Storage Management in INDIGO

Paul Millar

paul.millar@desy.de

with contributions from Marcus Hardt, Patrick Fuhrmann, Łukasz Dutka, Giacinto Donvito.

INDIGO-DataCloud is co-founded by the Horizon 2020Framework Programme

INDIGO-DataCloud: cheat sheet

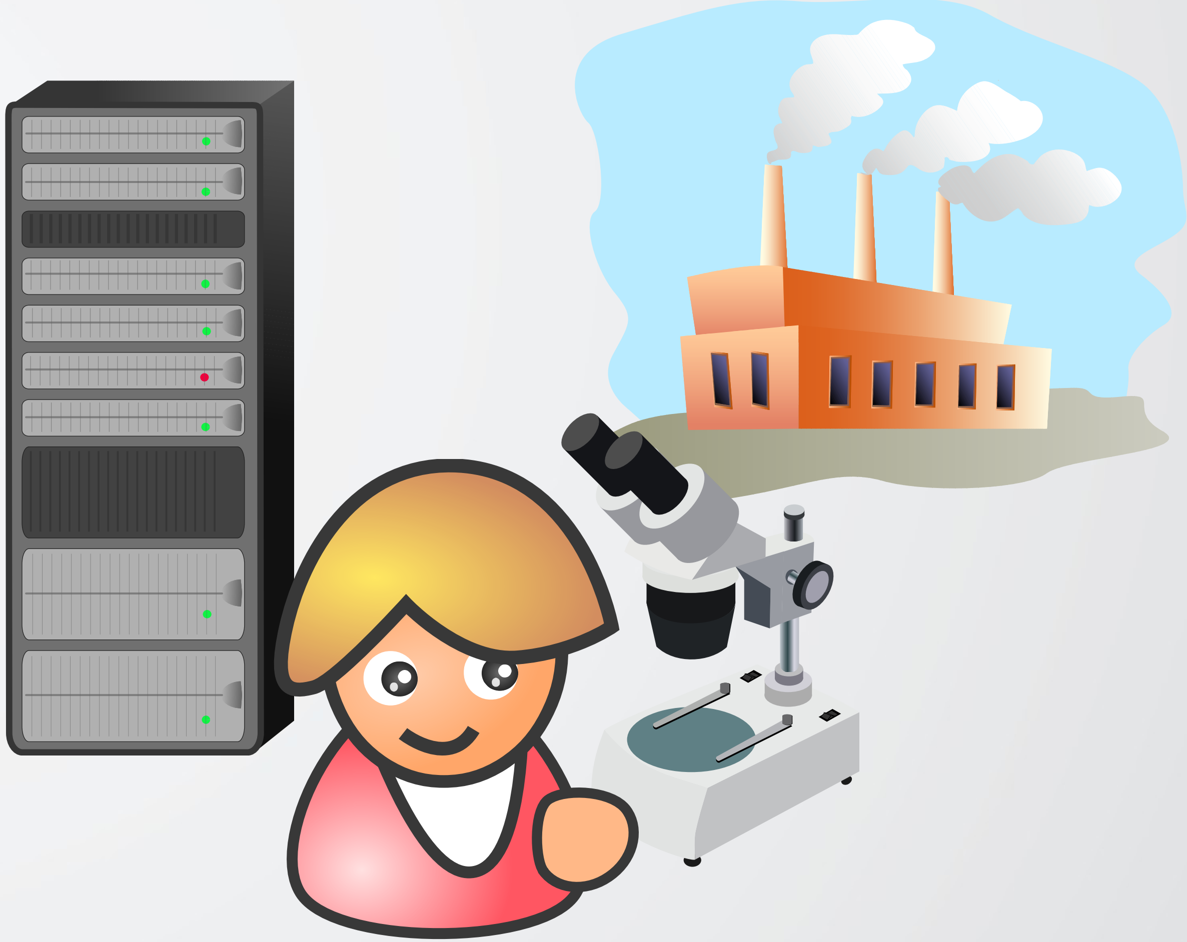
- A Horizon-2020 project

  Approved: January 2015; **Started:** April 2015; **Ends:** September 2017.

- 26 partners from 11 European countries.
- Over €11 million
- **Objective**: develop an Open-Source platform for computing and data, deployable on public and private cloud infrastructures.
- Requirements from 11 INDIGO communities.

More details: http://indigo-datacloud.eu/

The “golden era”

