Data Management in an International Data Grid Project

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Present by Ran Liu

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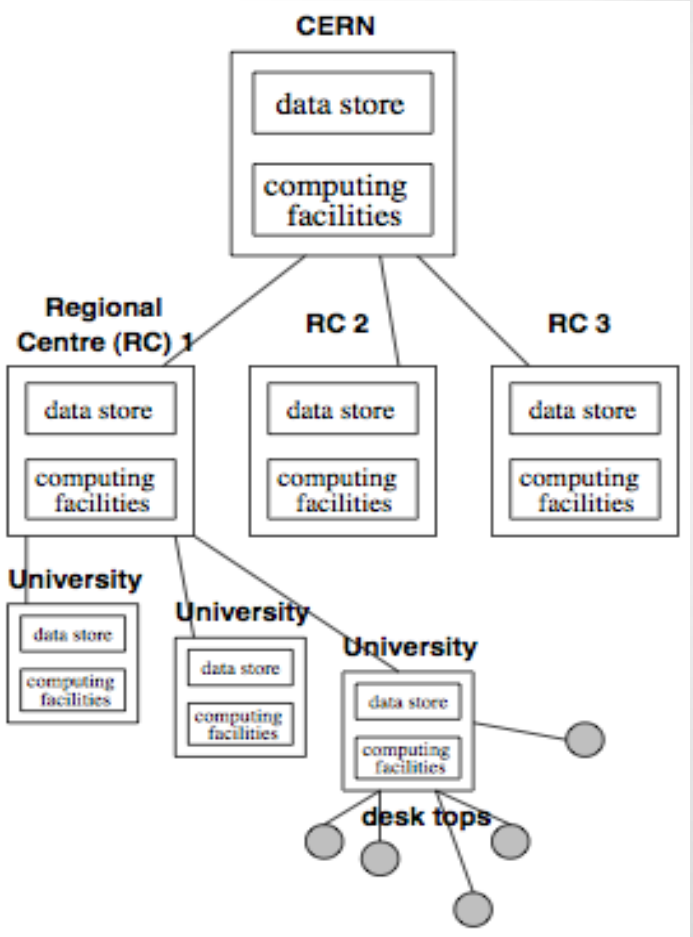
Introduction

- Large Hadron Collider (LHC) provide several **Petabytes** of data per year.
- Data are stored at world-wide distributed sites called **Regional Center**



