Big Data Management

for large Experiments @ DESY

Volker Guelzow
IT-Gruppe
Bruxelles, May 8th, 2014

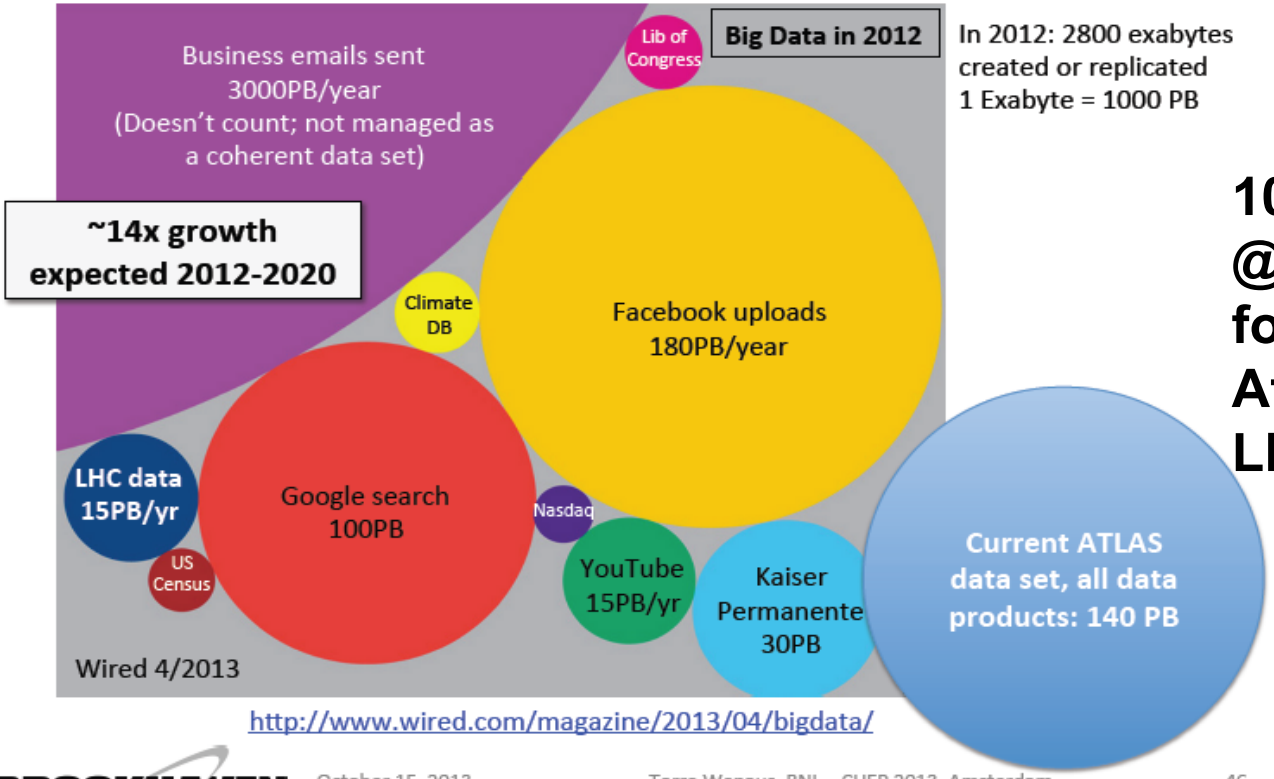
HELMHOLTZ GEMEINSCHAFT

DESY

Big Data in High Energy Physics

From: Torre Wenaus, CHEP 2013

Data Management
Where is LHC in Big Data Terms?

