SRM-SRB Development and Interoperation

Eric Yen, Fu-ming Tsai
Academia Sinica Grid Computing Centre
Taipei, Taiwan

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Outline

- Experiences of Taiwan
- Examples
- SRM-SRB Development
- Summary
All e-Science Data must be Curated and Managed, but Digital Information is Very Fragile!
Threat Model

- Media failure
- Hardware failure
- Software failure
- Network failure
- Obsolescence
- Natural Disaster

- Operator error
- External Attack
- Insider Attack
- Economic Failure
- Organization Failure
Types of Science Data Management and Core Technology

- **Types**
  - Simulation-driven, Observation/Experiment-driven, and Information intensive applications

- **Core Technology**
  - Workflow, data flow and transformation
  - Metadata and content architecture
  - Efficient access and queries, data integration
  - Distributed data management, data movement and networks
  - Storage and Caching
  - Data analysis, visualization, and integrated environment

- **Emergence of a new e-Science or Data-centric research paradigm**

Source: report from DOE Office of Science Data Management Workshops, 2004
Our Experiences

• WLCG Tier-1 Center
  • attained > 7.3 Gb inbound traffic and > 4.5 Gb outbound traffic
  • provide > 1PB disk storage and 800TB Tape storage in 2007, and will have > 2PB disk and >1.5PB tape storage by Aug. 2008.

• Long-term Preservation Services for Digital Archives
  • taking advantage of DataGrid technology
  • > 300TB digital contents for preservation, 3 independent replications in different domains

• Bioinformatics and Drug Virtual Screening
• Taiwan Biodiversity Resource Integration and to + Ecoinformatics
• Astronomy and Earthquake Data Centre
• HPC
Data Management Requirements

- Long-Term Preservation and Data Curation
  - preserving ability to read (physically) and understand (logically)
- Full Spectrum and Precise Metadata in Collection, Object and Management Level
- Workflow Support: Digital Information Life-Cycle
  - Create--> Content Analysis & Annotation--> IPR Protection --> Re-purposing--> Multi-modal/Integrative Search --> Archive
- Data Exploration across Institutional and Disciplinary Domains
- Petabyte Scale Storage Management with Performance
- User Applications by Disciplinary and Role
  - Data analysis, Visualization, Operation & Management, etc.
- A New Information Infrastructure is required!
System Architecture

Geographical Distribution of NDAP For Long-term Data Preservation

- Academia Sinica (AS)
- National Palace Museum (NPM)
- National Taiwan University (NTU)
- National Museum of History (NMH)
- Academia Historica (DRNH)
- National Central Library (NCL)

- National Museum of Natural Science (NMNS)
- Taiwan Historica (TH)

- > 3.68 M records, > 300 TB content generated from 2000
- > 500TB space in 9 SRB Zones established
Roadmap of the LTP Services

• Objectives of the first phase (~2007)
  • Enhance accessibility and disaster recovery
  • Data consolidation by central audit & analysis
  • Balance access load and improve availability by data distribution (also for offline query)
  • Reduce access latency
  • Reliability by removal of single point of failure

• Support the basic data archive & preservation services (~2009)
  • Customize and optimize the workflow to find data, understand data, access data, move data, transform data, combine data and present the output

• Study and roadmap building for Migration Mechanism (~2009)
  • Relationship between information sources, history, and provenance
  • Integration with NDAP collection/content Metadata Framework

• Quality Assurance
• Policy Making
Virtual Screening Service with GAP

A standalone GUI Application

- View the best conformation of a simulation
- One-click job submission
- Generate the histogram with a given energy threshold
- Visualize your job status

Submit the docking job to the Grid with just one click
Grid for Earthquake Data Center

Outputs
- Waveform Simulation
- Quick Focal Mechanism Determination

TEC Community Library
- Seismogram Retrieval

1999 Chi-Chi Taiwan Earthquake

Finite Source Inversion and 3D Wave Propagation
Webmapping for Biodiversity Informatics and GeoGrid
Institutional Repository Support and Federation by Grid

- Requirements
  - Large and distributed Institution Repositories has been established for Library services, but these resources have to be accessed, shared, exchanged, and archived according to SOPs/policy.
  - DSpace/Fedora + DataGrid (e.g., SRB, etc)
  - Based on OAIS model, evaluation of the grid data management technology, and integration with IR is under way
  - Study on metadata architecture to enhance digital preservation
Levels of Interoperation (DM)

- Application
- Job Management
- Data Management: Storage Interface, File System, movement, etc.
- Basics
  - Certificate
  - Grid Information
  - VO
  - Security

Source: Laurence Field, EGEE and Interoperation, CERN

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Source: report from DOE Office of Science Data Management Workshops, 2004
**gLite Data Management Services**

- **Storage Element**
  - Storage Resource Manager
  - POSIX-I/O
  - Access protocols

- **Catalogs**
  - File Catalog
  - Replica Catalog
  - File Authorization Service
  - Metadata Catalog

- **File Transfer**
  - Data Scheduler
  - File Transfer Service
  - File Placement Service

- gLite FiReMan Catalog
  - MySQL and Oracle

- gLite Standalone Metadata Catalog

- gLite FTS and glite-url-copy

- gLite FPS

- Planned for Release 2

- Not provided by gLite

- Relies on existing implementations
SRM-SRB Development

- **Objectives**: make SRM the common interfaces for grid storages, and be interoperable among those storages.