Architecture

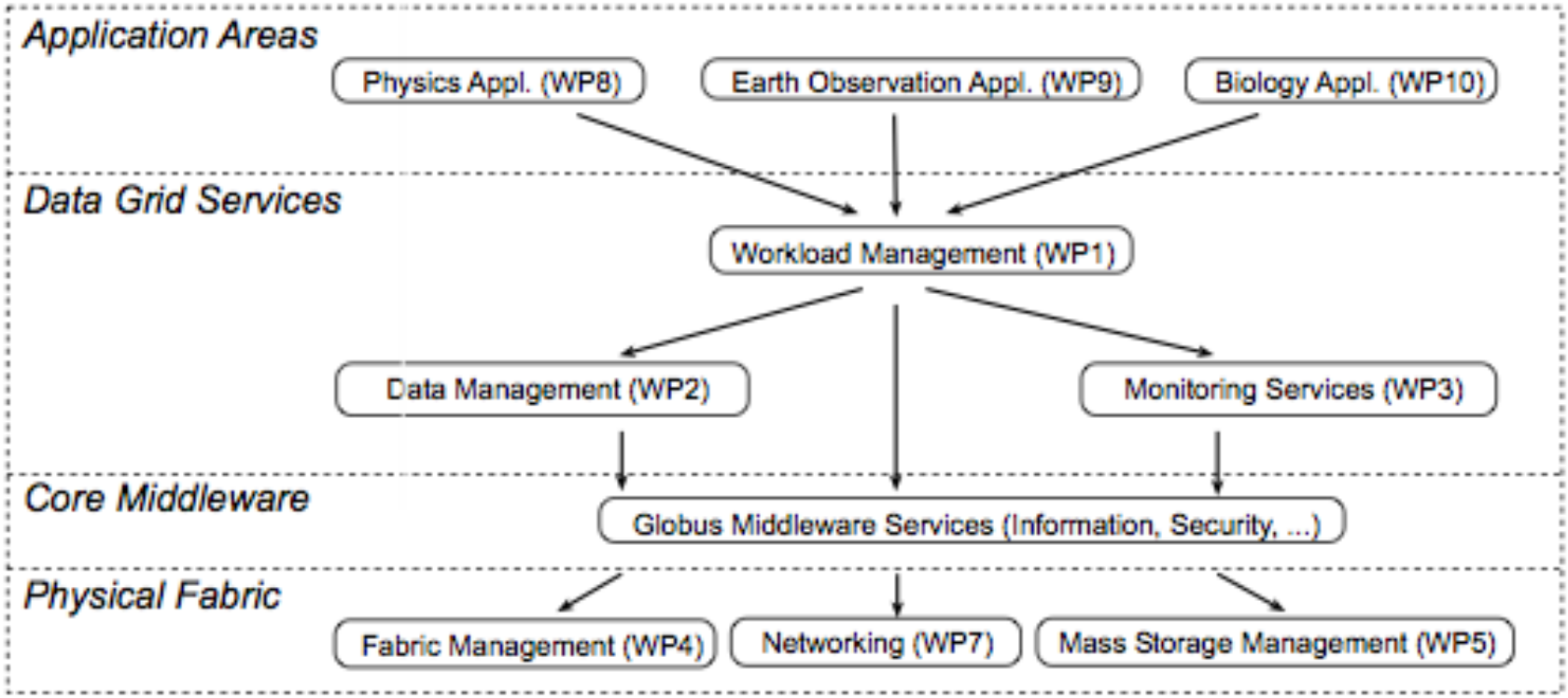


Fig. 2. Overall interaction of project work packages

Data Management

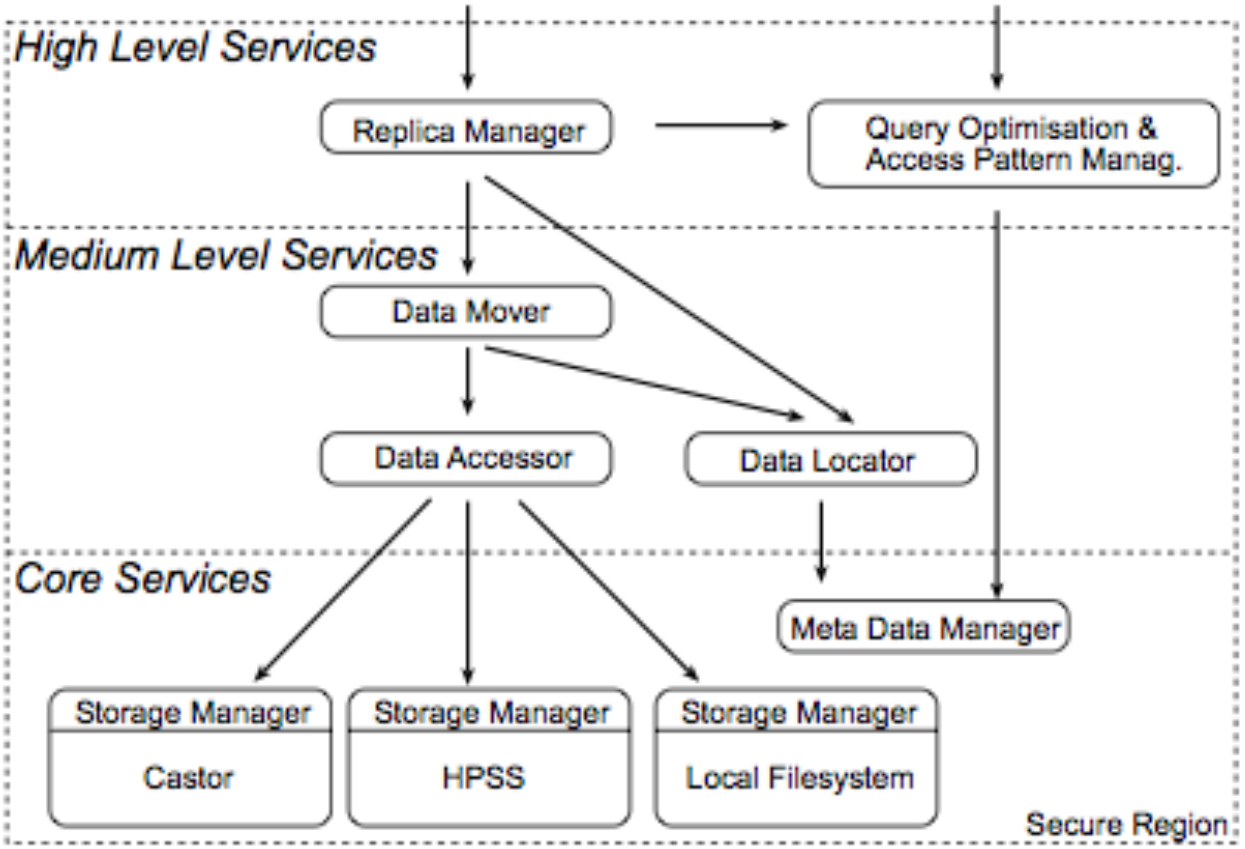


Fig. 3. Overall interaction of data management components

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
  - more dangerous than on-demand or scheduled
  - better consistency
- Replica selection: from more friendly nodes
- Sensitivity levels are different between data and meta data
  - Data more sensitive than meta data for some sites or vice versa.

