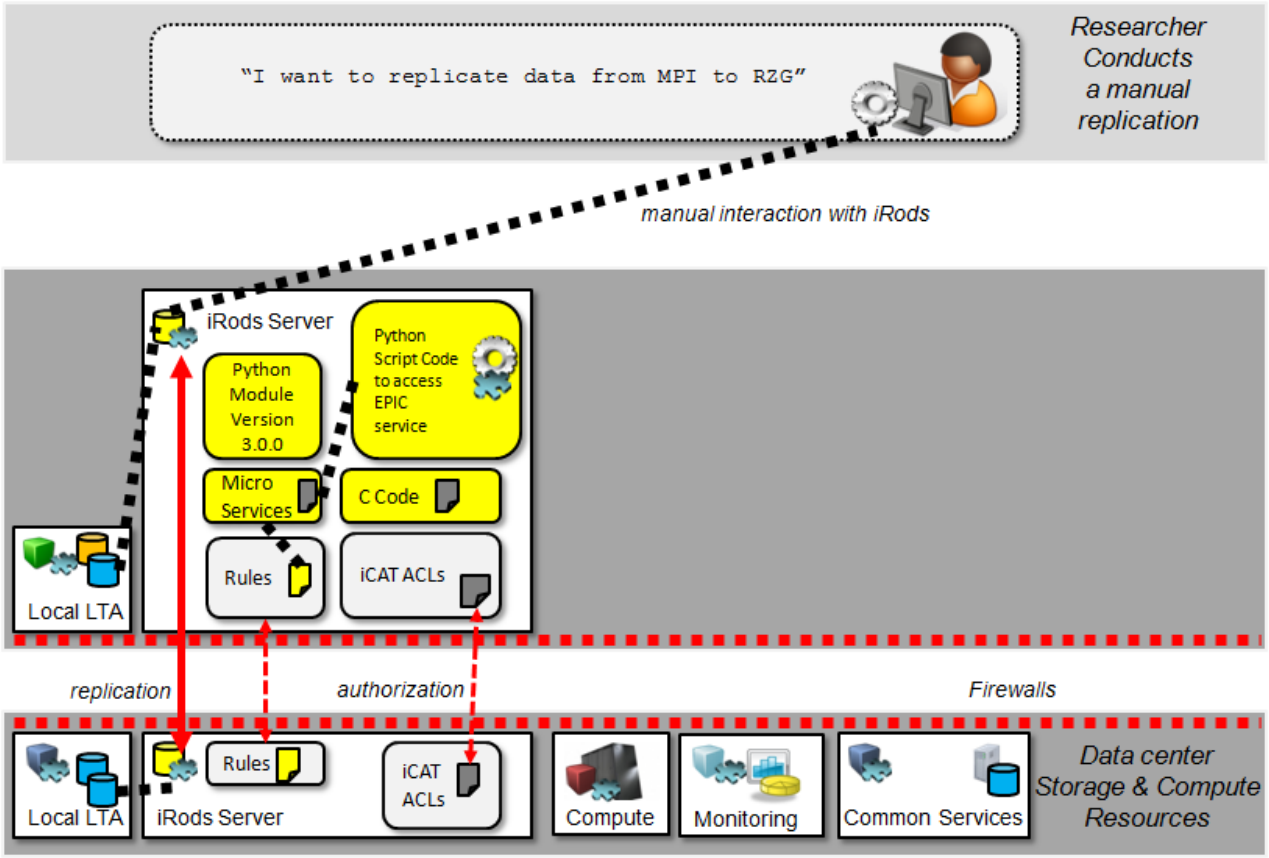
Create M replications at different data centers for N years,
exclude data centers X to data centers Z from the replication scheme
and make them all accessible by maintaining the given access permissions.

