DESY IT

Challenges and future directions in supporting scientific exploration

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DESY IT
DESY, 2015-03-12

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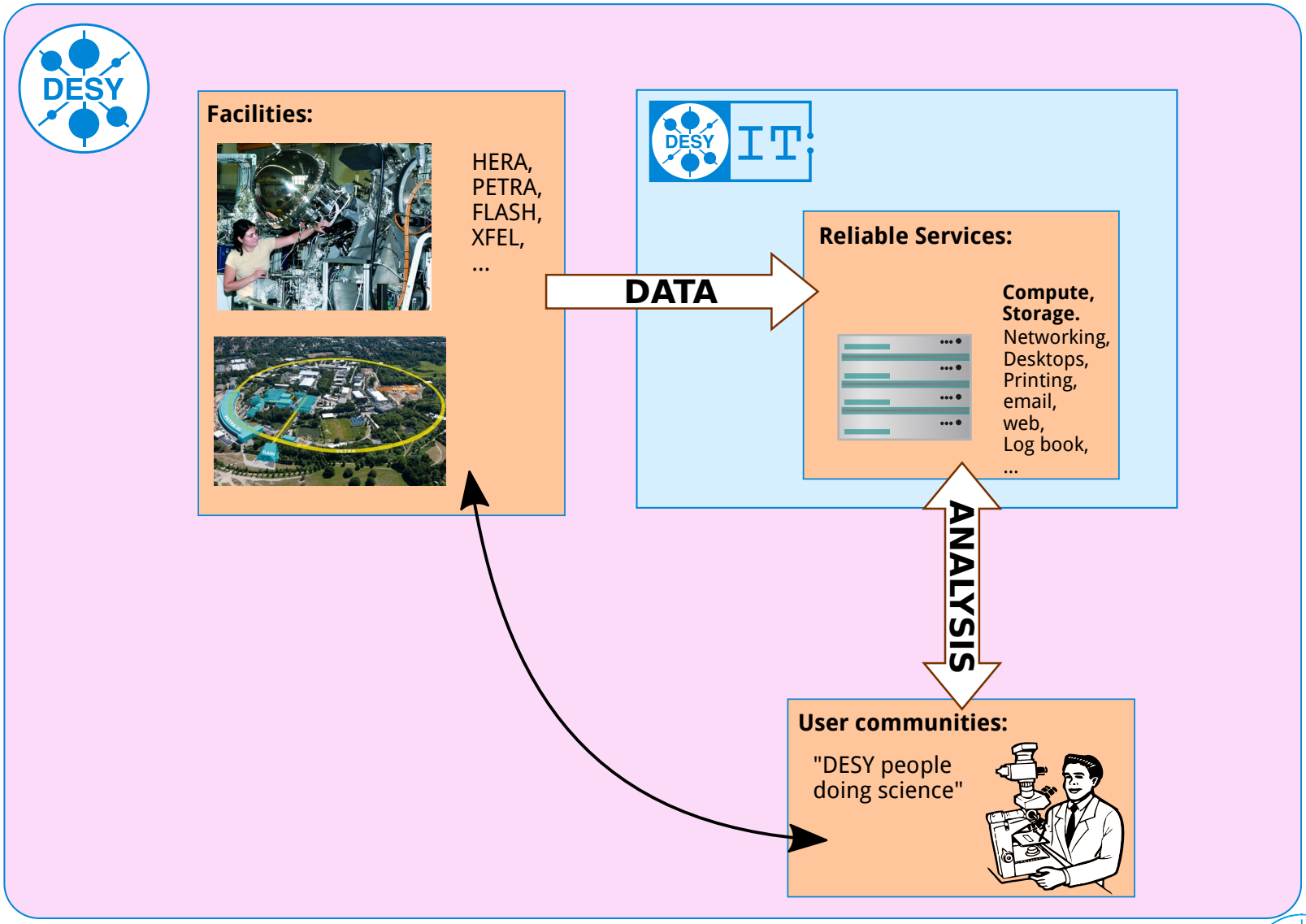
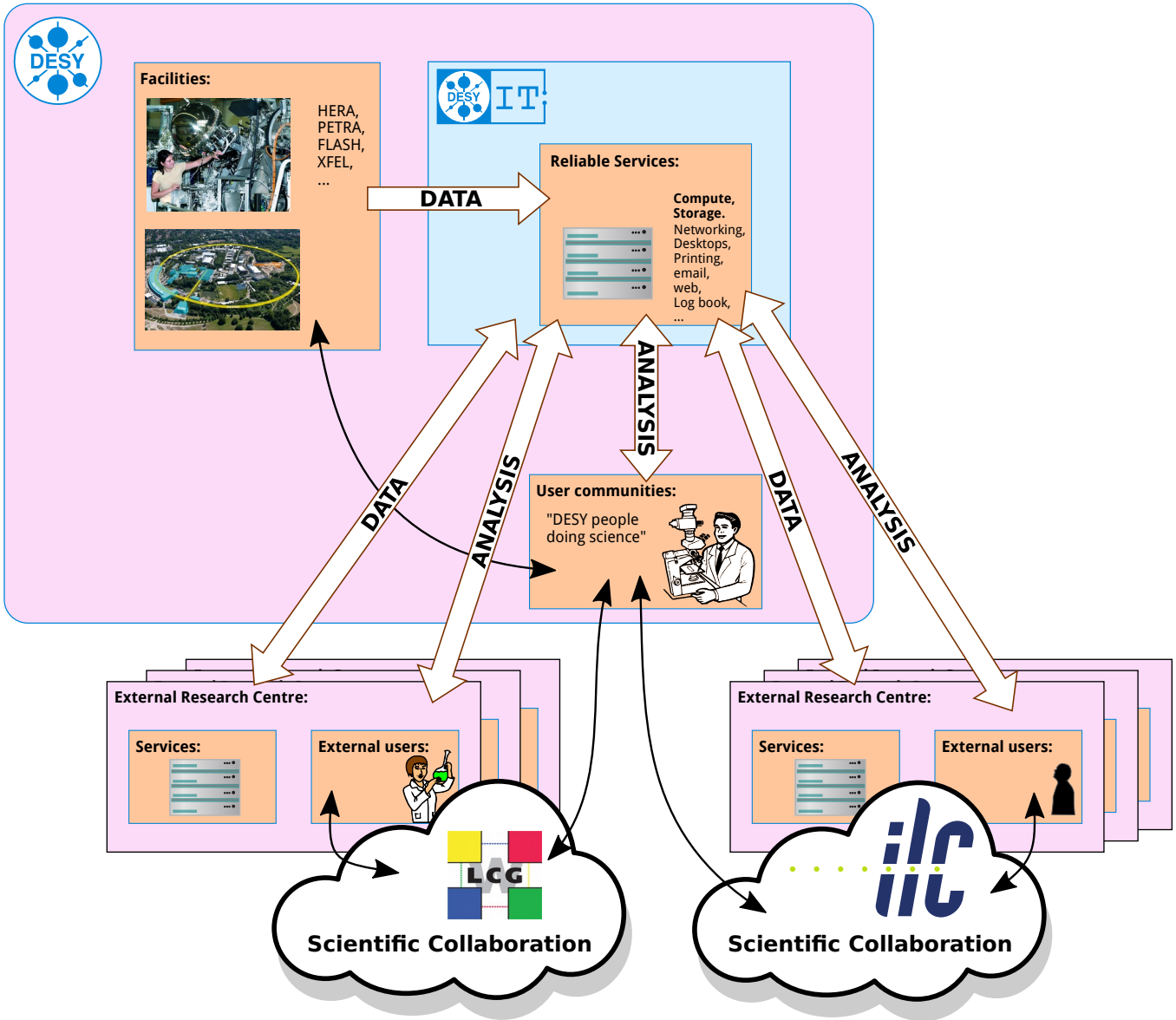
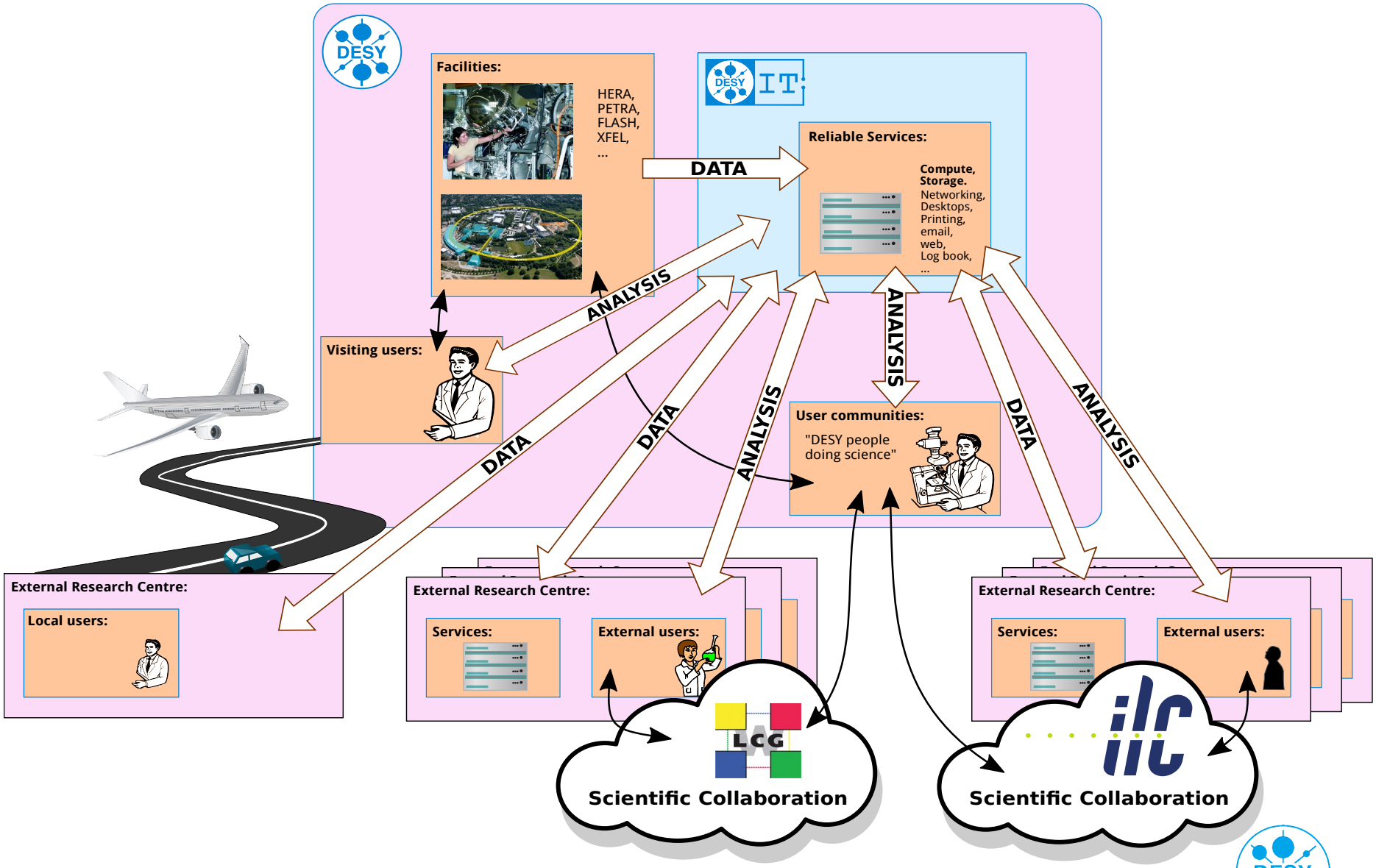
“Traditional” in-house research