- **Features**
  - Flexible file/space type supported: volatile, durable and permanent
  - Disk usage status checking is available
  - space reservation functions

- **Progress**
  - Implementation of discovery, permission, directory, space functions are all finished.
  - transfer function will be finished in June.
  - Endpoint ready for testing

Testbed: http://fct01.grid.sinica.edu.tw:8443/axis/services/srm
Preproduction: http://tap02.grid.sinica.edu.tw:8443/axis/services/srm
Architecture Overview

Users/applications

File transfer (gridftp)

SRM API

Web Service

Core

Data server management

Auxiliary Filecatalog

Gridftp/management API

SRB+DSI

EGEE-II INFSO-RI-031688
**Support Flexible File/Space Types**

- SRM system has a caching mechanism and has to take care of SRM issues like file lifetime, space management, ..., etc.
  - Volatile space
  - Durable space
  - Permanent space

- In our implementation
  - Use AMGA as auxiliary catalog and record all space usage, space type inside.
Checking Disk Status

• How to get the disk usage of the space?
  – Need to know the free and used space on SRB server
  – SRB does not provide the mechanism to monitor resource usage
  – We need to know the usage
    ▪ Space management

• In our implementation
  – InfoServer:
    ▪ Deployed on non-Mcat enabled SRB server
  – SRBInfoServer:
    ▪ Deployed on Mcat-enabled SRB server
**Testbed deployment**

**User Interface**
- Hostname: fct01.grid.sinica.edu.tw
- The end point: http://fct01.grid.sinica.edu.tw:8443/axis/services/srm
- Info: SRM interface

**Gridftp/management commands**

**SURL**
- Hostname: t-ap20.grid.sinica.edu.tw
- Info: SRB server (SRB-DSI installed)

**Return some information**

**TURL**
- Hostname: t-ap51.grid.sinica.edu.tw
- Info: AMGA server

**Host information**
- Hostname: t-ap51.grid.sinica.edu.tw
- Info: AMGA server
Future Plan

- **Short term**
  - Implement interface compatible SRM version 2.2.

- **Mid-term**
  - Interact and test with other data management systems such as Castor, dCache,…,etc.

- **Long-term**
  - Interoperate with gLite.
    - Hope glite users who join VO can access files and resources in SRB and vice versa.
Progress

• What we have done:
  • We have finished the parts about authorizing users, web service interface (just interface) and gridftp deployment, and SRB-DSI, and some functions like directory functions, permission functions, etc.

• What we are doing:
  • Now, we are focusing on the implementation of the core data transfer functions.

• Sample Use Cases Implemented
  • Support flexible file/space types: Volatile, Durable and Permanent space
  • Disk Status Checking
  • Enable Uniform Name Space by AMGA
References

- **SRM-SRB interface project wiki page**
- **SRM working group:**
- **SRB:**
  - http://www.sdsc.edu/srb/index.php/Main_Page
- **AMGA:**
  - http://amga.web.cern.ch/amga
- **Globus:**
  - http://www.globus.org
- **CoG:**
- **Axis:**
  - http://ws.apache.org/axis/
Thanks to Partners of SRM-SRB Project
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   - EGEE
   - ASGC

and to you all
Grid Application Platform (GAP)
A light-weight framework for developing problem solving applications on the Grid

Seamless access to Grid applications

Distributed system architecture

Components
- Portable application package: light-weight client-side package for managing jobs and running applications
- Virtual Queuing System: high-level meta-schedule with application specific resource matching
- Local System Agent: uniform interface for adapting heterogeneous computing environments

Supported computing environments
- Single Server
- Computing Cluster: PBS, Grid: LCG, gLite

Features
- Service-oriented architecture
- Portable, intuitive and application specific user interface
- Integrated proxy delegation and automatic proxy renewal with MyProxy server
- Multi-user environment with historical job archiving and grid proxy management
- Uniform interface integrating a variety of computing environments ranged from single workstation to world-wide Grid
- Dynamic resource allocation based on application specification
- Full Java implementation
- Workflow support