EUDAT: Example of Safe Replication



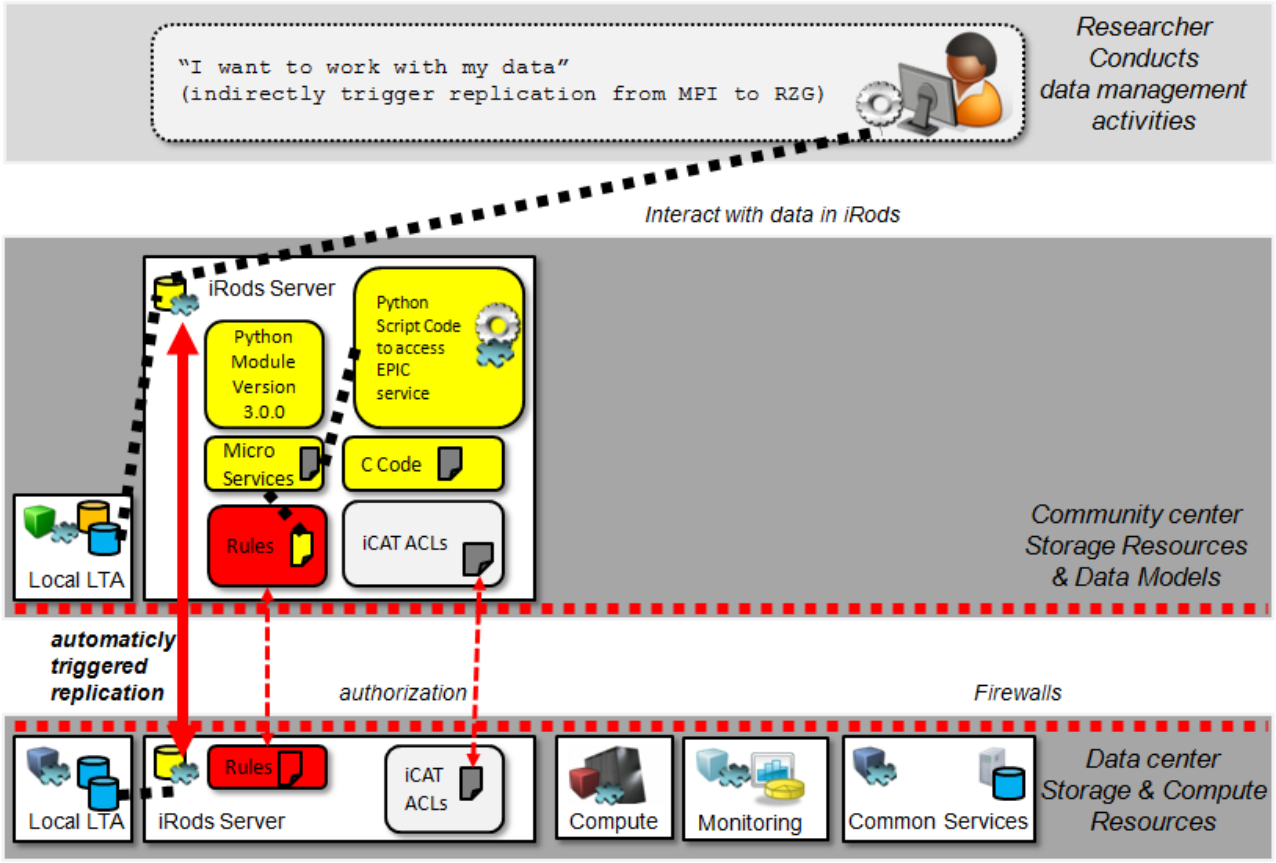
Overview: Manual Upload Replicated File

- Need to understand federations and zones in iRods

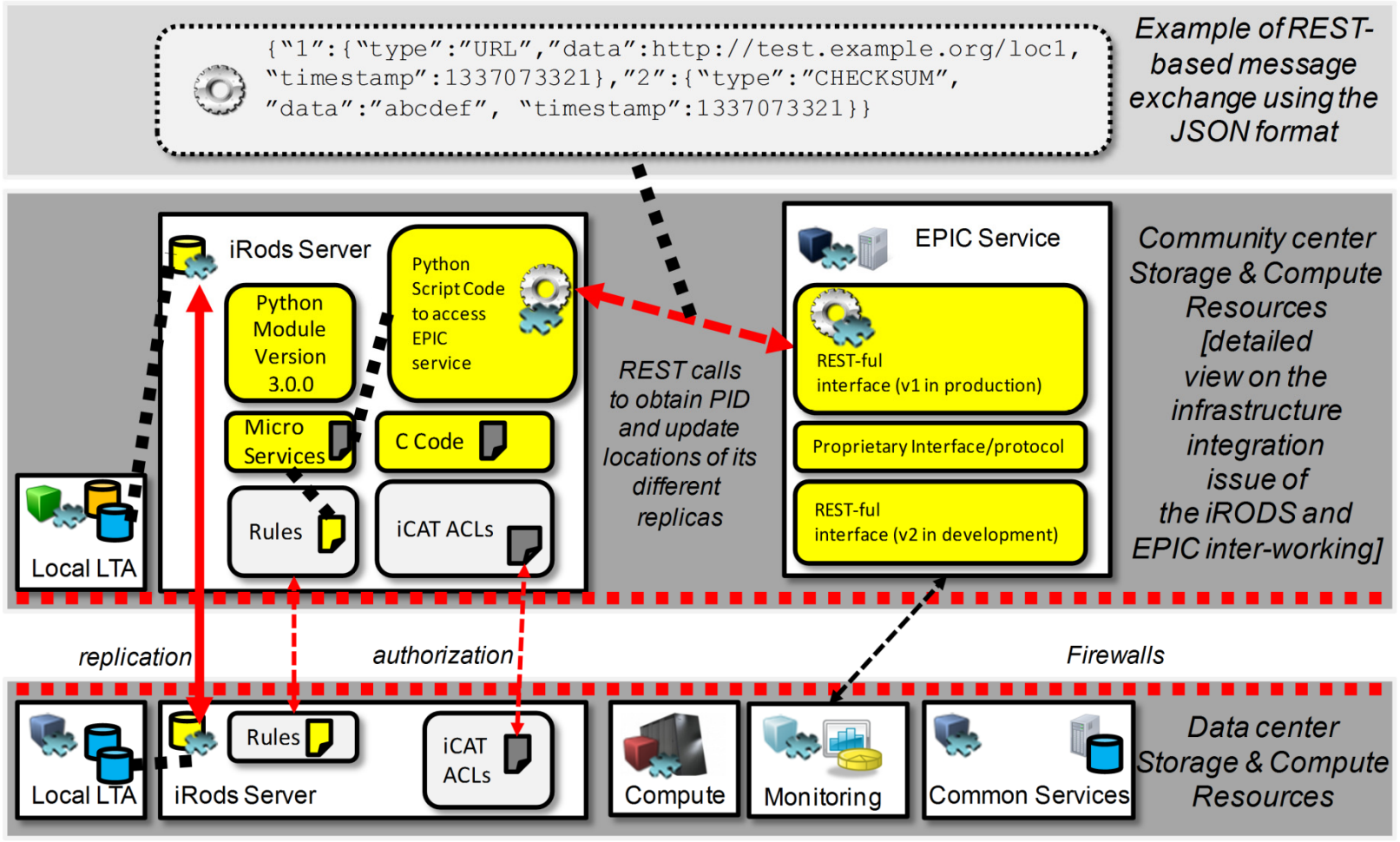