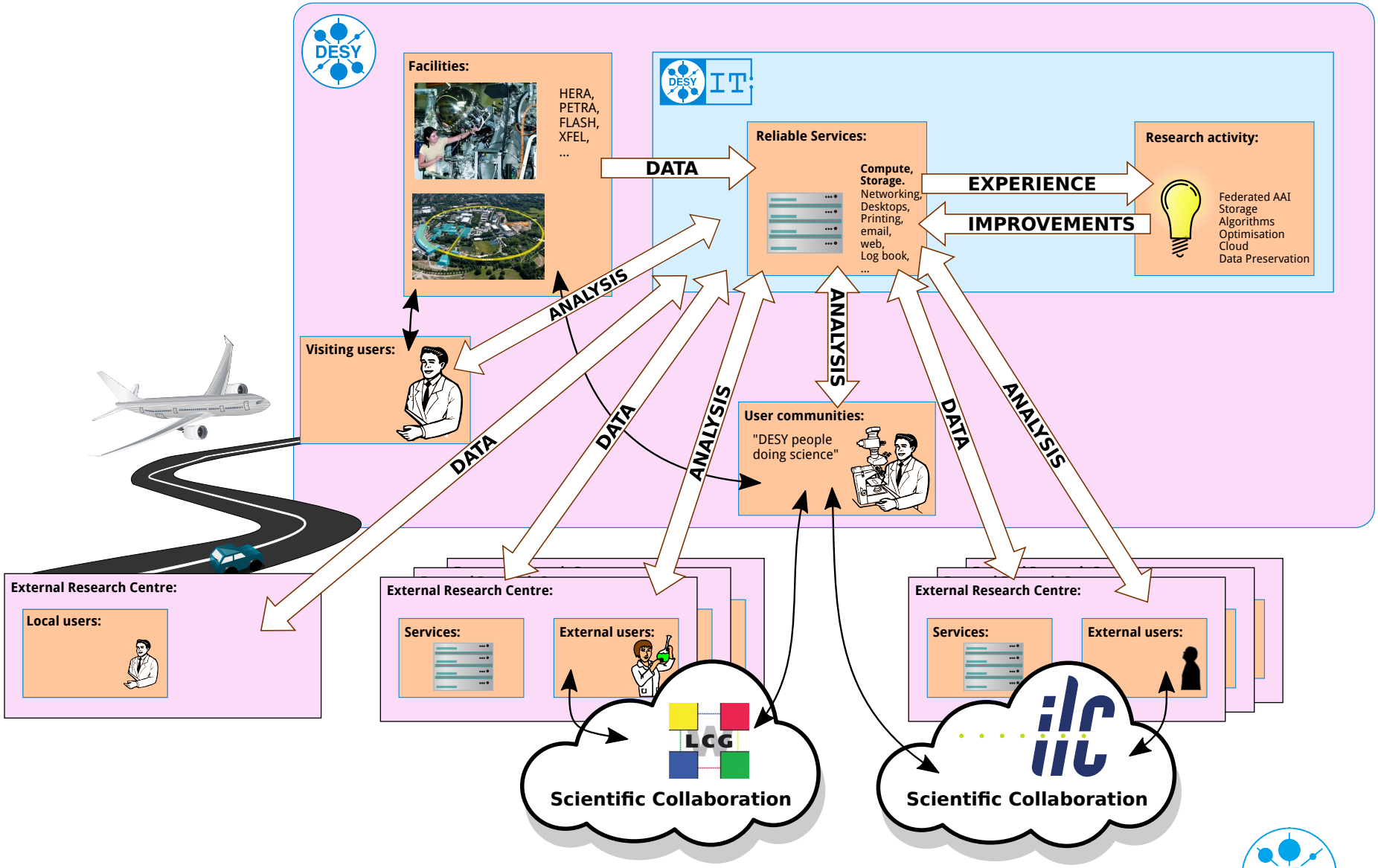
Membership of international collaborations



