4 sessioni in 2 giorni

- Introduction and Keynotes
- Technology and research
- Site reports
- Software solutions

Sul sito dell'evento sono disponibili le riprese di molti degli interventi

http://indico.cern.ch/event/336753/

Ma tutto è chiaro fin dall'inizio.....

"....CERN adopted ownCloud....."

A Little History

- Unison is the only synchronizer based on a formal specification (AFAIK)
- Main designers
  - Trevor Jim, Jerome Vouillon, and BCP
- First version distributed in 1998
  - Earlier prototypes going back to 1995
  - Still widely used
- Open-source, multi-platform (Windows, OSX, Linux)
- *Very* few reported bugs with potential to lose data

But the world has changed…

Synchronization tools: (bidirectional, sync operations explicit)
- Unison, …

Synchronization *services:* (multi-directional, sync in background)
- Central server ("cloud-based") • • •   concentrate on these
  - Dropbox, Google Drive, OneDrive, Owncloud, SpiderOak, Sugarsync, Box.net, Seafile, Pulse, Wuala, Teamdrive, Cloudme, Cx, Amazon cloud service, …
  - Also distributed filesystems (Coda, GFS, …)
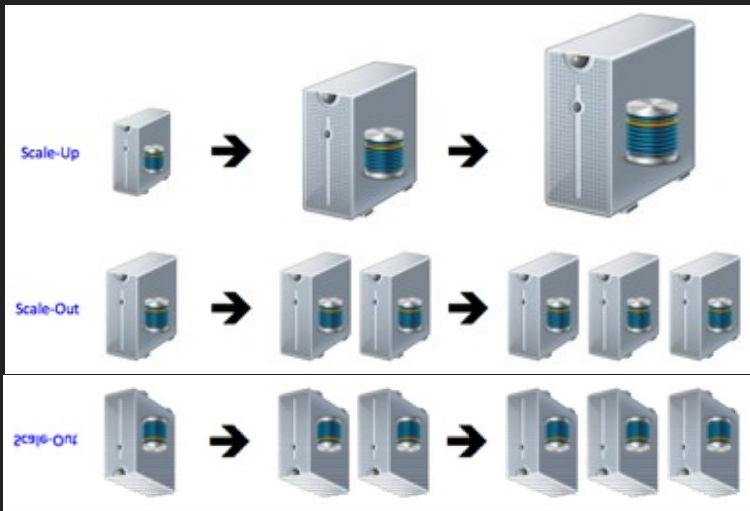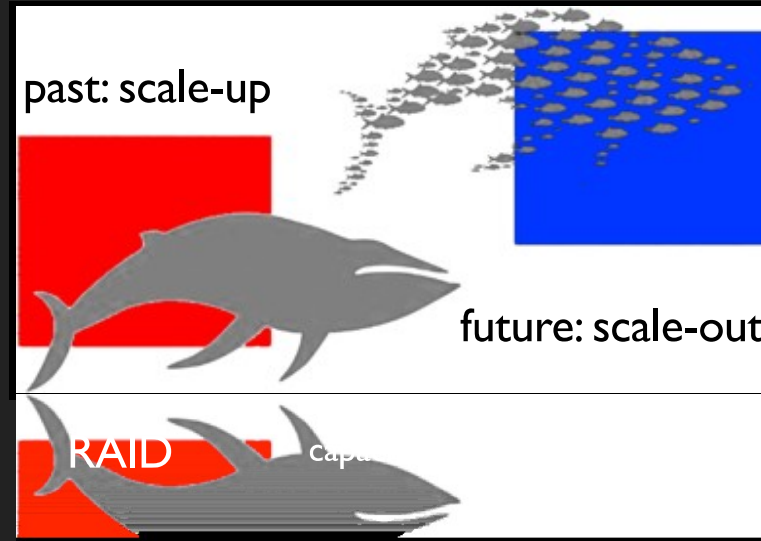- Peer to Peer
  - Bittorrentsync

▶ The Problem
Big Data Storage Technologies

- data growth faster than budget/technology

- 'traditional' systems not long-term scalable

- cost & complexity increase when scaling

- Growth of data
- IT Storage Budget

2010   2020
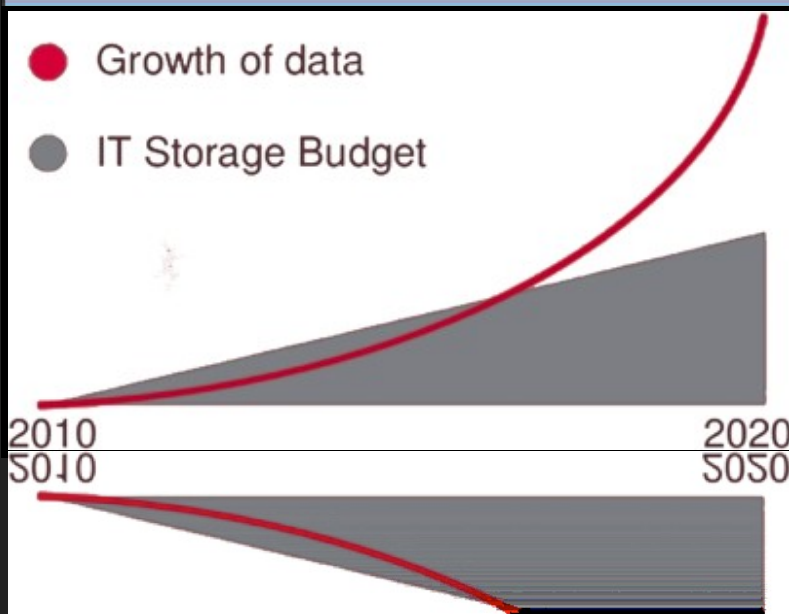
'The Solution'
From Scale-Up to Scale-Out Storage

past: scale-up

future: scale-out

RAID

- structured data with central view & strong consistency
- predictable access
- SPOF
- slow growth rate

