dCache meets SNIC

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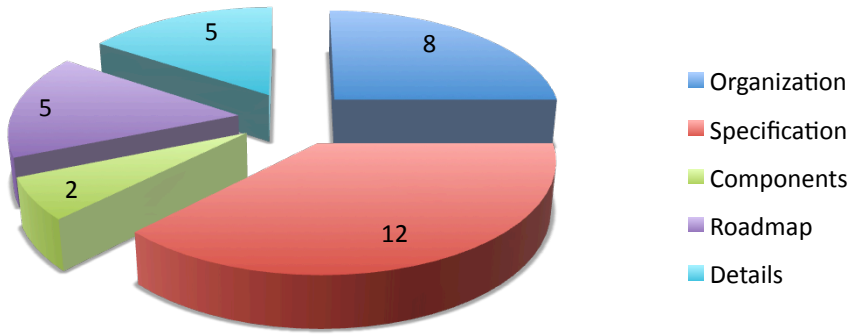
- The dCache System Specification
- The dCache Components
- (Rather detailed) Roadmap

Slides per topic



The dCache Organization

or

the “What is …. ? “ section

What is dCache ?

dCache is **storage software** for storing and retrieving huge amounts of data distributed among a large number of heterogeneous server nodes, under a single virtual file-system tree with a variety of standard and GRID access methods.

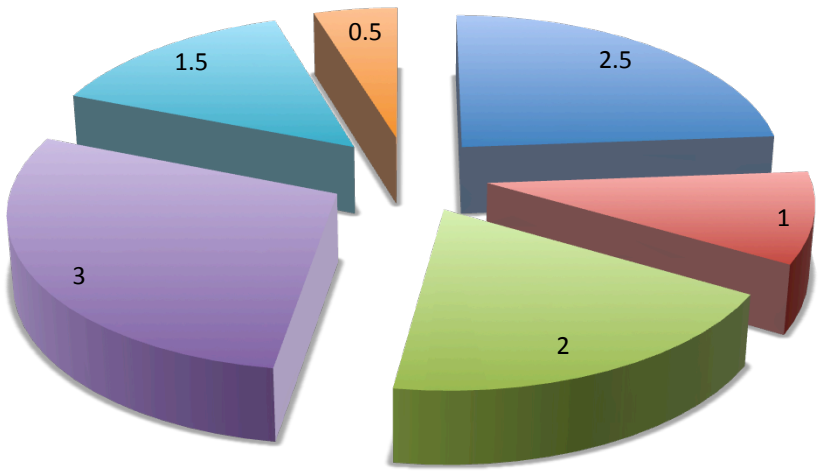
What is the dCache collaboration ?

DESY

Nordic Data Grid Facility

Fermi National Lab

What/who is funding dCache ?



About 10 team members in total.

- Labs:
  - DESY
  - FermiLab
- Organizations:
  - NDGF
  - EGEE III hopefully followed up by 1 FTE from the European Middle Initiative
  - Open Science Grid (US) [no funding, only first level support]
- German Government:
  - Helmholtz Alliance, “Physics at the Terra Scale”
  - German D-Grid, “Integration Project II”

What are the goals ?

This depends on the stakeholder.

Goals, common to all:

A royalty-free software which covers the needs of their customers and can be adjusted to upcoming requirements by contributing developers/development and support stuff.

The more you contribute, the more influence you get on the future direction of the software.

NDGF: Mainly the LHC **distributed** Tier I.

FERMIlab:
- US-CMS Tier I : largest dCache instance.
- CDF (RUNII) dCache
- Public dCache

DESY:
- CMS, ATLAS, LHCb Tier II
- Other HEP Experiments (HERA, ILC)
- Light sources : Petra III, FLASH
- In preparation : Euro.XFEL, The European free electron X-Ray Laser.

Germany:
- Single Storage Element for German Tier I and Tier II's to reduce support load.
- German Storage Support Group.

dCache is in production at :

WLCG (Europe plus OSG)