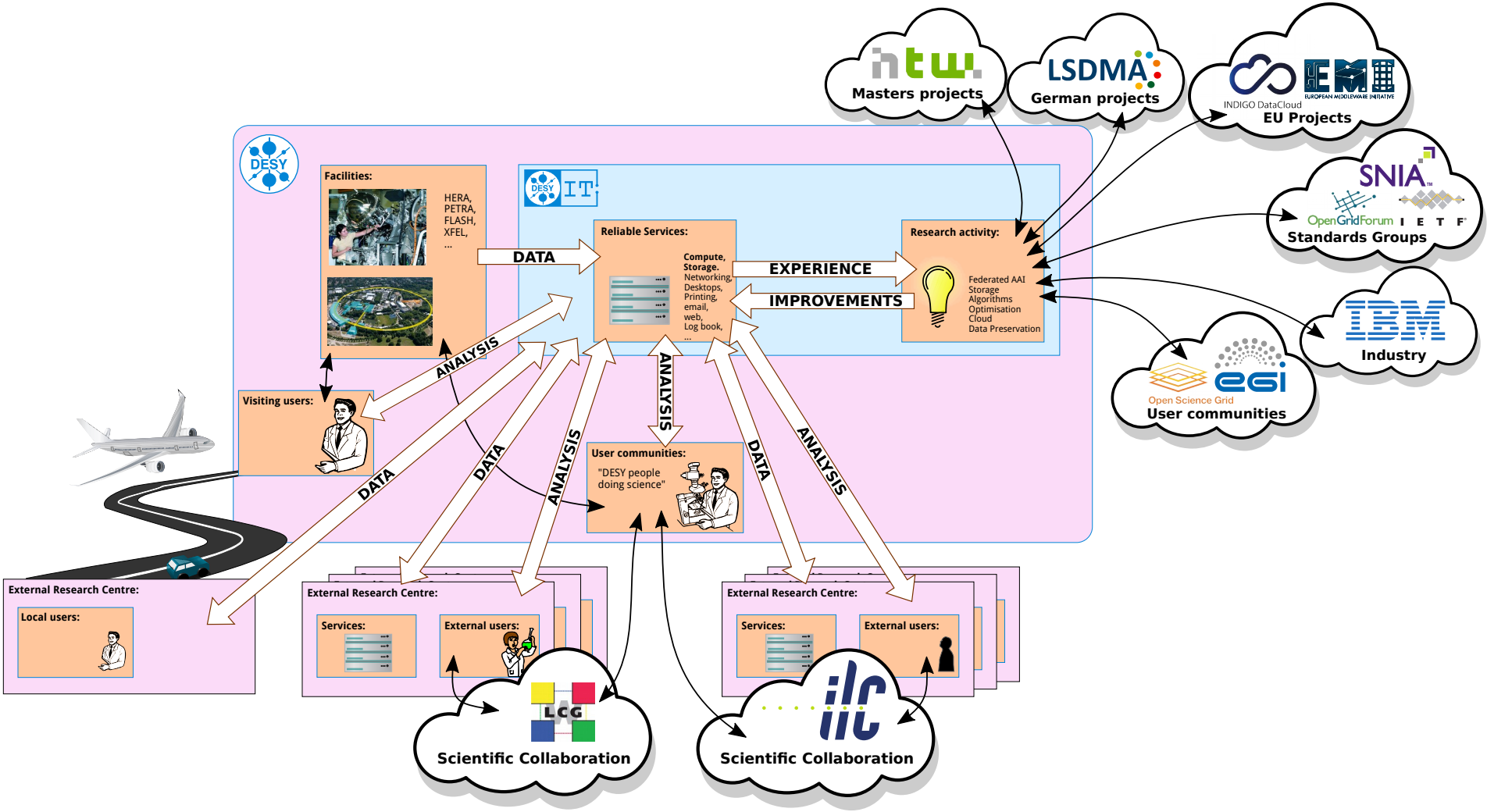
DESY hosting “visitor” scientists



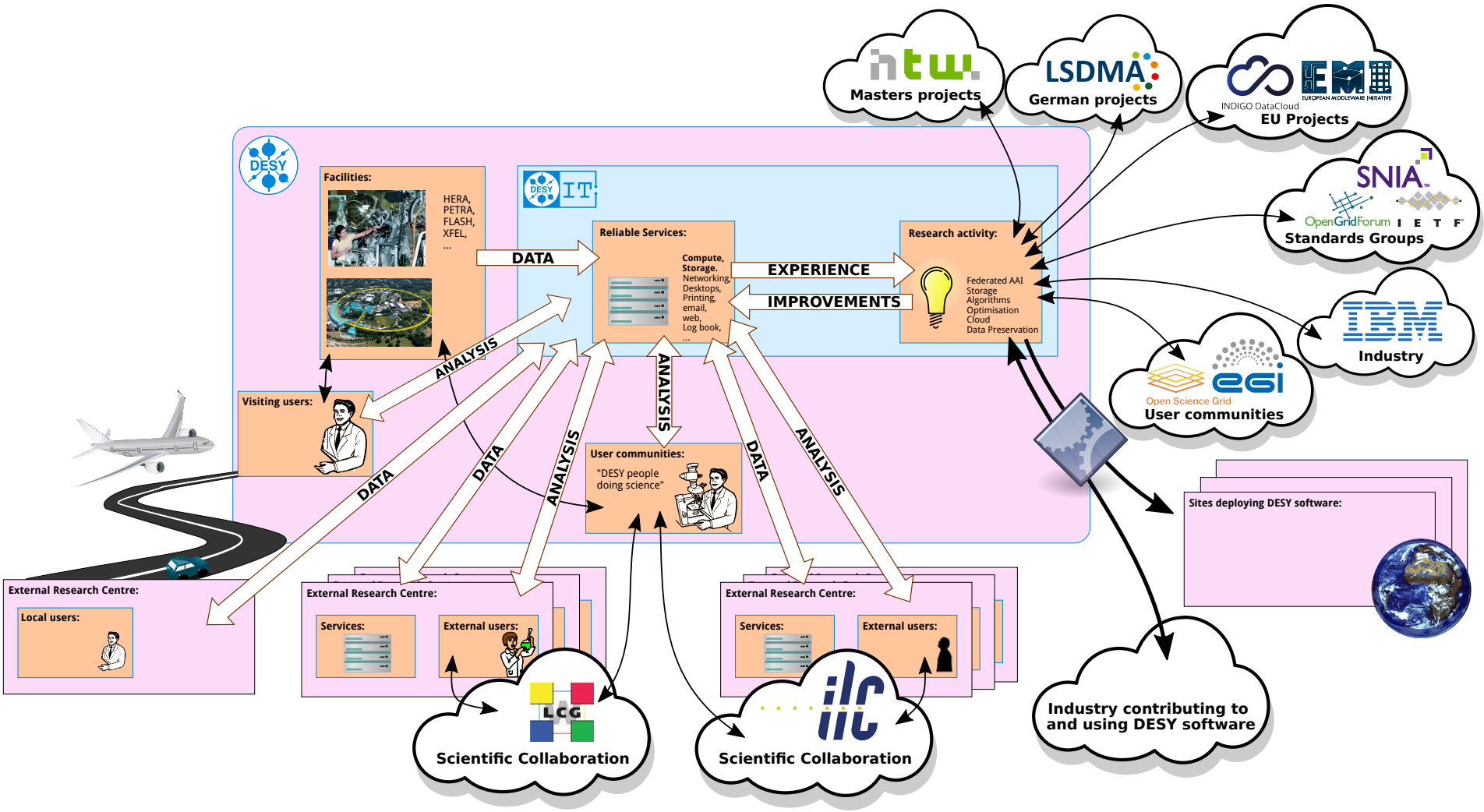
Researching improvements



Research connected



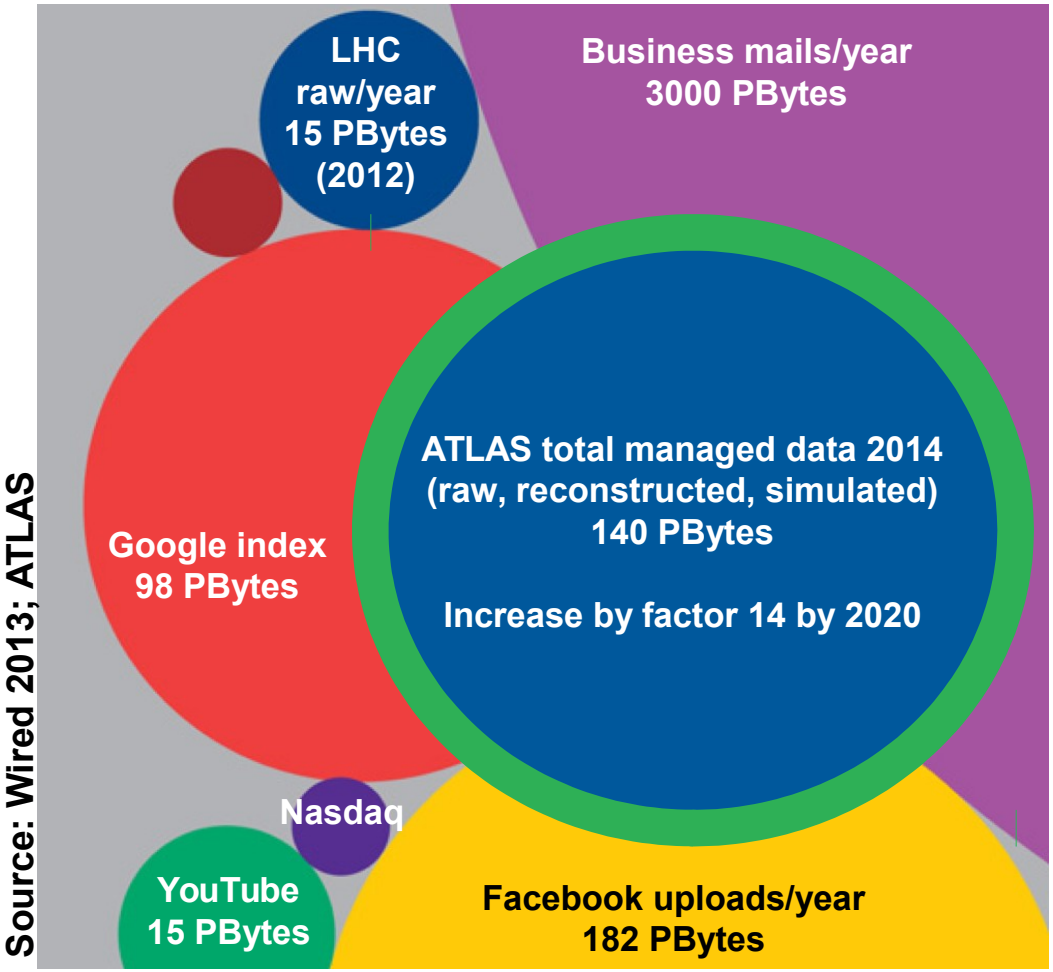
Complete overview



The WLCG “computer” for LHC computation

- 170 computer centres, located at 40 countries spread over the world
- Networking originally hierarchically structured:
  - Single Tier-0 is CERN, countries (mostly) have a single Tier-1 and multiple Tier-2
  - Now less structured: network traffic crosses country boundaries.
- Compute facility provided as various independent batch systems:
  - Some 490,000 job slots (i.e., cores), ~3% by DESY.
- Storage capacity at sites is provided by various software
  - Some 254 PiB (~5% by DESY) of disk capacity and 200 PiB tape capacity
- Dedicated networking:
  - LHC-OPN: dedicated fibre-optic link from CERN to Tier-1 centres and between Tier-1 centres.
  - LHC-ONE: isolated WLCG traffic from normal Internet activity.

Comparison of data sizes



Slide thanks to Dr. Patrick Fuhrmann

dCache … an example of DESY research project

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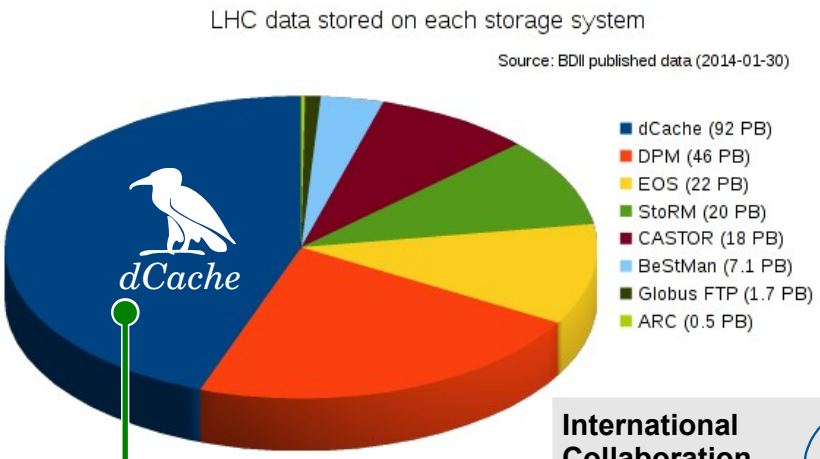
dCache: managed storage for big data



International Collaboration

DESY
5 FTEs

Fermilab
2 FTEs

dCache

neic
1.5 FTEs

open source™

Collaborations

