DESY IT

Challenges and future directions in supporting scientific exploration

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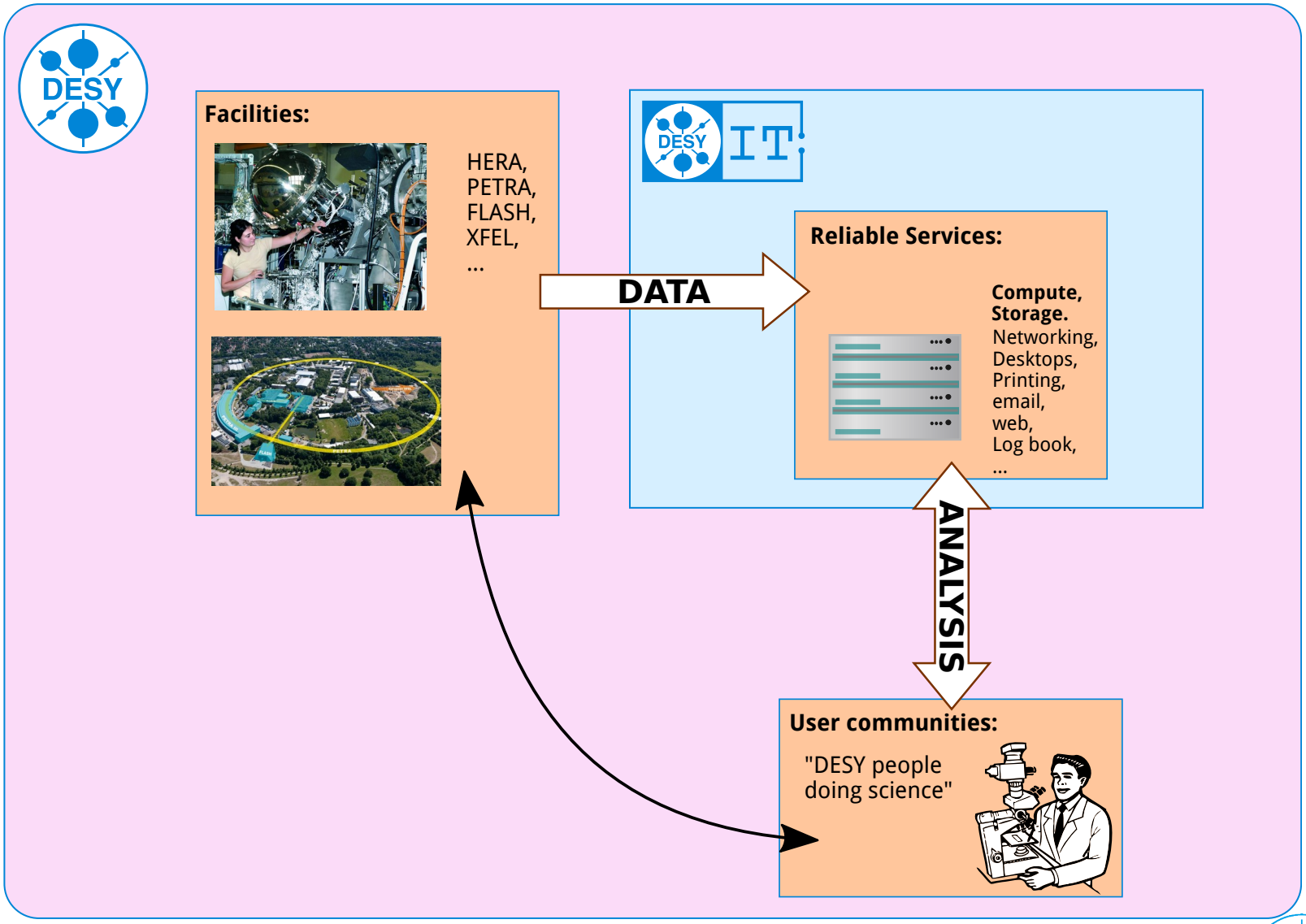
DESY IT
DESY, 2015-03-12