- 5 Tier I's in Europe
- 3 Tier I's in North America

- 40 Tier II's worldwide

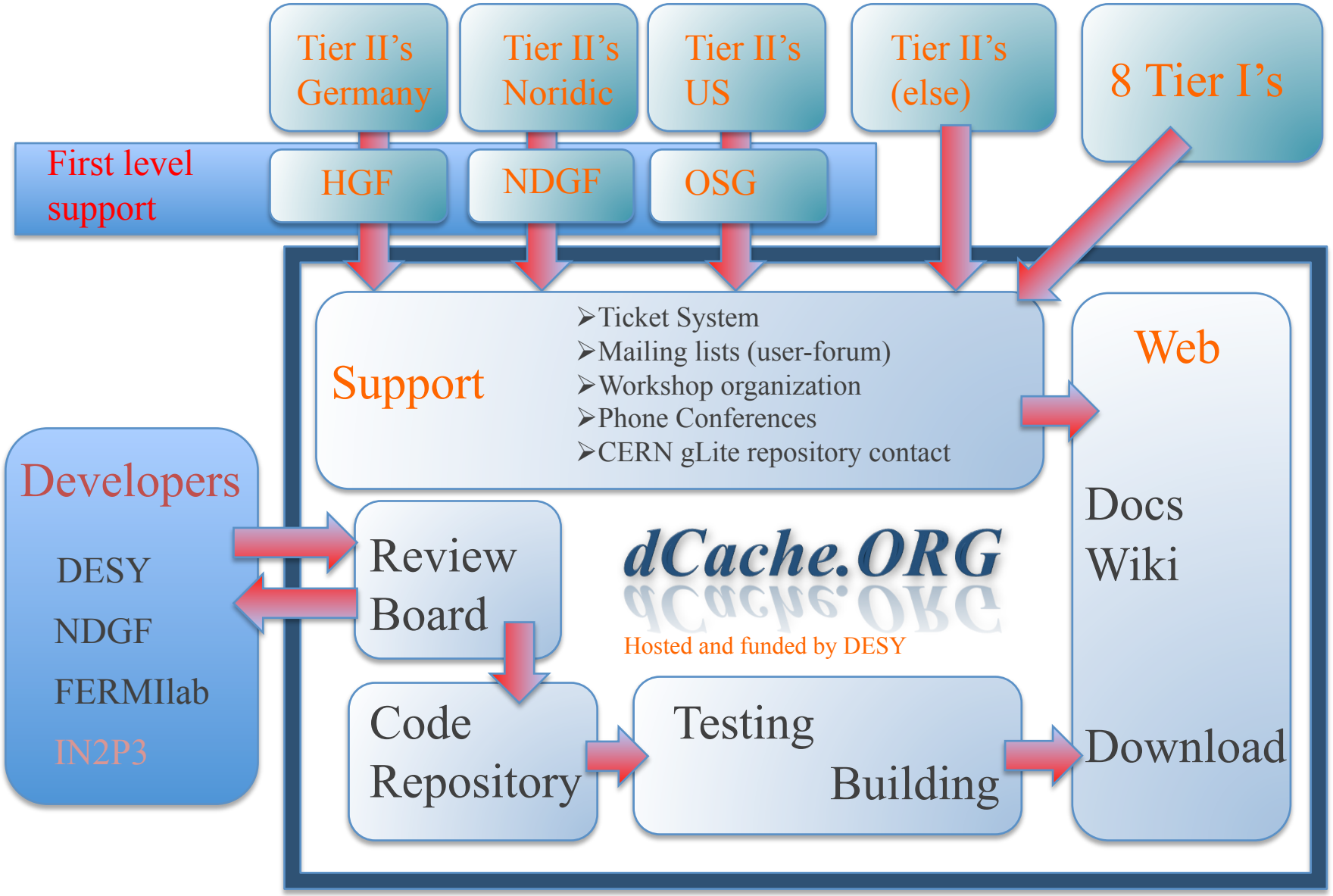
HEP

- Hera Tier 0
- ILC

Other communities

- Bio Med (NDGF)
- Photon Science (DESY)

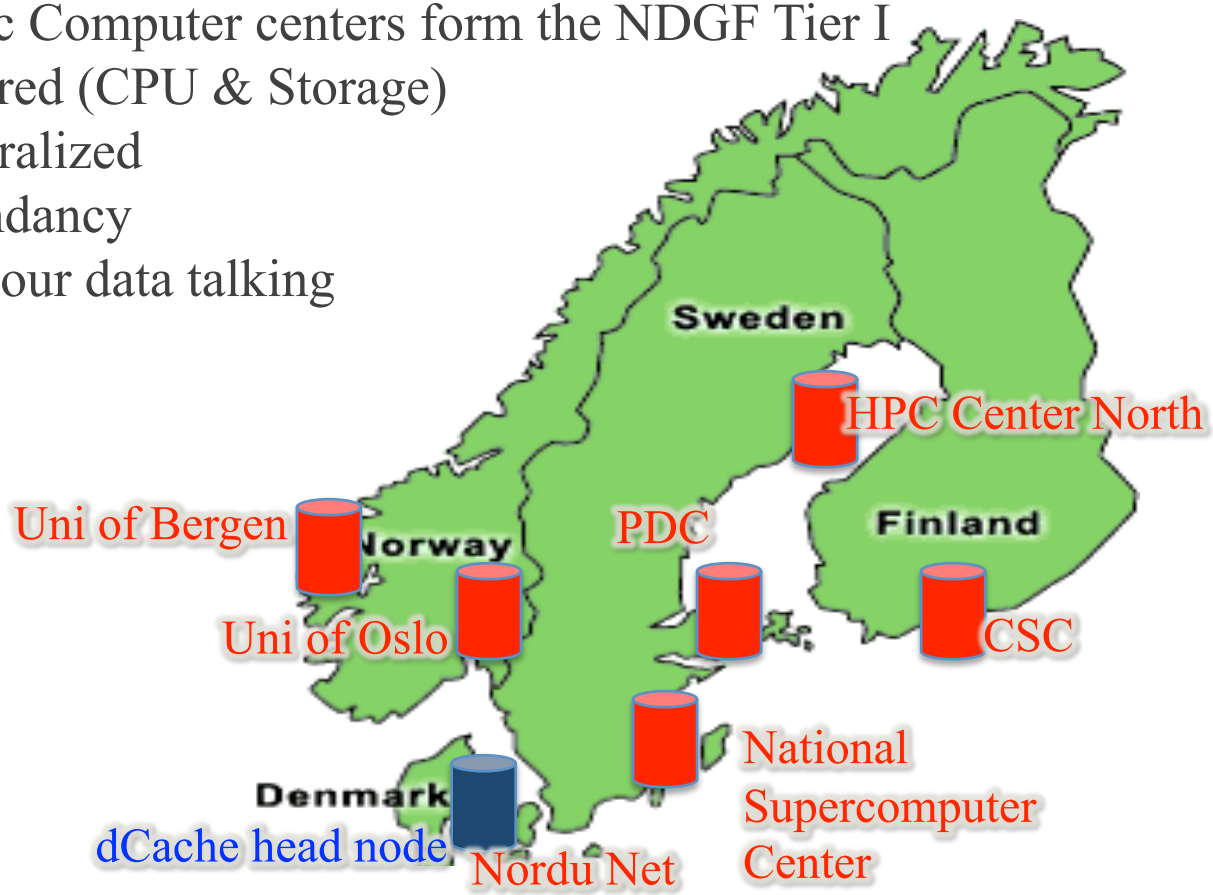
What is dCache.ORG ?



What are the most prominent dCache instances ?

The most complex dCache (for sure)