- best for unstructured data
- unpredictable growth rates
- MPOF resistant

many storage systems like HDFS use hybrid approaches with scale-up for meta-data and scale-out for data path
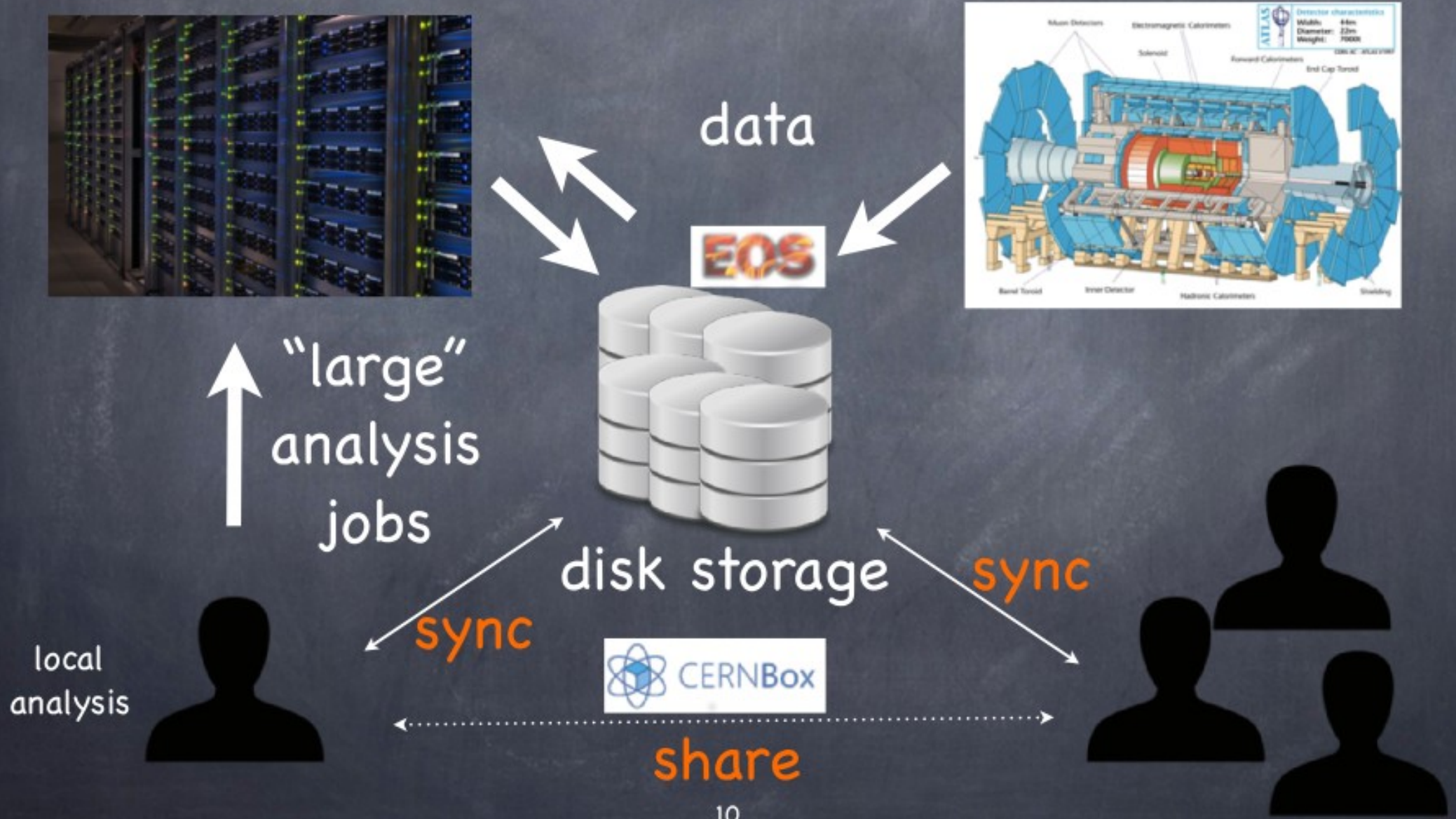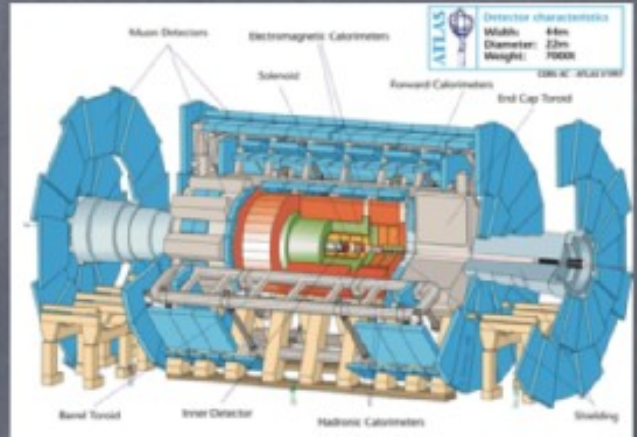
"Dropbox" for science

- Provide "Sync and Share" Service for the core business of doing science

- Challenge: "highly nontrivial" use-case

- Reward: unique capability for our researchers perfectly integrated in their daily environment

