The Big-Data Cloud

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On behave of the project team
Content

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• Project Goals
• Suggested Solution and components
• Quick introduction of
  – dCache
  – ownCloud
• The proposed hybrid System
• Status and issues
dCache and Cloud

- This is how it started: Status Oct 2013
  - Auto-Registration: www.dcache.org/cloud
  - You need a certificate to register
  - Set your private user/password to log in
  - Works with available WebDAV Clients
  - You get your private space
  - There is no way of sharing

- Next Step: public sharing

- Further: slowly implementing “Cloud System”
  - With proper sync’n share
Why did we suddenly change our plans?
Why suddenly “Cloud”?

• Due to the well know political affaires, DESY banned all non-local mail and storage providers.
  – For mail we had a replacement right away
  – No replacement for DropBox
• Replacement had to be available asap.
• So we had to find a “Cloud” system for DESY within months.
Project Goal

- Currently maintained storage systems are focused on “Scientific Big Data”.
  - Access with POSIX semantics
  - Sharing via ACLs.
- Customers, especially new/young communities (Photon Science), are requesting “Cloud” storage semantics.
- Project Objective:
  - Installation of a modern Cloud Storage System for scientists within 6 months.
  - Integrated into the existing AAI and storage infrastructure.
  - If possible: Reducing amount of existing systems.
We had to find out what “Cloud” means for our scientific customers.

- Big Data management
- Support of Scientific data lifecycle
- Web 2.0 feeling
The “Big Data” management?

- Unlimited storage space, pay per use
  - Quotas are a “no go” and pointless

- Indestructible data store, never loosing data
  - “Amazon S3 is designed to provide 99.999999999% durability of objects over a given year. … For example, if you store 10,000 objects with Amazon S3, you can on average expect to incur a loss of a single object once every 10,000,000 years.“

- Different Quality of Services (payments)
  - Access Latency (How long do I have to wait)
  - Retention Policy (How save is my data, durability)

- Extremely high availability of storage service
  - No regular maintenance breaks below “once a year, 4 days”
Scientific Data Lifecycle

- High Speed Data Ingest
- Fast Analysis
  - NFS 4.1/pNFS
- Wide Area Transfers
  - (Globus Online, FTS)
  - by GridFTP
- Visualization & Sharing
  - by WebDAV
The “Web 2.0” experience?

- Easy sharing with
  - Registered Users and Groups
  - The public (publishing)

- Synchronizing (bidirectional) with all relevant OS’es

- Access from mobile devices, preferable upload/download OS integrated.

- Web Browser access and configuration
The DESY Cloud

What does that mean for DESY?

Big Data Part

Web 2.0

Here we need some help
Web 2.0 Cloud interface

- For the web 2.0 interface we needed some experts.
- Not much time for evaluation.
- Going for the most popular solution
  - Reduce likelihood for ‘product disappearing’
  - Possibly building a user-community (like today)
    - TU-Berlin, FZ-Jülich, TU-Dresden ****
    - CERN, United Nations
  - CERN is evaluating a similar approach and we are in contact anyway (WLCG)
What exactly do we need from ownCloud

• The sync clients for all OS’s
• Upload/download clients for mobile devices
• Sharing of data with individuals and groups (including public links)
• Web Browser based file access and configuration
• That’s it for now.
Now, what’s a dCache?
dCache Cheat-sheet

- dCache.org is an international Collaboration, composed of developers and support people from DESY, Fermilab, NDGF and the HTW Berlin.
- dCache is operated on about 70 sites around the world.
- Total space about 120 Petabytes.
  - We store 50 % of the entire WLCG storage.
- Biggest dCache holds about 50 Petabytes.
- Large dCache spans 4 countries.
dCache spec for Dummies

Virtual File-system Layer

- Unlimited hierarchical Storage Space
- SSDs
- Spinning Disks
- Tape, Blue Ray …

Automatic and Manual Media transitions

NFS/pNFS  httpWebDAV  gridFTP  xRootd/dCap

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Starting with possibly the biggest

40 PBytes Tape

770 Write Pools

420 Read Pools

26 Stage Pools

US-CMS Tier I
14 PBytes on Disk

260 Doors

Total:
6 Head
280 Pool/Door

Physical Hosts

Information provided by Catalin Dumitrescu and Dmitry Litvintsev
To certainly the most widespread