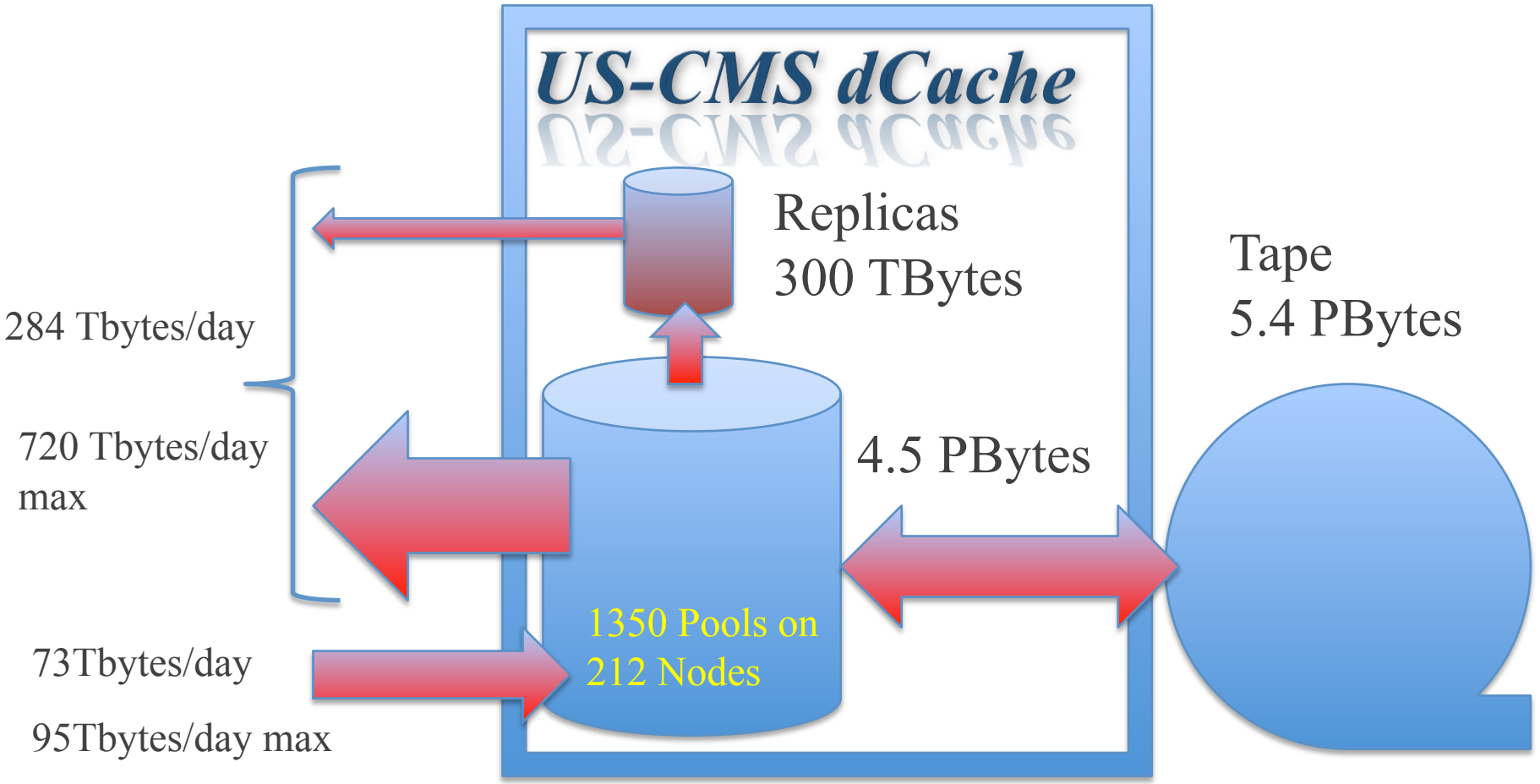
- ✓The 7 biggest Nordic Computer centers form the NDGF Tier I
- ✓Resources are scattered (CPU & Storage)
- ✓Services can be centralized
- ✓Advantages in redundancy
- ✓Especially in 7*24 hour data talking



Slide stolen from Mattias Wadenstein, NDGF

The largest dCache (as far as I know)

(Information provided by Jon Bakken, FEMILab)



dCache Specification

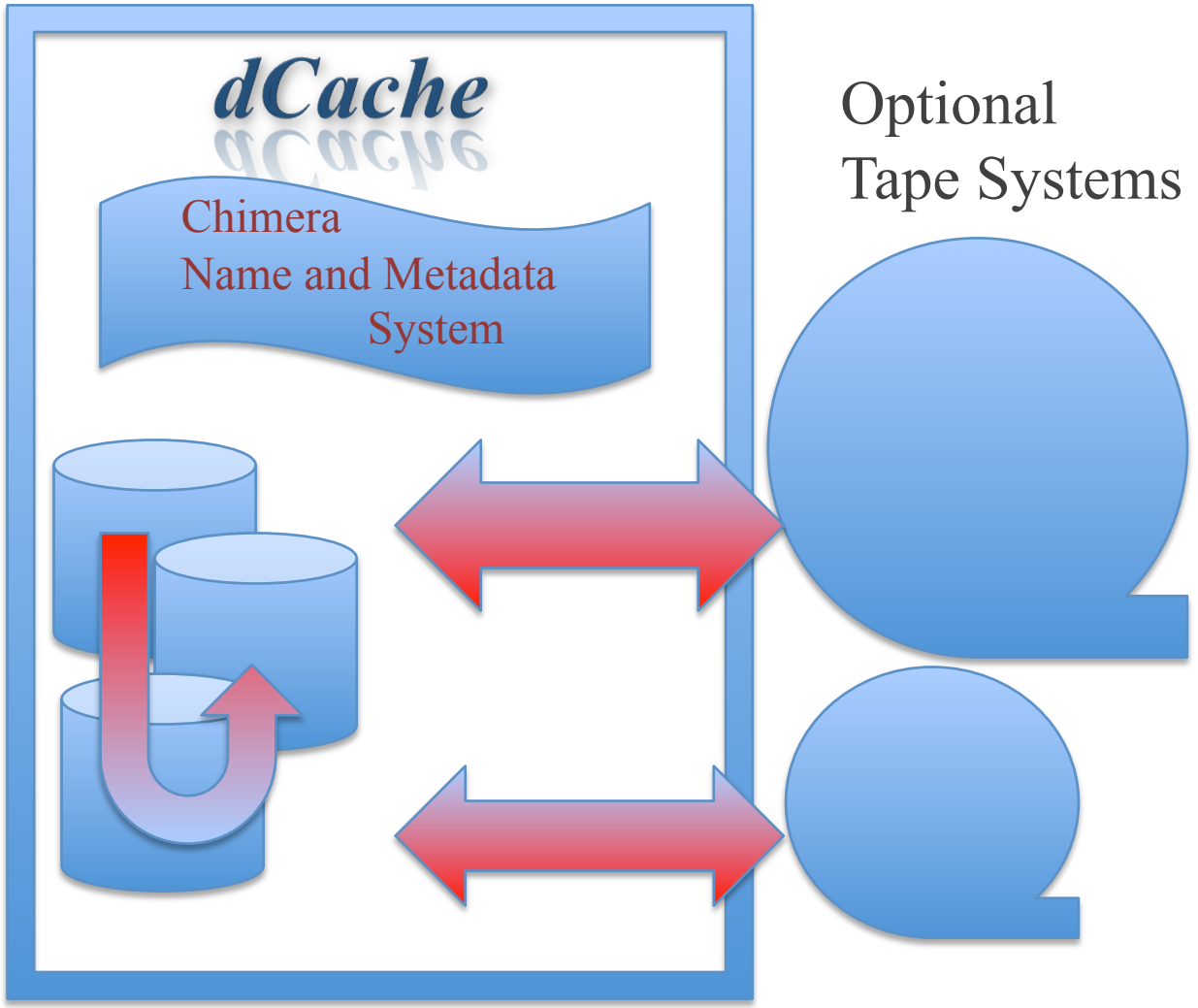
dCache BOX View

Storage Control
SRM

Wide AreaTransport
(gsi)Ftp
http(s) / WebDav

Posix LIKE Access
(gsi)dCap
xRoot

Posix native Access
NFS 4.1



In other words

Data access from client to dCache storage

- ✧ Name space protocol : NFS3, NFS4, Ftp, dCap, http(WebDav)
- ✧ Data access NFS4, gsiFtp, gsidCap, xrootd, http(s)/WebDav