EGI · globus online · PHYSICS AT THE TERA SCALE Helmholtz Alliance · LSDMA · European Middleware Initiative · OpenGridForum · SNIC · Open Science Grid

Student mentor programme

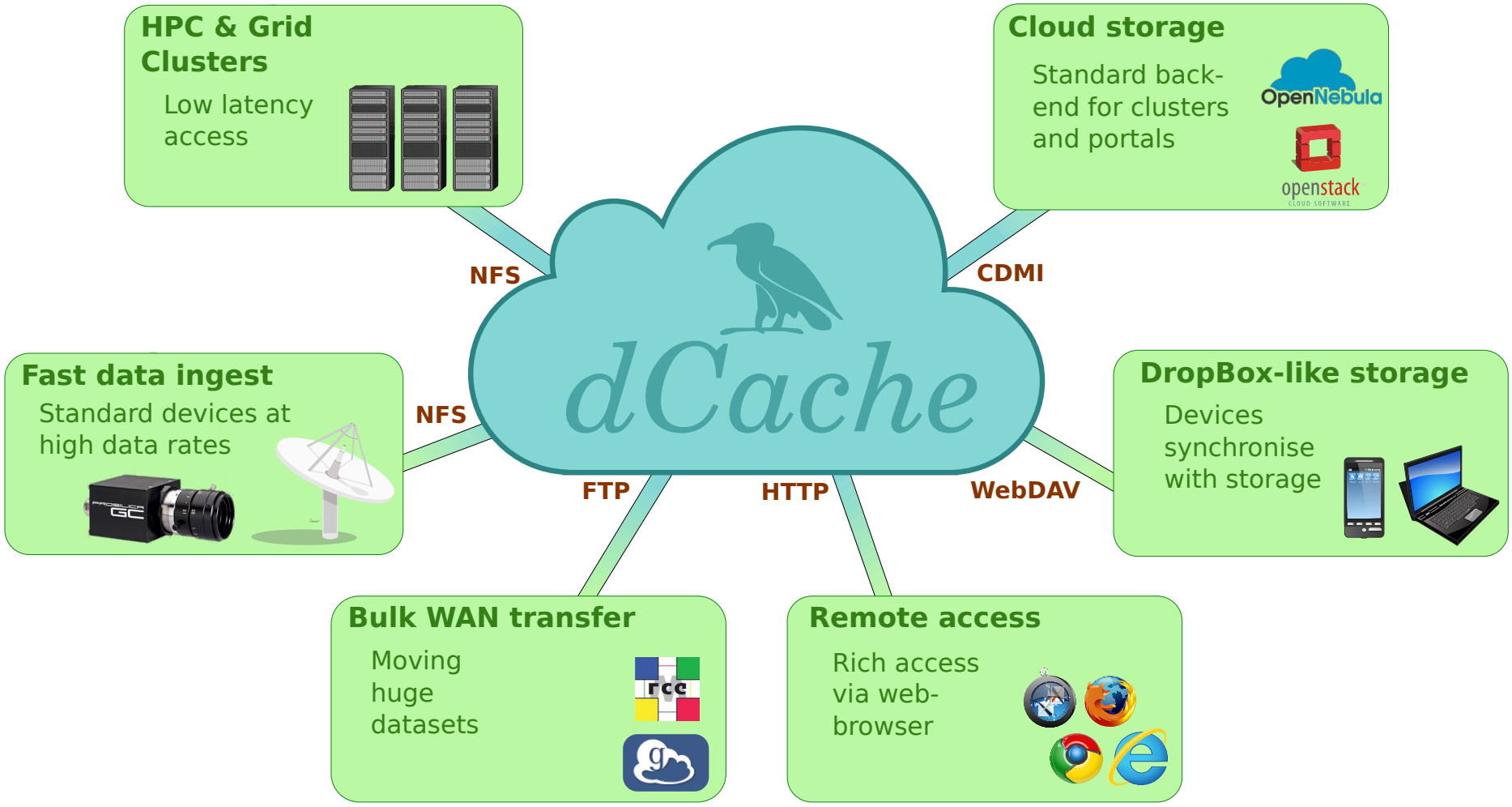
htw Hochschule für Technik und Wirtschaft Berlin
3 students

DESY

dCache: evolution of big data

Era	Disk cache	Grid Storage	Generic Storage	Cloud Storage
Additional Communities	hermes, ZEUS, CDF, H1, HERA B	ALICE, ATLAS, CMS, IceCube, LHCb	Fermilab Intensity Frontier, European XFEL, Belle II, LOFAR, SNIC, Industry, CFEL SCIENCE, PETRA III	EGI, LSDMA
Additional Authen-tication	Trusted host	X.509, Kerberos	Username+PW	SAML, OpenID, OAuth, Token, ...

Storage Vision



dCache future directions

- Building on existing support for standards:
  - Strong support for NFS v4.1 pNFS.
- Taking advantage of others' work:
  - Technologies like CEPH partially overlap with dCache; can we build on it?
- Rethinking storage:
  - New protocols, like CDMI, define much richer semantics of storage; do these provide new opportunities?
  - Clients using dCache as an object store.
- INDIGO DataCloud:
  - €11.1M, 26 parters (11 countries), 30 months H2020 project.
  - Building software to support a European-wide federated cloud.
- Work towards the Storage Vision:
  - Many parts already there, we're adding the remaining bit.

