

# Fermi National Accelerator Laboratory

Storage Resource Manager

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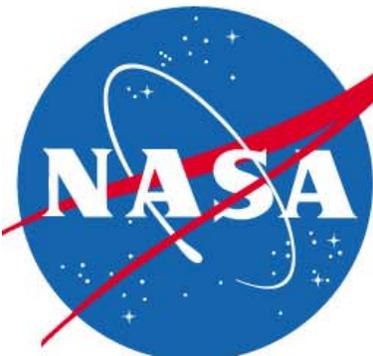
12th NASA Goddard/21st IEEE Conference on  
Mass Storage Systems & Technologies

The Inn and Conference Center

University of Maryland University College

Adelphi MD USA

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# SRM Motivation

Grid Architecture requires Reservation and Scheduling of the Following **Shared** Resources

- Computing Resources
- Network Resources
- Storage Resources (often neglected)

SRM provides Reservation and Scheduling of the Storage Resources

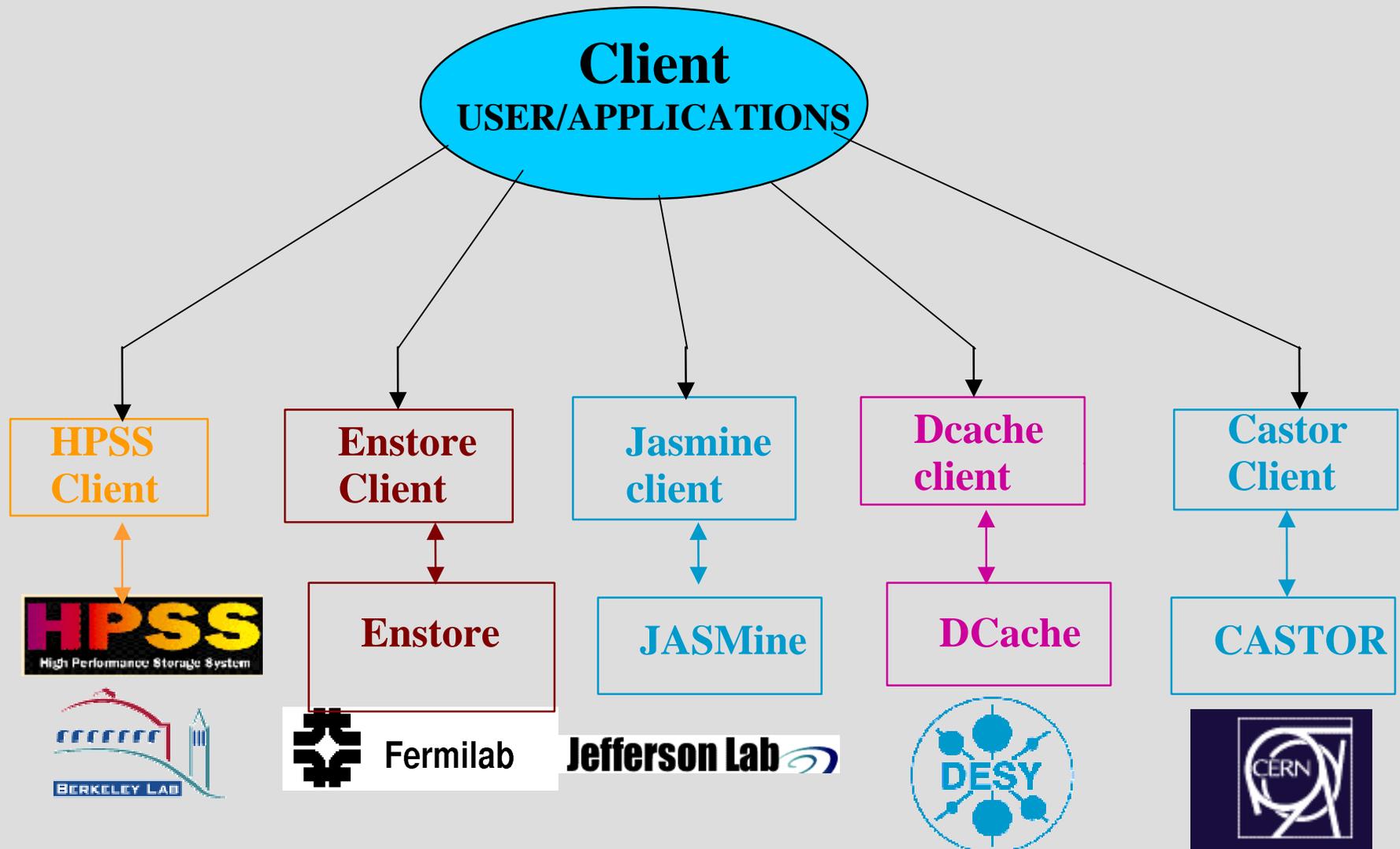
# SRM Motivation

High Energy Physics Collaborations span multiple institutions where

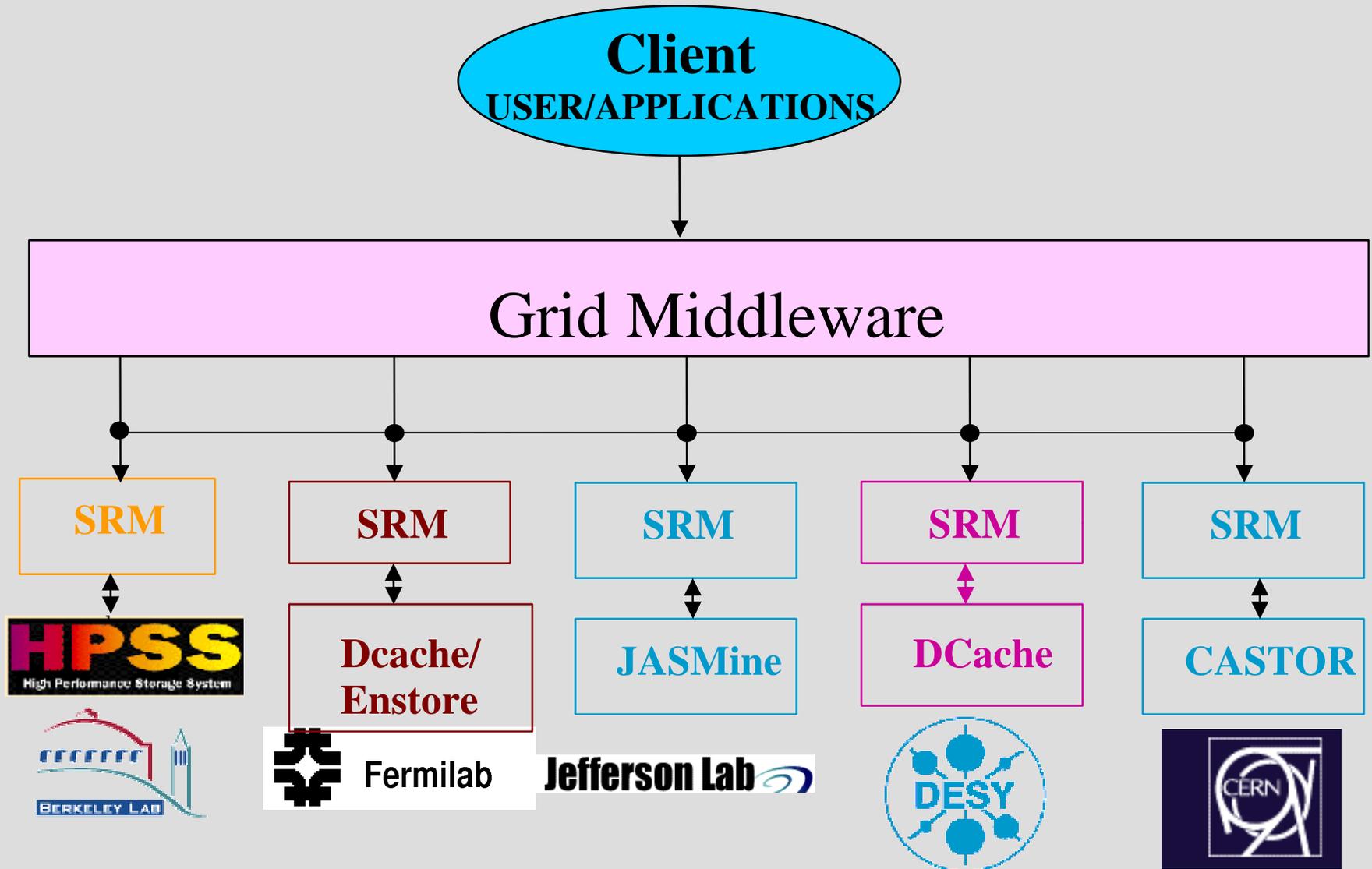
- A large variety of types of Storage Systems exist
  - Single Disk / Raid
  - Robotic Tape Storage System (Enstore, HPSS)
  - Distributed Disk Cache (dCache)