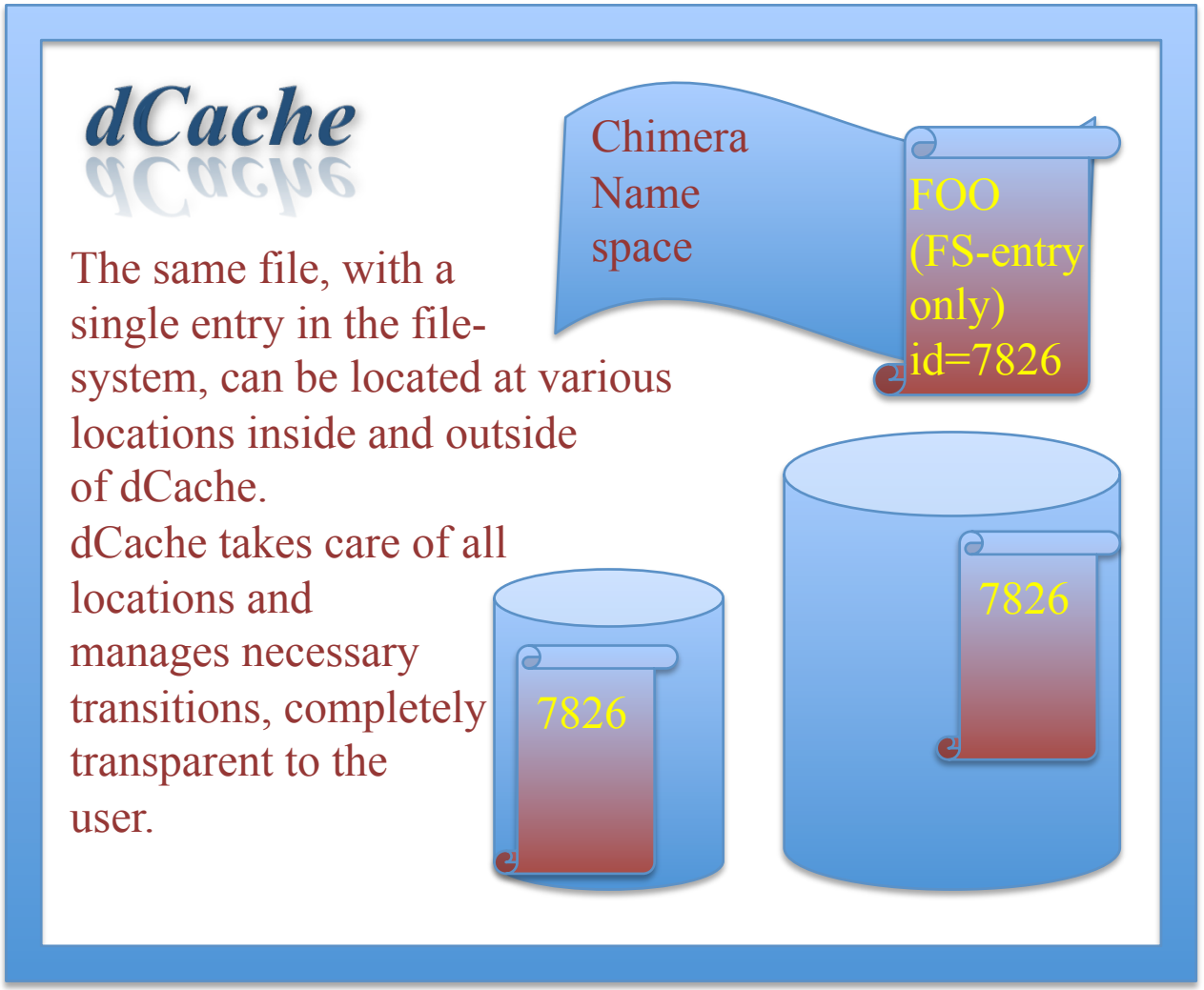
Data access from dCache to back-end tertiary storage

- ✧ Supports a variety of back-storage systems
- ✧ TSM®, HPSS®, DMF®, Enstore, OSM

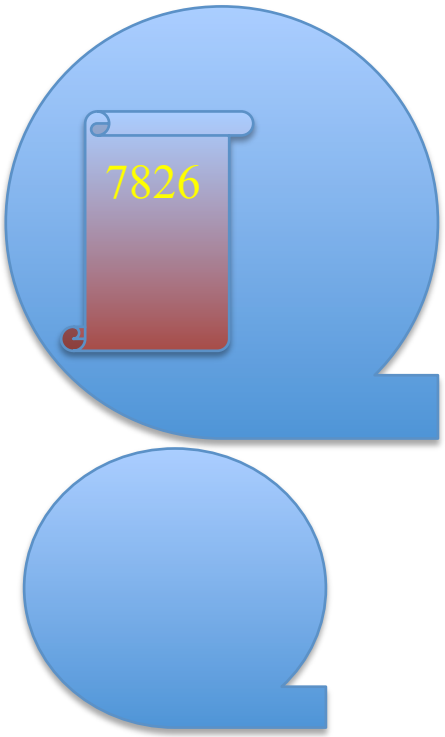
Managed Storage

- ✧ File name (Metadata) independent of data storage.
- ✧ Supports highly distributed heterogeneous data servers.
- ✧ Automatically manages storage based on internal event triggers.
- ✧ Allows manual storage management by SRM and dCap.