Globus Striped GridFTP Framework and Server

William Allcock et al.
Presented by Ran Liu
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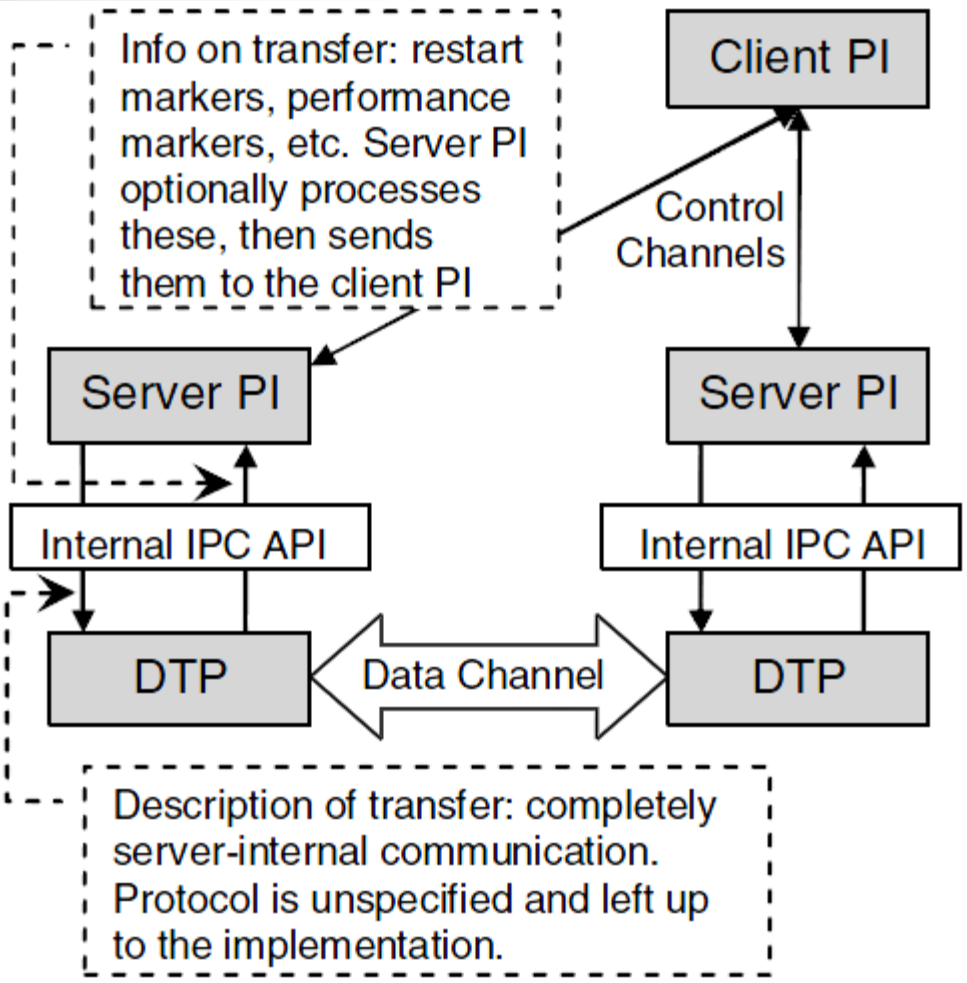
Introduction

- GridFTP - a general-purpose mechanism for secure, reliable and high performance data movement.
- Third party control of data transfer
  - User at one site to initiate, monitor and control data transfer operation between two other sites: source and destination
- Parallel data transfer
  - Multiple transport streams between a single source and destination
- Striped data transfer
  - 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

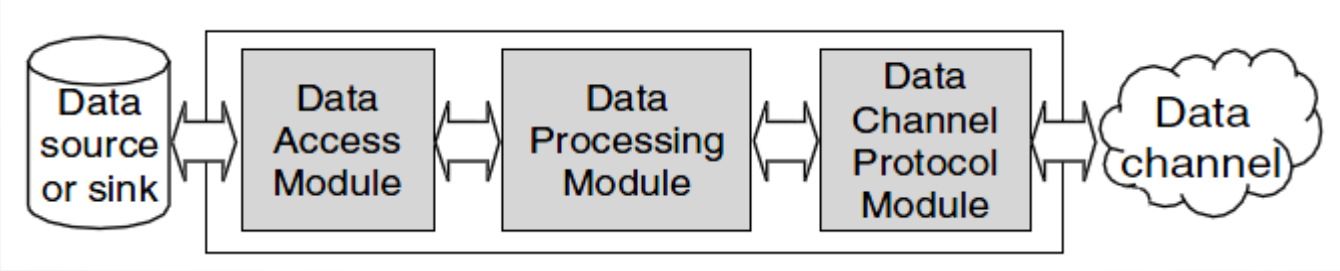
- In order for a client to contact a GridFTP server
  - Either the server PI must be running as a daemon and listening on a well known port
  - Or some other service must be listening on the port and be configured to invoke the server PI.
- When the server PI receives a command that requires DTP activity, 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.
  - 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.
  - Compression, on-the-fly concatenation of multiple files etc
  - 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**
W. Hoschek, J. Jaen-Martinez, A. Samar, H. Stockinger, and K.Stockinger. In *Proceedings of the First IEEE/ACM International Workshop on Grid Computing*, 2000.
- **The Globus Striped GridFTP Framework and Server**
W. Allcock, J. Bresnahan, R. Kettimuthu, M. Link, C. Dumitrescu, I. Raicu, and I. Foster. In *Proceedings of SC'05*, Nov. 2005.

This presentation is based on the intelligence of:

- Timur Chabuk and Raj Kettimuthu