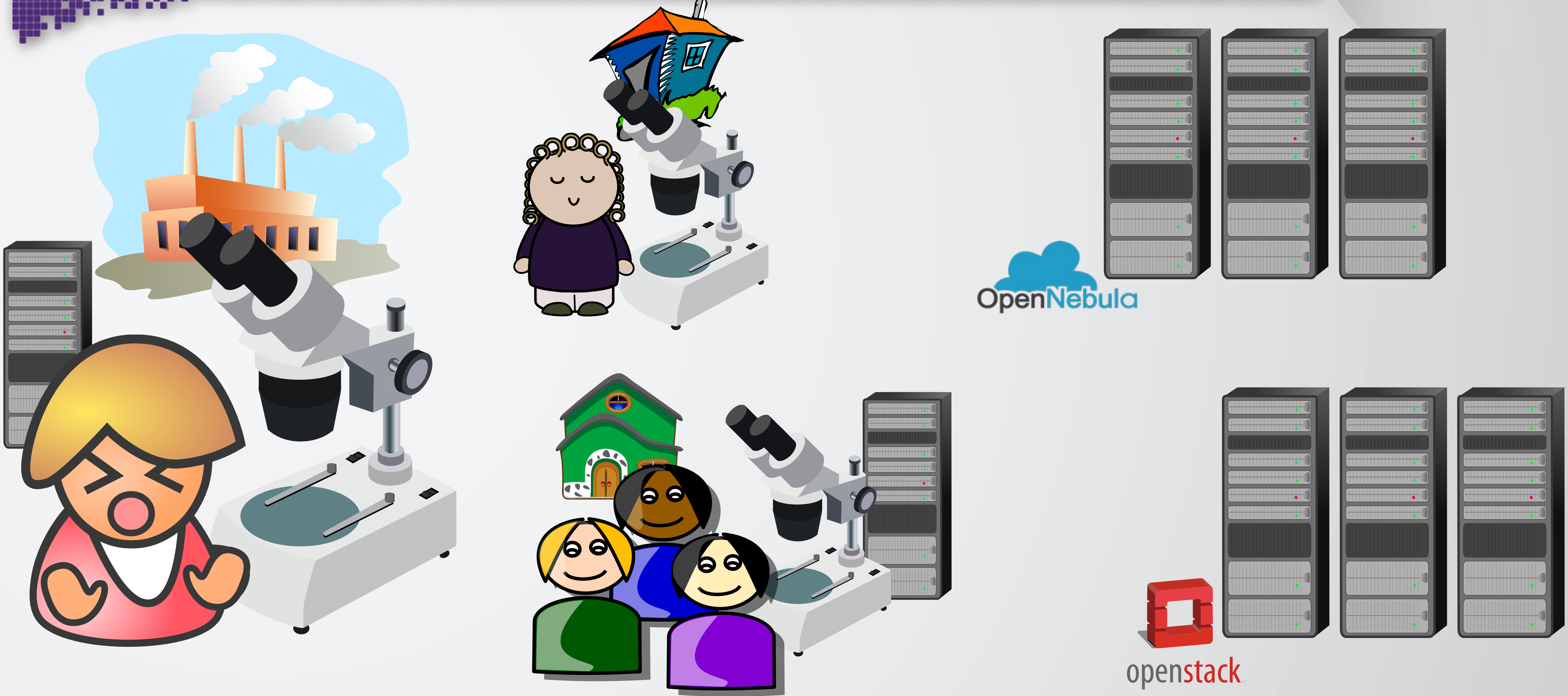


Collaborations & new equipment

INDIGO - DataCloud

More resources, but “cloud”!

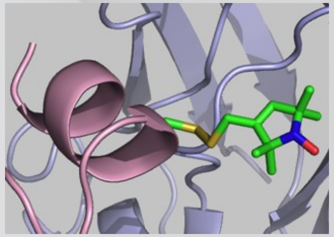
INDIGO - DataCloud



Who is involved

- **Biological and medical science**

  Biological, molecular and medical imaging, life science research applied to medicine, agriculture, bio-industries and society, structural biology.



- **Social science, arts and humanities**

  Georeferencing (e.g., of current and historical maps), cultural heritage, smart sensors.

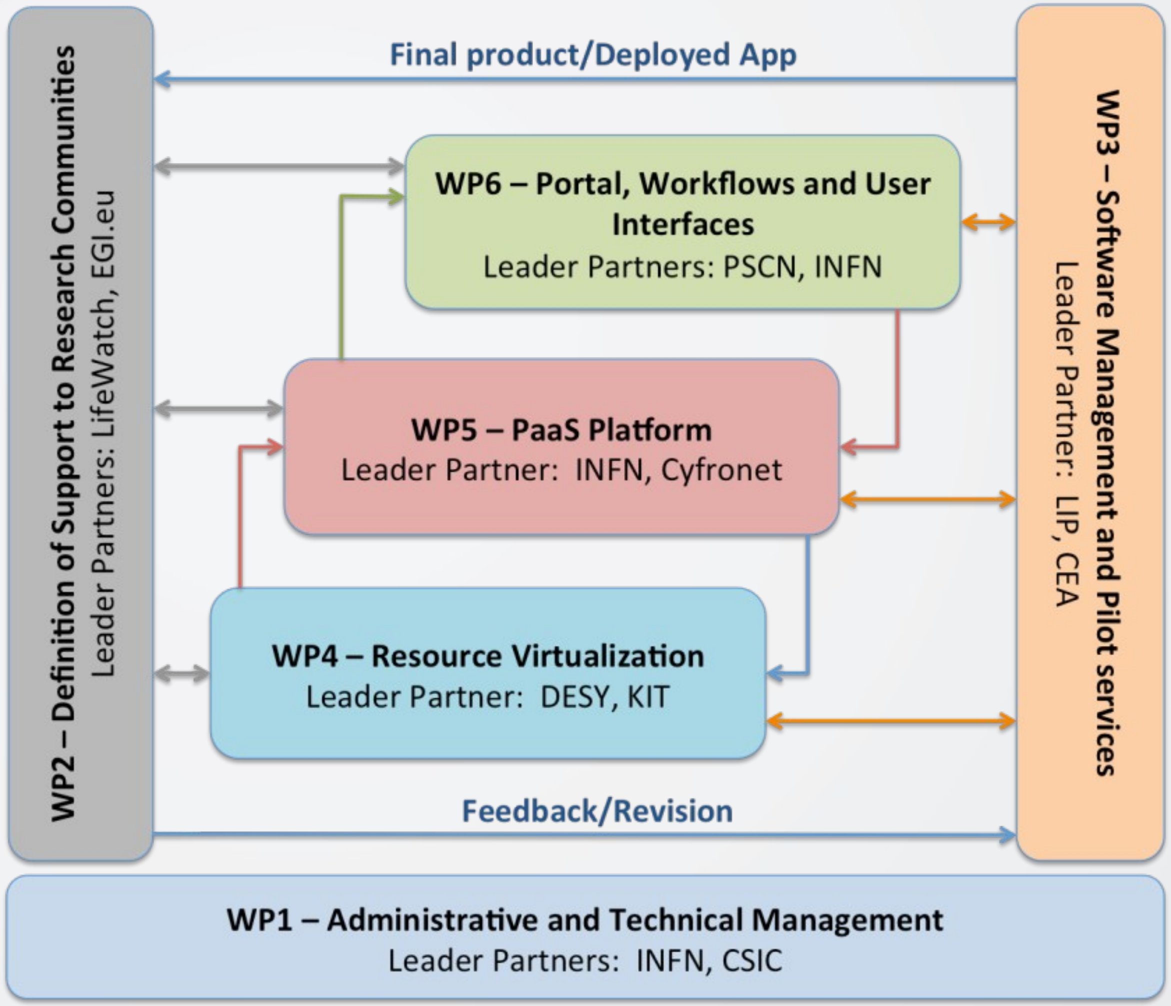
- **Environment and earth science**

  Biodiversity and ecosystem research, interactions between geosphere, biosphere and hydrosphere, earth system modelling.

- **Physical sciences**

  Astrophysics, theoretical and experimental research in physics.