dCache Idea



Optional
Tape Systems

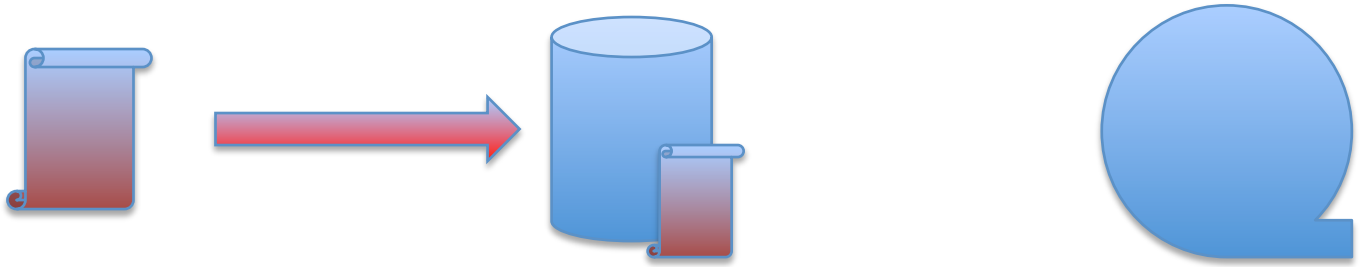


The consequence

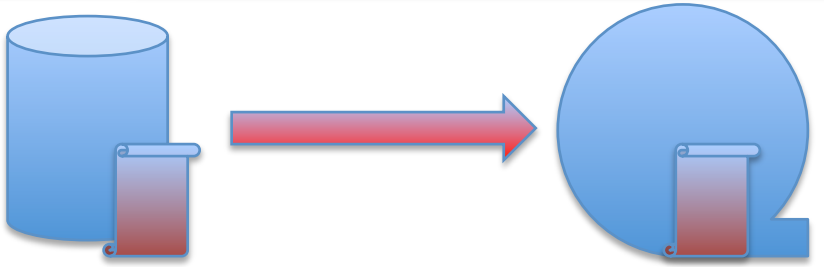
- ✧ Data can be automatically replicated on detection of access hotspots.
- ✧ Data can be replicated on arrival. (second copy prior to tape backup)
- ✧ Data is migrated to tape if configured and restored if necessary.
- ✧ Data can be scheduled for replication for maintenance operations.
- ✧ Configuration can enforce a second or third copy of each file.

Basic file life cycle (all protocols)

File written to dCache

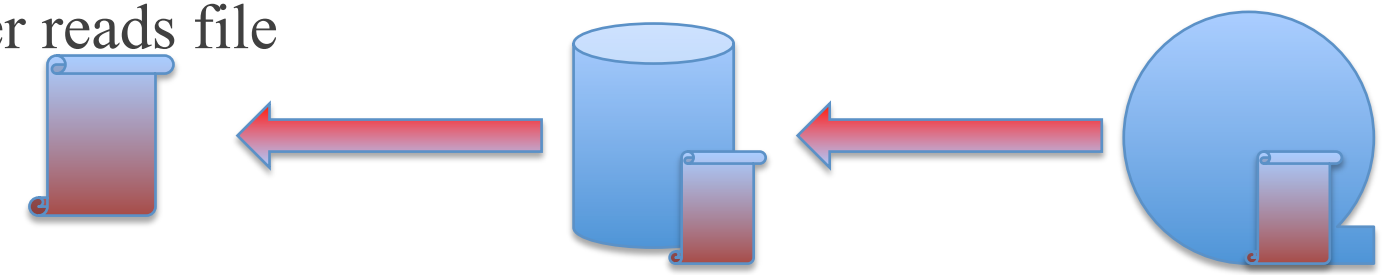


After awhile
(file is flushed to tape)

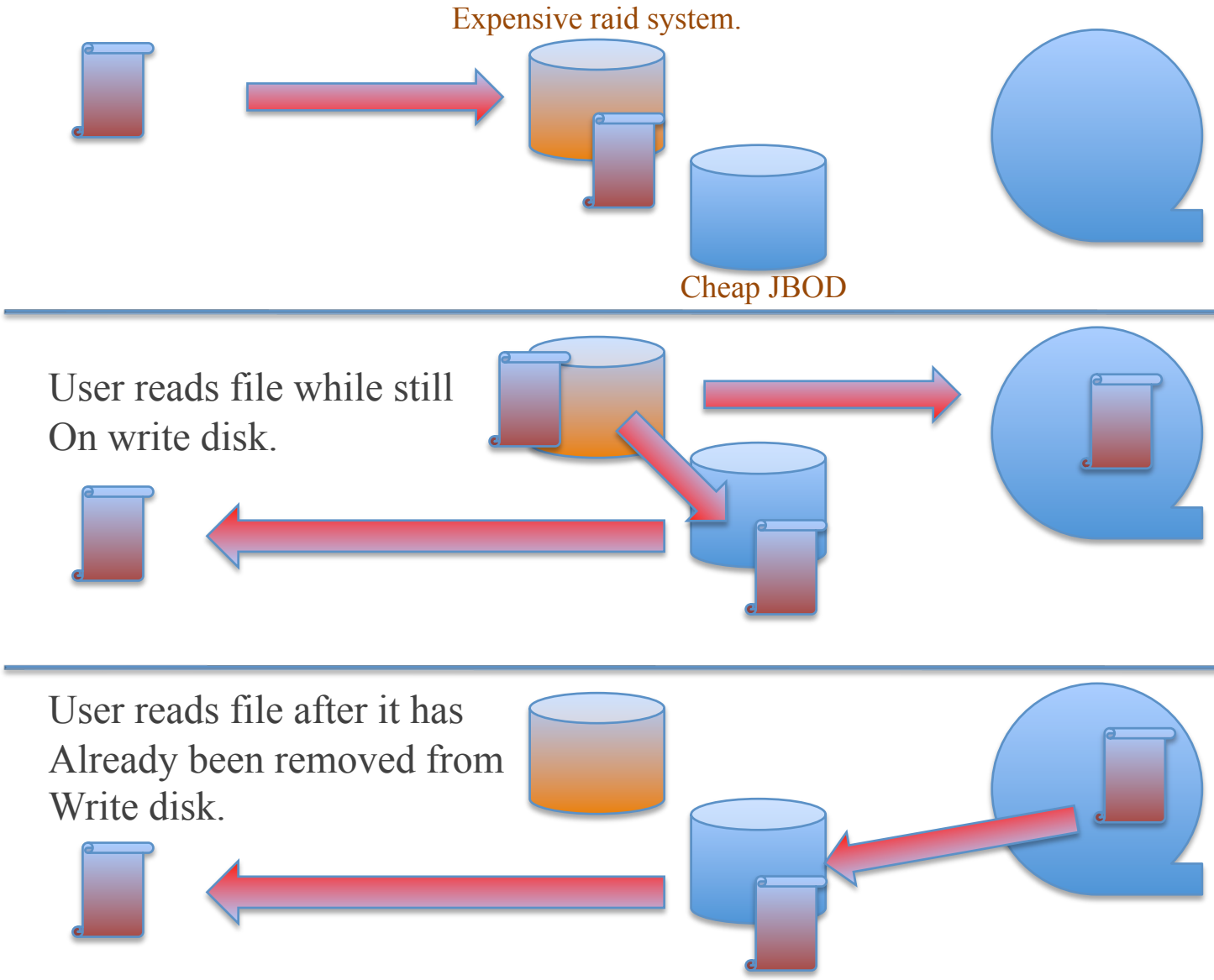


Space is running short
(File is removed from disk)

