Data Replication Service

Sandeep Chandra
GEON Systems Group
San Diego Supercomputer Center
Outline

• Motivation
• Data Replication Service (DRS)
• Components for DRS
  – RLS, GridFTP, RFT
• DRS Deployment
• DRS setup on GEON
• Next Steps
Motivation

- Science domains spend considerable effort collecting and managing large amounts of data
- Science domains develop customized data management services that vary with the type of application
- Common data management requirements
  - Publish and replicate large datasets
  - Register data replicas in catalogs and discover them
  - Perform metadata-based discovery of datasets
  - May require ability to validate correctness of replicas
Motivation (cont.)

• These systems demand considerable resources to design, implement & maintain
  – Typically cannot be re-used by other applications

• Need for a long-term solution
  – Generalize functionality provided by these data management systems
  – Provide suite of application-independent services

• Design and build on lower-level grid services
  – Globus Reliable File Transfer (RFT) service
  – Replica Location Service (RLS)
  – GridFTP
A possible solution: Data Replication System (DRS)

• Higher level data management service based on low level data management components like RLS and RFT

• The primary functionality is to
  – Allow users to identify a set of desired files existing in their grid environment
  – Make local replicas of those data files by transferring files from one or more source locations
  – Register the new replicas in a Replica Location Service
Replica Location Service (RLS)

- A simple registry that keeps track of where replicas exist on physical storage systems.
- Users or services register files in RLS when the files are created.
- Query RLS servers to find these replicas.
- RLS can be a distributed registry, consisting of multiple servers at different sites.
- Distributed RLS increases the overall scale and store more mappings than would be possible in a single, centralized catalog.
RLS (cont.)

- A logical file name is a unique identifier for the contents of a file.
- A physical file name is the location of a copy of the file on a storage system.
- RLS maintains mappings between logical file names and one or more physical file names of replicas.
- Users can provide a logical file name to an RLS server and ask for all the registered physical file names of replicas.
- Users can also query an RLS server to find the logical file name associated with a particular physical file location.
RLS (cont.)

- Two servers: LRI, LRC
- LRC stores mappings between logical names for data items and the physical locations of replicas.
- Query the LRC to discover replicas associated with a logical name.
- RLI server collects information about the logical name mappings stored in one or more LRCs.
- RLI returns a list of all the LRCs it is aware of that contain mappings for the logical name contained in a query.
- The client then queries these LRCs to find the physical locations of replicas.
RLS in Context

• The RLS is one component in a layered data management architecture
• Consistency management provided by higher-level services
GridFTP

• The GridFTP protocol provides for the secure, robust, fast and efficient transfer of (especially bulk) data.

• Globus Toolkit provides the most commonly used implementation of the protocol, though others exist.

• The Globus Toolkit provides
  – server implementation called globus-gridftp-server
  – scriptable command line client called globus-url-copy
  – a set of development libraries for custom clients
Reliable File Transfer (RFT)

- A WSRF compliant web service that provides “job scheduler” like functionality for data movement.
- You provide a list of source and destination URLs (including directories or files), then the service writes your job description into a database and moves the files on your behalf.
RFT (cont.)

- Accepts SOAP description of a desired transfer
- Service methods are provided for querying the transfer status
- WSRF tools to subscribe for notifications of state change events
- Supports all the same options as globus-url-copy (buffer size, etc)
- Increased reliability because state is stored in a database
- Supports concurrency, multiple files transferred for better performance
Globus Services

- **WSRF Services**
  - Data Replication Service
  - Delegation Service
  - Reliable File Transfer Service

- **Pre WSRF Components**
  - Replica Location Service (Local Replica Catalog, Replica Location Index)
  - GridFTP Server
DRS Deployment

- Local storage system
- GridFTP server for file transfer
- Replica Location Service:
  - LRCs stores mappings from logical names to storage locations
  - RLI collects state summaries from LRCs
- RFT: WSRF service to perform data transfer
- DRS: The master replication service
DRS Functionality

- Initiate a DRS Request
- Create a delegated credential (Delegate Authority)
- Create a Replicator resource (Replication Service)
- Monitor Replicator resource (Status)
- Discover replicas of files in RLS, select among replicas
- Start data transfer to local site with RFT service
- Check status
- Register new replicas in RLS catalogs
- Allow client inspection of DRS results
- Destroy Replicator resource
Geon DRS Test Setup

ASU

Globus Container

DRS Service

Create a Transfer request

RFT Service

GridFTP Server

Replica Location Index

Replica Location Catalog

Database

Site Storage System

SDSC

Globus Container

DRS Service

Create a Transfer request

RFT Service

GridFTP Server

Replica Location Index

Replica Location Catalog

Database

Site Storage System

Data Transfer
Next Tasks

• Transfer LIDAR data from ASU to SDSC resource. (HPSS, etc)
• Extend the testbed to include more nodes.
• Benchmarking data movement.
• Package DRS and components with GEON software stack version 2.0
Acknowledgement

• Ann Chervenak & Robert Schuler (ISI)
• www.globus.org (slides)
Questions?