How INDIGO-DataCloud helps


Final product/Deployed App
WP2 – Definition of Support to Research Communities
Leader Partners: LifeWatch, EGI.eu
WP6 – Portal, Workflows and User Interfaces
Leader Partners: PSCN, INFN
WP5 – PaaS Platform
Leader Partner: INFN, Cyfronet
WP4 – Resource Virtualization
Leader Partner: DESY, KIT
WP3 – Software Management and Pilot services
Leader Partner: LIP, CEA
Feedback/Revision
WP1 – Administrative and Technical Management
Leader Partners: INFN, CSIC

WP4:

Providing common interfaces for site-local resources

IaaS

WP5:

Providing a useful, high-level service that combines multiple resources.

PaaS

IaaS: Quality of Service

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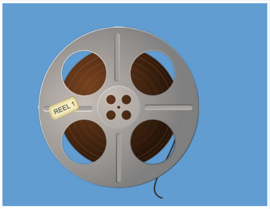
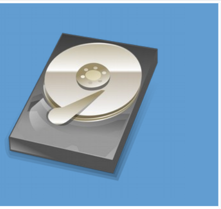
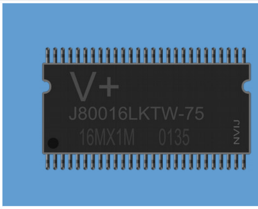
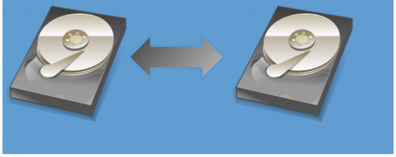
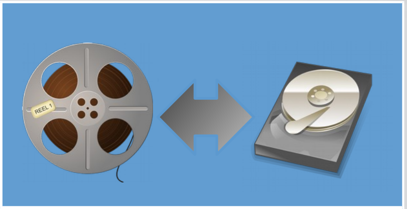
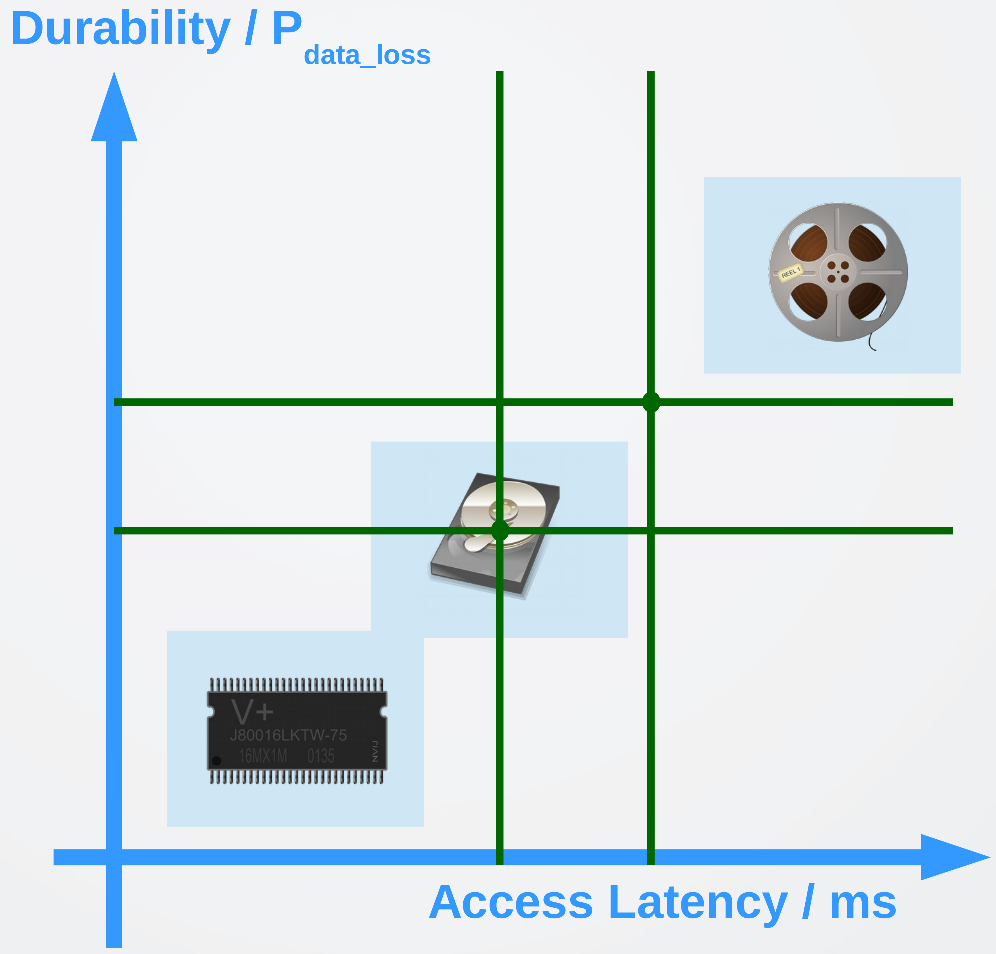
Media Quality					
Access Latency	HIGH	MEDIUM	LOW	MEDIUM	MEDIUM
Durability	OK	MEDIUM	Not so clear	Quite OK	OK
Data rate	OK	OK	MEDIUM	OK	OK
Cost	Very low	Reasonable	Very high	MEDIUM	MEDIUM