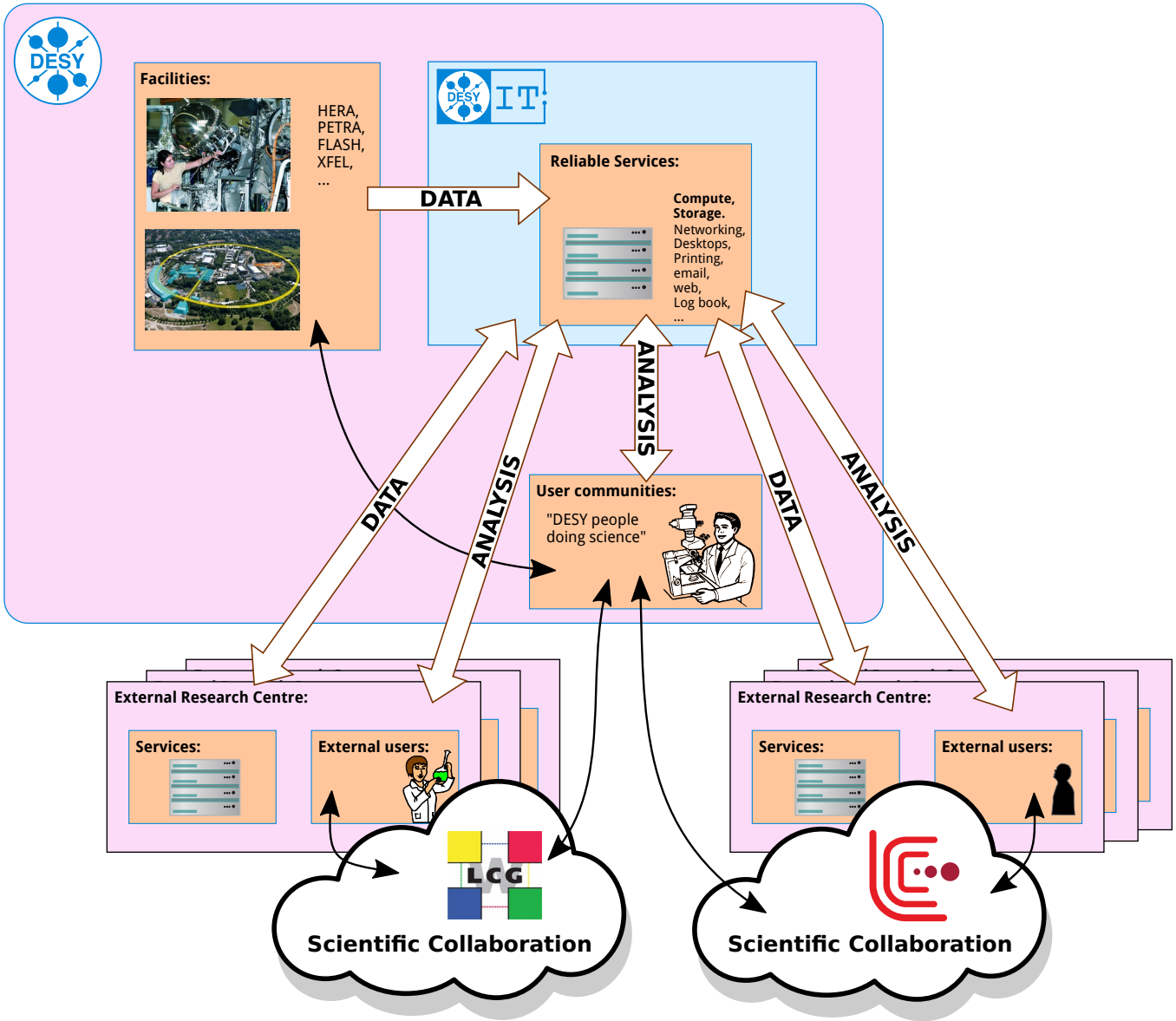
HELMHOLTZ ASSOCIATION

DESY

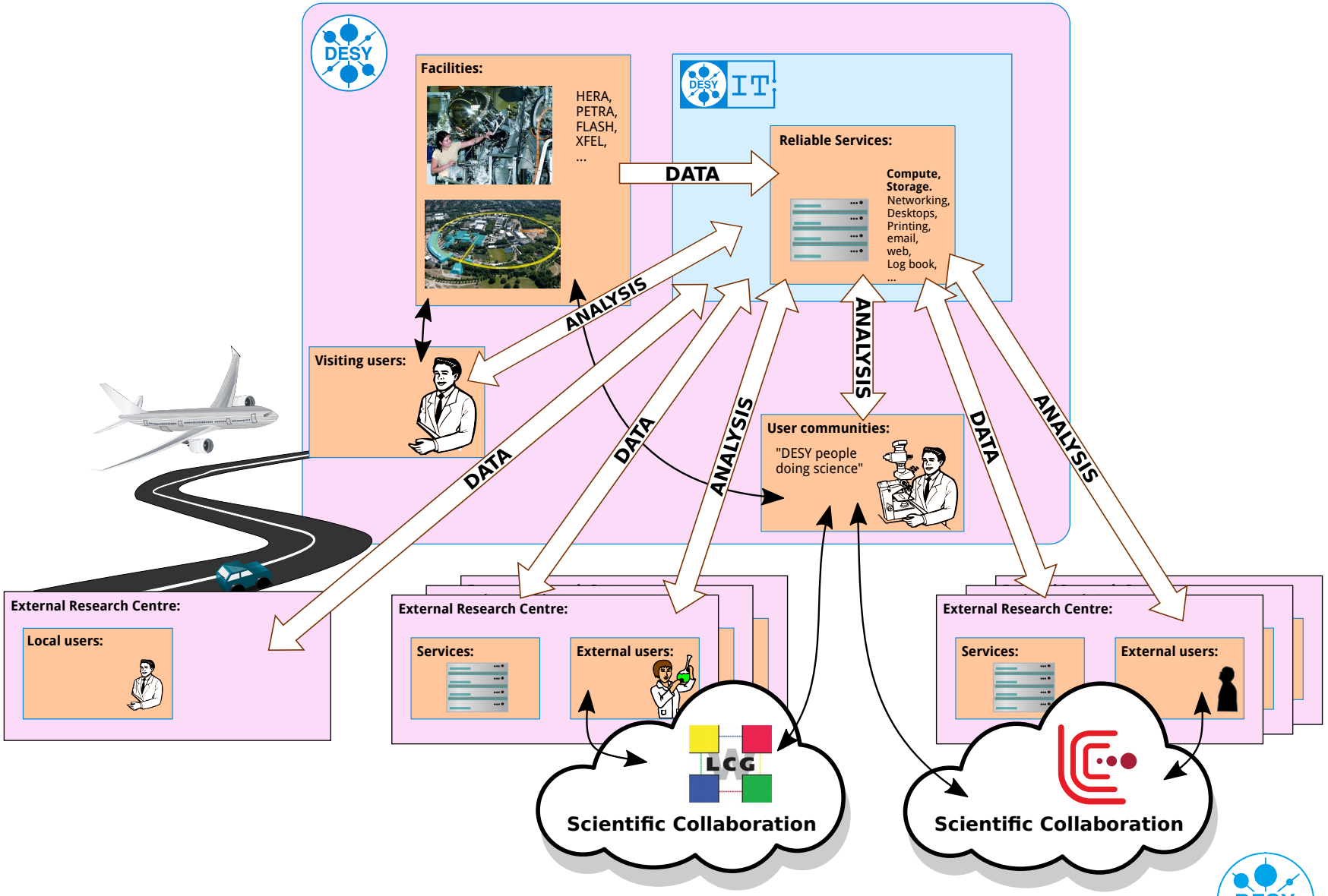
“Traditional” in-house research



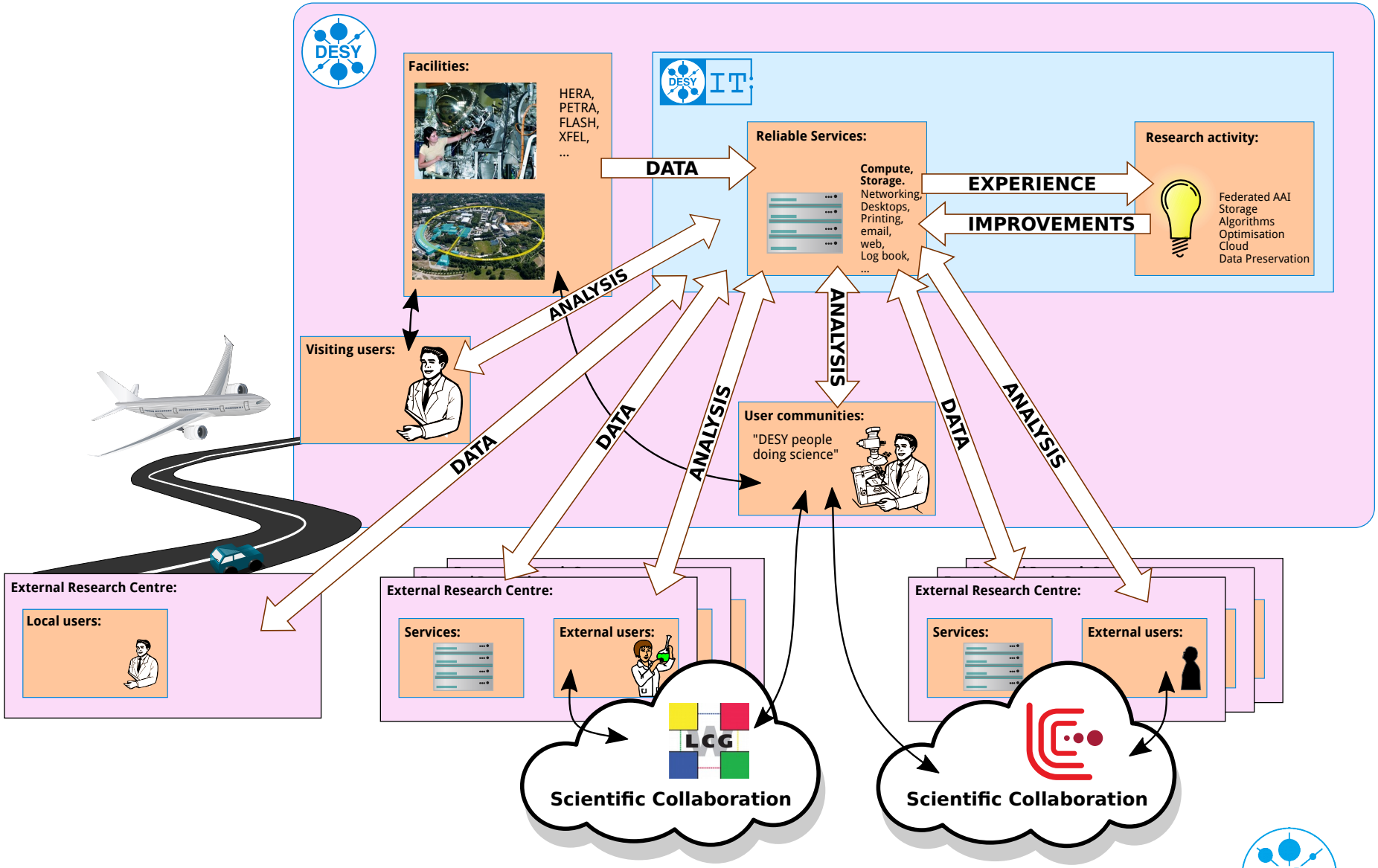
Membership of international collaborations