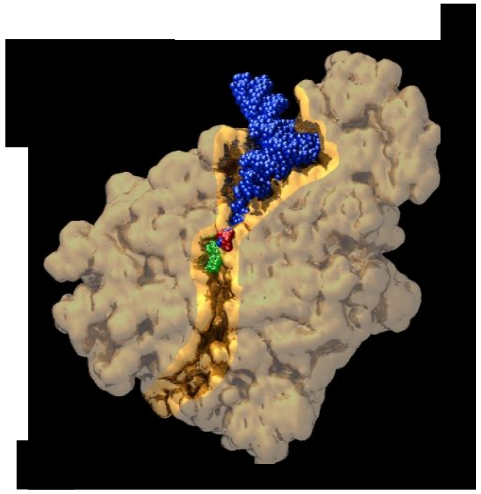


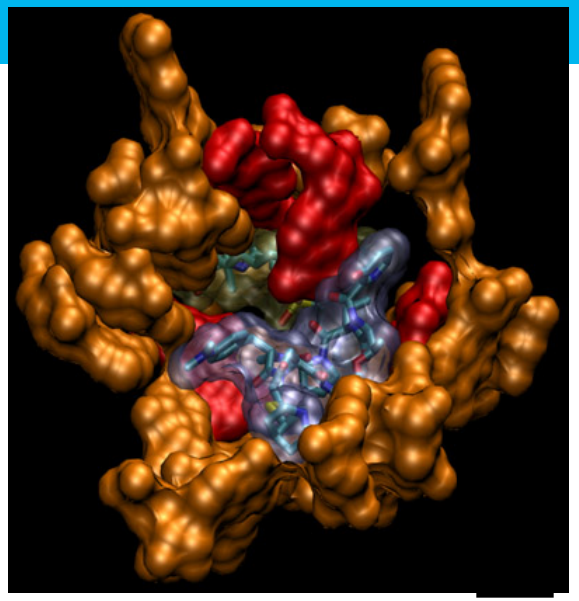
In 2012: 2800 exabytes created or replicated
1 Exabyte = 1000 PB

http://www.wired.com/magazine/2013/04/bigdata/

10 PB HEP Data @ DESY Tier 2 for Atlas, CMS, LHCb

Big Data in Photon Science





- Examples:
- Simulation of nano structures -> N**3*log (N)
- Protein Cristallography -> 4 MPixels *10**6 Crystals -> analysis of hundreds TB
- Tomography -> 3D Reconstruction on some 10th TB data/experiment
- Online analysis with some TB/beamline and some Gb/s/beamline
- Offline analysis for some PB/year

Detectors and Data rates

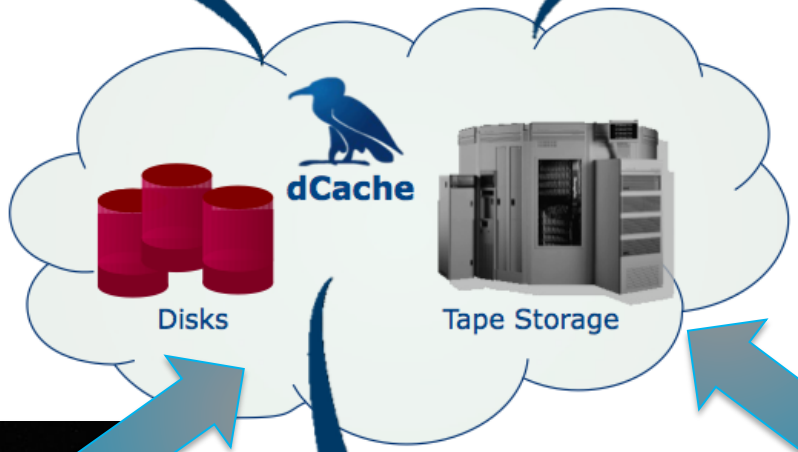
Type	Frame size	Frame rate	Peak rate	Os	Avail.
Medipix	n x 256 x 256 x 2			SL6	Now
PerkinElmer	2048 x 2048 x 2	15 Hz	1.9Gb/s + 8kb/s (log)	Windows-7	Now
Pilatus300k	487 x 619 x 4	~200 Hz	1.56Gb/s	Suse-10	Now
Pilatus1M	981 x 1043 x 4	25 Hz	0.8Gb/s	Suse-10	Now
Pilatus 6M	2463 x 2527 x 4	25 Hz	4.6Gb/s	Ubuntu 10	Now
AGIPD	128 x 512 x 2 x 2 x 352	10 Hz	55 Gb/s	SL6	2015
Eiger	1k x 1k x 2	3 kHz	50 Gb/s	RHEL6	now
Lambda-Si	3 x 1536 x 512 x 2	2 kHz	60 Gb/s	SL6	2013
PCO Edge	2560 x 2160	100 Hz	5.6 Gb/s	Windows-7	now
Percival (1S)	4k x 4k x 2	120 Hz	60 Gb/s	(SL6)	2015
Percival (4S)	8k x 8k	120 Hz	240 Gb/s	(SL6)	late 2015