Use Case: Data Analysis
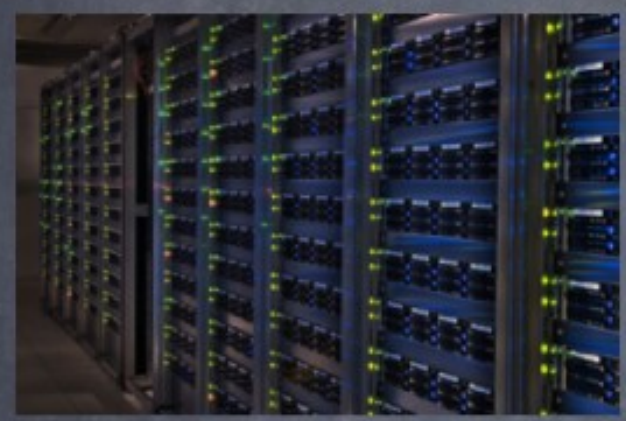
Use Case: Global Science
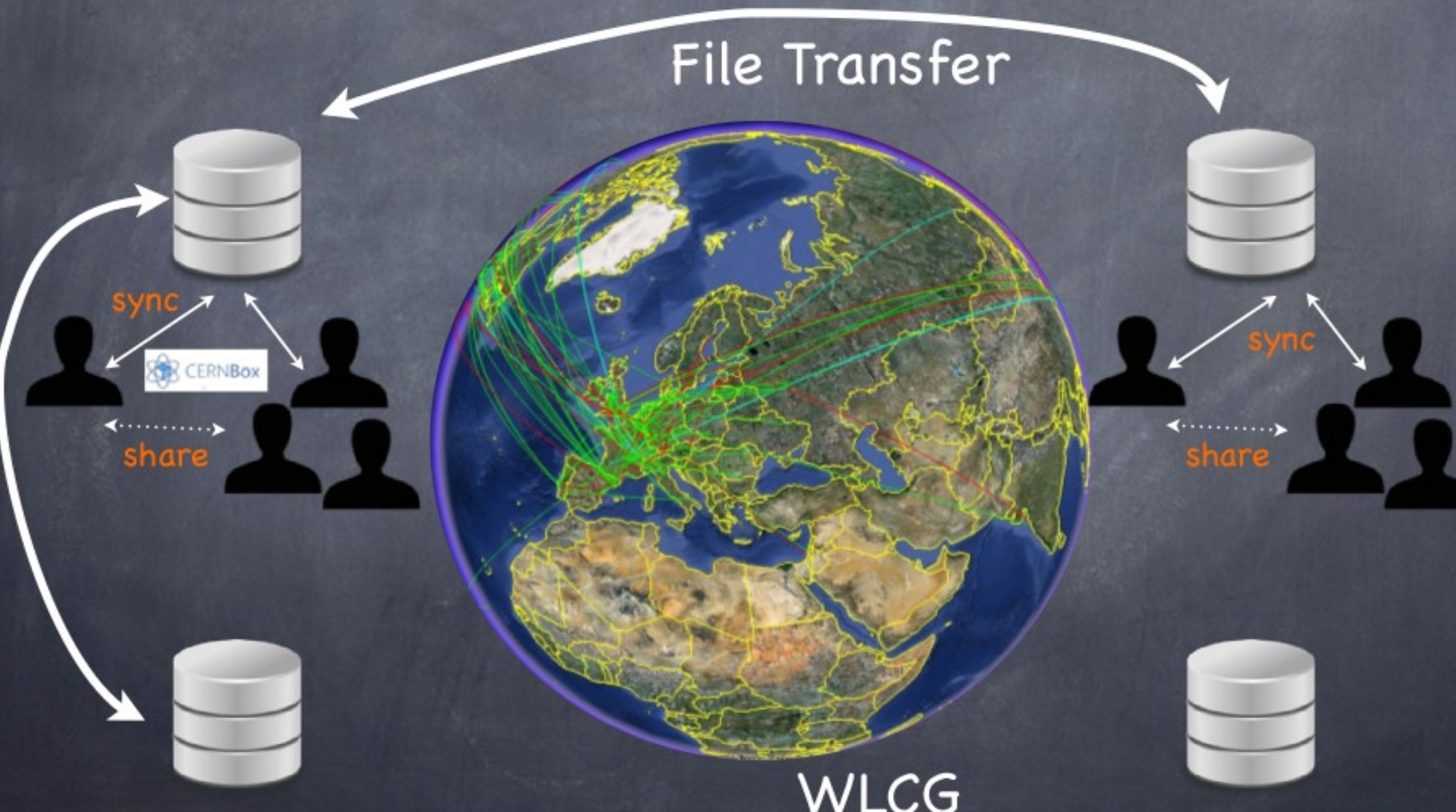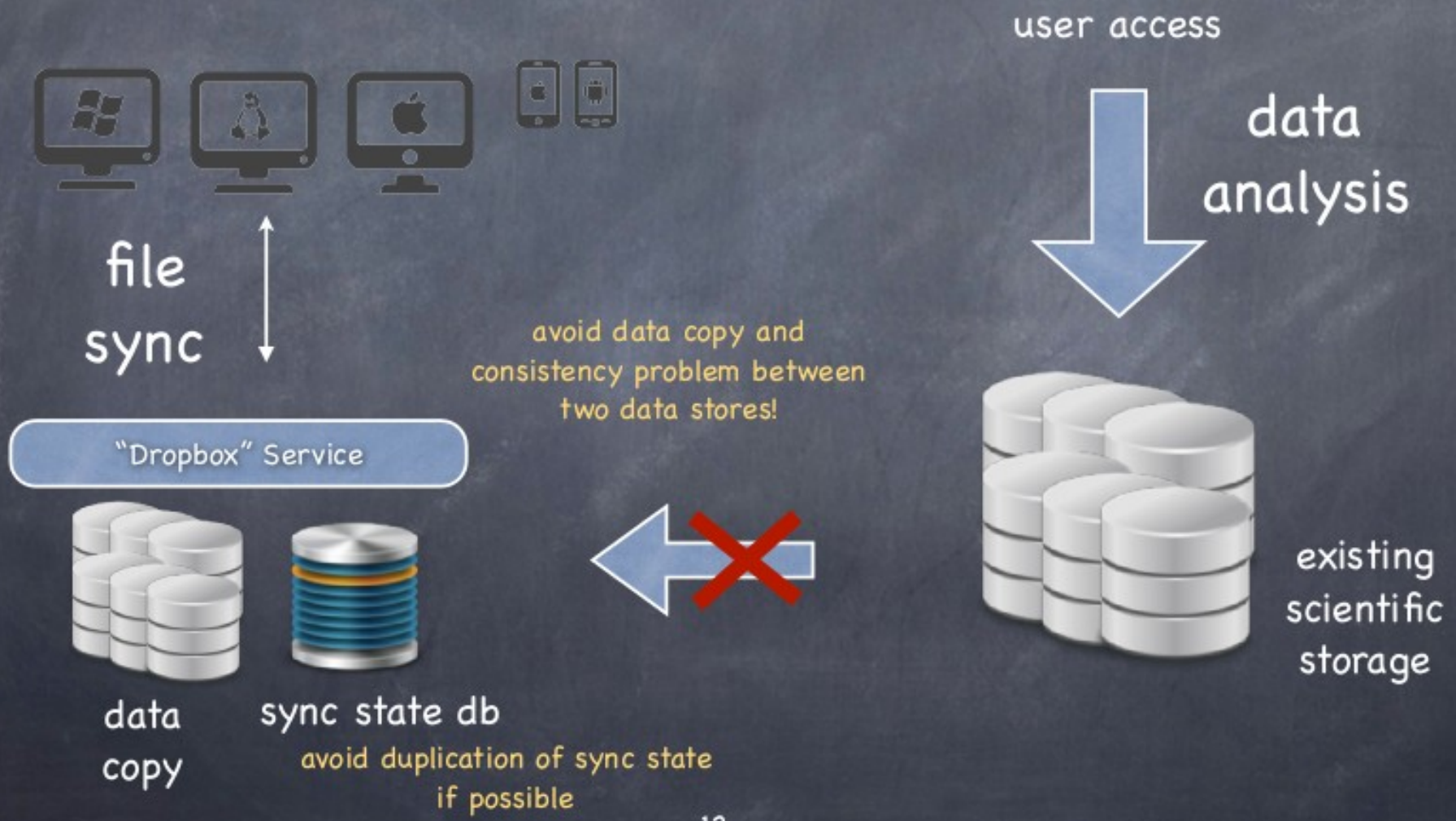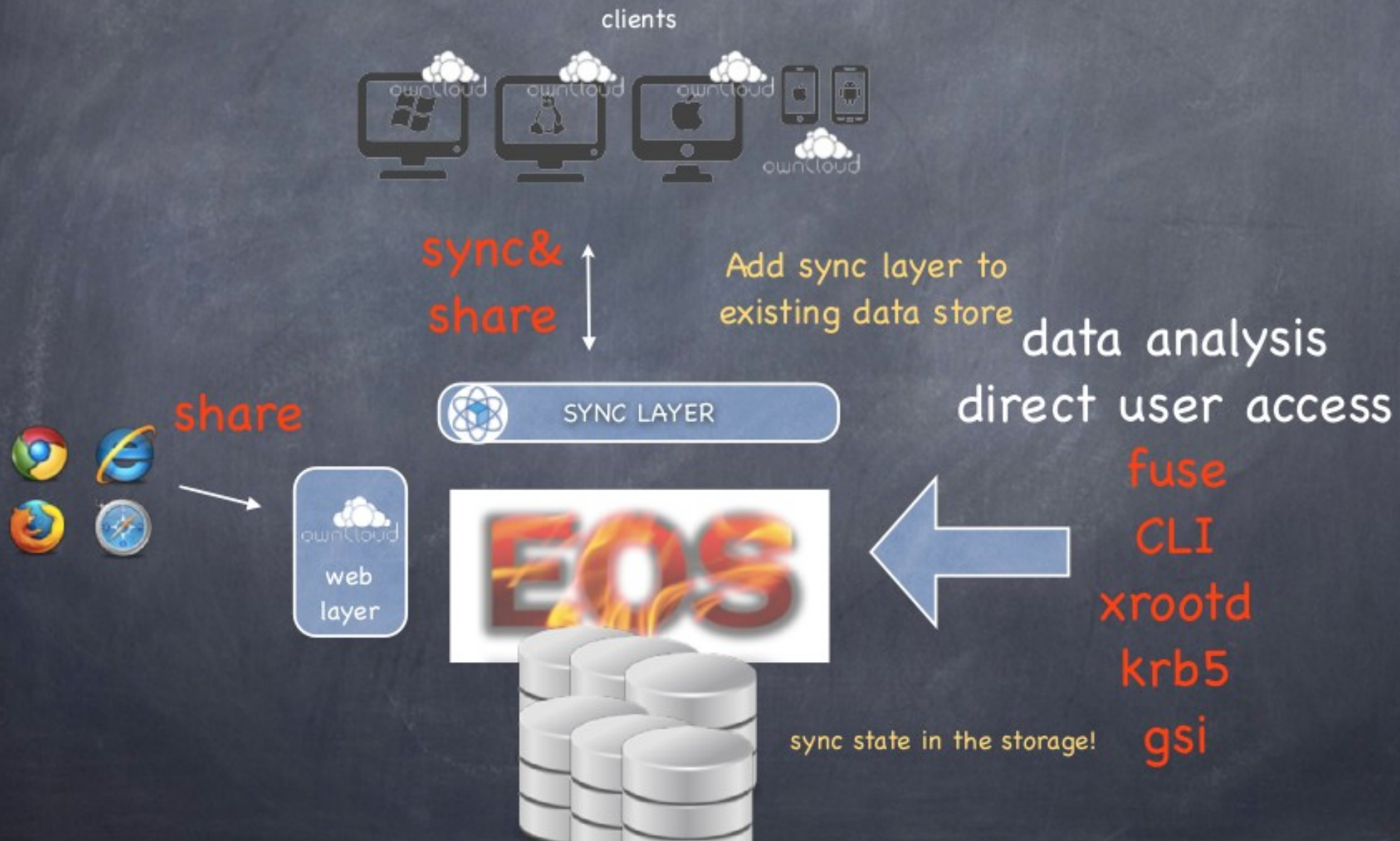
Immediate access to all our data!
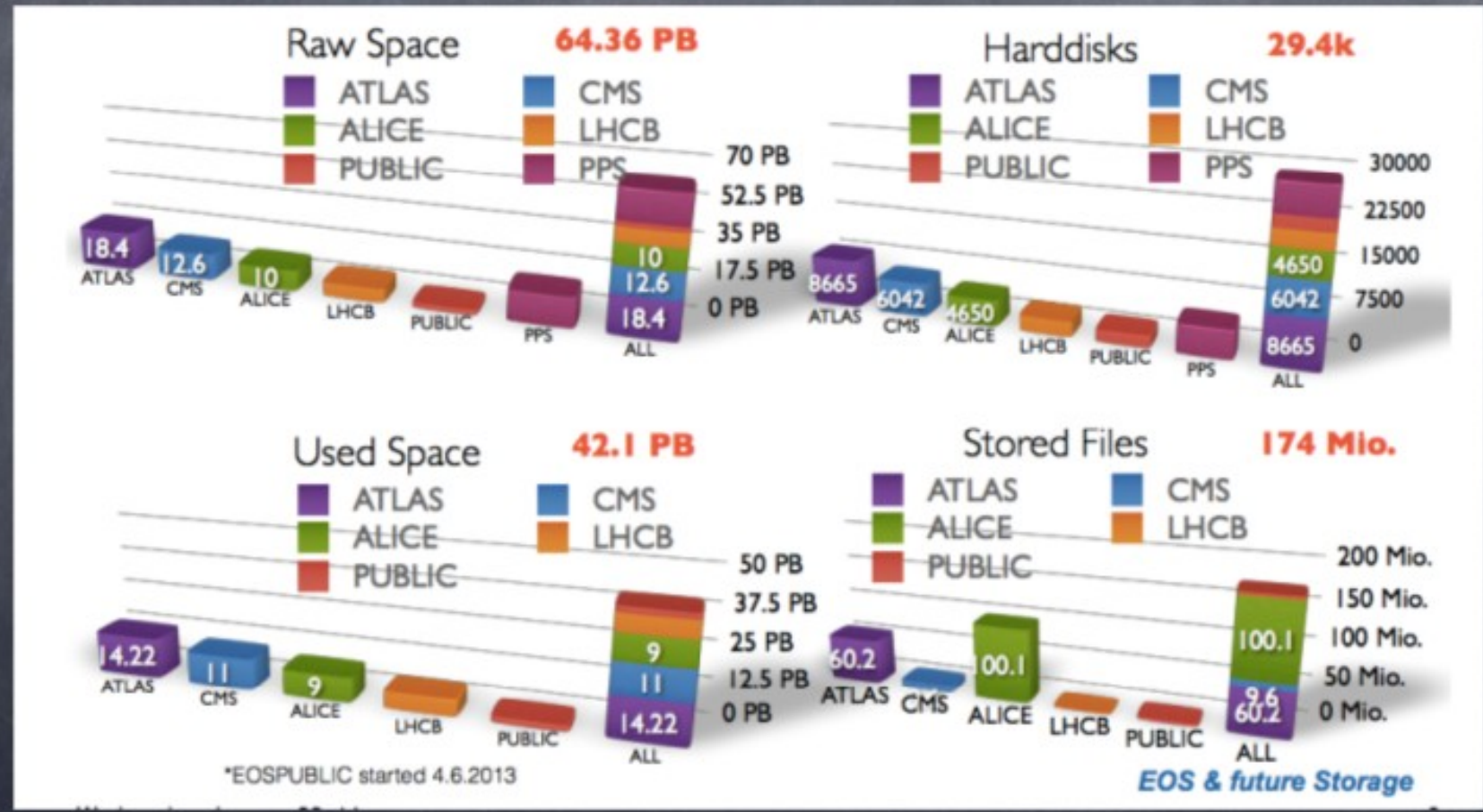
Software Solutions