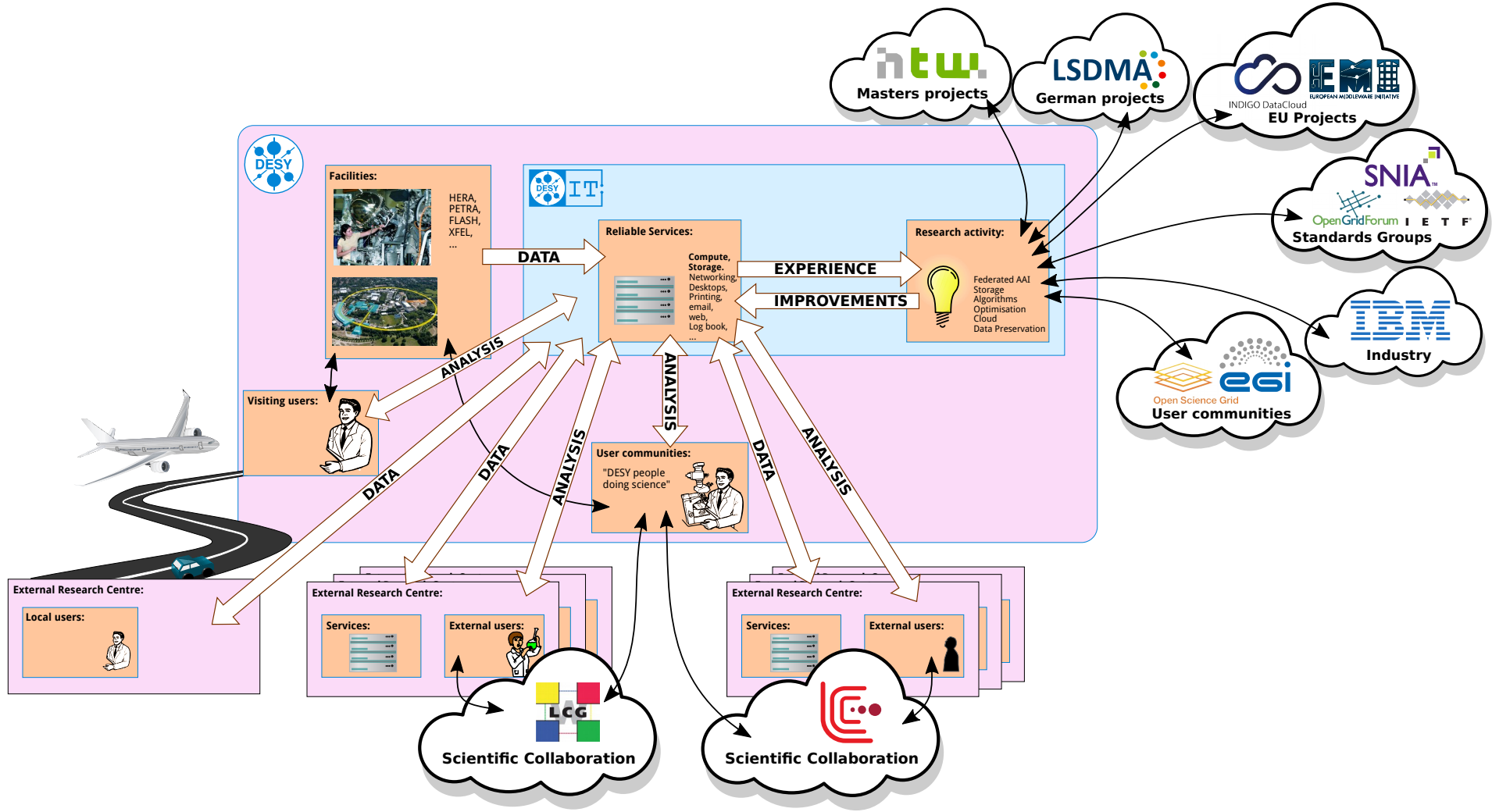
DESY hosting “visitor” scientists



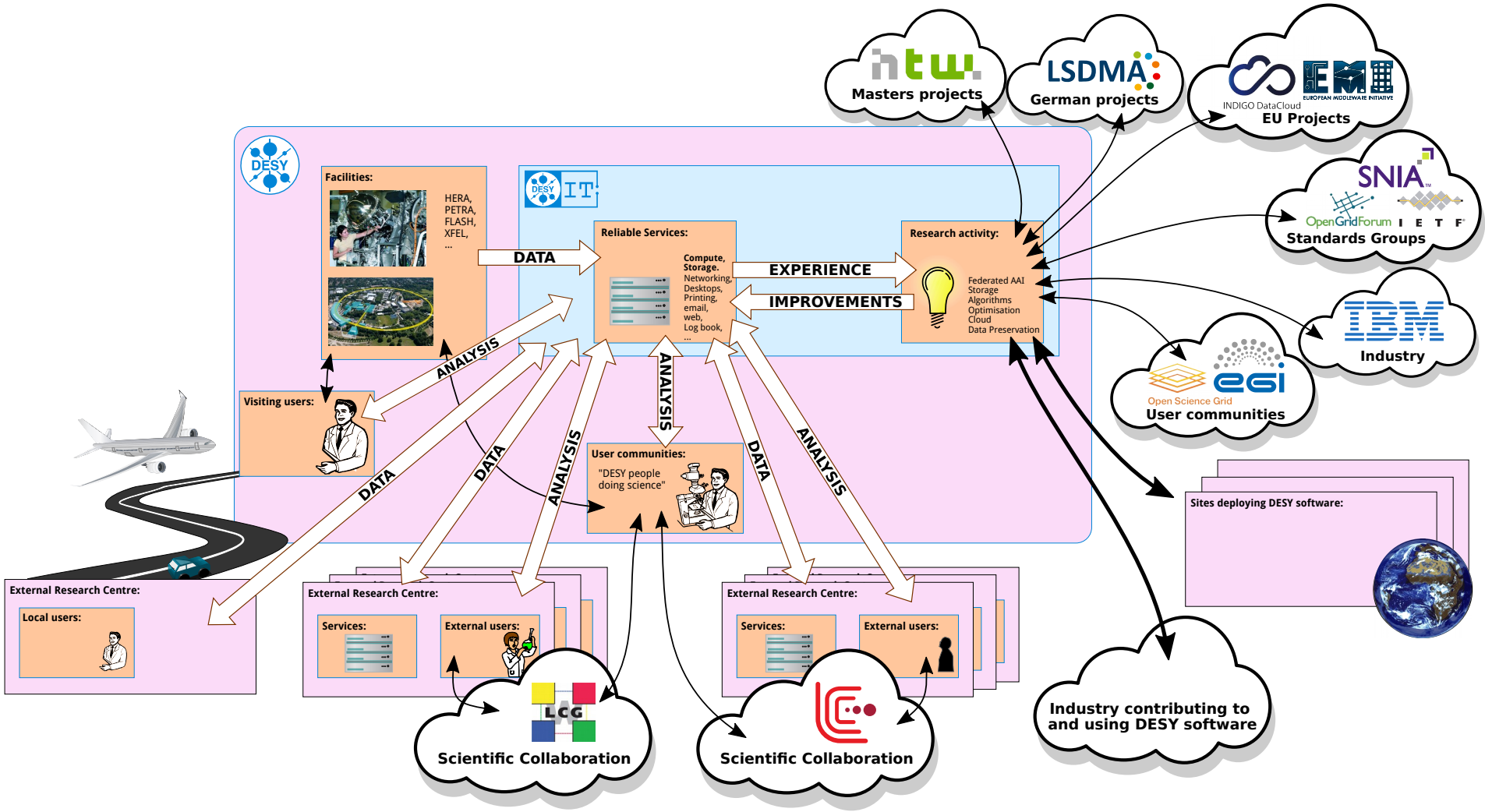
Researching improvements



Research connected



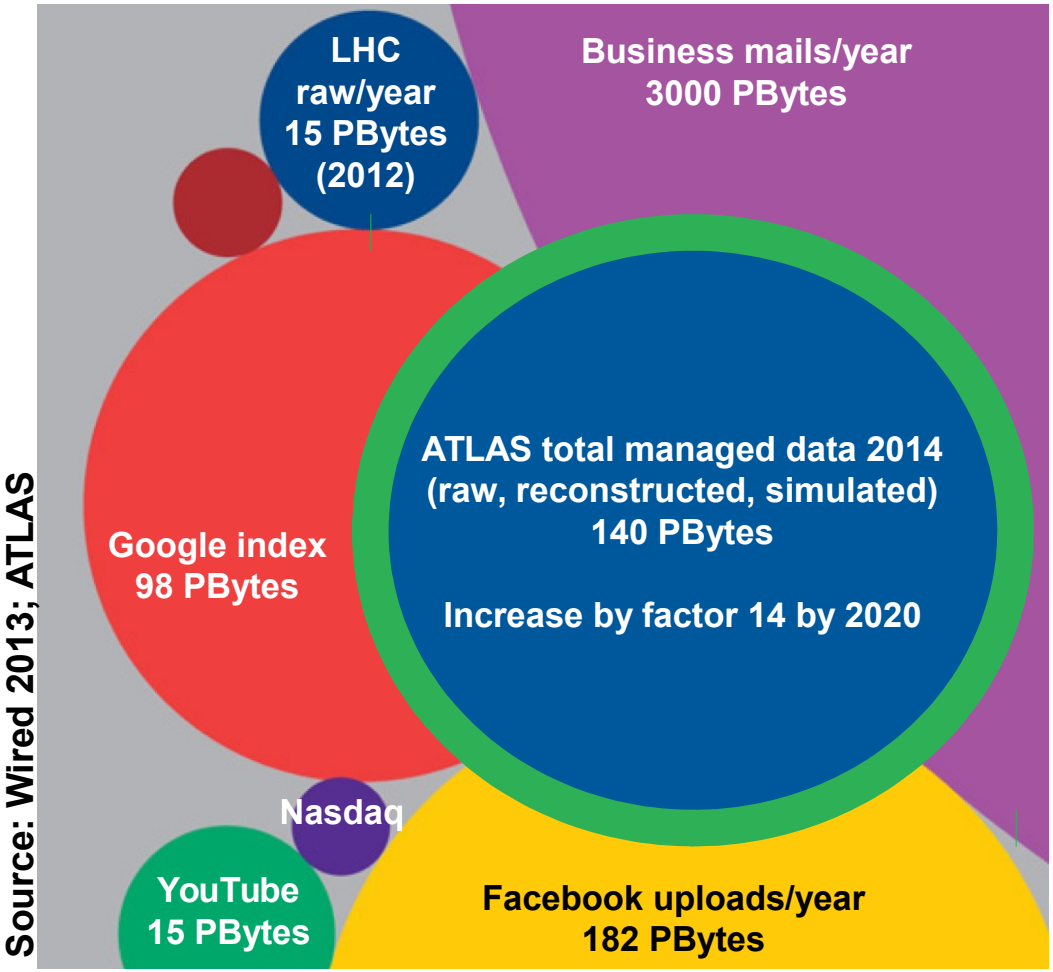
The complete overview



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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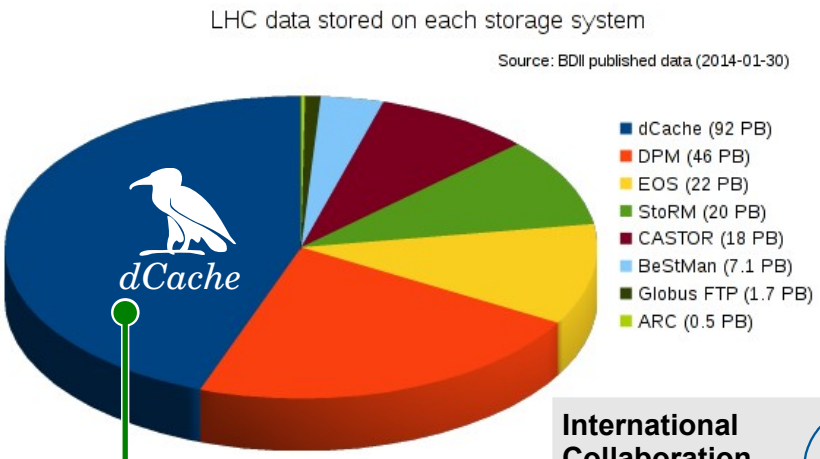
dCache: managed storage for big data



International Collaboration

DESY
5 FTEs

Fermilab
2 FTEs

dCache

neic
1.5 FTEs

open source

Collaborations

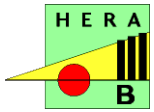
EGI
globus online
PHYSICS AT THE TERA SCALE Helmholtz Alliance
LSDMA
EUROPEAN MIDDLEWARE INITIATIVE
OpenGridForum
SNIC
Open Science Grid

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	    	   IceCube 	    Industry  	 
Additional Authen-tication	Trusted host	X.509, Kerberos	Username+PW	SAML, OpenID, OAuth, Token, ...