Overview: Rule-based data management

- Need to understand rules & micro-services in iRods



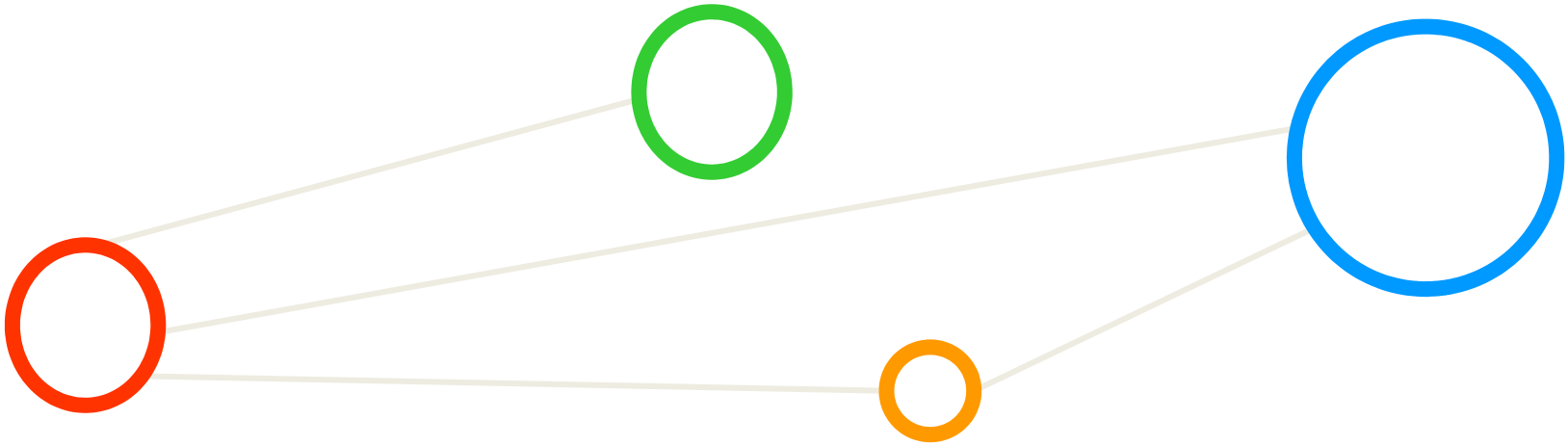
Use of Persistent Identifier (PID) Service