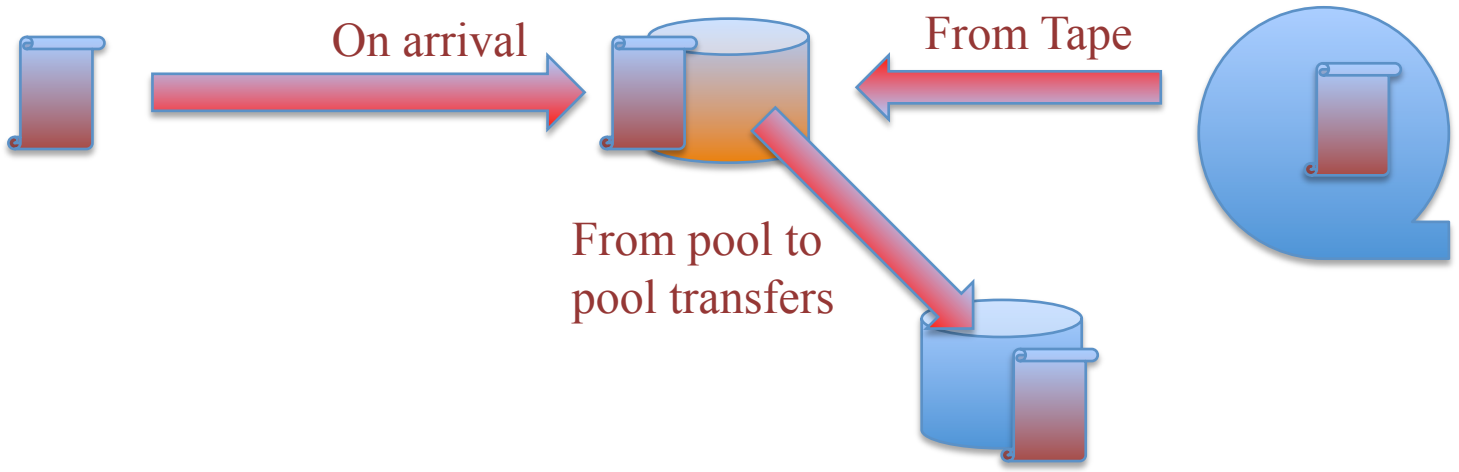
User reads file



Basic file life cycle (technical view)



Data integrity

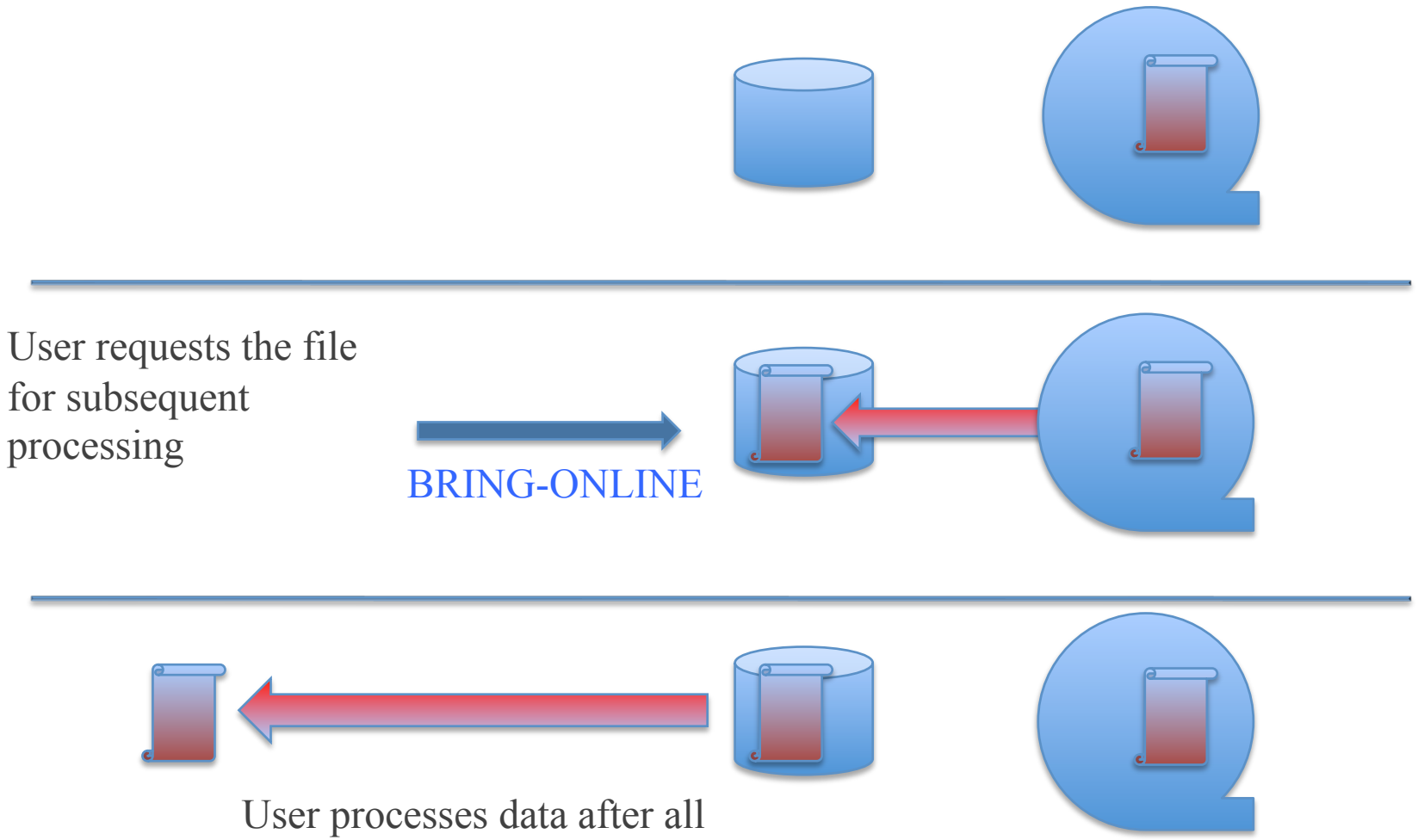


Checksums are calculated on all transfers (except for reading) and if triggered on an entire storage pool.

What is storage control ?