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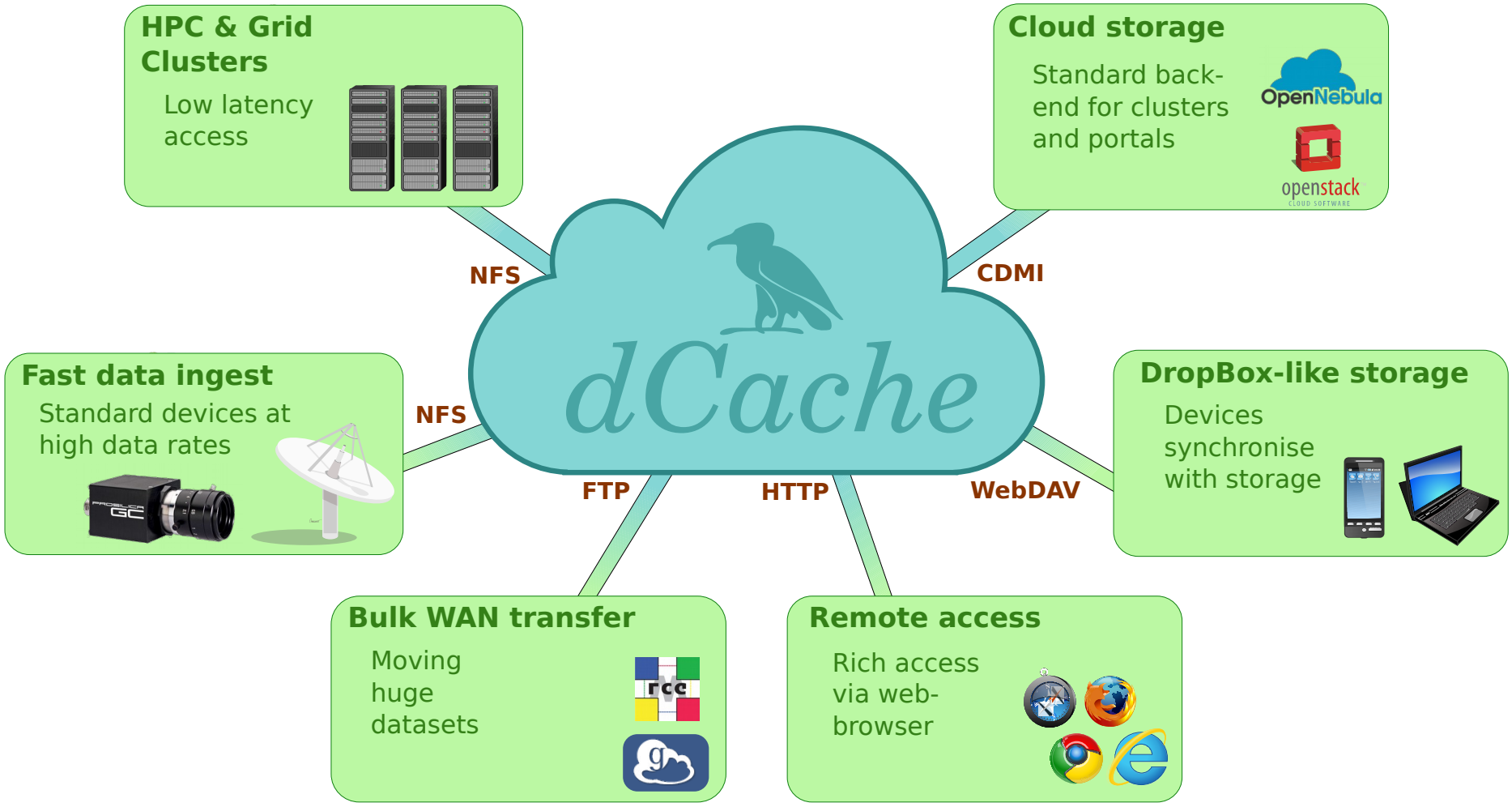
Storage Vision