Lessons Learned in this Training Section

- ✓ **Understand that long-term relationships matter**
- ✓ **Knowing the difference between simple backups and safe data replication**
- ✓ **Understand key aspects of policy-based replication by defining policies on different levels (i.e. rules global/local/infrastructure)**
- ✓ **Having an idea for what rules can be used in the context of the registered domain of data**

Summary & Possible Actions



Summary

- Services are available
  - Safe Replication and Data Staging in operation for a few data centers of core communities
  - Simple Store and MetaData Services will come soon
  - Production means enabling 'the services' together with user communities
- Worked hard to get this done and to understand how to interface with communities
  - Each community is different – it is a long-term process of working together
- Needed to chose for some technologies – but take care of technology lock-in
  - iRODS just as a thin layer for example and not as a system doing all
- There is a far way between "we know how it works" and having a "real service"
  - Communities & researchers are interested in operational services
- Go ahead and extend the collaborative infrastructure with three levels of thinking
  - Working habit of Mindset, Skillset, Toolset

Possible Actions Together

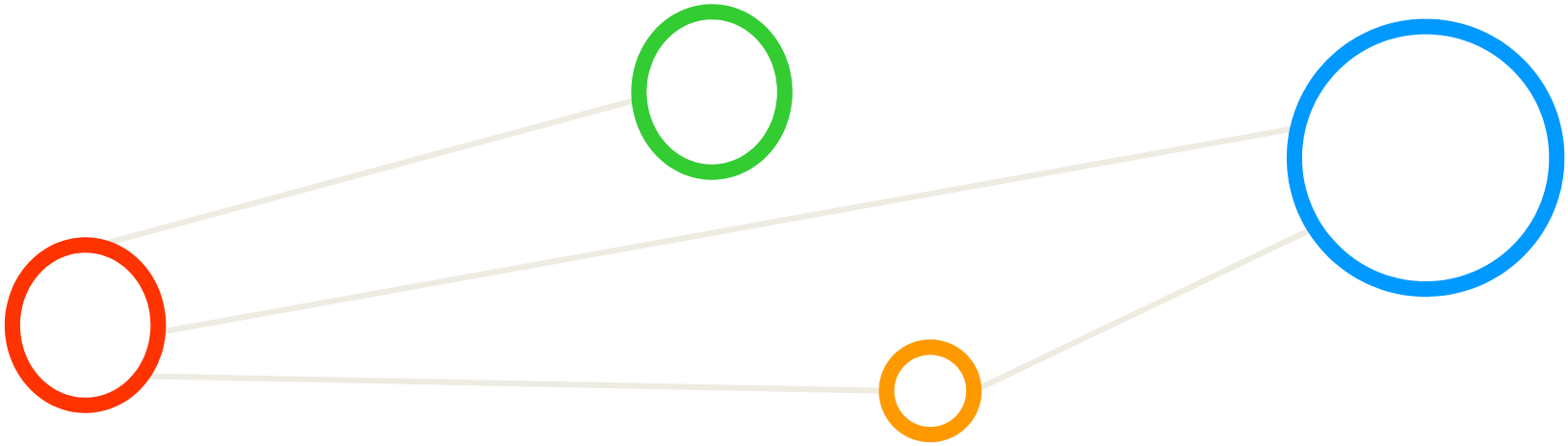
- Synergies between EUDAT and IAGOS seem to exist (also through common partners)
  - Opening data to much more communities, increase IAGOS/MOZAIC uptake
  - Long-term preservation and link of metadata to others
- We need to understand IAGOS better from EUDAT perspective
  - Data Management Plans and links to added value services
- EUDAT is forming Working Groups
  - Dynamic Data (database, real-time transmissions), Scientific Workflows, etc.
  - Explore possibilities for creating an MoU between IAGOS and EUDAT
- Research Data Alliance (RDA) for research data sharing without barriers
  - Community Group for the IAGOS community to link with US(+China) activities?
  - Something similiar as 'Agriculture Interoperability Interest Group'

Thanks for the attention.

Get in contact with us:
http://www.eudat.eu

Join the Research Data Alliance
http://rd-alliance.org/

References



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