Storage in OSG and BeStMan

Alex Sim

Scientific Data Management Research Group
Computational Research Division
Lawrence Berkeley National Laboratory
**Storages in OSG**

- **OSG supports users!**
  - Storage Group in OSG
  - Packaging storage software for VDT
    - dCache, BeStMan, BeStMan-gateway/Xrootd
    - Develop/maintain/package accounting and monitoring tools
    - Support/test/package community tools
    - Simplify configuration/installation for OSG
  - Develop and run validation tests
    - Perform troubleshooting and debugging
  - Provide users and admins support
    - Help VOs to use storage on OSG sites
  - OSG liaison to storage developer groups
  - Educate OSG community about storage, provide documentation
    - Participate in grid schools organized by OSG

- **Two commonly used, very different storage services in OSG**
  - dCache (FNAL, DESY)
  - BeStMan (LBNL)

These are SRMs!

And end-users do not see the differences in accessing these!
What is SRM?

- **SRM : Storage Resource Manager**
  - Well-defined storage management interface specification based on standard
  - Different implementations for underlying storage systems are based on the same SRM specification
  - Provides dynamic space allocation and file management on shared storage components on the Grid
- Over 300 deployments of different SRM servers in the world
  - Managing more than 10 PB
Why do you need SRM?

- **Suppose you want to run a job on your local machine**
  - Need to allocate space, and bring all input files
  - Need to ensure correctness of files transferred
  - Need to monitor and recover from errors
  - What if files don’t fit space? Need to manage file “streaming”
    - Need to remove files to make space for more files
    - Need to remove files after the job is done for more jobs

- **Now, suppose that the machine and storage space is a shared resource**
  - Need to do the above for many users,
    - Need to enforce quotas
    - Need to ensure fairness of space allocation and scheduling

- **Now, suppose you want to do that on a Grid**
  - Need to access a variety of storage systems
    - mostly remote systems, need to have access privileges
    - Need to have special software to access mass storage systems

- **Now, suppose you want to run distributed jobs on the Grid**
  - Need to allocate remote spaces
  - Need to copy (or stream) files to remote sites
  - Need to manage file outputs and their transfer to destination site(s)
What does SRM do?

- **Support space management for files with lifetime**
  - Allocation of space, garbage collection
- **Support dynamic space reservation – opportunistic storage**
- **Support for multiple file transfer protocols**
  - Support for transfer protocol negotiation
  - Support for multiple file transfer servers
  - Incoming and outgoing file transfer queue management and transfer monitoring
- **Support for asynchronous multi-file requests**
- **Directory management and ACLs**
- **Support file sharing and file streaming**
- **Gives compatibility and interoperability based on standard**
What do users do with SRM?

**PUT/GET**

Client

- GridFTP file transfers
- TURL
- srmPrepareToGet/Put
- srmReleaseFiles/srmPutDone

SRM

File System / Storage

- Gridftp server
- ...
- Gridftp server

**Ls/Rm/Mkdir/Rmdir**

Client

- srmLs/srmRm/srmMkdir/srmRmdir

SRM

File System / Storage

- Gridftp server
- ...
- Gridftp server
SRMs Facilitate Analysis Jobs

SC2008 Demo:
Analysis jobs at NERSC/LBNL with 6 SRM implementations at 12 participating sites
Interoperability in SRMs
Berkeley Storage Manager (BeStMan)

• **Light-weight implementation of SRM v2.2**
  - Works on existing disk storages with posix compliant file systems
    - E.g. NFS, GPFS, GFS, NGFS, PNFS, HFS+, PVFS, Lustre, Xrootd, Hadoop, Ibrix
  - Supports multiple partitions
  - Adaptable to other file systems and storages
    - Supports customized plug-in for file system access
    - Supports customized plug-in for MSS to stage/archive such as HPSS
  - Easy adaptability and integration to special project environments

• **Supports multiple transfer protocols**
  - Supports load balancing for multiple transfer servers

• **Scales well with some file systems and storages**
  - Xrootd, Hadoop

• **Works with grid-mapfile or GUMS server**

• **Simple installation and easy maintenance**

• **Packaged in VDT using Pacman**

• **Who would benefit from BeStMan?**
  - Sites with limited resources and/or limited admin effort
What can BeStMan do?

• In addition to what SRMs do.

• Dynamic installation, configuration and running
  • If the target host does not have an SRM, BeStMan can be installed, configured, and started with a few commands by the user.

• BeStMan can restrict all user access to certain directory paths through configuration

• BeStMan (full mode) can be configured to restrict user access to files by owners/creators only without external service component

• A site can customize the load-balancing mechanism for transfer servers through plug-in
Some BeStMan Use Cases

- **CMS**
  - BeStMan Gateway as an SRM frontend for Hadoop at UNL
  - Passed all the automated CMS tests through EGEE SAM

- **ATLAS**
  - BeStMan on NFS
  - BeStMan Gateway on Xrootd/FS, GPFS, Ibrix

- **STAR**
  - Data replication between BNL and NERSC/LBNL
    - HPSS access at BNL and NERSC
    - SRMs in production for over 4 years
  - Part of analysis scenario to move job-generated data files from PDSF/NERSC to remote BNL storage

- **Earth System Grid**
  - Serving about 6000 users
    - Over a million files and 170TB of climate data
    - from 5 storage sites (LANL, LLNL, NCAR, NERSC, ORNL)
  - Uses an adapted BeStMan for NCAR’s own MSS
• **SRM is an essential part of Grid and OSG**
  • Users have uniform access to Grid storages
  • OSG supports users!

• **BeStMan is an implementation of SRM v2.2**
  • Great for disk-based storage and file systems
  • BeStMan Gateway mode gives scalable performance on some file systems and storages
  • Easy installation and maintenance through VDT or tar file
  • Works with other SRM v2.2 implementations
    • Servers: CASTOR, dCache, DPM, StoRM, SRM/SRB, …
    • Clients: PhEDEx, FTS, glite-url-copy, lcg-cp, srm-copy, srmcp, …
    • In OSG, WLCG/EGEE, ESG, …
Documents and Support

- OSG Storage documentation
  - https://twiki.grid.iu.edu/twiki/bin/view/Documentation/WebHome
- BeStMan
  - http://datagrid.lbl.gov/bestman
  - https://twiki.grid.iu.edu/bin/view/Documentation/BestmanGateway
  - https://twiki.grid.iu.edu/bin/view/Documentation/BestmanGateway-Xrootd
- Xrootd and XrootdFS
  - http://xrootd.slac.stanford.edu
- SRM Collaboration and SRM Specifications
  - http://sdm.lbl.gov/srm-wg

- Contact and support
  - osg-storage@opensciencegrid.org
  - SRM@LBL.GOV