- Presentation of **Pydio**

- **PowerFolder** – Peer-to-Peer powered Sync and Share

- **Seafile** open source cloud storage, technology and design

- **ownCloud**

- IBM Software Defined Storage and ownCloud Enterprise Editon - a perfect match for hyperscale Enterprise File Sync and Share

Mature solution, backed by a growing community...

in a Nutshell, Pydio...

... has had **5,772 commits** made by 60 contributors representing **322,372 lines of code**

... has a **well established, mature codebase**, maintained by a large development team with **stable Y-O-Y commits**

... took an **estimated 84 years of effort** (COCOMO model), starting with its first commit in June, 2007 ending with its **most recent commit 2 days ago**

Source: OPENHUB.NET

Pydio

PUT YOUR DATA IN ORBIT

> AGPL v3
> 80k+ active installs
> 20k forum members
> 10k Newsletter subscribers
> 60 contributors
> Source code on Github
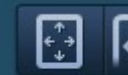
PydioSync - reloaded

Sync client completamente riscritto

Welcome to the Pydio Sync
The easiest way to keep your data in control

Per-workspace & per folder choice

Bidirectionnal, up or down only.

Ability to run headless

Limited resources even for huge number of files

Still in beta but promising

pydio
PUT YOUR DATA IN ORBIT
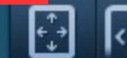
Seafile

- **Seafile** ci è sembrato particolarmente interessante

- Ma gli sviluppatori sono 2!!!

Seafile

Design Advantage

- Object storage is more scalable than file system
    - Heavy DB + Filesystem v.s. Light DB + Object Storage
- No database bottleneck
    - Metadata is in object storage
    - Filesystem level versioning v.s. File-level versioning
- File system designed for syncing
    - Storage/Network deduplication
    - No upload/download limit, fast upload
- Backend daemons implemented in C

Seafile
Server Architecture

Sync	Mobile	Browser	WebAPI	FUSE	...
Seafile					
Ext4	NFS	AWS S3	Swift	Ceph	
Machines					
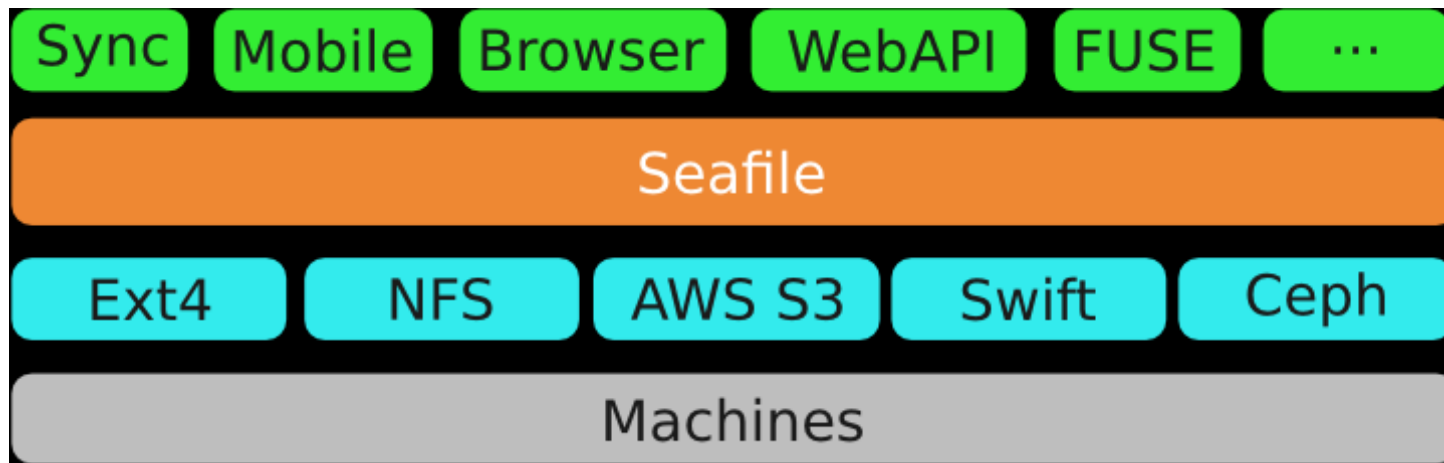
Seafile is a "file system" built on top of object storage