Learn more in Femto “Big Data” issue

The next issue will focus on **Big Data**.

Subscribe:

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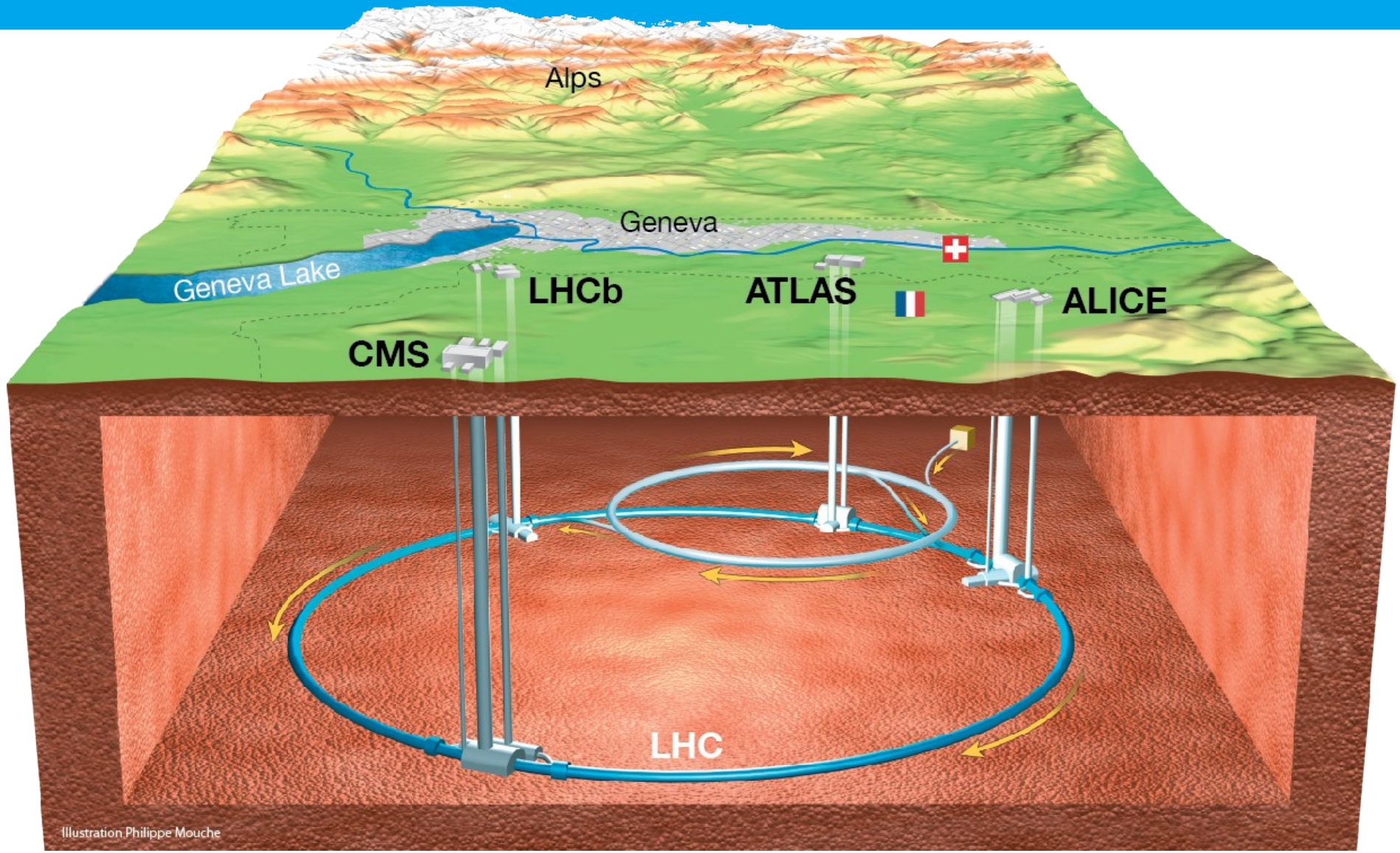
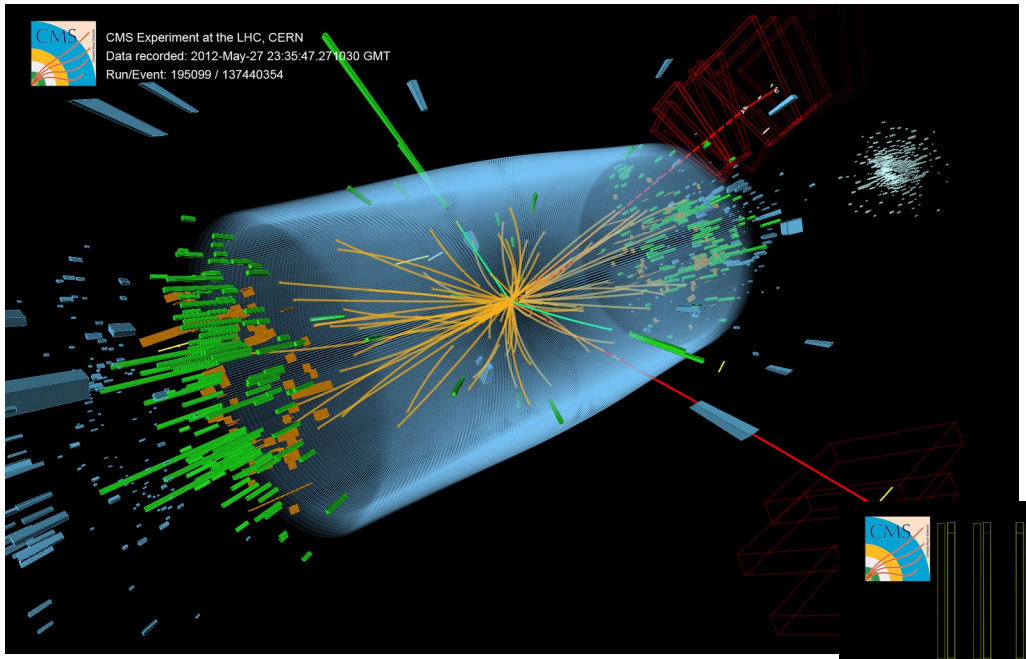
http://www.desy.de/femto_eng/