Making the choice meaningful

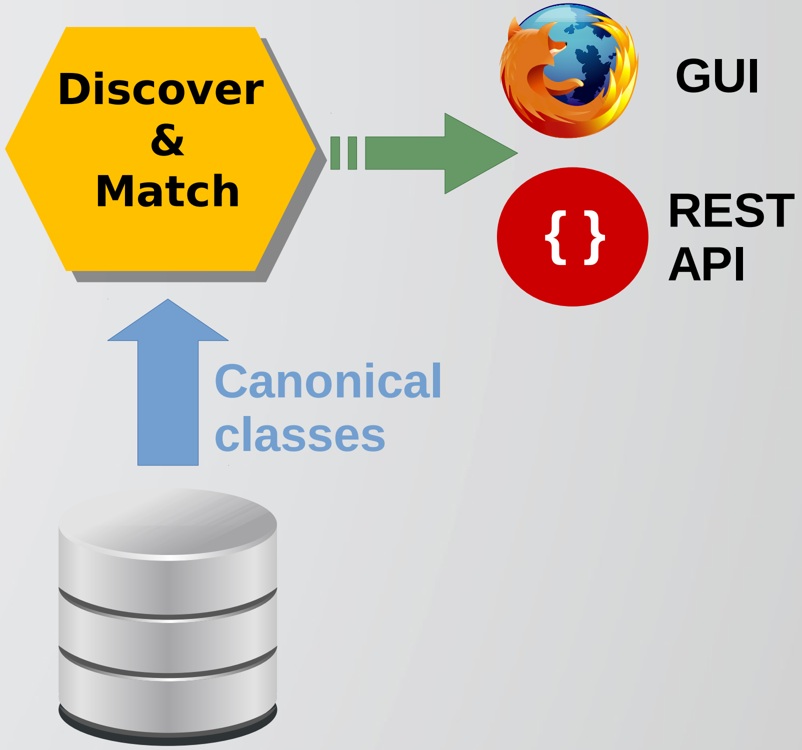


VS

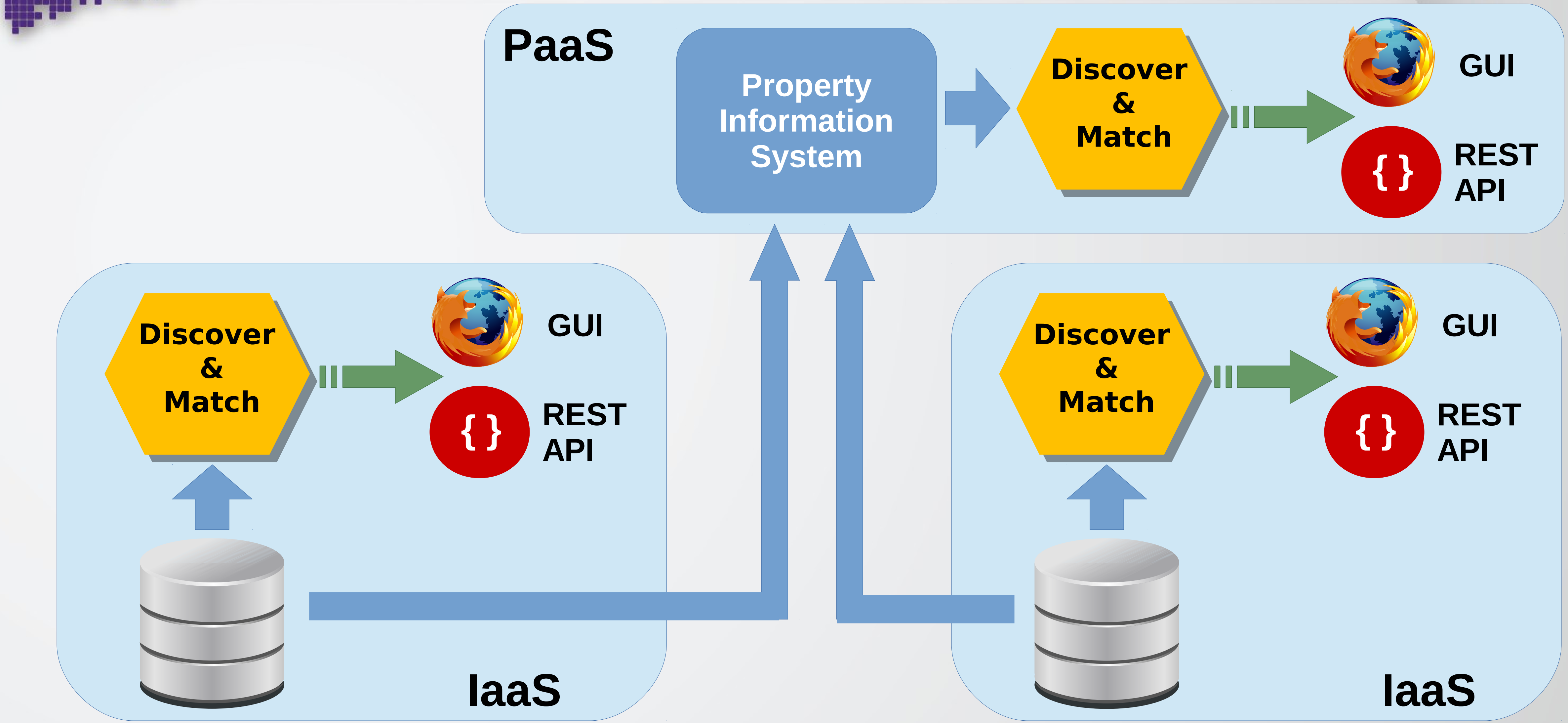
Low latency & lowest price → Class #1

High throughput & super durable → Class #2

Large volume & cheap & archive → Class #3



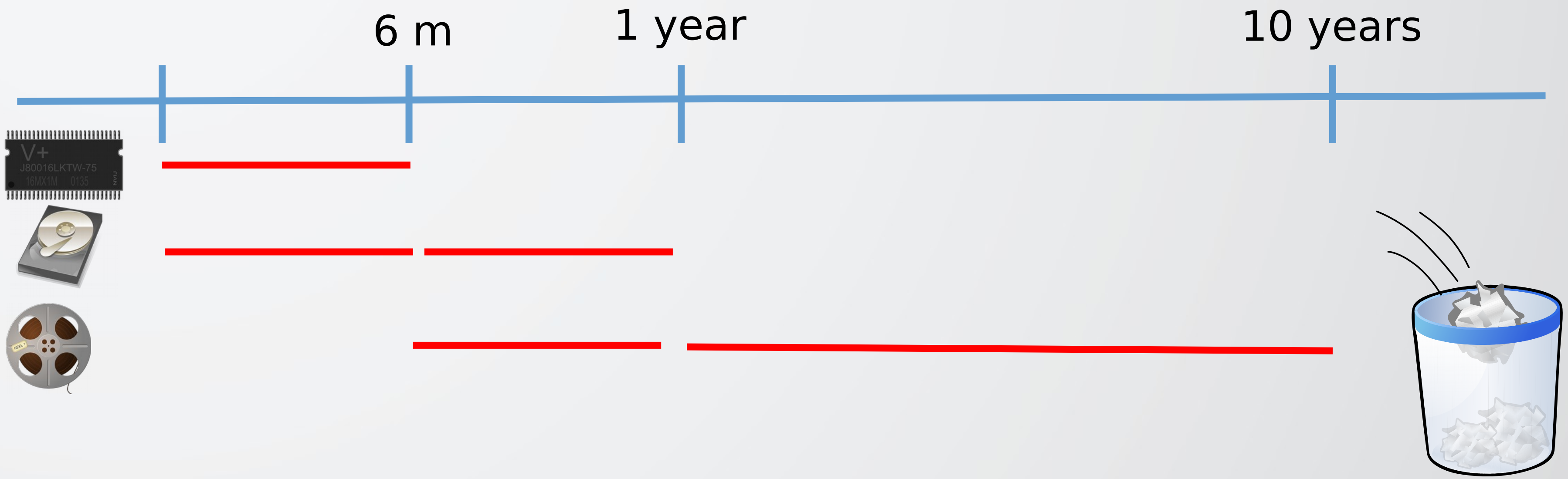
Federating QoS Choice



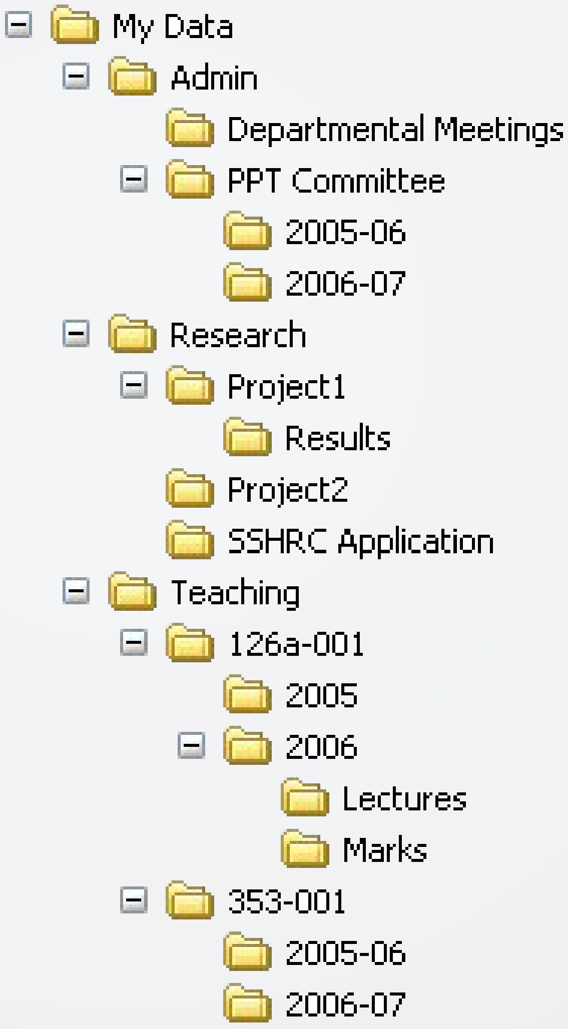