Non-POSIX, User space, Light weight

Seafile

How Syncing Works

2:Write objects

Relational DB

Object Storage

3: Update head commit ID
after objects are saved

1: Client uploads commit,
dir, file, and block objects

4: Client download objects
and check out to folder

Almost looks like Git
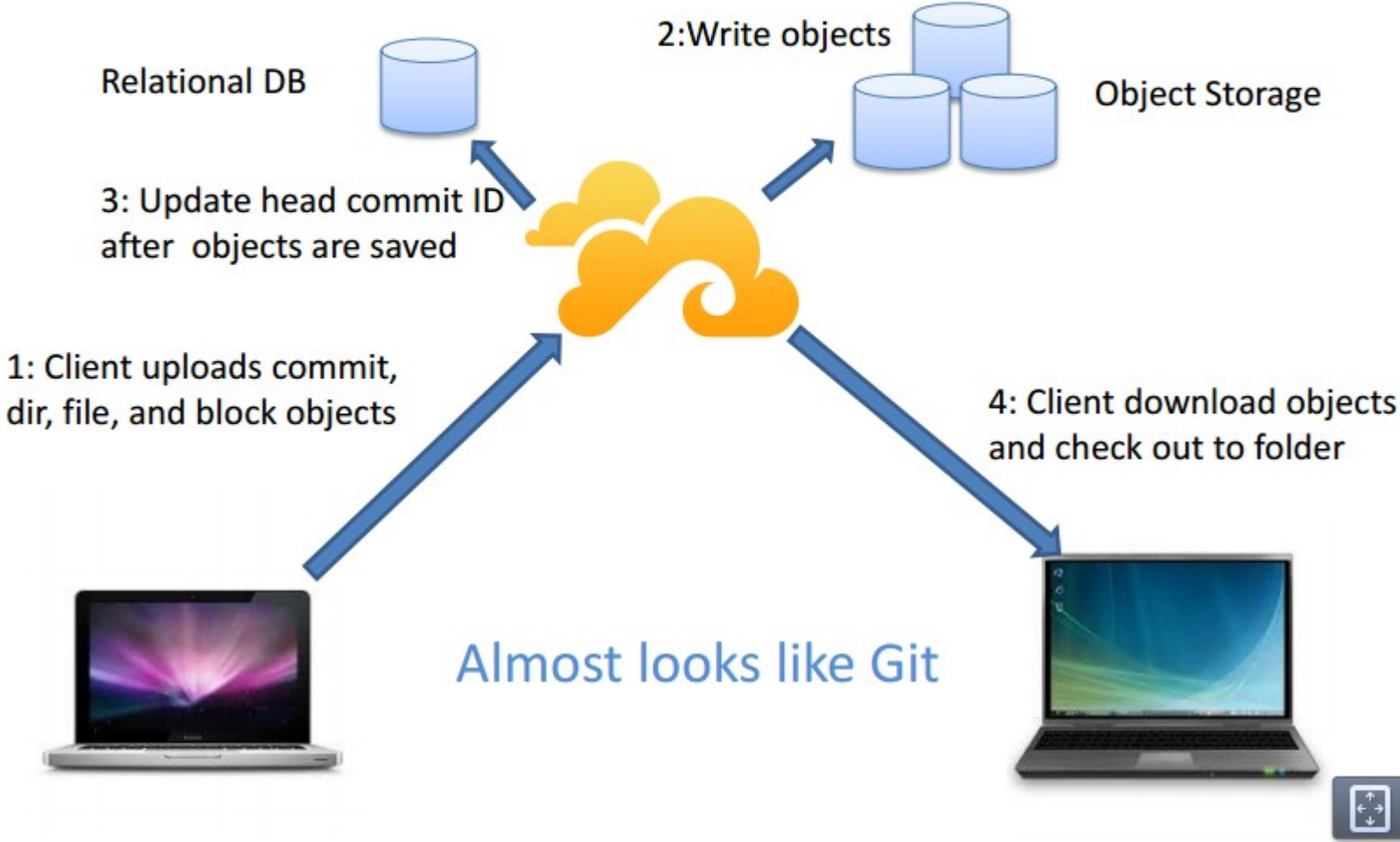
Technology and Research /1

- OpenStack Swift as Multi-Region Eventual Consistency Storage for ownCloud Primary Storage

- Programmatic access to file syncing services

- Data Management Services for VPH Applications

- Storage solutions for a production-level cloud infrastructure

- DataNet: A flexible metadata overlay over file resources

Technology and Research /2

- Adaptive Query Processing on RAW Data

- The File Sync Algorithm of the ownCloud Desktop Clients

- Combining sync&share functionality with filesystem-like access

- Dynamic Federations: scalable, high performance Grid/Cloud storage federations

- The dCache scientific storage cloud

- WebFTS: File Transfer Web Interface for FTS3

- Current practical experience with the distributed cloud data services

Technology and Research /1

- OpenStac... Consister... Storage

- Programm...

- Data Mana... Applications

- **Storage solutions for a production-level cloud infrastructure**

- DataNet: A flexible metadata overlay over file resources

Unico contributo INFN ed unico contributo italiano della conferenza.

AARNet – OwnCloud + Swift

With the addition of features to the ownCloud software allowing primary data storage on OpenStack Swift, AARNet has chosen to deploy Swift in a nation spanning multi-region ring to take advantage of Swift's eventual consistency capabilities and the local region quorum functionality for fast writes.

The scaling capability of Swift resolves the twin problems of geographic redundancy, and user proximal access while scaling into the petabyte range.

…

Additionally, the policy capabilities within Swift combined with the ability to grant a user multiple storage targets within ownCloud, allow us to honour data sovereignty rules with respect to the physical location of the data on a per top level folder basis.

Finally, using the combined read and write affinity features of the Swift proxy, AARNet is presently experimenting with deployment of flash cache backed site local application nodes, providing the perception to the user of near instant data ingestion, while the node trickle uploads data to the redundant bulk storage ring using private layer 3 networks.

By switching to true object store systems, AARNet is able to achieve two of its original design goals for cloud storage services, chiefly being user proximal data storage, and continent-spanning geographic redundancy, from hundreds of terabytes into the petabyte scale.

AARNet – OwnCloud + Swift

With the addition of features to the ownCloud software allowing primary data storage on OpenStack Swift, AARNet has chosen to deploy Swift in a nation spanning multi-region ring to take advantage of Swift's eventual consistency capabilities and the local region quorum functionality for fast writes.

The scaling capability of Swift resolves the twin problems of geographic redundancy, and user proximal access, using a distributed deployment strategy.

…

Additionally, the policy capabilities within Swift combined with the ability to grant a user multiple storage targets within ownCloud, allow us to honour data sovereignty rules with respect to the physical location of the data on a per top-level folder basis.

Finally, using the combined read and write affinity features of the Swift proxy, AARNet is presently experimenting with deployment of local cache-backed site-local application nodes, providing the perception to the user of near instant data ingestion, while the node trickle uploads data to the redundant bulk storage ring using private layer 3 networks.

By switching to true object store systems, AARNet is able to achieve two of its original design goals for cloud storage services, chiefly being user proximal data storage, and continent-spanning geographic redundancy, from hundreds of terabytes into the petabyte scale.