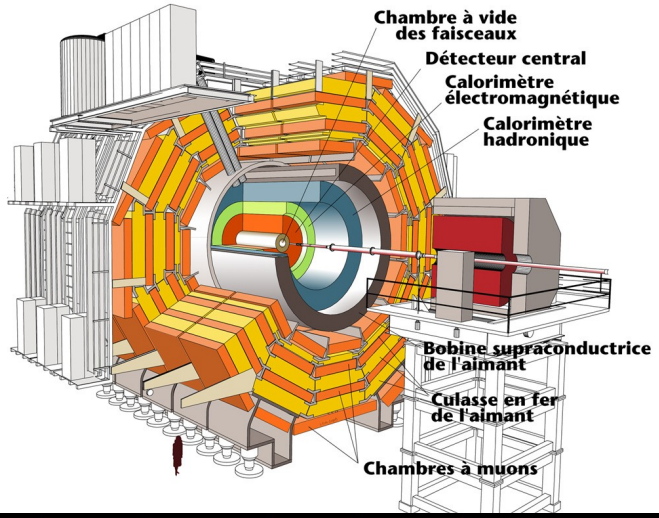
Backup slides

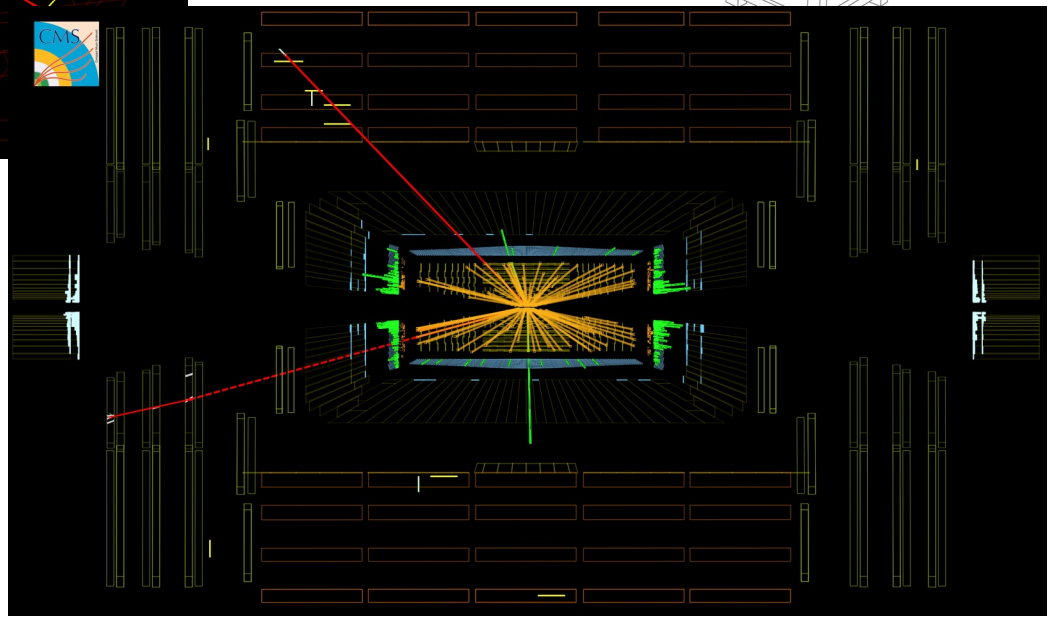
Overview of the LHC

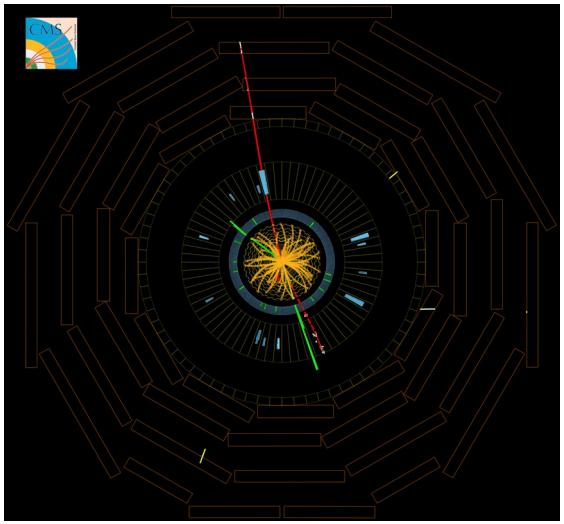


HEP data analysis: reconstruction



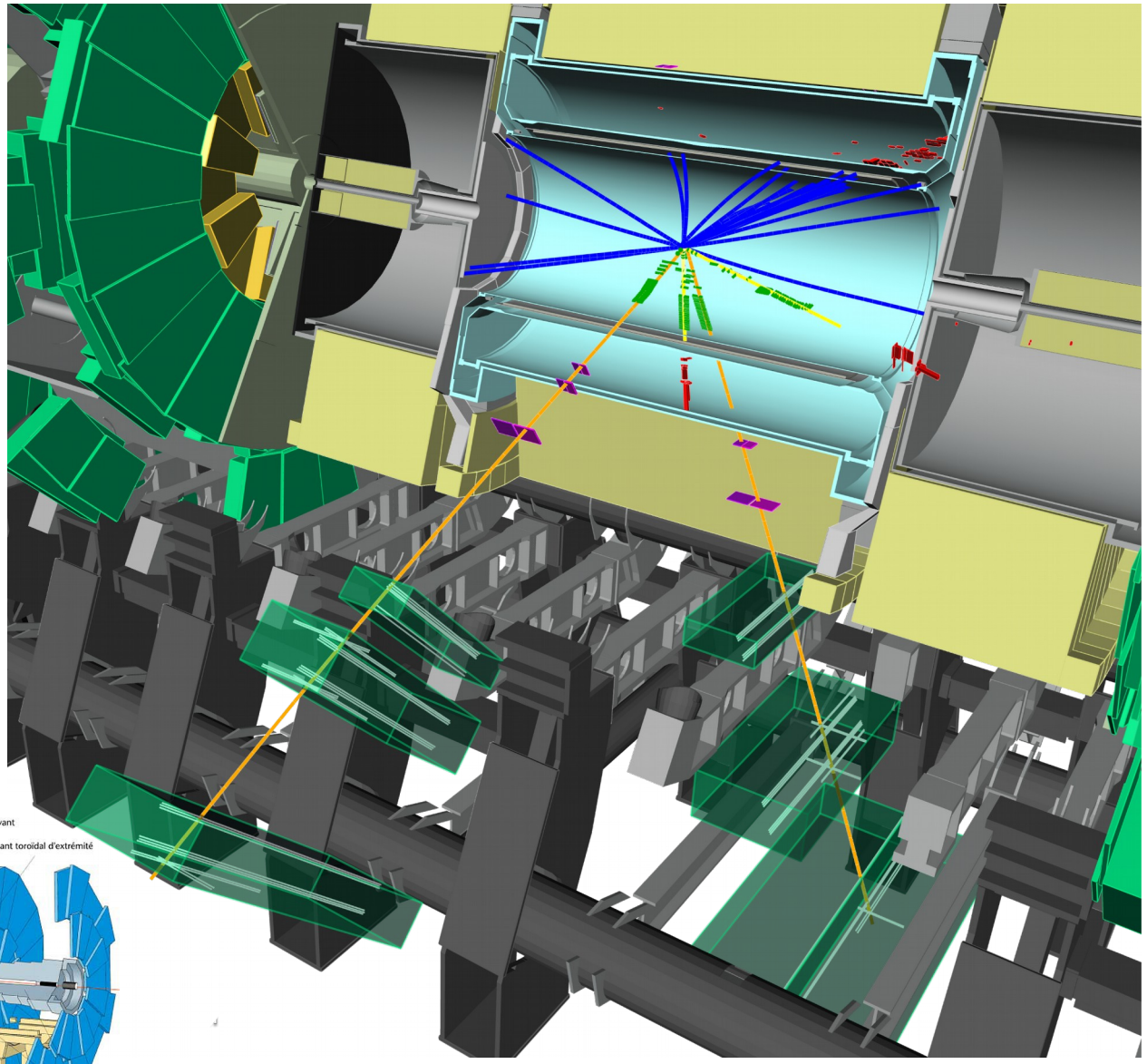


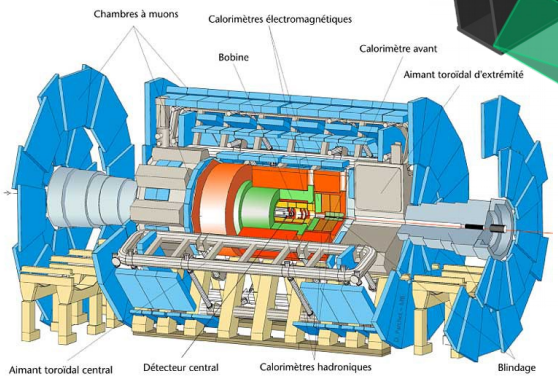




Images curtsey of CERN and the CMS collaboration

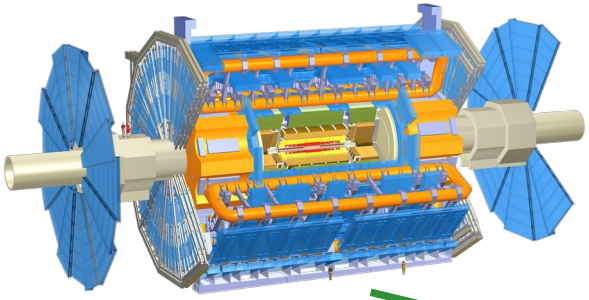
HEP analysis: reconstruction

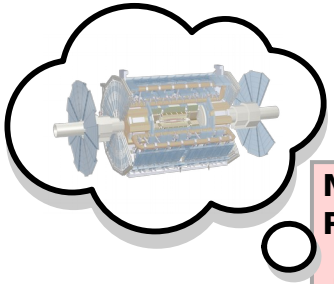




Images curtsey of CERN and the ATLAS collaboration

HEP data analysis workflow



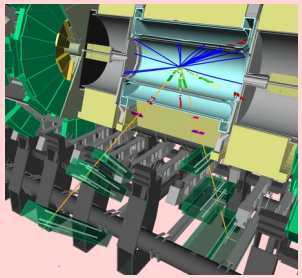


RAW

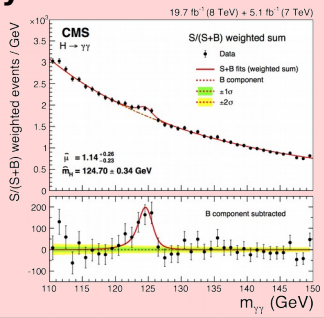
0101110101010010
1000101011010 1
0101001010111 1
0101001001010 0
1101010010101