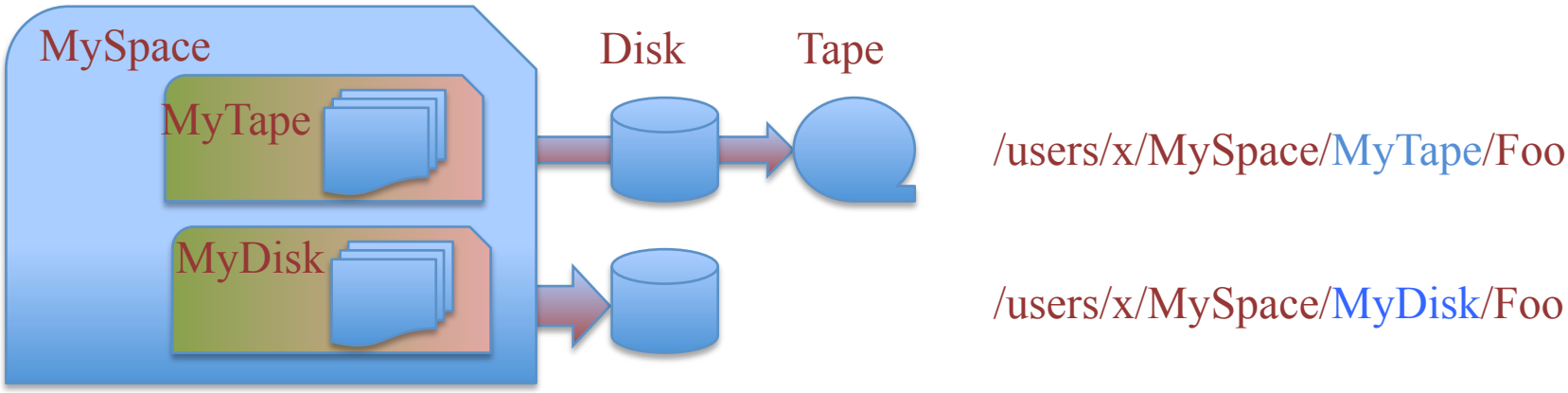
- ✧ dCache supports both : manual and automatic storage control
- ✧ Data is directed to pool-groups based on directory, client IP, protocol …
- ✧ Data can be directed to disk-only or disk-tape (Storage attributes)
    - ✧ Directory based storage attributes for all protocols
    - ✧ File based attributes for SRM only (Storage Resource Manager)
- ✧ Files can be pinned to disk (forever or for a fixed time) using SRM.
- ✧ Files can be restored to disk to schedule subsequent access.
- ✧ Automatic restore (tape -> disk) can be protected to avoid tape disaster.

Basic file life cycle and storage control (User)



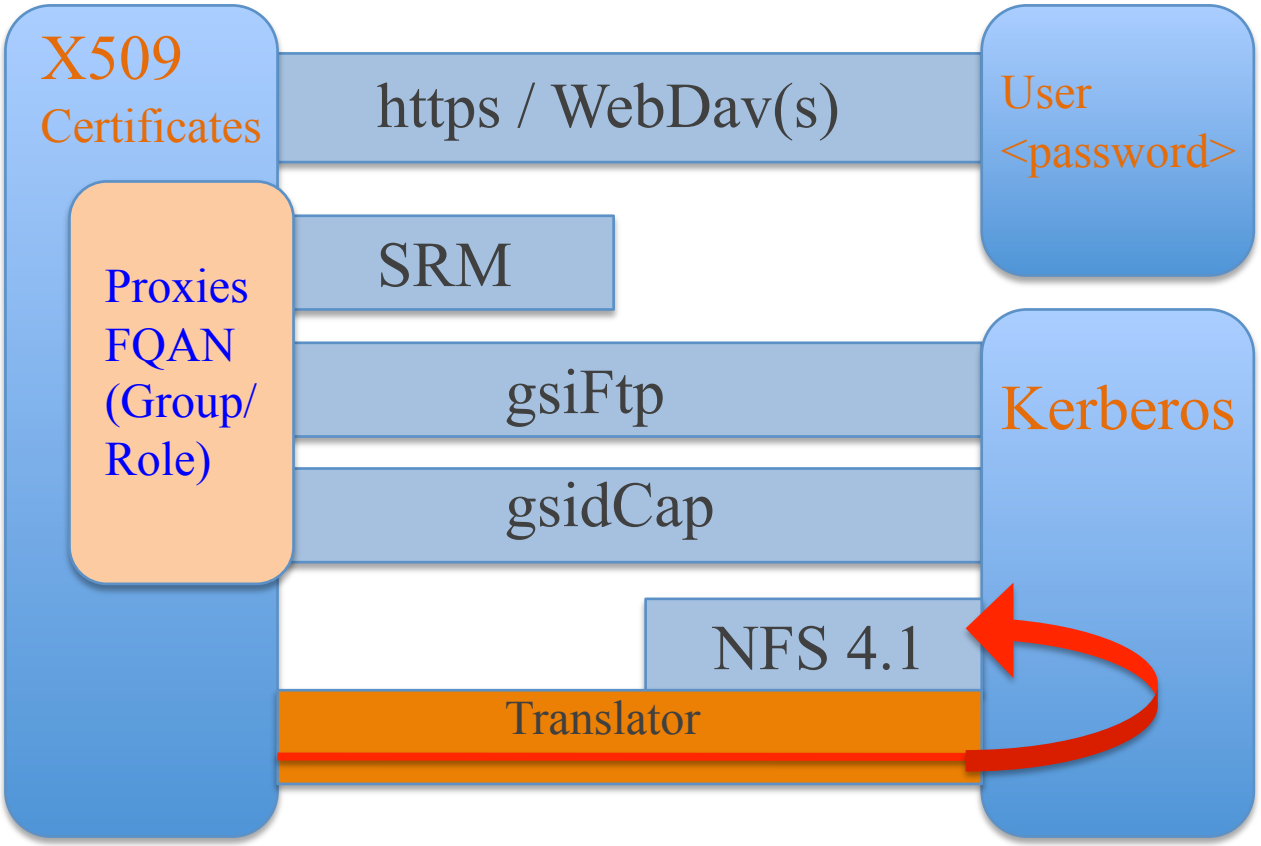
Another example for User-Storage-Control

User may specify whether a file should end up on tape or on disk only.