Il gruppo di lavoro Cloud-MR sta lavorando ad un'infrastruttura Swift distribuita concettualmente molto simile a quella di AARNet ed ha già provato, con successo, ad agganciarvi ownCloud.
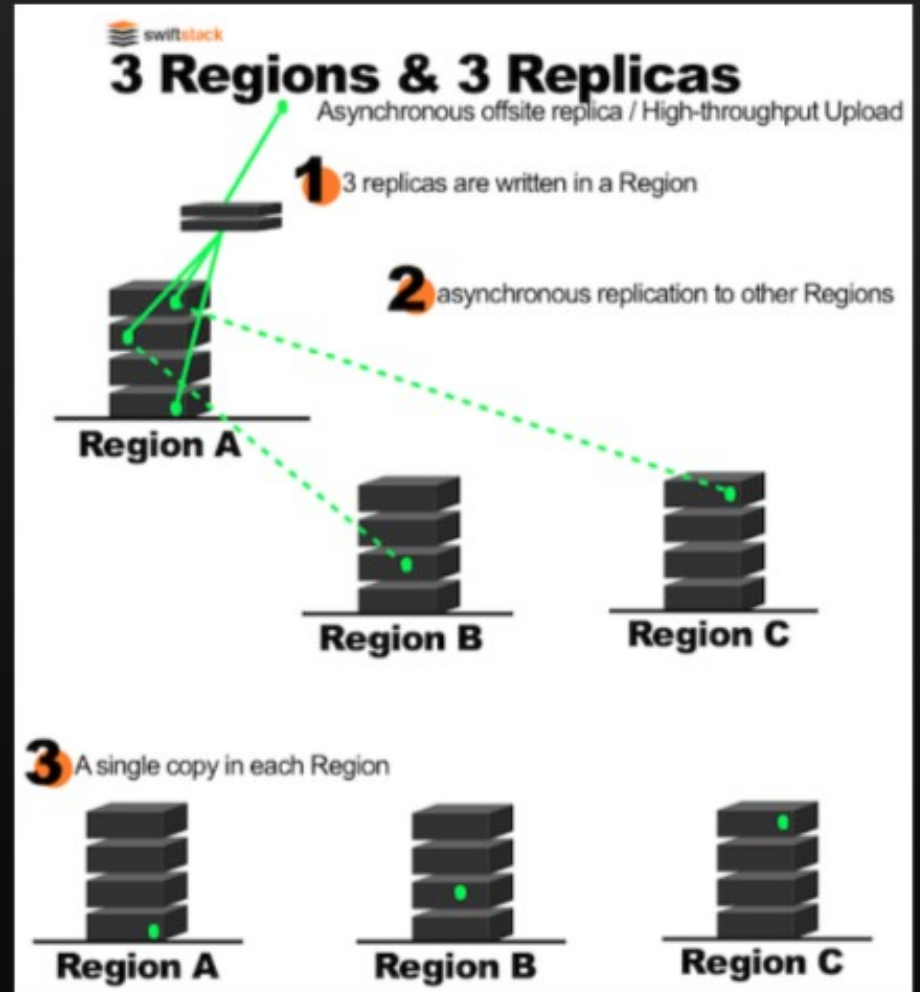
Swift in a Nutshell

On Swift: Swift and writing replicas

System "peels" off locally written replicas to remote regions

Step 1 very easily could be a single host with 3 PCI-e flash devices

Policies then have the data moved to cheaper bulk storage behind the scenes

Image source: https://swiftstack.com/blog/2012/09/16/globally-distributed-openstack-swift-cluster/

ownCloud project at CNRS

CNRS will launch next November an ownCloud based service with the intend to serve CNRS research units. The first step is to deploy this service as a beta solution for 2 months and 2000 end users, and then to generalize this offer to the whole CNRS users (potentially 100000 users).

Our platform is based on **ownCloud 7** community edition, with **VMWare for virtualization**, a **Galera/MariaDB** cluster database and **Scality** for the distributed storage backend.

How it al started about a year ago

We want our own
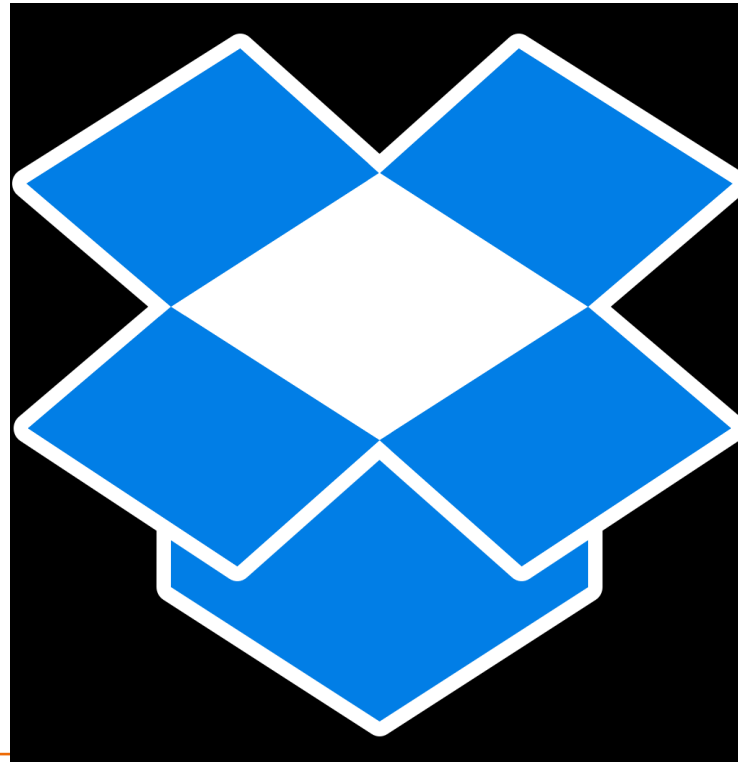
How it al started about a year ago

But,

- Privacy of data is important.
- No NSA allowed!
- Dutch institutes agreed on security & privacy rules/guidelines.
- Large number of whishes and requirements.

SURF

The cloud storage service bwSync&Share at KIT

The **Karlsruhe Institute of Technology** introduced the bwSync&Share collaboration service in January 2014. The service is an **on-premise alternative to existing public cloud storage solutions for students and scientists** in the German state of Baden-Württemberg, which allows the synchronization and sharing of documents between multiple devices and users. The service is based on the commercial software PowerFolder and is deployed on a **virtual environment to support high reliability and scalability for potential 450,000 users**.

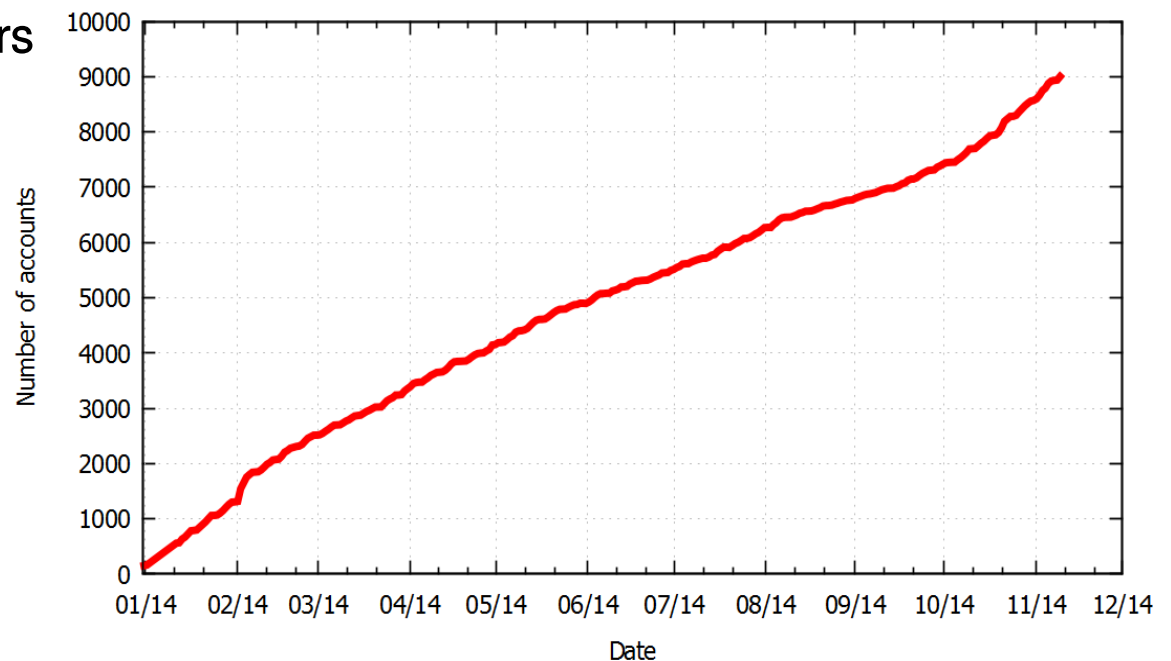The integration of the state-wide federated identity management system (bwIDM) and a centralized helpdesk portal allows the service to be used by all academic institutions in the state of Baden-Württemberg. Since starting, approximately 15 organizations and 8,000 users joined the service. The talk gives an overview of related challenges, technical and organizational requirements, current architecture and future development plans.