IaaS: Data Lifecycle

Data Lifecycle is just time dependent changes of

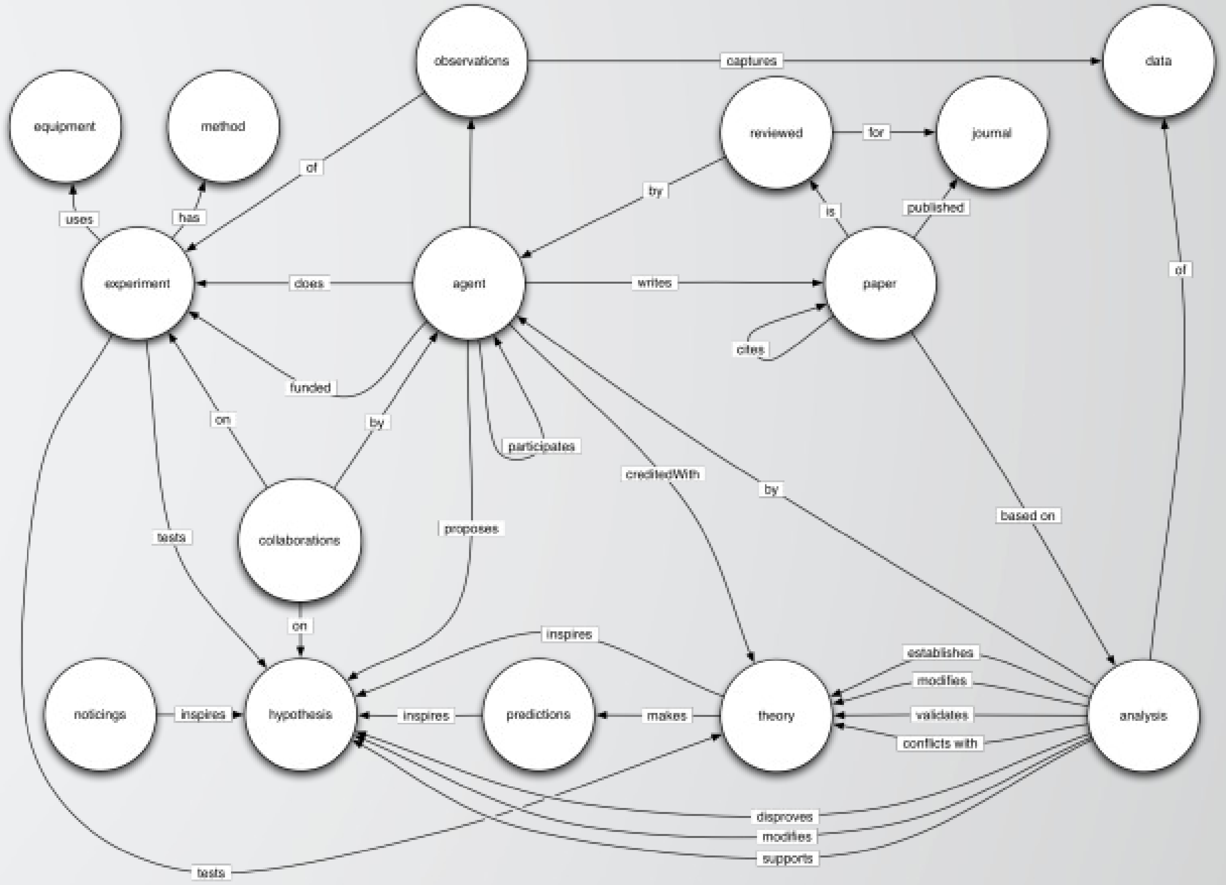
- Storage Quality of Service
- Ownership and Access Control: PI Owned, limited access → Site Owned, Public access
- Payment model: pay-as-you-go → pay-in-advance for rest of lifetime
- Maybe other things