  - Hierarchical Storage System (dCache - Enstore)
- Heterogeneous environments and proliferation of custom Mass Storage Systems (MSSs) exist
- User applications often need to access data at multiple institutions on multiple MSSs

SRM provides Standardized Uniform Access to Heterogeneous Storage

# Access to Multiple MSS



# Uniform Access via SRM



# Storage Classification

Storage systems can be classified by:

- Persistence of data
  - Permanent
  - Temporary
- Data access availability
  - Data immediately available
  - Data needs advanced reservation before utilization (tapes need to be mounted, files need to migrate to disks, etc.)
- Supported transfer protocols
  - File transfer protocols
  - POSIX like access protocols

Need management interface that supports all of the above

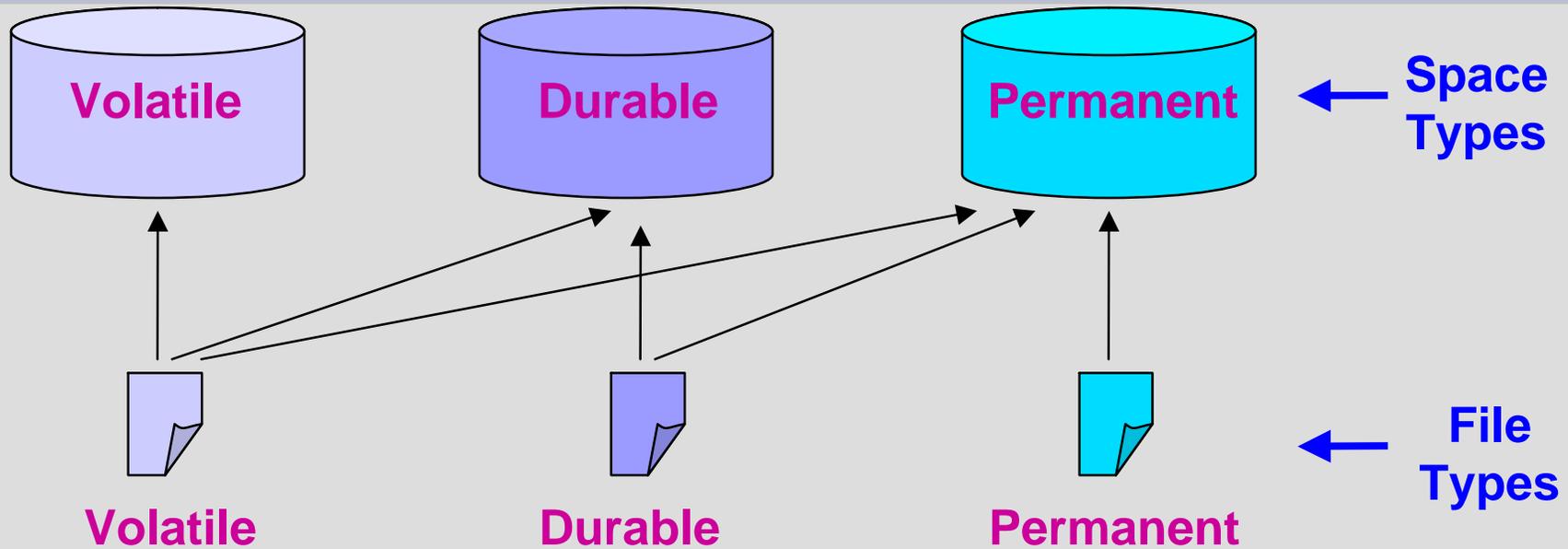
# Storage Resource Managers

SRMs Are Middleware Components That Manage Shared Storage Resources on the Grid and Provide:

- ✓Uniform Access to Heterogeneous Storage
- ✓Protocol Negotiation
- ✓Access to Permanent and Temporary Type of Storage
- ✓Advanced Space and File Reservation
- ✓Reliable Transfer Services

# SRM

## File and Space Types



File Type \ Property	Volatile	Durable	Permanent
Archived	No	No	Yes
Lifetime	Yes	Yes	No
AutoDeleted	Yes	No	No

# SRM

## Groups of Functions

SRM interface consists of the following groups of functions:

- Space Management Functions
- Data Transfer Functions
- Directory Functions
- Permission Functions
- Status Functions

# SRM Interface Details

## Space Management Functions

- SrmReserveSpace
- SrmReleaseSpace
- srmUpdateSpace
- srmCompactSpace
- srmGetSpaceMetaData
- srmChangeFileStorageType
- srmGetSpaceToken

## Directory

- SrmMkdir
- srmRmdir
- srmRm
- srmLs
- srmMv

## Data transfer functions

- srmPrepareToGet
- SrmPrepareToPut
- srmCopy
- SrmRemoveFiles
- srmReleaseFiles
- srmPutDone
- srmAbortRequest
- srmAbortFiles
- srmSuspendRequest
- srmResumeRequest

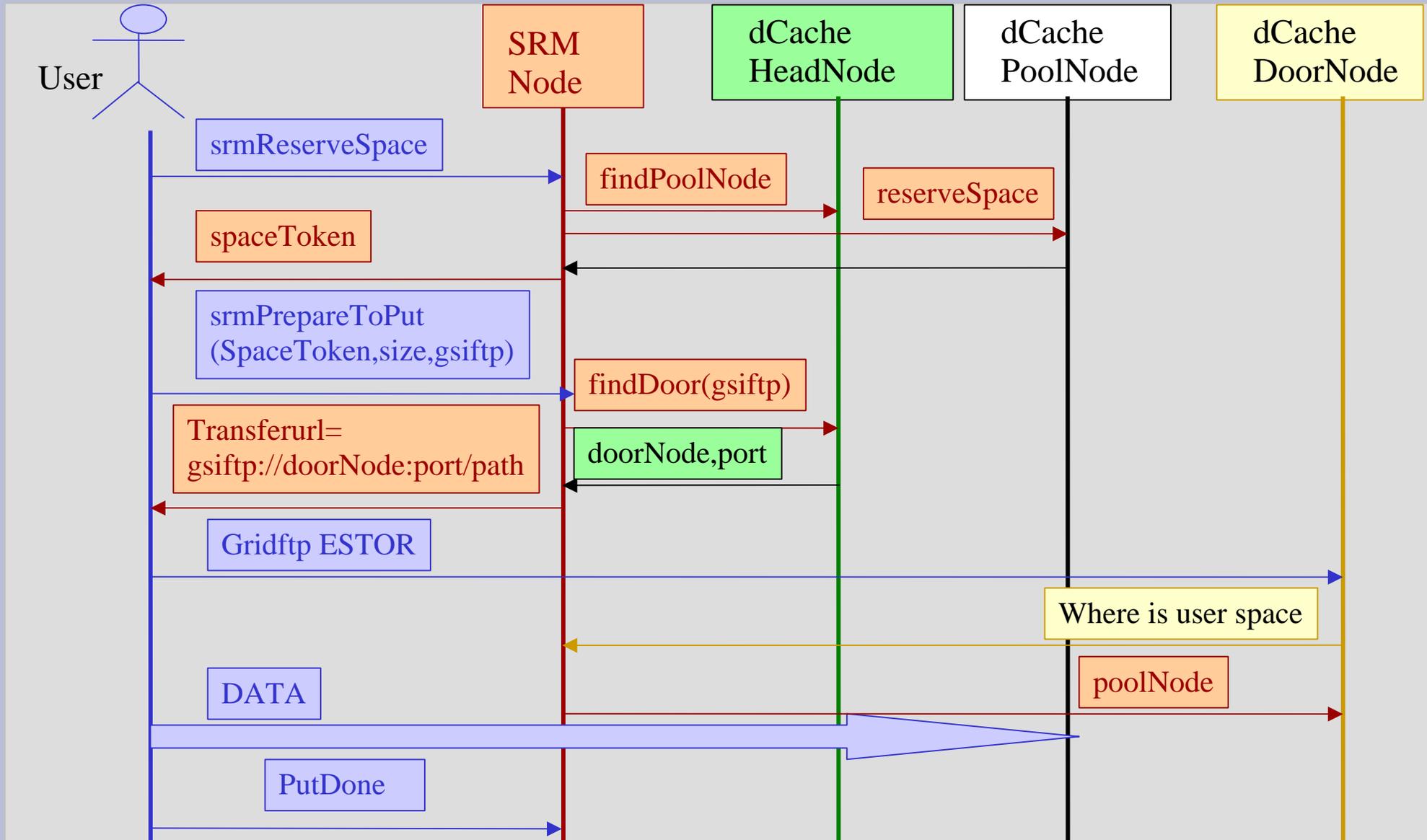
## Status Functions

- srmStatusOfGetRequest
- srmStatusOfPutRequest
- srmStatusOfCopyRequest
- srmGetRequestSummary
- srmExtendFileLifeTime
- SrmGetRequestID