The European XFeL

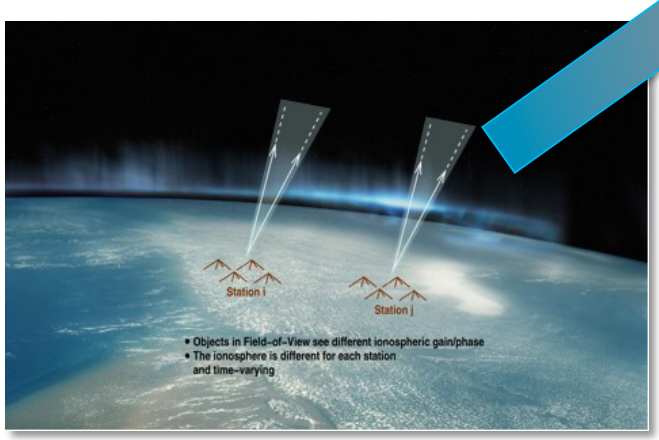
- Operational 2016
- Expect: 20 PB 2016 –> 100 PB (2019) per year

- Big Data Management through dCache
- Tier0 @ DESY
- Distributed Analysis

dCache Big Data Cloud



LOFAR antenna
Huge amounts of data



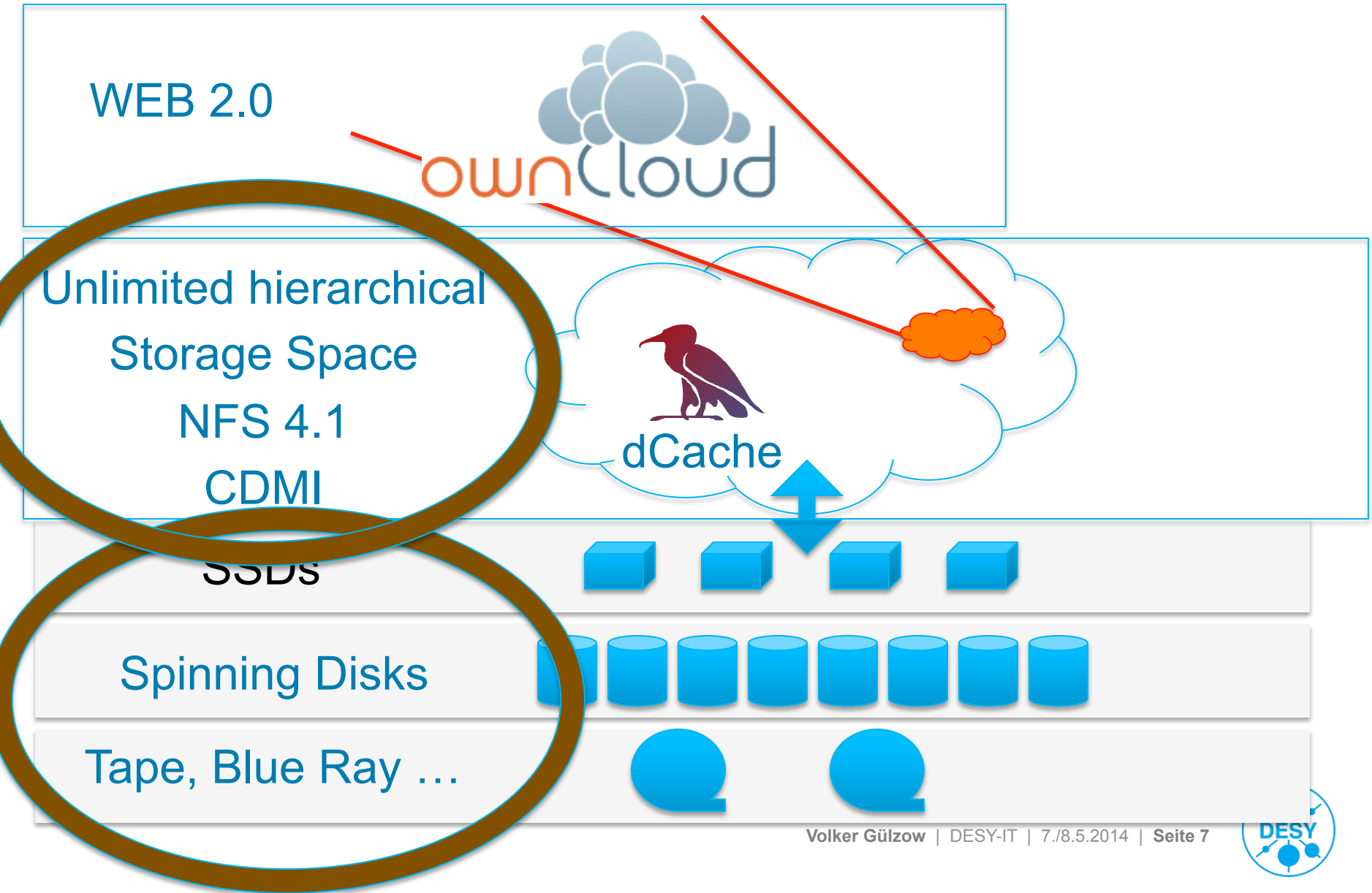
Mounted POSIX FS
(NFSv4.1, pNFS)