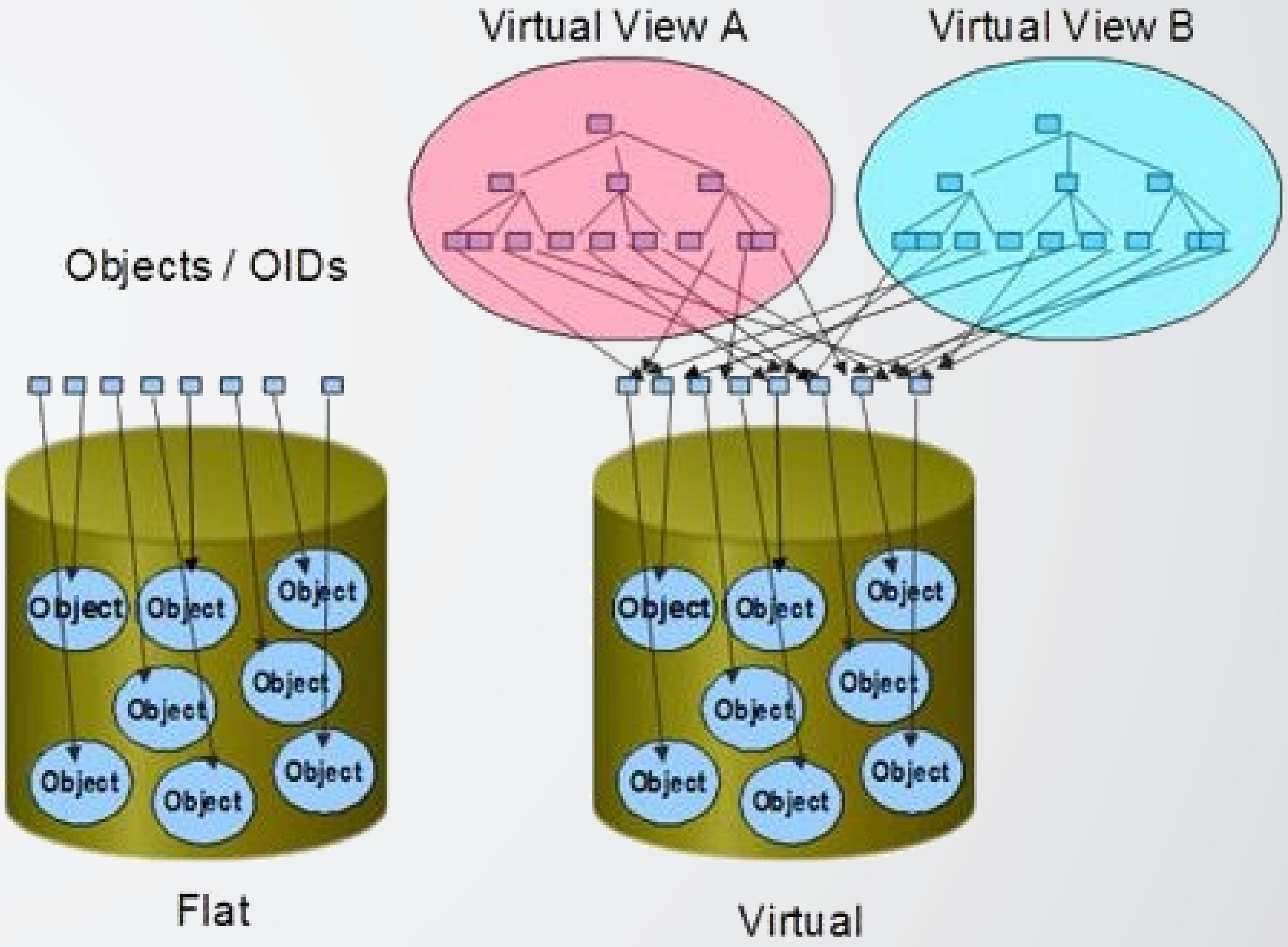
IaaS: Metadata-driven storage

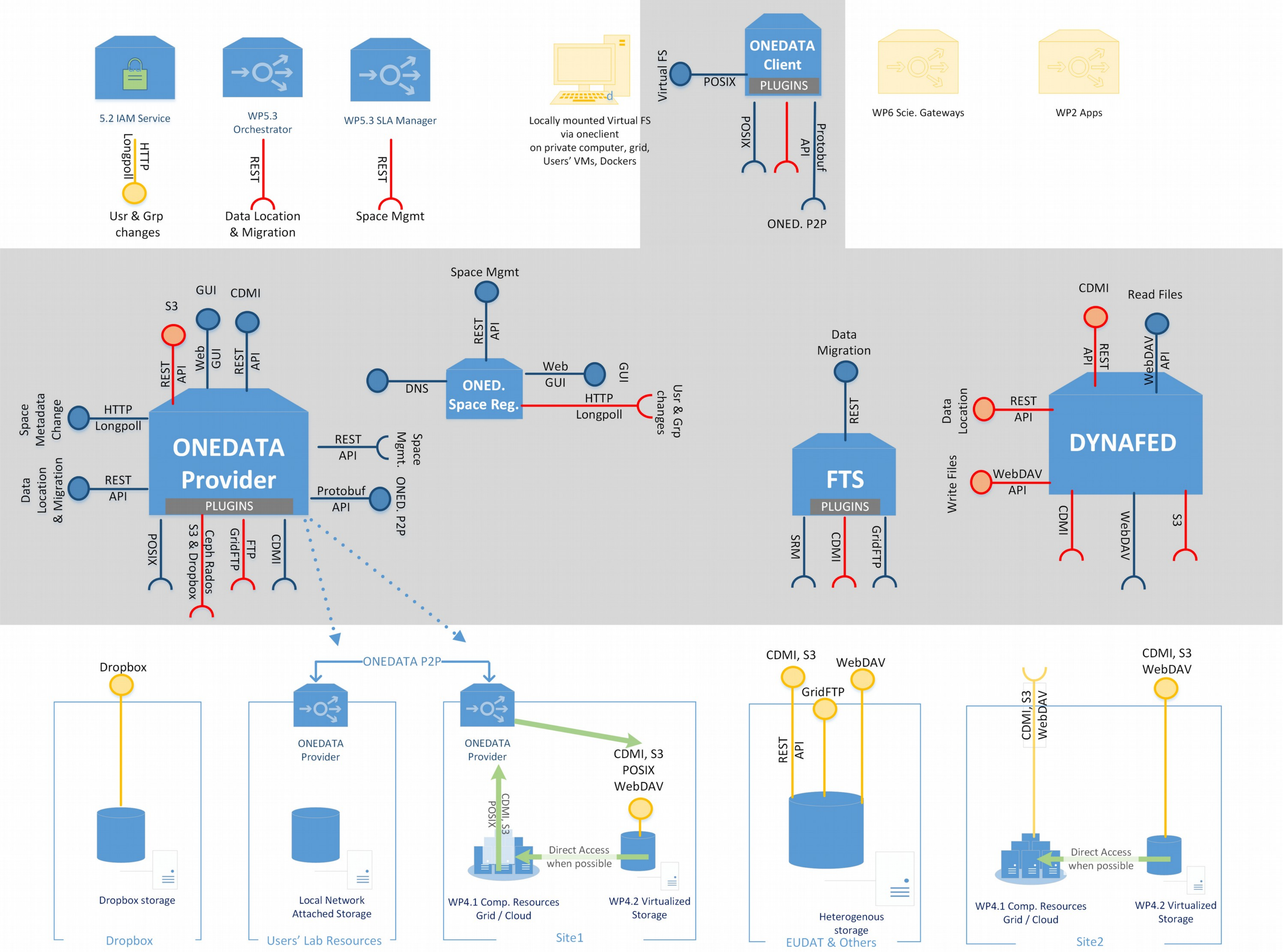


- My Data
  - Admin
    - Departmental Meetings
    - PPT Committee
      - 2005-06
      - 2006-07
  - Research
    - Project1
      - Results
    - Project2
    - SSHRC Application
  - Teaching
    - 126a-001
      - 2005
      - 2006
        - Lectures
        - Marks
    - 353-001
      - 2005-06
      - 2006-07



IaaS: laying hierarchical storage




5.2 IAM Service
HTTP
Longpoll
Usr & Grp changes
WP5.3 Orchestrator
REST
Data Location & Migration
WP5.3 SLA Manager
REST
Space Mgmt
Locally mounted Virtual FS via oneclient on private computer, grid, Users' VMs, Dockers
Virtual FS
POSIX
ONEDATA Client
PLUGINS
POSIX
API
Protobuf
ONED. P2P
WP6 Scie. Gateways
WP2 Apps
Space Mgmt
REST
API
DNS
ONED. Space Reg.
Web
GUI
GUI
HTTP
Longpoll
Usr & Grp changes
S3
GUI
CDMI
REST
API
Web
GUI
REST
API
Space Metadata Change
HTTP
Longpoll
Data Location & Migration
REST
API
ONEDATA Provider
PLUGINS
REST
API
Space Mgmt.
Protobuf
API
ONED. P2P
POSIX
S3 & Dropbox
Ceph Rados
GridFTP
FTP
CDMI
Data Migration
REST
FTS
PLUGINS
SRM
CDMI
GridFTP
CDMI
Read Files
API
REST
WebDAV
API
Data Location
REST
API
DYNAFED
Write Files
WebDAV
API
CDMI
WebDAV
S3
Dropbox
Dropbox storage
Dropbox
ONEDATA P2P
ONEDATA Provider