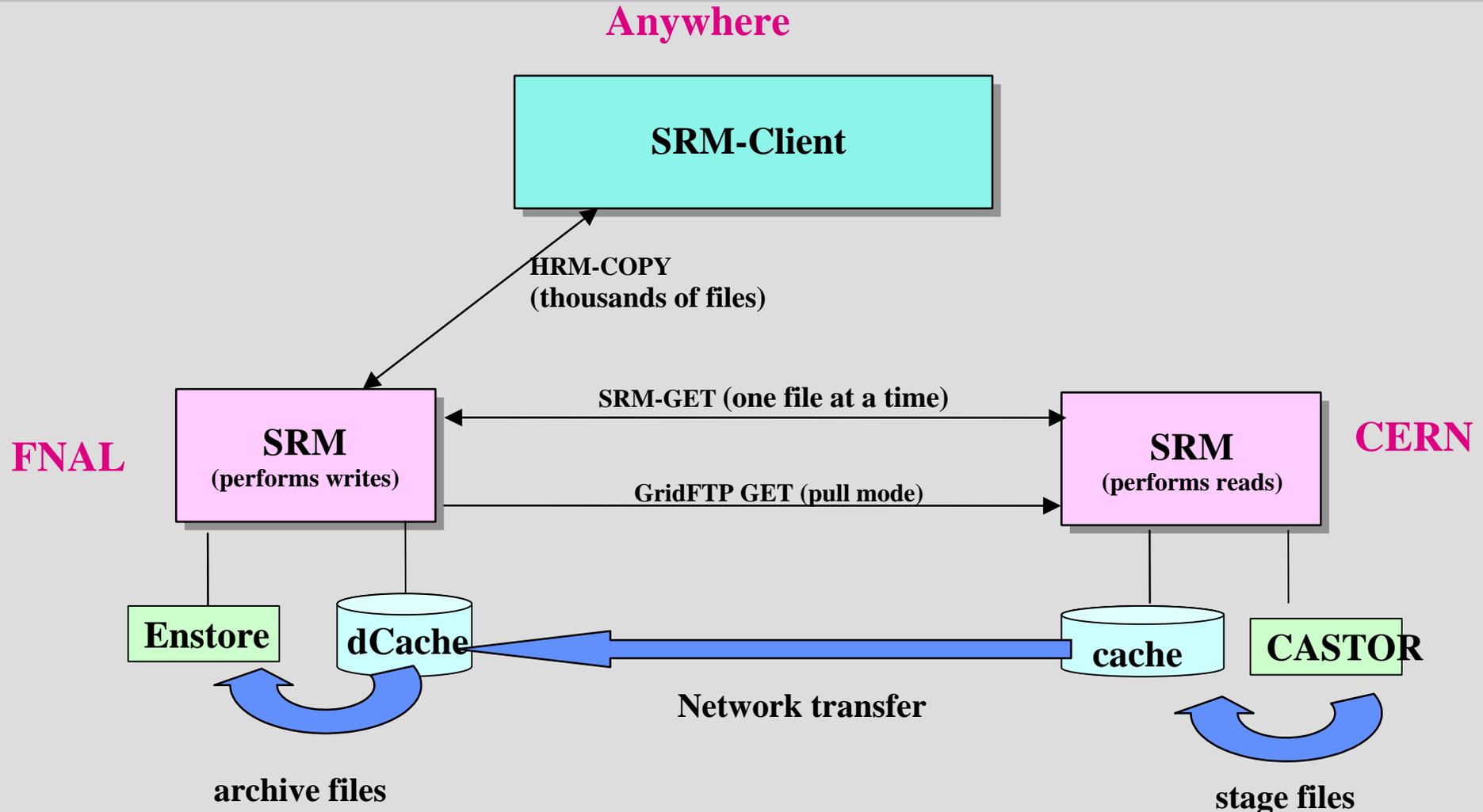
## Permission

- srmSetPermission
- srmReassignToUser
- srmCheckPermission

# Srm Example - srmPrepareToPut

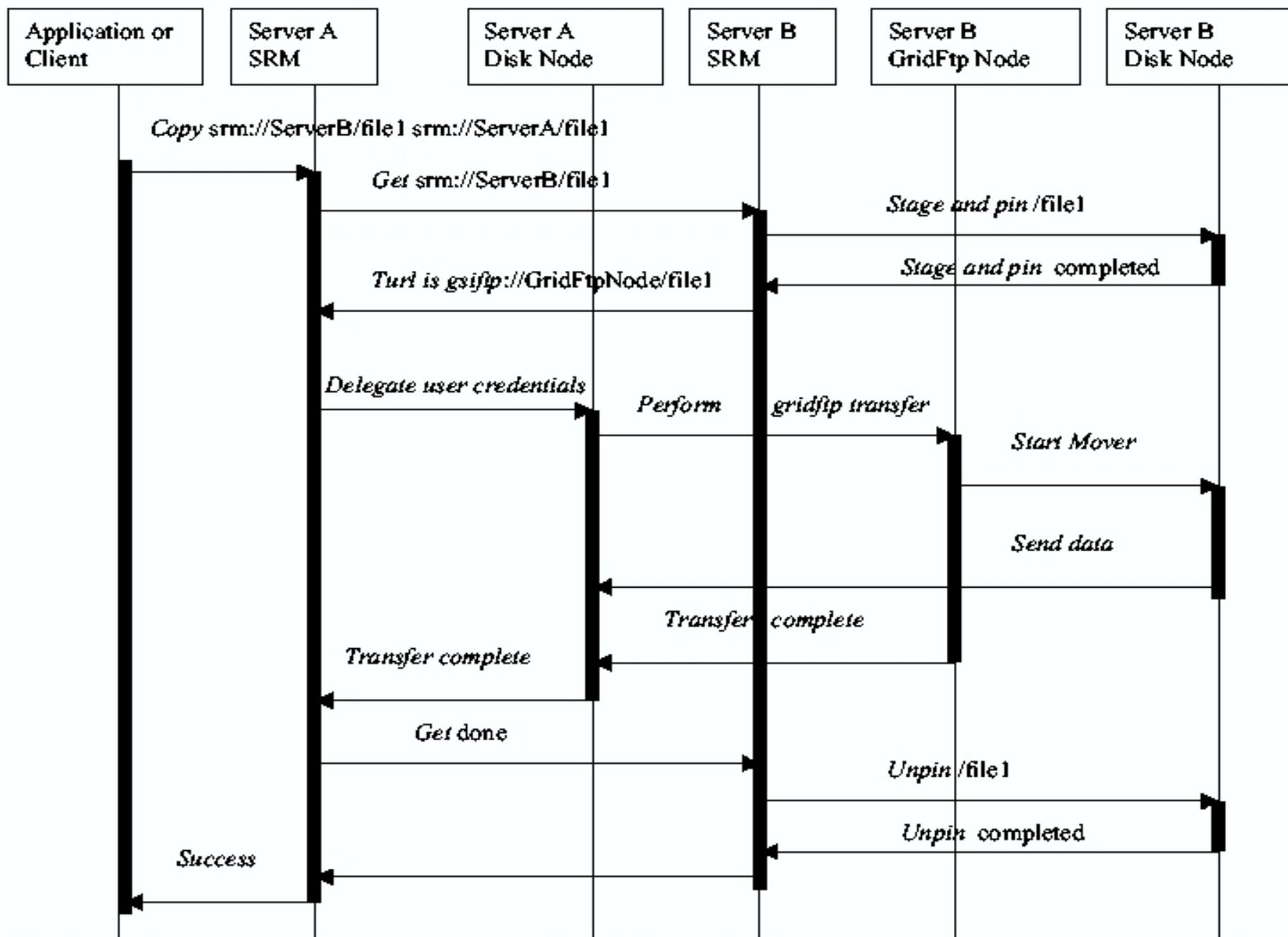


# Srm Example - Robust Replication

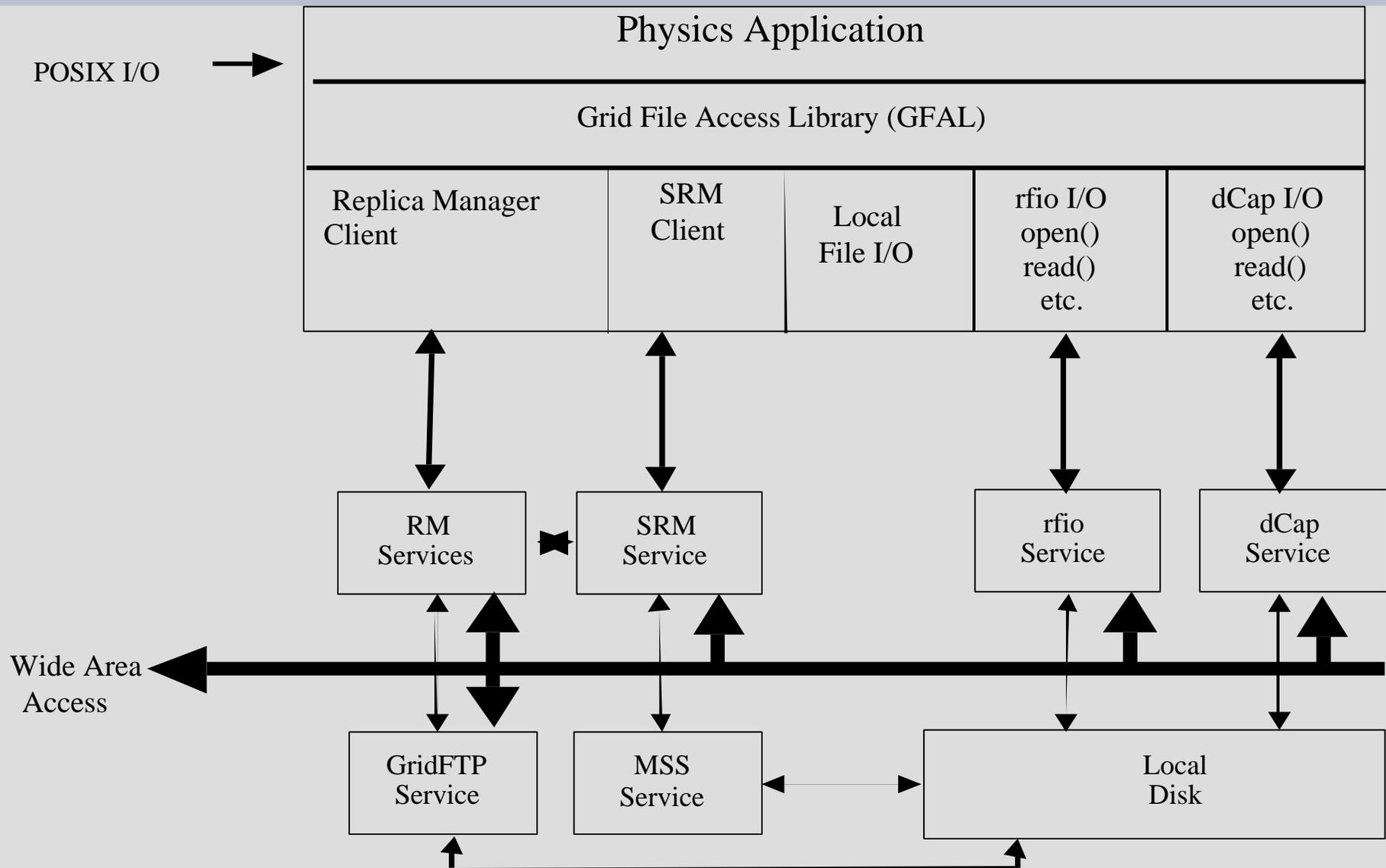