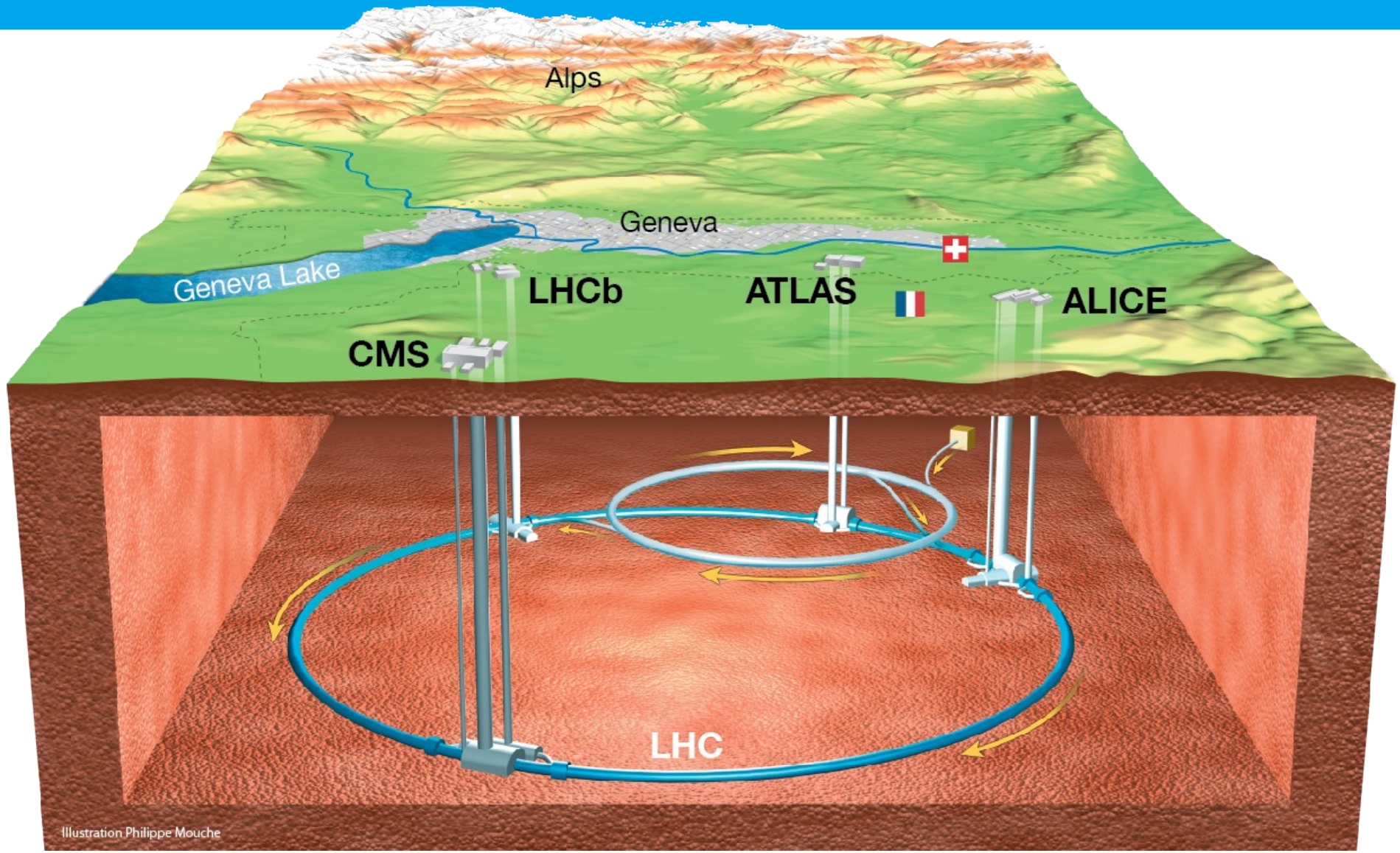


dCache future directions

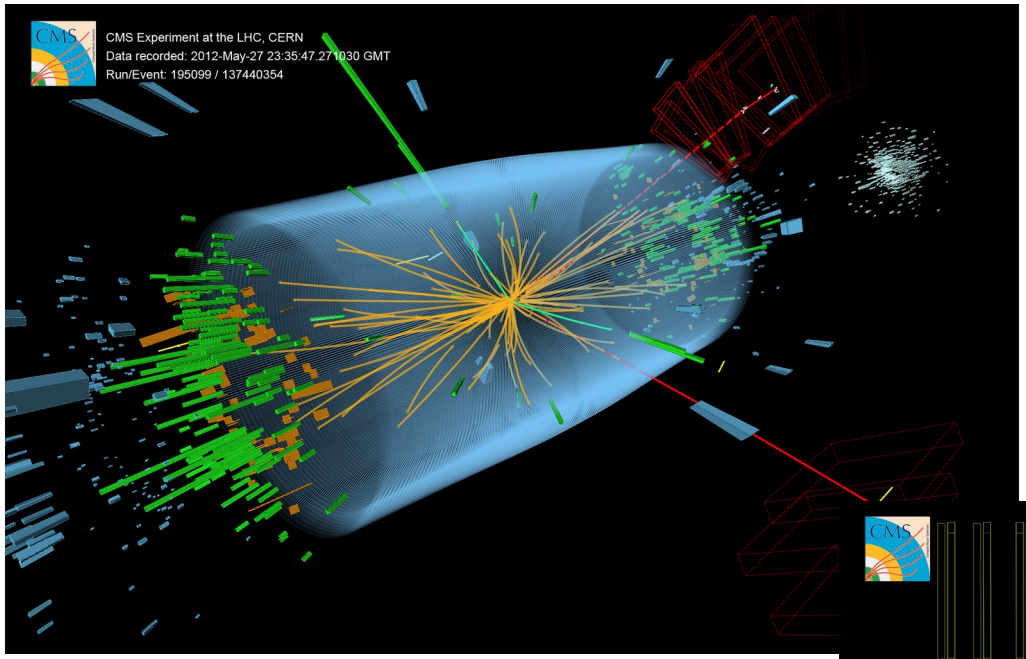
- Building on existing support for standards:
  - Strong support for NFS v4.1 pNFS.
- Taking advantage of others' work:
  - Technologies like CEPH partially overlap with dCache; can we build on it?
- Rethinking storage:
  - Standard protocols (like CDMI) define much richer semantics of storage; do these 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.