Site reports – bwSync&Share at KIT

Service usage (Accounts)

- 9123 accounts (12.11.14)

- Potential:
  - 450 000 eligible users
    - 9 universities
    - >50 colleges
  - 55 000 expected users

bwSync&Share. Number of accounts over the year 2014.

Alexander Yasnogor - The cloud storage service bwSync&Share at KIT

Steinbuch Centre for Computing

"Dropbox-like" service for the University of Vienna

The increasing popularity of dropbox and at the same time increasing awareness for data security did create the demand for an onsite "Dropbox-like" "sync and share" service at the University of Vienna. It has been decided that **ownCloud would be a good start**, since other academic institutions have been working on an ownCloud based solution as well.

Based on ownCloud enterprise Version 6 the service is currently in test operation with campus wide availability for staff only planned for 12/2014. Major concerns were the scalability of the storage backend. So instead of using an enterprise storage solution **we use Scality's RING as backend**. The RING is an object storage based solution using local storage nodes. Since the ownCloud architecture does so far not allow a REST based storage backend we use Scality's FUSE connector to simulate a virtually limitless filesystem (POSIX). Based on the experiences reported by other academic facilities and our own, our main concerns have been database performance-scalability, storage backend architecture and general software design. Some of which might already have been addressed by ownCloud community version 7. It's also noteworthy, that **ownCloud's support team responds properly to submitted bug reports.** The admittedly limited user feedback has been quite positive so far.

A other issue which have to be solved is the legal issue: What happened with the data, which are shared, after a stuff member leaves the University? We want to establish special terms of use for this service, which everybody who want to use the ownCloud service have to accept.

"Dropbox-like" service for the

our main concerns have been database performance and scalability, storage backend architecture and general software design.
Some of which might already have been addressed by ownCloud community version 7. It's also noteworthy that <u>ownCloud's support team responds properly to submitted bug reports.</u>

The
crea
has
wor

Bas
ava
back
RING is an object storage based solution using local storage nodes. Since the ownCloud architecture does so far not allow a REST based storage backend we use Scality's FUSE connector to simulate a virtually limitless filesystem (POSIX). Based on the experiences reported by other academic facilities and our own, our main concerns have been database performance-scalability, storage backend architecture and general software design. Some of which might already have been addressed by ownCloud community version 7. It's also noteworthy, that **ownCloud's support team responds properly to submitted bug reports.** The admittedly limited user feedback has been quite positive so far.

A other issue which have to be solved is the legal issue: What happened with the data, which are shared, after a stuff member leaves the University? We want to establish special terms of use for this service, which everybody who want to use the ownCloud service have to accept.

Ma cos'è questo Scality ring d'oltralpe???

http://www.scality.com/ring/

The RING is a software-based storage that is built to scale to petabytes with performance, scaling and protection mechanisms appropriate for such scale. It enables your business to grow without limitations and extra overhead, works across 80% of your applications, and protects your data over 200% more efficiently at 50–70% lower cost.

SCALITY

Ma cos'è questo Scality ring d'oltralpe???
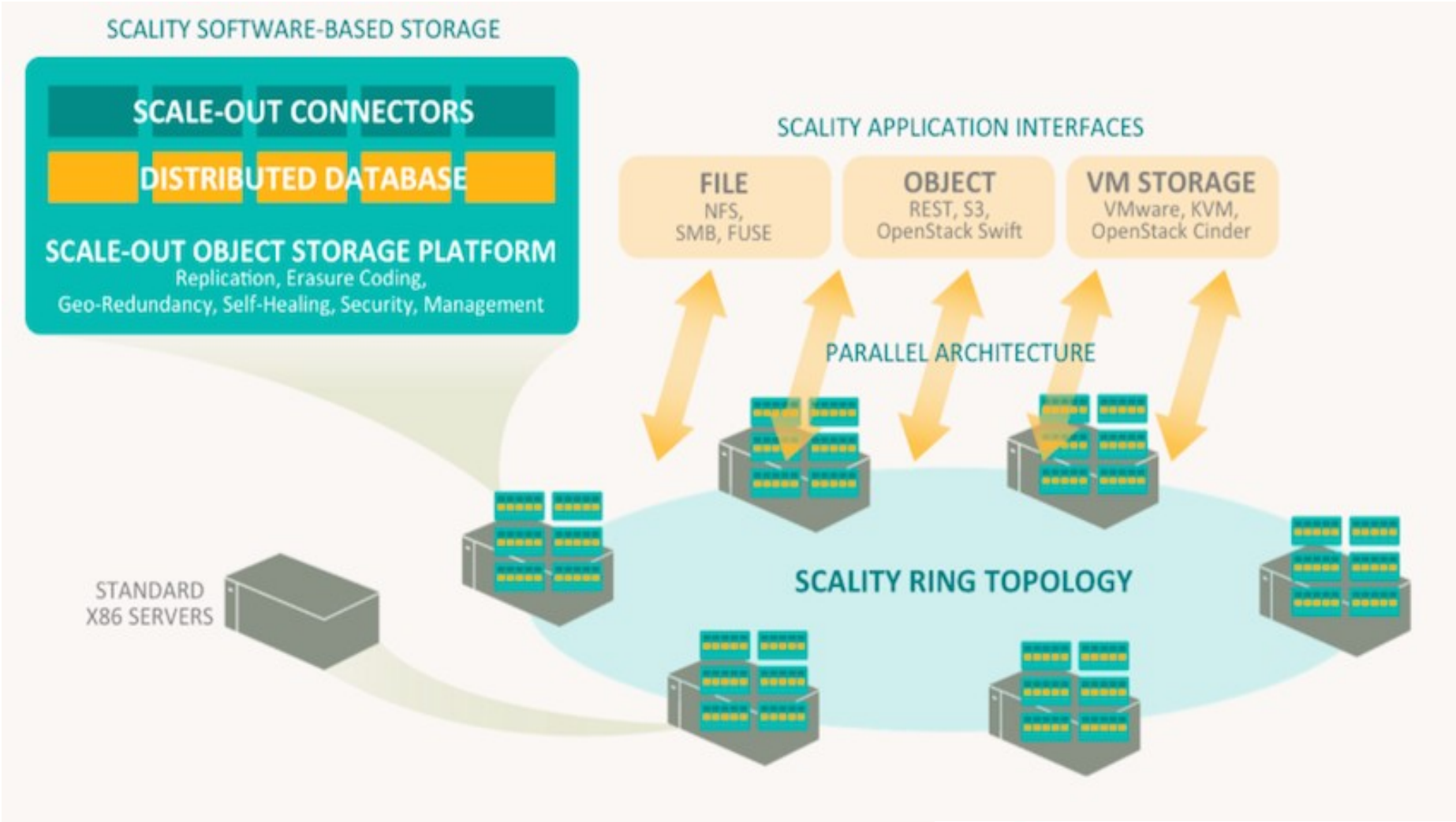
<u>Altri siti che usano OwnCloud</u>