# The sequence diagram of the SRM Copy Function performing “Copy srm://ServerB/file1 srm://ServerA/file1”



# Grid File Access Library and SRM



# Role of SRM in Grid

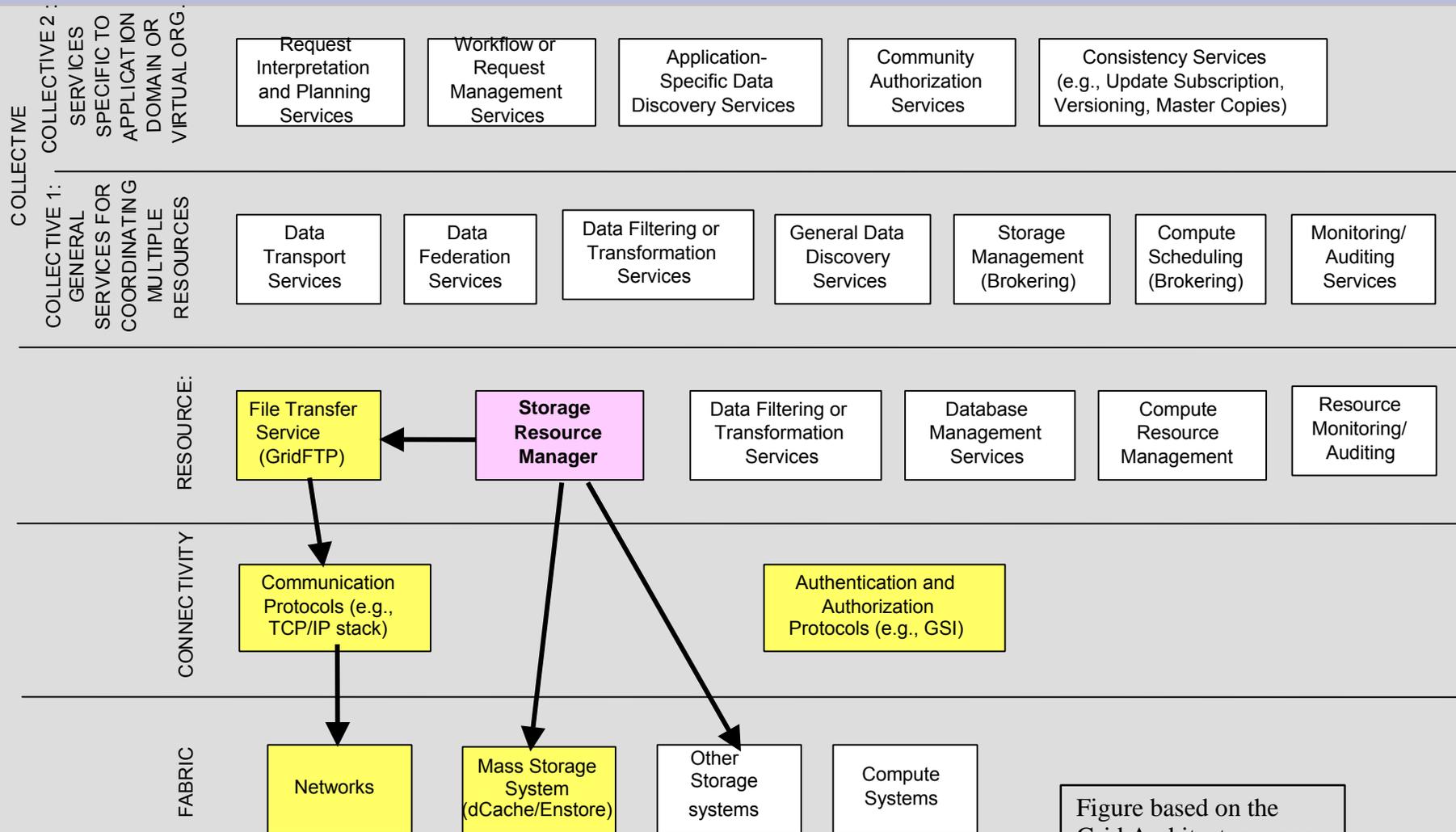


Figure based on the Grid Architecture paper by Globus

# US-CMS DATAGRID

Compact Muon solenoid (CMS) is an experiment at the lepton Hadron Collider (LHC) at CERN in Geneva, Switzerland.

- US-CMS is building data grid to facilitate physics data analysis at academic institutions across the united states.

- Data grid 3 tier architecture.

- Tier 0 CERN, Geneva, Switzerland.