Computer farm

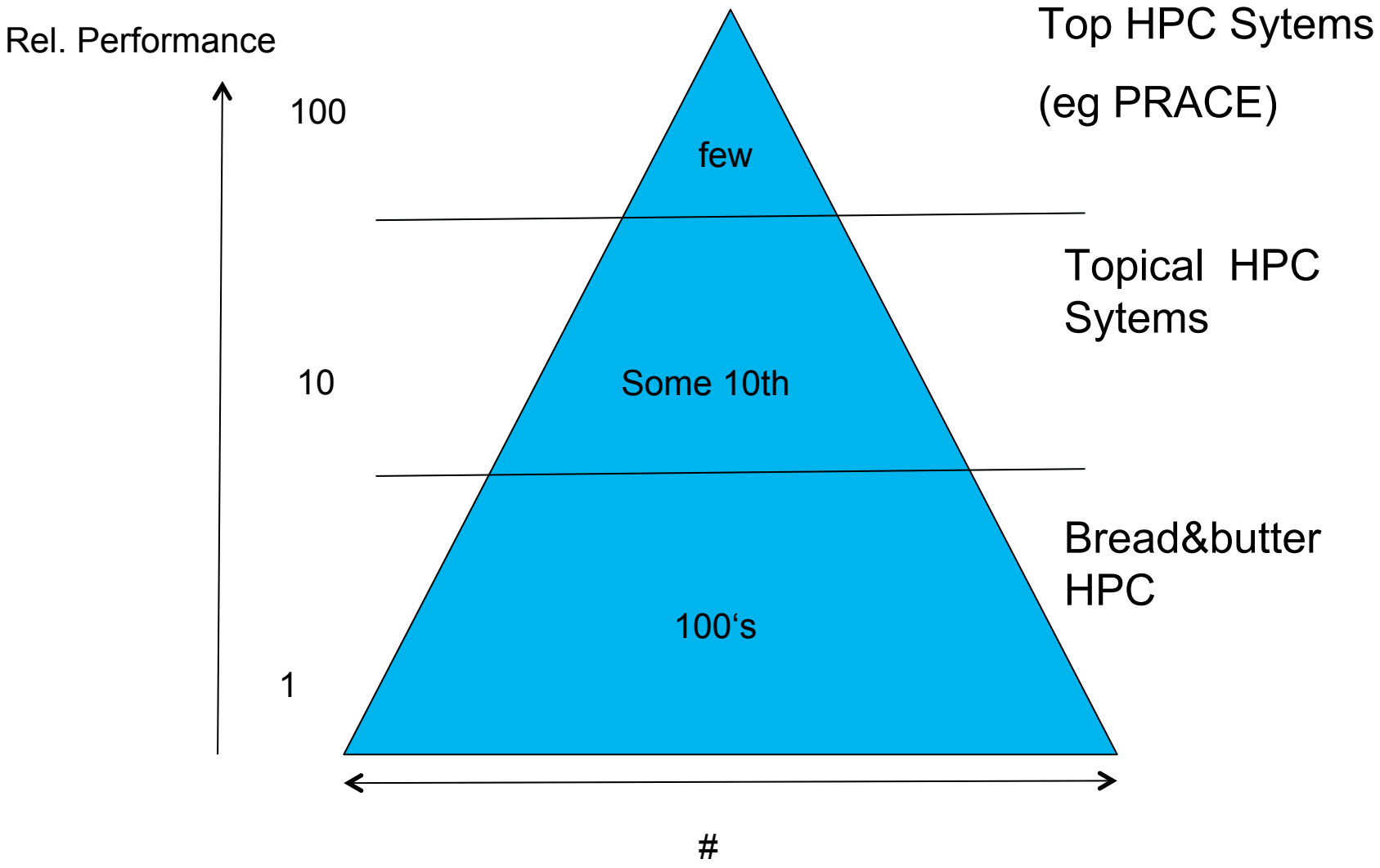
European XFEL

X-FEL
(Free Electron Lasers)
Fast Ingest

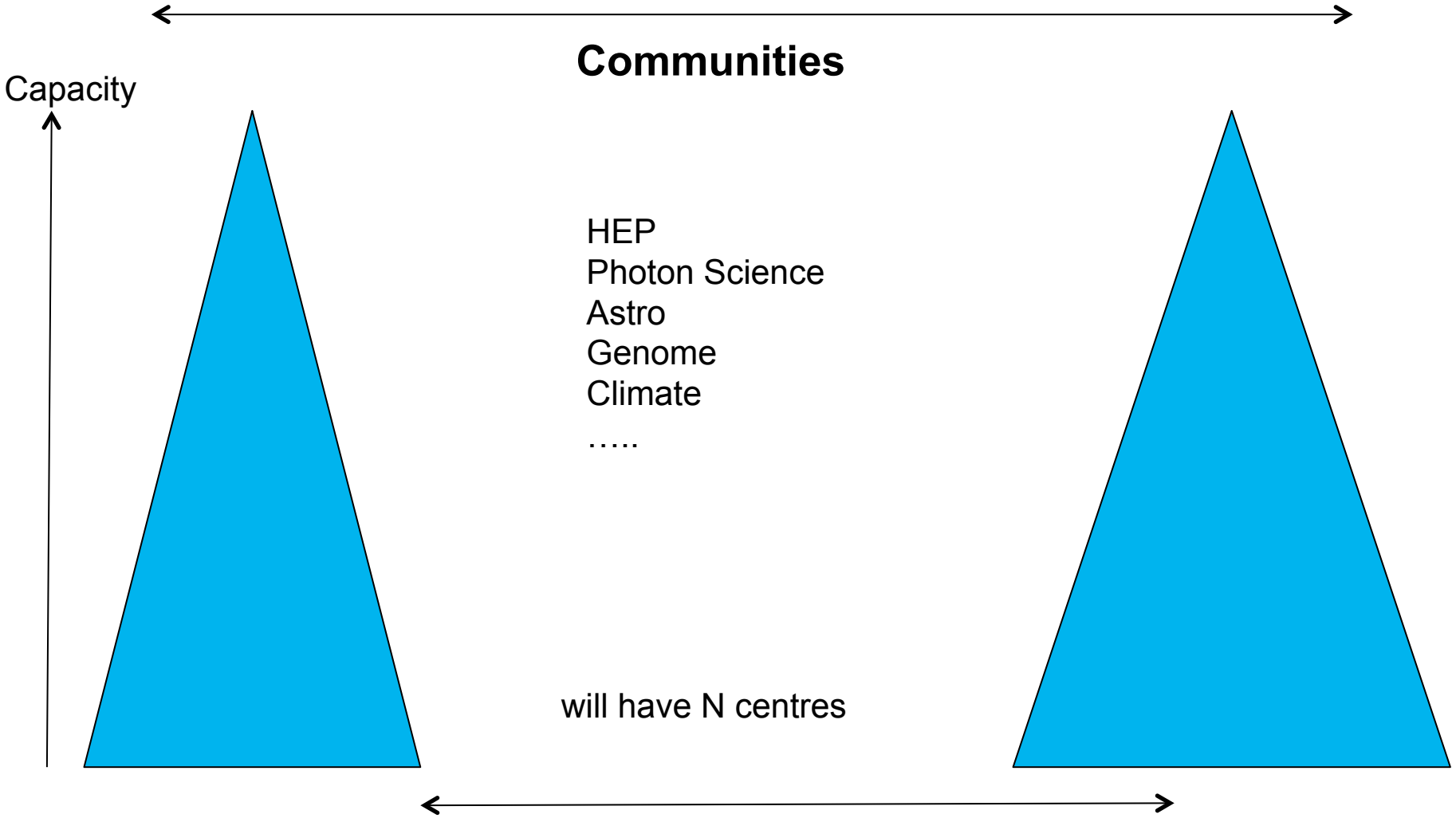
dCache – OwnCloud Data Management



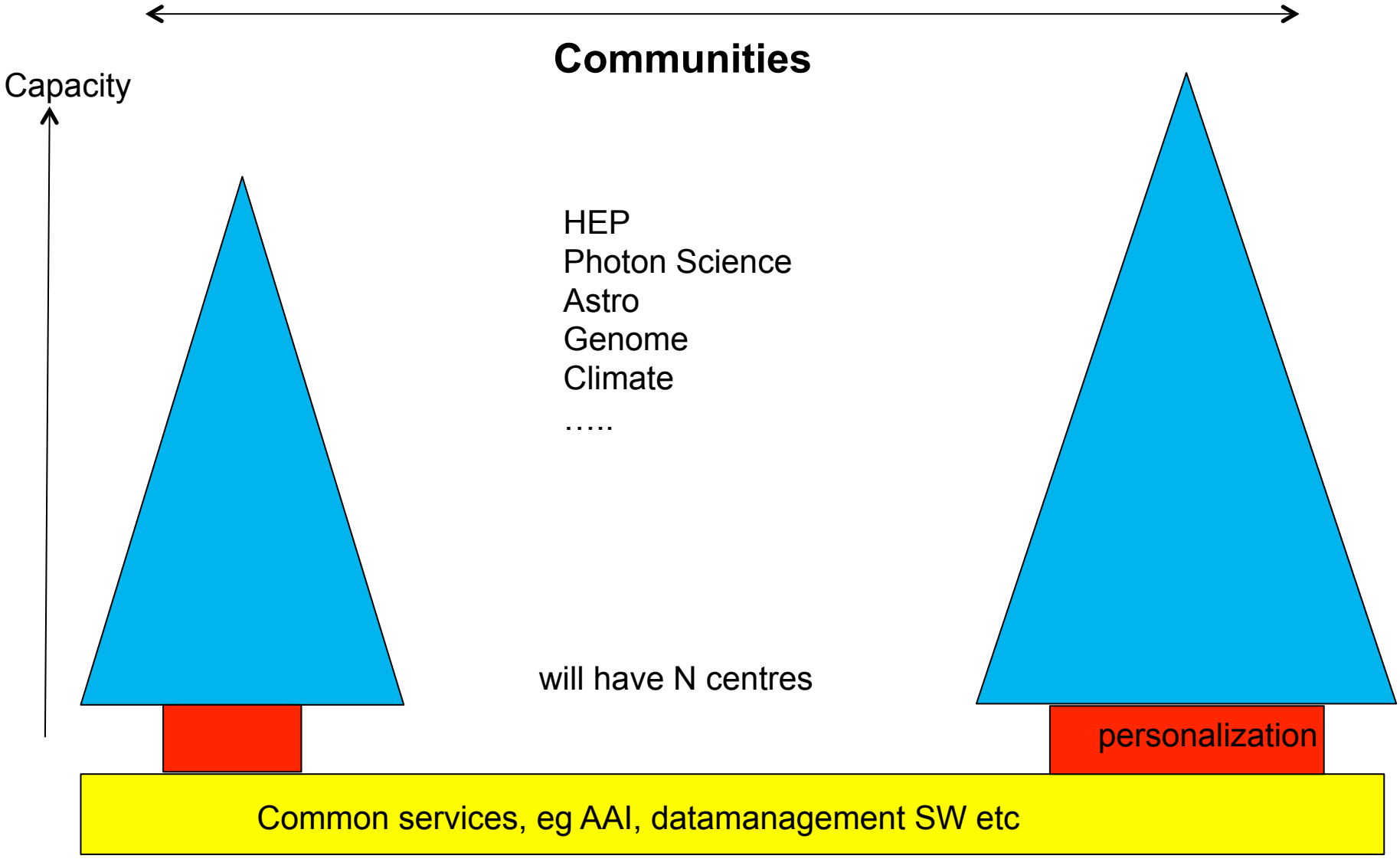
The HPC Pyramide, a european model for „big data“?



The federated data infrastructure model for science



The federated data infrastructure model for science



User interface layer

- AAI: access to federated resources

  (adapting existing solutions from other projects

  like EduGain based solutions)

- Security, policies, life cycle management

  (like „how long? Ownership? Who has access? What kind of data?..)

- Portals for scientific and industrial users

  (like access to resources, virtual accounting, industrial usage,..)

- Open Access

Computing layer

- Cloud solutions

  (open stack, Helix Nebula, Dirac-like systems)
- Provisioning of an advanced computing facility (GPU, parallel, green programming) in a federation
- Distributed competence through simulation Lab‘s
- Cooperation with PRACE and potentially others

Data management

- Advanced (distributed) baseline storage solutions

  (f.i. high performance for ingest und access,…)
- Advanced data management software solutions
- Data cloud solutions
- Metadata handling
- Distributed competence through data Lab‘s
- Data preservation (extension of DPHEP)

Summary

- Setting up federated structures for scientific users
- Making Distributed competence accessible
- Setting up advanced Network strategies and developments (like LHCone) with NREN‘s, Dante, Terena
- Making advanced ICT technology available to science
- Cooperation through RDA