Geometry & Conditions:

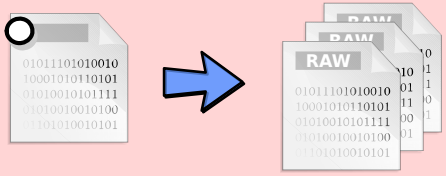
Reconstruction:



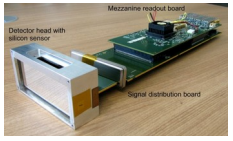
Analysis:

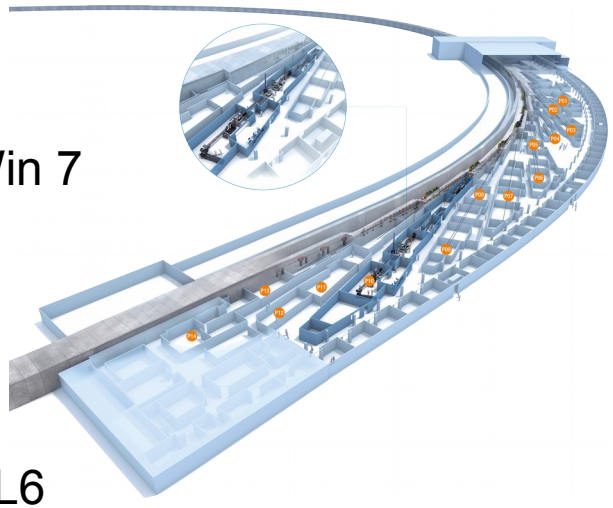


Monte Carlo Production:



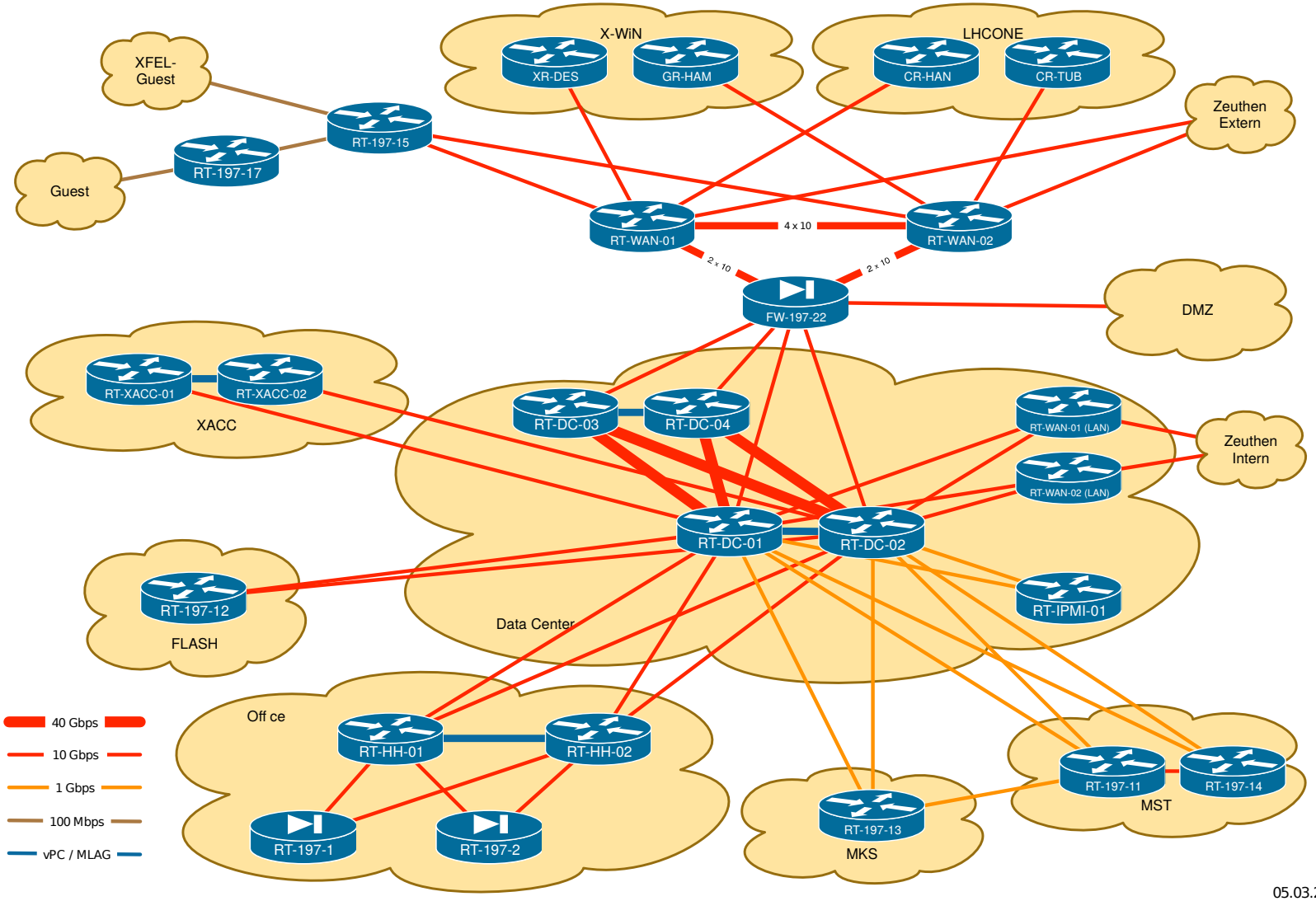
Next generation photon-science detectors

	Pixels	Frame Rate	Data Rate	OS
 Eiger	1k x 1k x 2	2 kHz	30 Gb/s	RHEL6
 PCO Edge	2560 x 2160	100 Hz	5.6 Gb/s	Win 7
 LAMBDA	3x1536x512x2	2 kHz	60 Gb/s	SL6