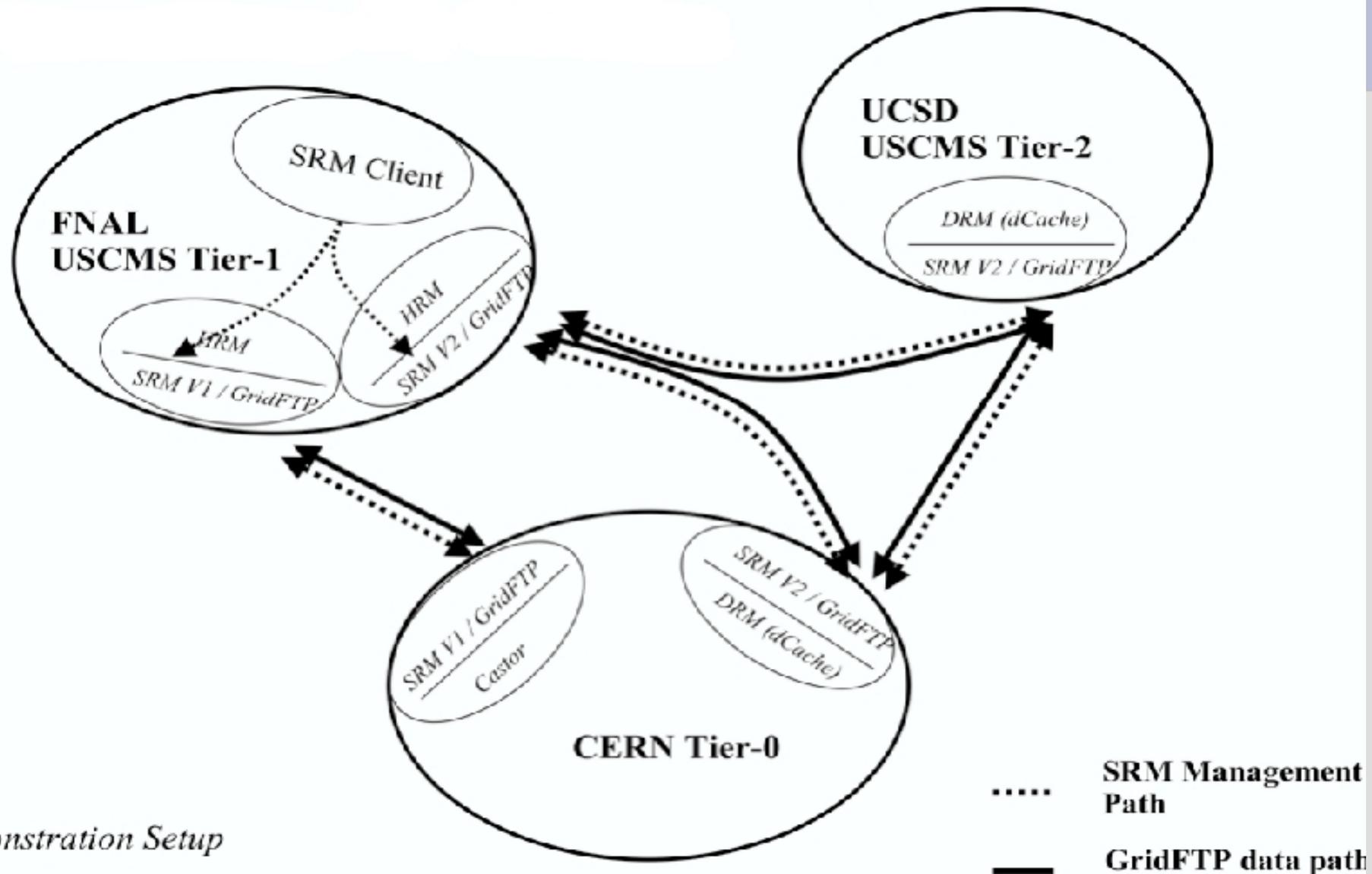
- Tier 1 consists of 5 regional Centers, FERMILAB in Batavia, IL is a north American Center.

- Tier 2 consists of 25 Centers, 5 of these are in north America.

SRM copy is used as a management protocol and reliable replication service for movement of data from tier 0 to tier 1 and from tier 1 to tier 2.

