Data Management in an International Data Grid Project

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Mar 29 2011
Introduction

- Large Hadron Collider (LHC) provide several **Petabytes** of data per year.
- Data are stored at world-wide distributed sites called **Regional Center**
Fig. 2. Overall interaction of project work packages
Data Management

Fig. 3. Overall interaction of data management components
Data Accessor

• Must access a variety of storage systems
• Converts Grid data access requests into something underlying storage will understand
• Also prepares storage to deliver data
• Hides complexities of data access from higher levels
Replication

- Caching strategy, multiple identical files are stored in multiple locations
- Faster access, better fault tolerance, better availability of data.
- Slower updates and writes.
- Policies are not decided by a single entity
  - task schedulers, grid admin, local resource managers
Replication cont.

• Users requests are routed through the Replication Manager

• Provides an intelligent service:
  ○ Knows about the distribution of files
  ○ Analyzes access patterns

• Data Accessor access files selected by Replication Manager
Security

• Site that owns data must ensure that sites hosting replicas provide same level of security

• Synchronous update of replicas
  o more dangerous than on-demand or scheduled
  o better consistency

• Replica selection: from more friendly nodes

• Sensitivity levels are different between data and meta data
  o Data more sensitive than meta data for some sites or vice versa.
Globus Striped Grid FTP Framework and Server

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Presented by Ran Liu
Mar 29 2011
Introduction

• GridFTP - a general-purpose mechanism for secure, reliable and high performance data movement.

• Third party control of data transfer
  o User at one site to initiate, monitor and control data transfer operation between two other sites: source and destination

• Parallel data transfer
  o Multiple transport streams between a single source and destination

• Striped data transfer
  o 1 or more transport streams between m network endpoints on the sending side and n network endpoints on the receiving side
Architecture

Protocol Interpreters (PIs):
The server PI handles the control channel exchange
The client PI carries out its protocol exchange with the server PI.

Data transfer process (DTP):
Handles the accessing of the actual data

These components can be combined in various ways to create servers with different capabilities.
Protocol Interpreter

• In order for a client to contact a GridFTP server
  o Either the server PI must be running as a daemon and listening on a well known port
  o Or some other service must be listening on the port and be configured to invoke the server PI.

• When the server PI receives a command that requires DTP activity, the server PI passes the description of the transfer to DTP

• After that, DTP can carry out the transfer on its own.

• The server PI then simply acts as a relay for transfer status information.
  o Performance markers, restart markers, etc.
Protocol Interpreter Cont.

- PI-to-DTP communications are internal to the server
  - Protocol used can evolve with no impact on the client.
- The data channel communication structure is governed by data layout.
  - If the number of nodes at both ends is equal, each node communicates with just one other node.
  - Otherwise, each sender makes a connection to each receiver, and sends data based on data offsets.
Data Transfer Pipeline

- **Data Access Module** provides an interface to data sources/sinks
- **Data processing module** performs server-side data processing
- **Data channel protocol module** reads from/writes to the data channel.
Data Access Module

• It provides a modular pluggable interface to data storage systems.
• Reads from/writes to a data source/sink

Data Processing Module

• Allows for server-side data processing.
  o Compression, on-the-fly concatenation of multiple files etc
  o make this a separate module in the future
Data Channel Protocol Module

- handles the operations required to fetch data from, or send data to, the data channel.
- A single server may support multiple data channel protocols.
- the **MODE** command is used to select the protocol to be used for a particular transfer.
Thanks!
Acknowledgments

This presentation is based on the following papers:

• **Data Management in an International Data Grid Project**

• **The Globus Striped GridFTP Framework and Server**

This presentation is based on the intelligence of:

• Timur Chabuk and Raj Kettimuthu