Security

Authentication



Security

Authorization

File system, all protocols : full NFS 4.1 ACLs

Tape Protection : simple FQAN/DN based

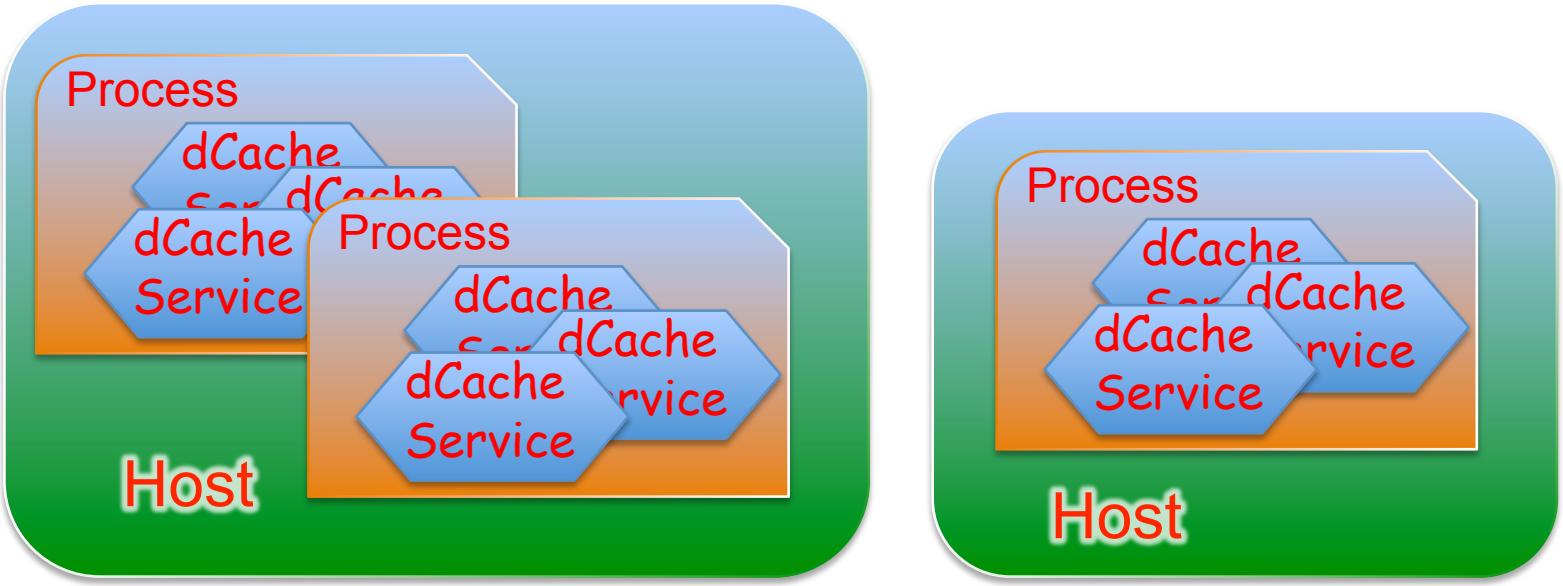
Space tokens : indirect through file system and link groups

The dCache Components

Quick Reference

dCache Internal Structure

- dCache Internal Services are location independent
- All Services can be run within on process
- Or each service may run in a different process
- Or on different physical machines (hosts).
- Services are communicating my message passing mechanisms.



dCache Internal Services

- Doors (http,webdav,gsidcap,gsiftp)
  - ✓Converts control protocol to dCache internal messages.
- Pool Manager
  - ✓Keeps track on Storage Pool load (space, performance)
  - ✓Selects appropriate pools for store/retrieve/tape-access
- Pnfs Manager
  - ✓Interfaces between Chimera name space and dCache
- Space Manager
  - ✓Keeps track on space tokens
- Pin Manager
  - ✓Keeps track on pinned files
- Information Service
  - ✓Collects information on dCache services
  - ✓Prepares information for GLUE information provider
- Pool service
  - ✓Interfaces disk storage and I/O protocol
  - ✓Manages disk space

The dCache Roadmap

Going standard

New customers require standard data access protocols

- ✓Light Sources (Petra III, FLASH, X-FEL)
- ✓Astronomy: LOFAR (Amsterdam, Juelich)
- ✓BioMed

We are investing in

NFS 4.1

WebDav

Further roadmap : Going standard

- Already supported standards :
  - gsiFtp (IETF)
  - SRM (OGF)
  - Unsecure http (IETF)
- !!! In beta testing !!!!
  - NFS 4.1
  - WebDav (s)

Further roadmap (Sysadmin only)

- Integrated monitoring
  - Information provided in xml format
  - Already done for all GLUE values.
- Simplified component location configuration
  - Single file replaces node/pool config
  - Easy parameter setting per domain/host

Further roadmap (Sysadmin & User)

- Unifying of ‘User Representation’ (May workshop)
  - File system, tape protection and space tokens will us the same user representation.
- Improved data distribution on bulk transfers
    - Already done for pool to pool transfer
    - Next for write into dCache
- Moving from manual to automatic redistribution of data

Further roadmap (User)

- https : User/Password authentication
- https : support of Proxy/FQAN/Groups/Roles
- ACL's : setting ACLs by user and not only sysadmin
- NFS 4.1 : secure (Kerberos, Certs by modified KDC)

Details on the NFS 4.1 integration.

Further roadmap : NFS 4.1

Why not already NFS 2/3 for data access ?

dCache uses NFS 2/3 for name space operations (ls,mv..) only, as it doesn't support data of a single instance being distributed among different storage hosts.
NFS 4.1 (with parallel NFS) is the first standard posix access protocol allowing this.

Who is supporting NFS 4.1 (pNFS)

All major vendors :
EMC, IBM, Linux, NetApp, Panasas, Solaris server.
Coming soon : Windows client.

Roadmap : NFS 4.1 (pNFS) in dCache

- Name server and I/O protocol fully implemented.
- No security yet
  - Soon : Kerberos.
  - X509 possibly: Solution : modified KDC or user space gsi deamon.
- No automatic recall from tape to protect tape system.
  - Soon : part of the standard tape protection mech.
- Full support of NFS Access Control List (ACLs)
  - Right now only by system administrator
  - Soon : through NFS4 ‘setacl’ call by all users.
    - (NFS4 is already part of SL5 dist)
- Fully supports storage control (tape/disk) on directory bases.

Roadmap : NFS 4.1 (pNFS) Linux clients

- NFS 4.1 and the linux kernel
  - NFS 4 already in SL5
  - NFS 4.1 in 2.6.32
  - NFS 4.1 plus pNFS in 2.6.34
- Kernel 2.6.34 will be in Fedora 13 and RH6 Enterprise (summer)
- Windows Client expected 4Q10.
- We are testing with :
  - SL5 and 2.6.34 plus some special RPM. (mount tools)
  - See our wiki for further information

Details on the WebDav integration.

Roadmap : WebDav (s)

- Requested by
  - Bio Grid and other communities at NDGF
  - Light sources (Petra3 and XFEL) at DESY
- Beta release in 1.9.6 (3)
- Tested with Max OS, Windows(XP), SuSE11.2 (Gnome, KDE)
- Supports read and write
- Write via ‘redirect’ or if not supported by client via ‘proxy’.
- Security
  - Plain or x509
  - On redirect, only control line is encrypted.

Further Reading

www.dCache.org