Local Network Attached Storage
Users' Lab Resources
ONEDATA Provider
CDMI, S3
POSIX
WebDAV
CDMI, S3
POSIX
Direct Access when possible
WP4.1 Comp. Resources Grid / Cloud
WP4.2 Virtualized Storage
Site1
CDMI, S3
WebDAV
GridFTP
REST
API
Heterogenous storage
EUDAT & Others
CDMI, S3
WebDAV
CDMI, S3
WebDAV
Direct Access when possible
WP4.1 Comp. Resources Grid / Cloud
WP4.2 Virtualized Storage
Site2

Ease of deployment

Grid computing

INDIGO-DataCloud

Credit: U.S. Pacific Fleet @ flickr.com

Credit: Creative Tools @ flickr.com

Identity and group-membership

- Allow **different** authentication mechanisms

    SAML, OpenID-Connect, X.509, ...

- **Harmonise** user identities:

    User is the same person, irrespective of how they authenticate

- Support **group-membership**:

    Membership can be used for authorisation decisions.

- Support **third-party** group membership:

    VOMS-style: where membership *not* asserted by authentication service.

For more details, see Andrea's Talk: “**The Indigo AAI**”
tomorrow 10:15 in **Scuderia.**

Availability

- **First official release**: end of July next year
- We will start making available some services as soon as they are ready enough to be tested
- All the changes on the existing projects will be pushed back to the official releases.