4 Countries

One dCache

Slide stolen from Mattias Wadenstein, NDGF
To very likely the smallest
One Machine – One Process

NFS 4.1 Door
WebDAV Door
PoolManager
gPlazma

Pool

1 TB

700 MHz ARM
512 MB Memory
2 * USB 2
100 MB Ethernet
dCache cheat sheet (cont)

• Protocol support
  – NFS 4.1 / pNFS (scalable NFS)
  – WedDAV
  – GridFTP (Grid transfers)
  – xRootd
  – dCap

• User/Authz support
  – Kerberos
  – User / password
  – LDAP
  – X509 (Certificates and Proxies)
What do we need from dCache

• Scales out massively

• Managed space (Uptime)
  – Migration between media and decommissioning of hardware w/o downtime.

• Multi protocol access (Scientific use)
  – NFS, CDMI(Cloud), WebDAV, gridFTP(GlobusOnline)

• Service Classes with automatic and manual transitions (Access Latency, Retention Policy)
  • Hot spot detection
  • Tape
  • Spinning Disk
  • SSD’s
What does the integration look like?
dCache – ownCloud Integration

- WEB 2.0 Sync & share
- Unlimited hierarchical Storage Space
- NFS 4.1
- GridFTP, WebDAV
- SSDs
- Spinning Disks
- Tape, Blue Ray …
dCache – ownCloud
“Scientific Data Lifecycle”

Unlimited hierarchical Storage Space

NFS 4.1 / pNFS
HPC, HTC

GridFTP
Globus Online

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dCache ownCloud
What does it look like for the user

My dCache XXL Home

My ownCloud Home

Sync
Share
Web 2.0

NFS 4.1/pNFS
GridFTP
WebDAV
SRM
(some private Grid Protocols)
dCap
xRootD
dCache ownCloud
Scalability (NFS4.1/pNFS does it)
dCache OwnCloud integration

• Simply running ownCloud on dCache was the easy bit and works nicely.
• dCache provides an NFSv4.1/pNFS interface which lets it look like a regular file system.
• This is exactly what ownCloud needs.
• The fact the dCache doesn’t allow files to be modified doesn’t really bother ownCloud.
But how about ownership?

- **Ownership**
  - Files owned by ‘patrick’ in OwnCloud are owned by apache/owncloud in dCache.
  - That prevents us from using the same data with NFS4.1, gridFTP or CDMI from dCache.
  - Tigran solved that issue.

- **dCache ACL’s versus OwnCloud**
  - Files shared in OwnCloud should have similar ACLs in dCache.
  - Data shared in ownCloud is not automatically shared in dCache.
Ownership/mapping issue

Web 2.0
Sync
Share

NFS
WebDAV,
GridFTP,
CDMI

DESY LDAP
Kerberos

ownCloud

dCache.org
More issues

Besides the permission one
Name Space Issue

We have

Patrick
Paul
Tanja

We need

Patrick
Paul
***
What we need

WebDAV redirection to our nodes
What actually would be good

• Instead of requiring a mounted filesystem (POSIX) for ownCloud primary space, an network API/protocol would be better.

• Best would be a standard (e.g. Cloud Data Management Interface, CDMI).

• CDMI is provided by big vendors

• Allows to handle meta data and user and ownership as well.
What’s done

• We already installed two systems.
  – One connected to the DESY LDAP for DESY employees
  – One with the dCache.org private cloud
    • For HTW students (different user contract 😊)
    • Self registration with any valid Certificate

• Most features are already available

• Ordering more hardware
  – About 200 Terabytes on top of the 100 Terabytes which are already deployed in two systems.
What’s still missing?

- The platform adapter needs to be written
- Resource access to ownCloud defined by group membership in DESY LDAP
- Customizing the ownCloud name space to support our schema.
- HTW Student (Leonie) is evaluating a ownCloud sync client working against dCache directly (under supervision of Tigran)
Testing and verification

• Defining a set of reproducible test, which we can run on about 20 machines
  – Verify scalability
  – Guaranty for future dCache or OwnCloud updates
    • Functional
    • Performance
Further timeline

• We expect to have a pre-production system ready in about 6 - 8 weeks.

• DESY IT colleagues and HTW students will be guinea pigs
The End

further reading
www.dCache.org