Slide thanks to Dr. Steve Aplin

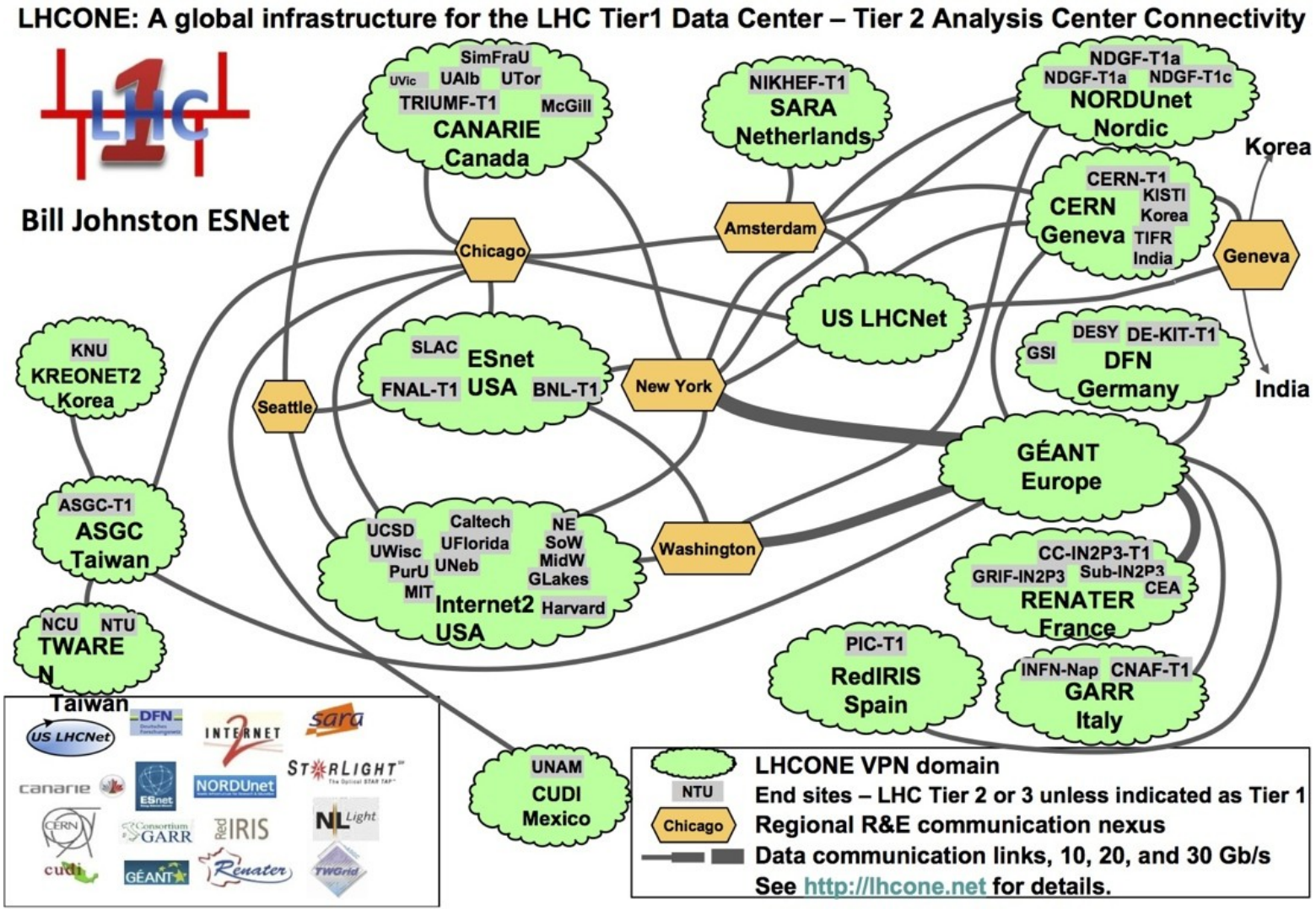
DESY network topology



05.03.2015

Slide thanks to Kars Ohrenberg

LHC ONE: global infrastructure for LHC connectivity



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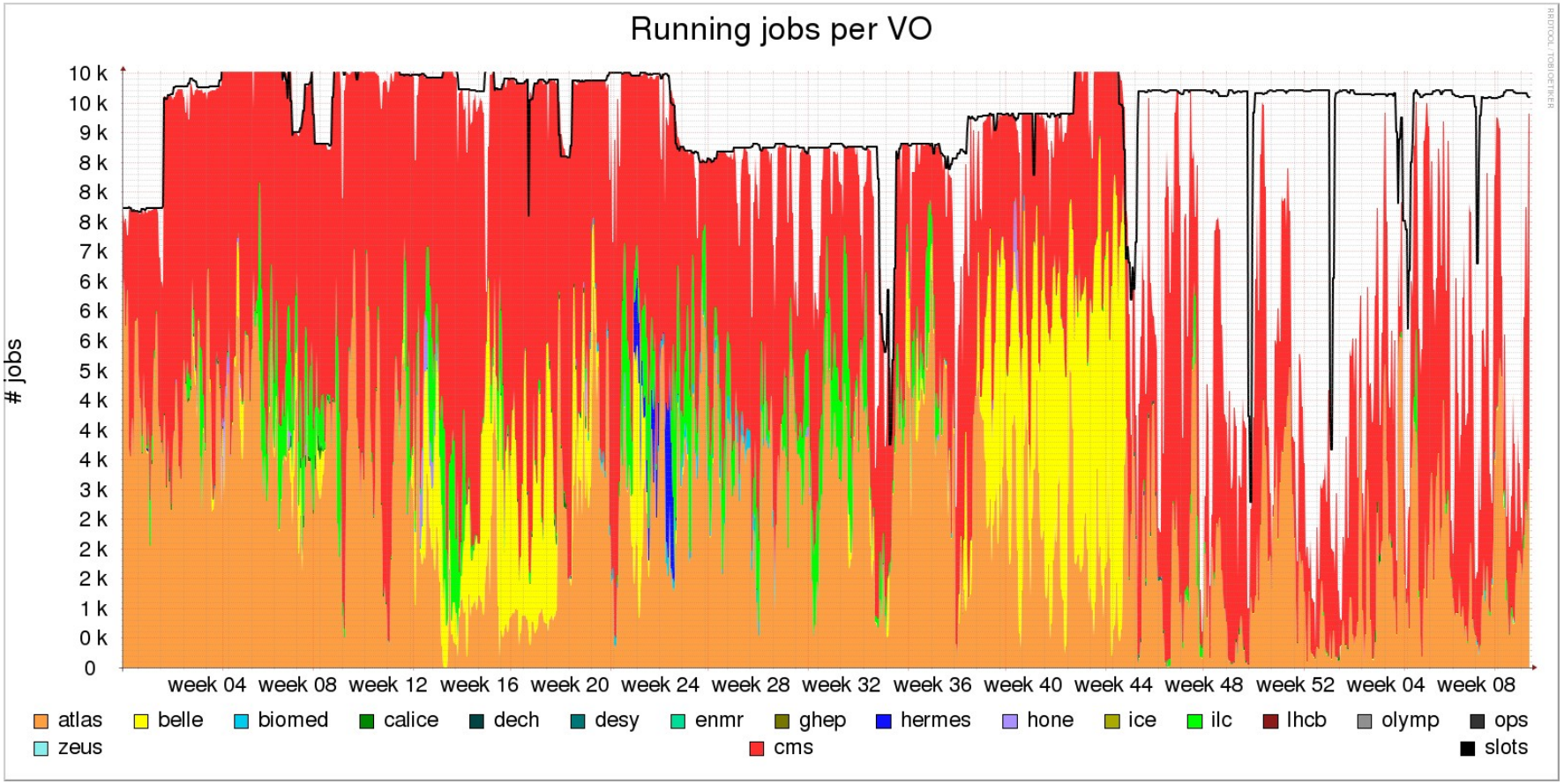
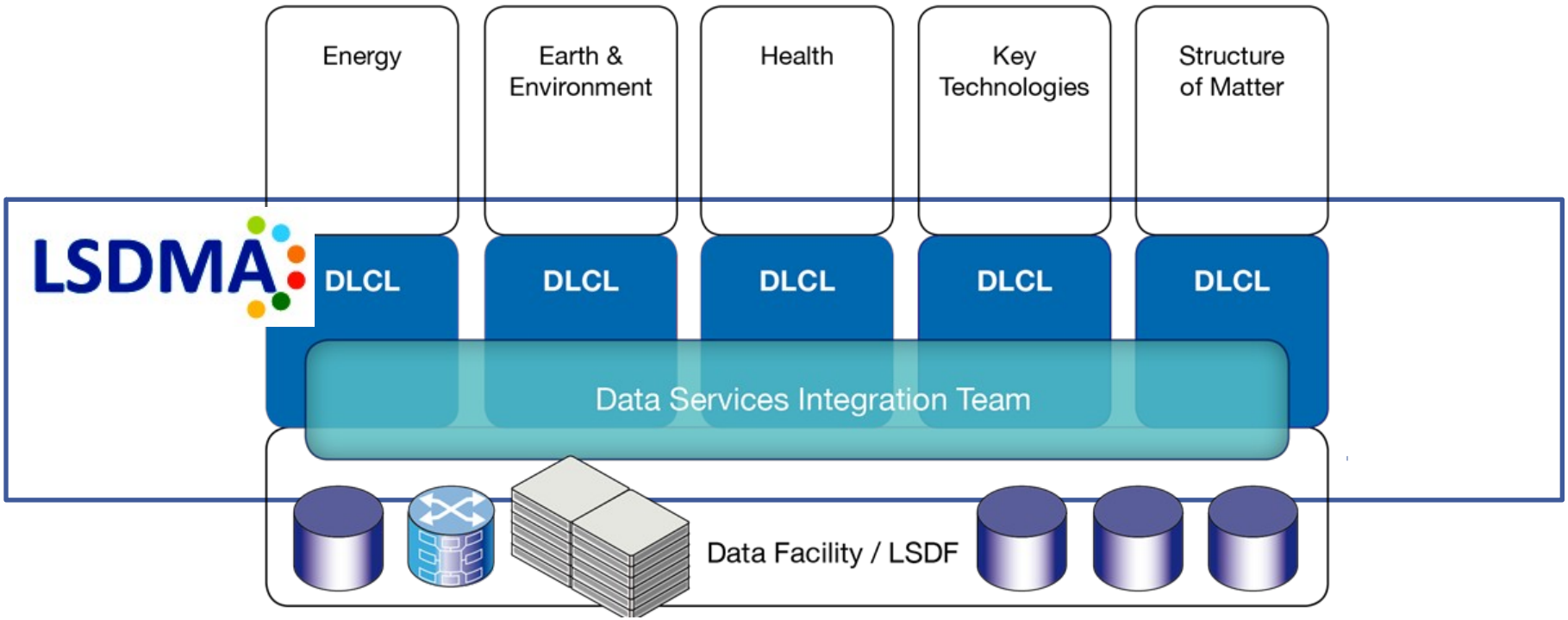
Computing usage



LSDMA: structure



LSDMA: data concept