    OpenStack, OpenNebula, dCache, OneData, Mesos, Accounting, QoS/SLA, etc…

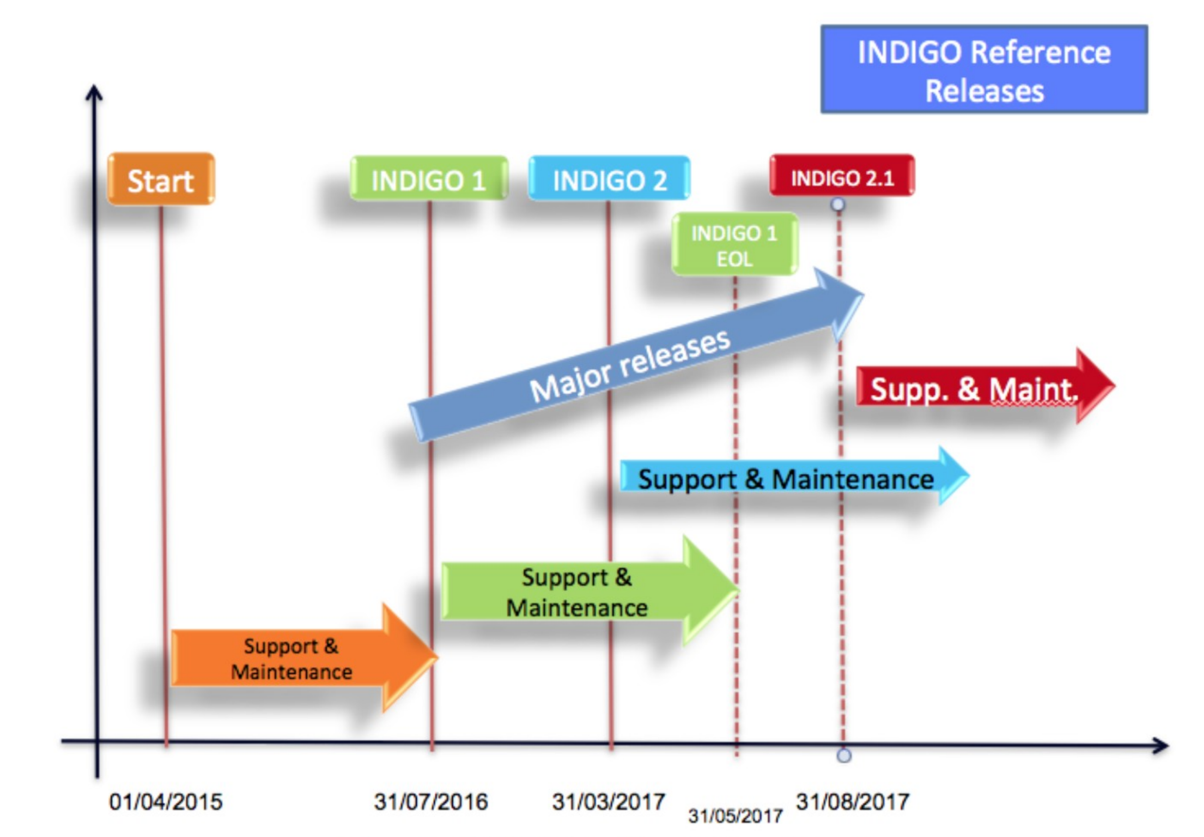
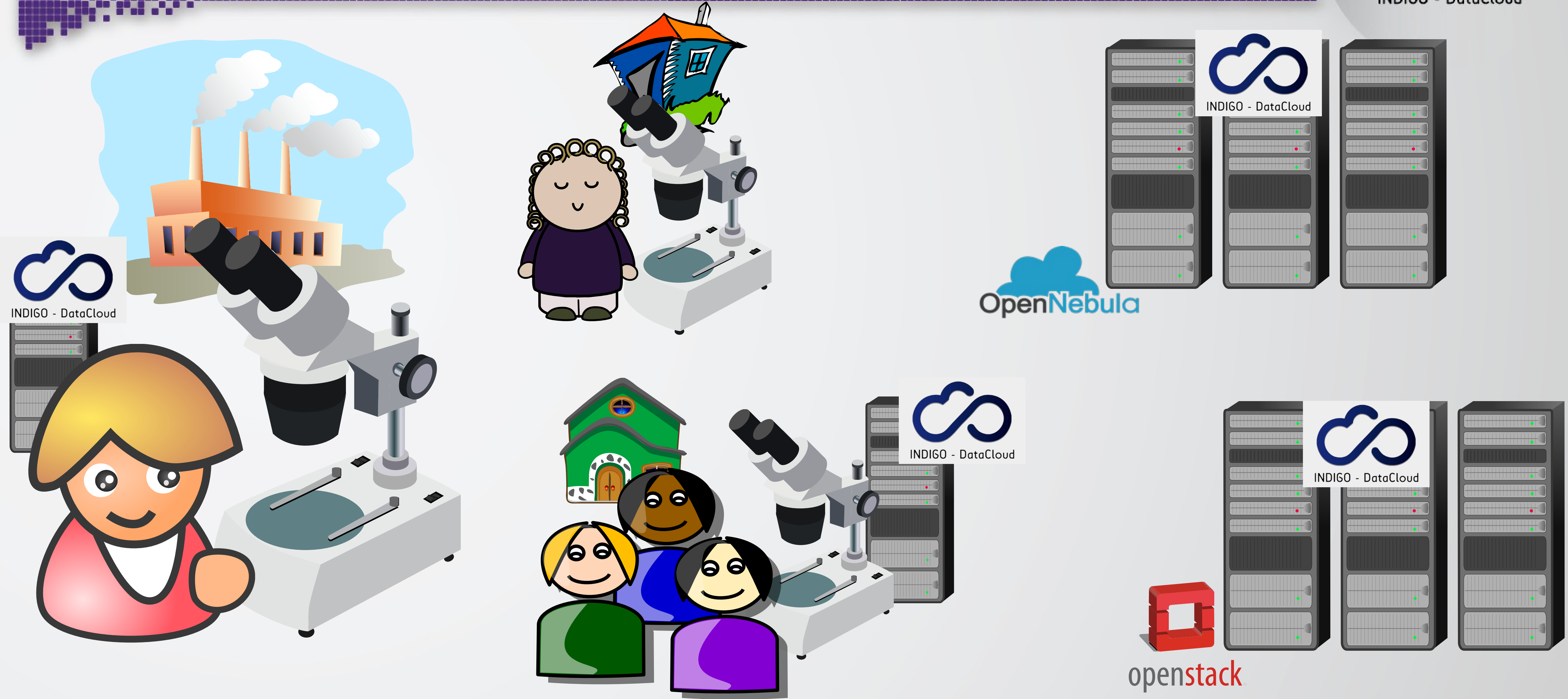


Figure 8: INDIGO-DataCloud Release Timeline

The result: more time researching



Backup slides

PaaS: Unified data access

- Data set registrar:

  Unified vision of geographically distributed data set.
- Data affinity:

  Computation jobs started on resources close to data.
- Automatic Staging:

  Replicating data when not close to specialist hardware.
- Optimised streaming access of remote data:

  When data is not staged.
- API for data and metadata management:

  registration, migration, replication, sharing; federated ACL management
- Optimised data movement
- Aggregate QoS through replication
- Gateway to external data repositories

PaaS: Unified storage interfaces

- Data access methods and protocols:

  CDMI, Web GUI, WebDAV, S3, POSIX (mounted virtual volume)

- Data locations:

  via CDMI or WebDAV

- Data migration and replication:

  REST API or CDMI extension allowing replication based on metadata.

PaaS: Data Affinity

- Knowledge of where data is located
- Identify which IaaS computing resource is closest
- Allow deployment of computation activity close to where the data is located
- Minimise data transfers to improve efficiency.