- **Polybox at ETH Zurich**

- **CERNBOX**

  Cloud sharing and data synchronization over modern backend storages, like EOS …

- **The Sync&Share project in North Rhine-Westphalia**

The Sync&Share project in North Rhine-Westphalia – utenza

WESTFÄLISCHE
WILHELMS-UNIVERSITÄT
MÜNSTER

2

> Scenario and Software

- Up to 500,000 users in North Rhine Westphalia (if all 30 universities and applied universities participate)
- We will start with 22 institutions and 350,000 potential users
- Will start in February 2015
- 30 GB/user with the possibility to increase the quota for the employees
- Project boxes for groups (with up to approx. 1 TB)
- ownCloud 7 Enterprise
- RedHat 6, later RedHat 7 (when GPFS support is available)
- Galera DB cluster with MariaDB

ownCloud

wissen.leben
WWU Münster

The Sync&Share project in North Rhine-Westphalia – forze in gioco

WESTFÄLISCHE
WILHELMS-UNIVERSITÄT
MÜNSTER

3

> Hardware

- Storage: 5 PB at three sites (3 PB in Muenster, 1 PB in Essen and 1 PB in Bonn)
- Filesystem: GPFS 3.5 with declustered RAID and triple parity
- Application servers: 16 IBM NeXtScale nx360 M4 (16 cores) for ownCloud per site
- Database: 4 IBM System x3650 M4 with 6 800 GB SSD (RAID 10) per site
- Loadbalancers: 2 Linux machines per site (LVS with keepalive)
- Management: 1 server per site

wissen.leben
WWU Münster

Site reports - CERNBOX

Site reports - CERNBOX
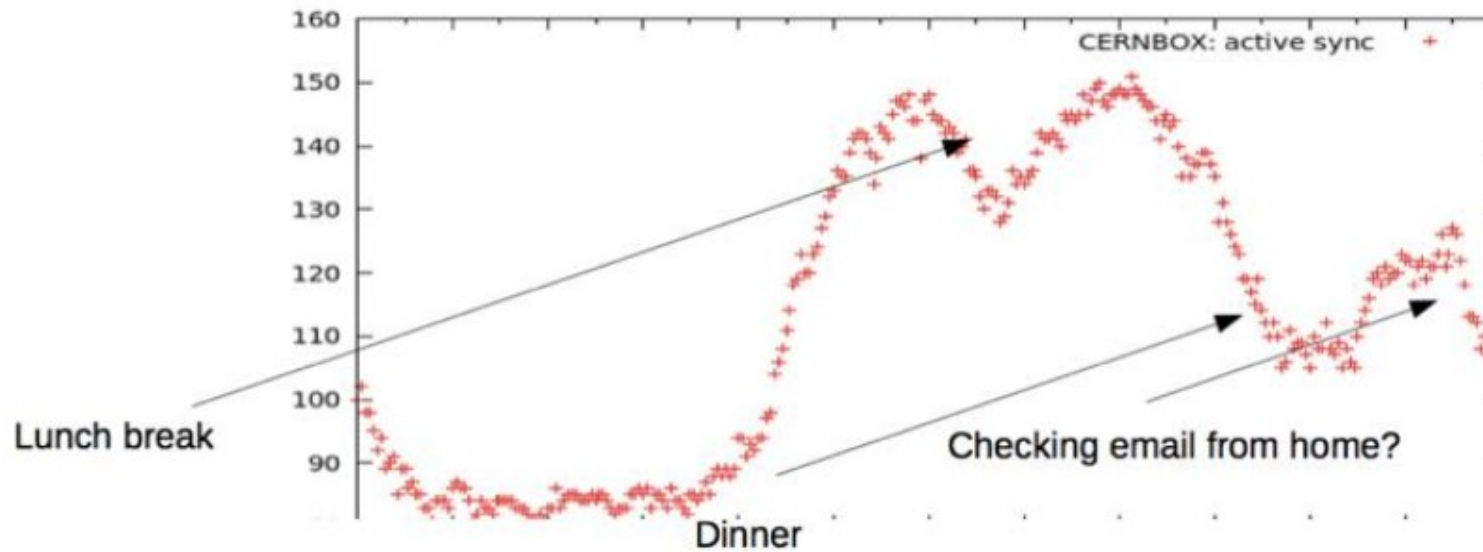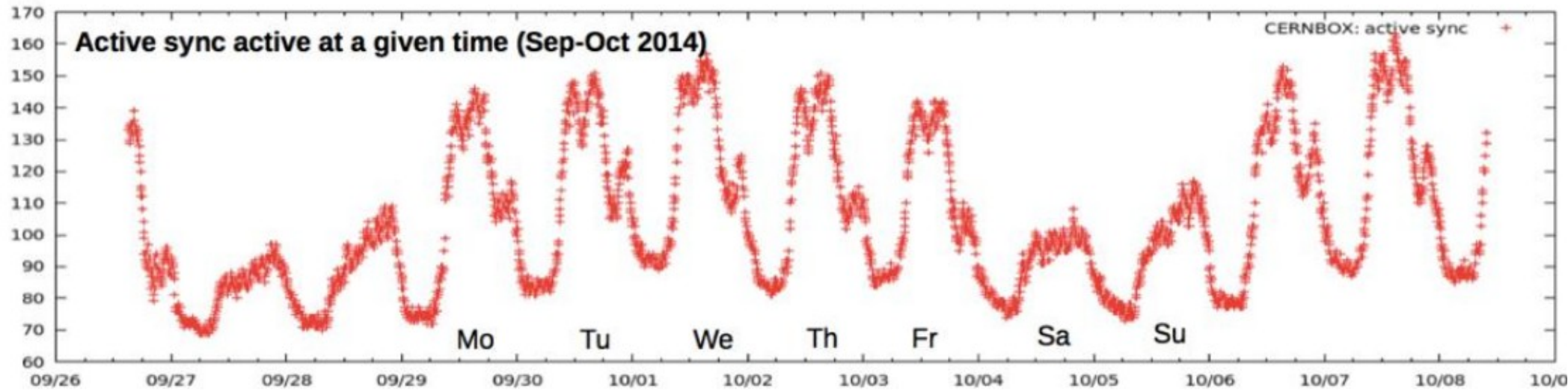
User feedback

"I start using the cernbox since I'm a heavy user of Dropbox and I recently reached the limit of free disk space (5Gb). For work it will be great to have at least 50Gb of personal space "

"I would like to have is a free client for Android, which should be much more stable. "

"I find the service perfect to be able to get always the files/sources/documents I need independently of the place and connection. "

Site reports - CERNBOX

User feedback

- "On my Macbook Air I noticed that the battery was draining much faster than usual. I checked on the activity monitor and CERNBOX was consuming 80-95% of the total energy. "

- "What I would like to do in the future is to combine my private data like my photos for example on my home owncloud server, and my work data on the Cern owncloud server."

- "I'm very glad that CERN has launched the service using the OwnCloud platform. "

- "I hope that you will be supporting this service officially soon!! "

Risk factors

- Stability of the sync clients across diff versions
- Resiliency of the system with "exotic" failure modes
  - Risk to lose files!!!
  - Risk to corrupt data!!!
- Product evolution
  - Stability of the sync protocol (controlled evolution)
  - Bulletproof core functionality
  - Market evolution

Conclusioni

- I servizi *sync and share* Dropbox-like sono visti non come accessori ma come **parte integrante** dell'infrastruttura di calcolo di Università ed enti di ricerca;

- **OwnCloud** è il software più gettonato, probabilmente perché più maturo e perché l'azienda è più forte di altre e in contatto diretto con Università ed enti di ricerca, ma **ci sono anche altri approcci molto promettenti**;

- I sistemi di **storage ad oggetti** sono visti come backend naturale per i servizi *sync and share*;

Conclusioni

C'è un fortissimo interesse **dall'alto** a mantenere l'informazione "in house" ed al sicuro dalle multinazionali potenzialmente controllate da NSA.

the German Federal Ministry of the Interior published guidelines that require cloud providers entering into contracts with German Federal Government agencies to enter into "no spy guarantees" ensuring that no sensitive data will be shared with unauthorized 3rd parties, regardless of where the data resides.