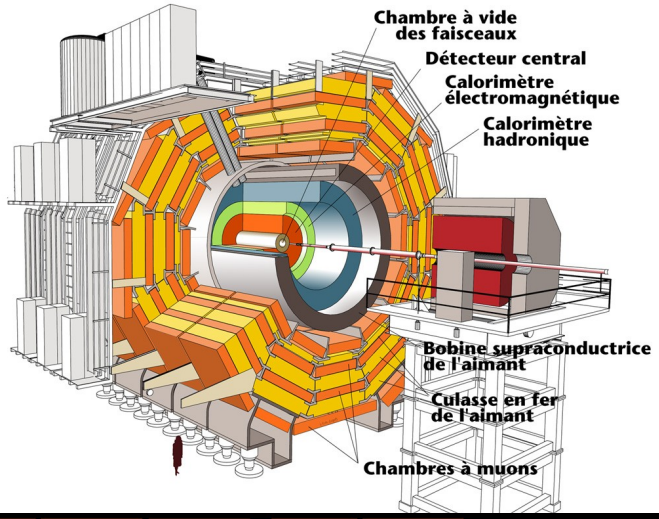
Backup slides

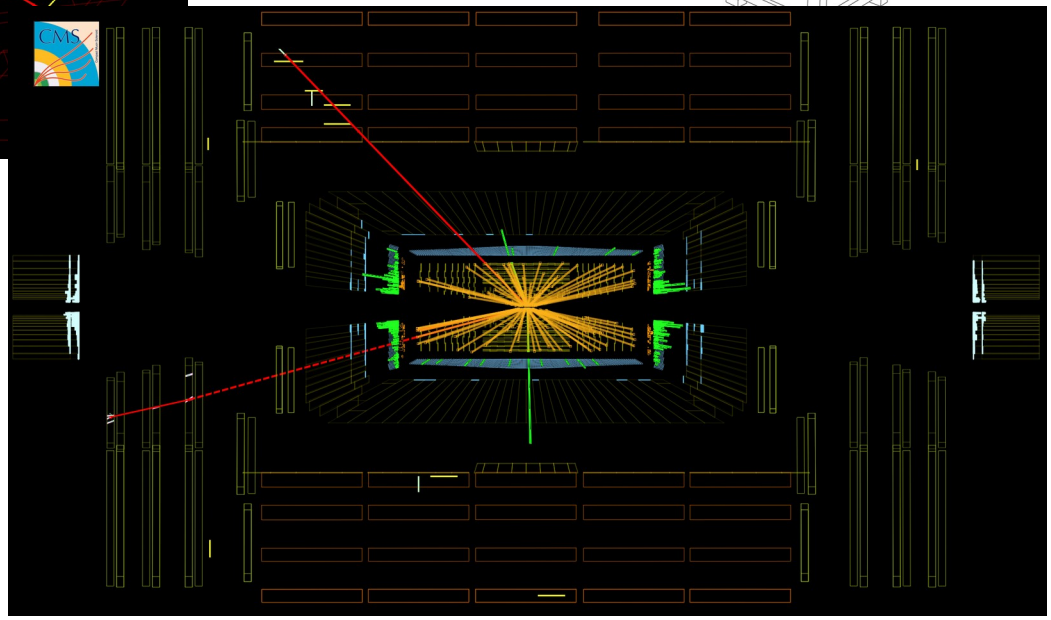
Overview of the LHC

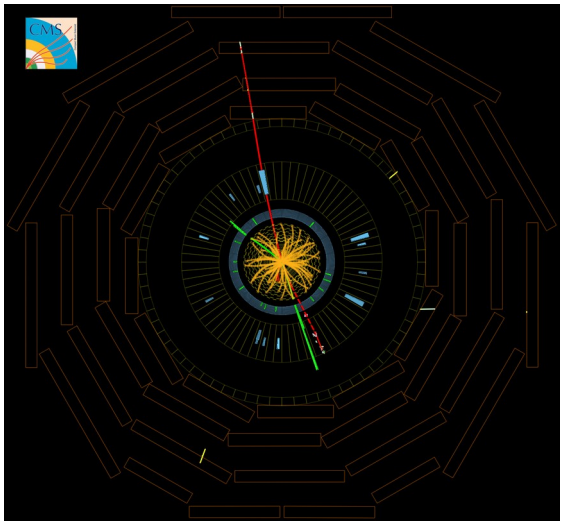


HEP data analysis: reconstruction



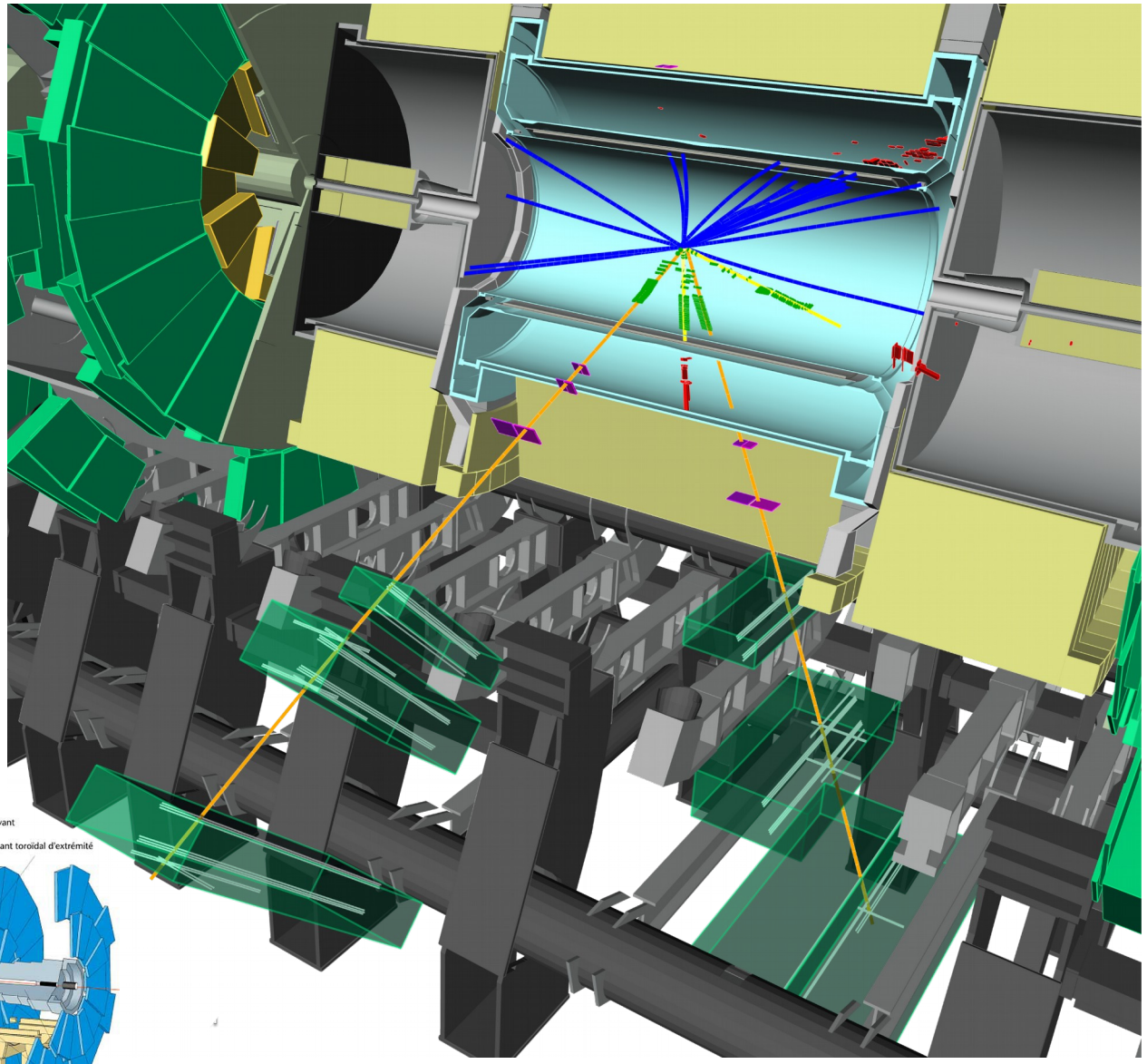


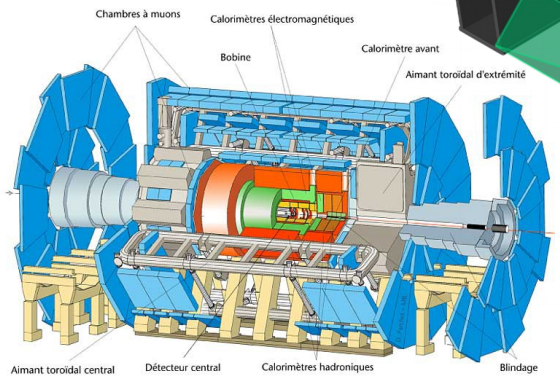




Images curtsey of CERN and the CMS collaboration

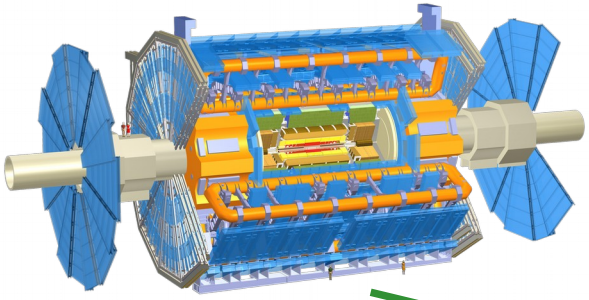
HEP analysis: reconstruction

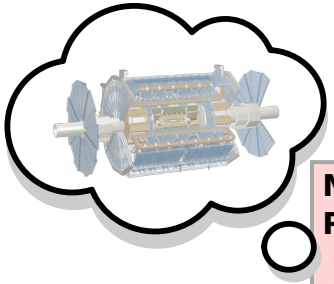




Images curtsey of CERN and the ATLAS collaboration

HEP data analysis workflow

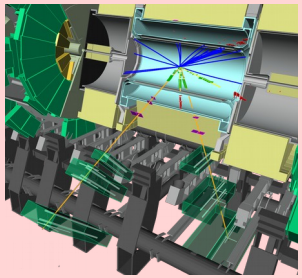




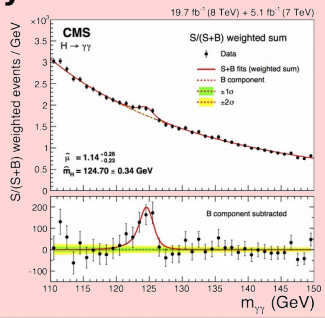
RAW

Geometry & Conditions:

Reconstruction:

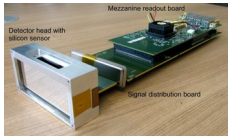


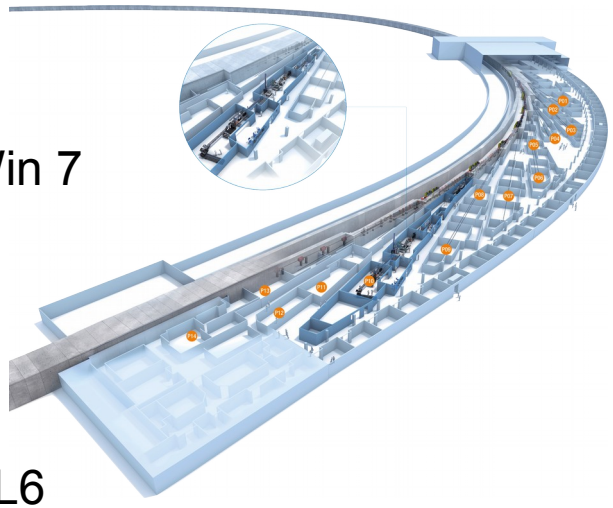
Analysis:



Monte Carlo Production:

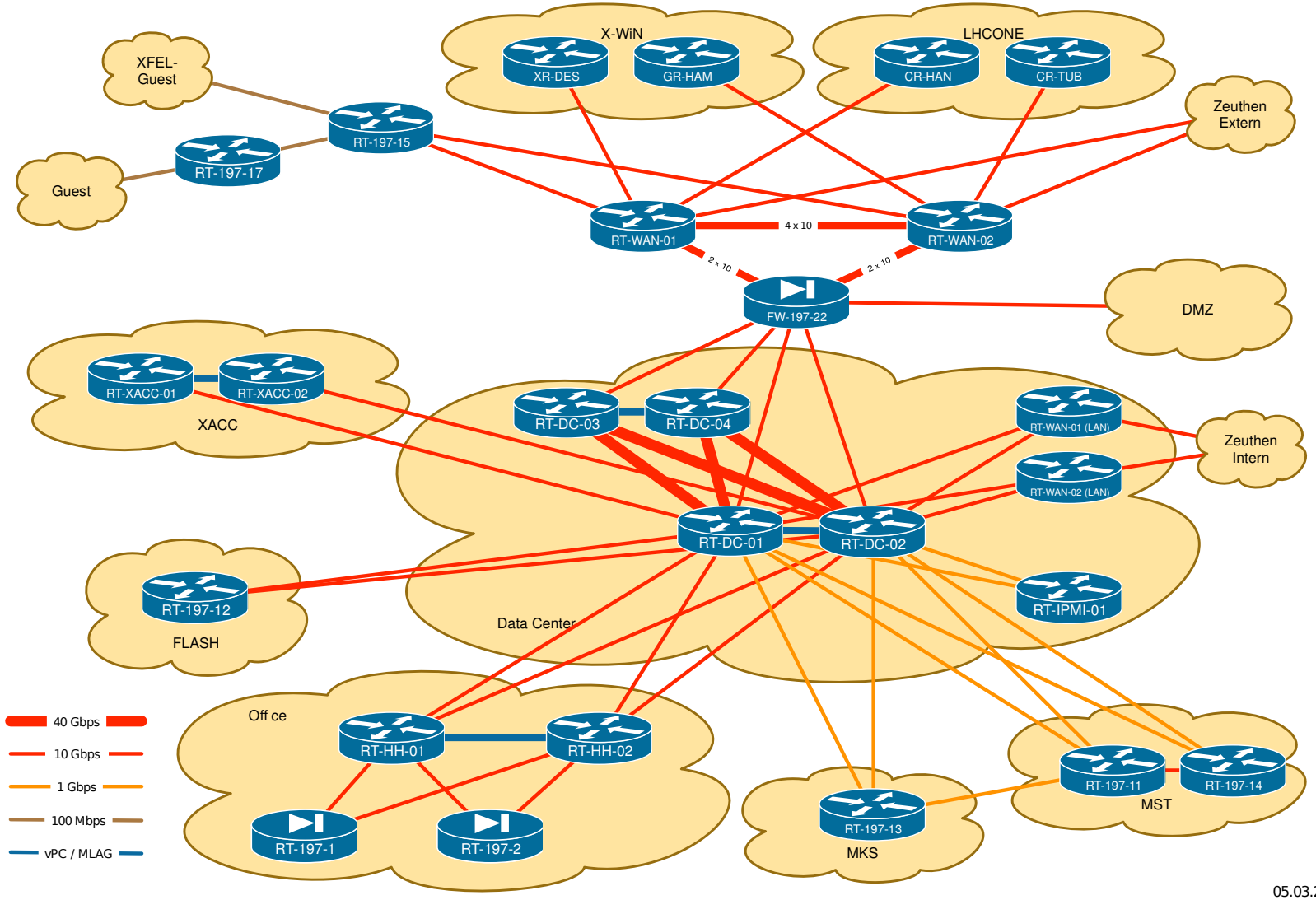
Next generation photon-science detectors

	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

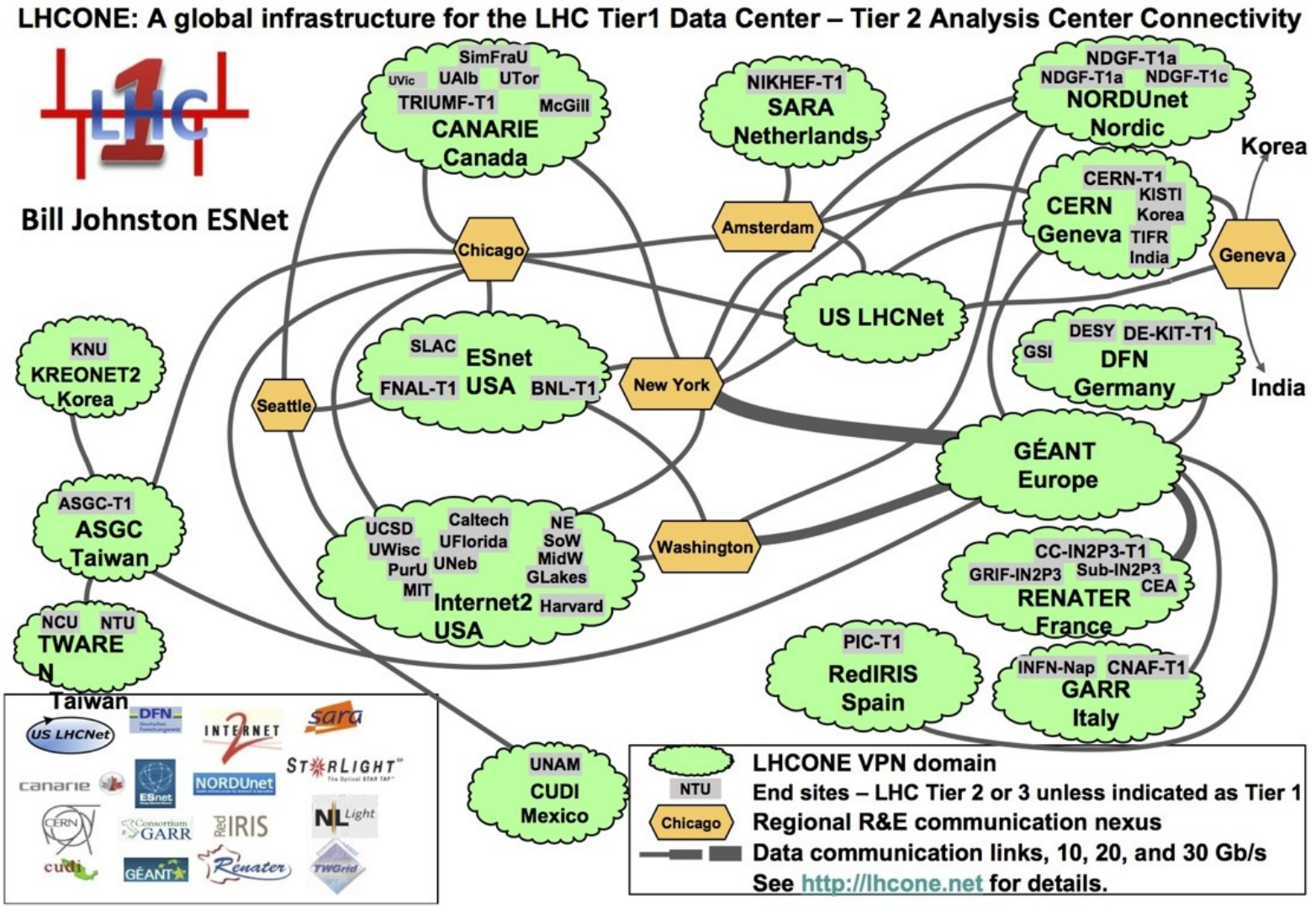
DESY network topology



05.03.2015

Slide thanks to Kars Ohrenberg

LHC ONE: global infrastructure for LHC connectivity



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Computing usage