# CMS SC2003 DEMO

## U.S. CMS Data and Storage Management (DCache, SRM)

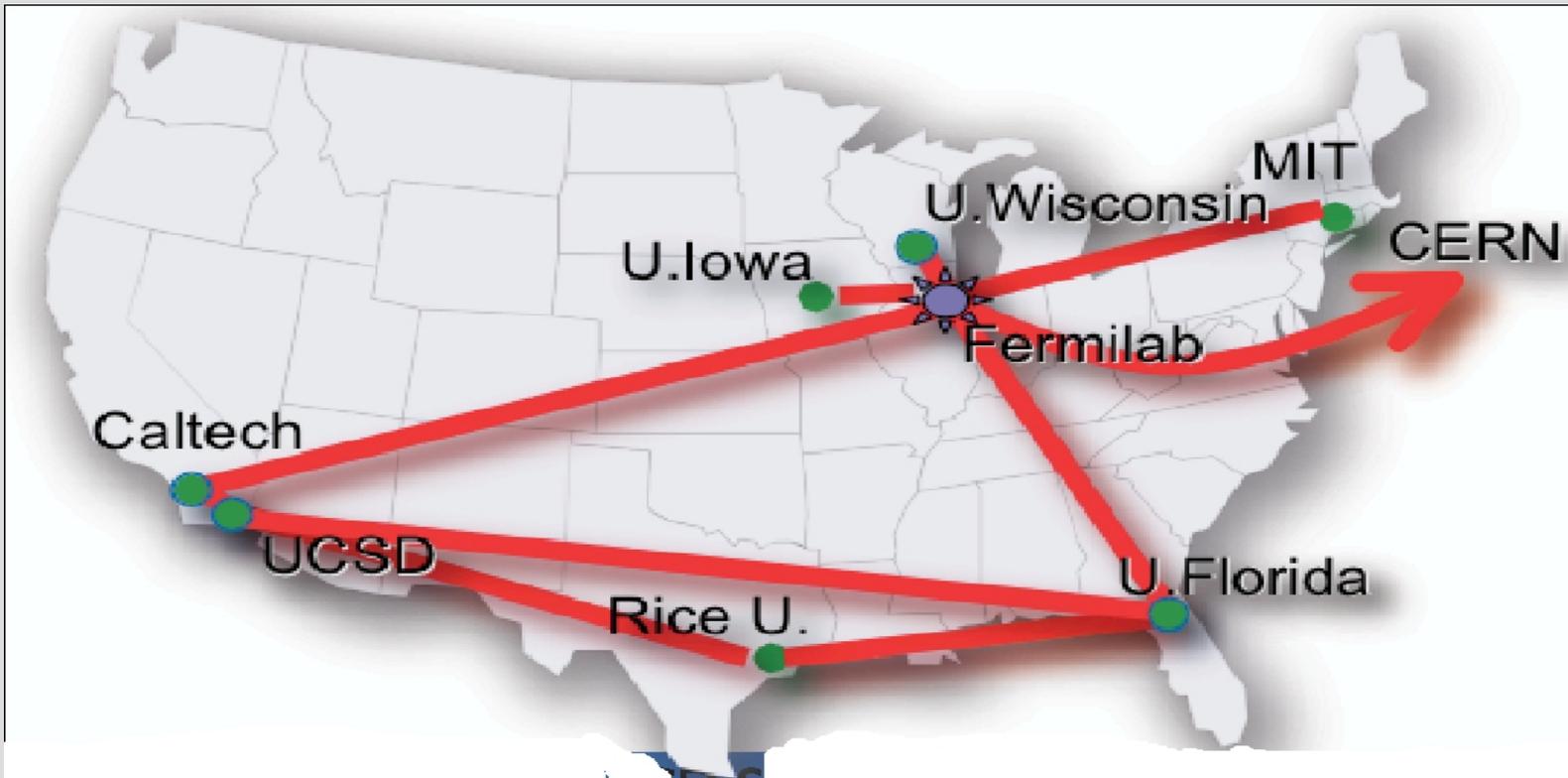


# US-CMS Data Challenge 2004

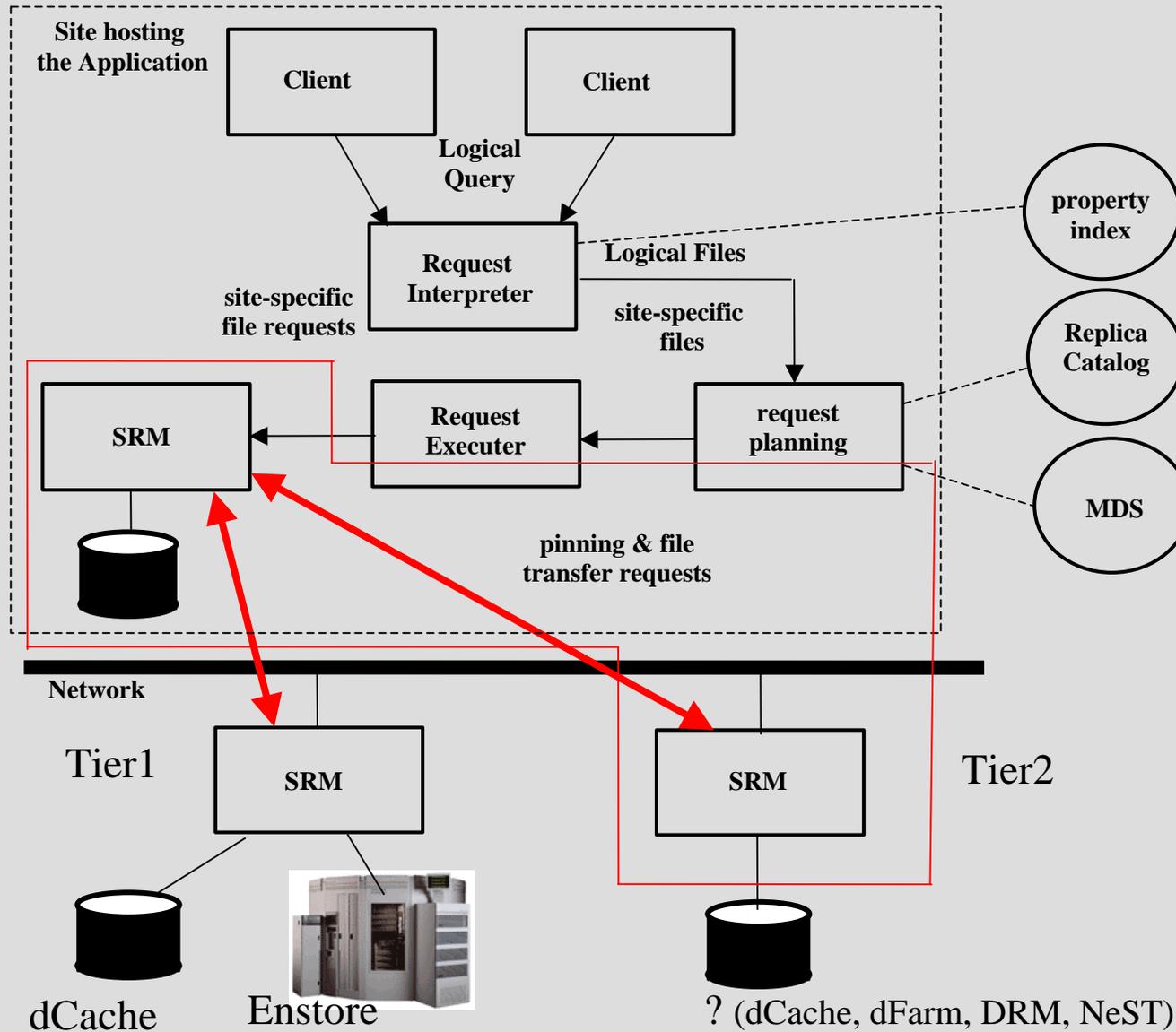
Event Reconstruction at the Tier-0 Center at 25Hz for the period of a month

Transfer of raw and reconstructed data to distributed Tier-1 centers

Access of events at distributed center for analysis-type applications



# Client Access to CMS-DATA



# Resources

- .The Storage Resource Manager Collaboration Web Site  
<http://sdm.lbl.gov/srm-wg/>
- .The Storage Resource Manager Interface Specification, version 2.1, Edited by Junmin Gu, Alex Sim, Arie Shoshani, LBL,  
<http://sdm.lbl.gov/srm/documents/joint.docs/SRM.spec.v2.1.final.doc>.
- .Dcache documentation by Patrick Fuhrmann, DESY, Germany, [www.dcache.org](http://www.dcache.org)
- .US-CMS <http://www.uscms.org>
- .US-CMS Data Challenge 2004  
<http://www.uscms.org/s&c/dc04>