

The Design of High Performance Data Replication in the Grid Environment

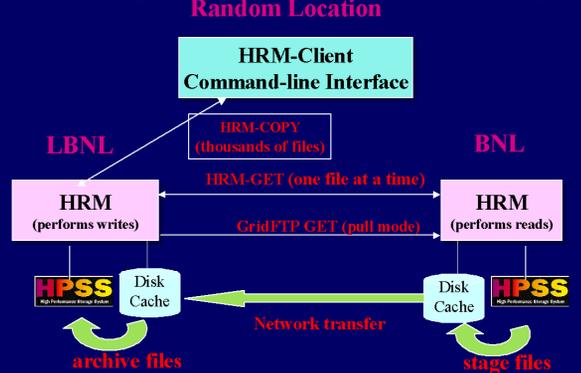
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The grid environment requires a sustained high-performance network to transfer large amounts of data between collaborating sites with high bandwidth connections. To satisfy this requirement, we will develop a grid-enabled data service infrastructure to replicate data across geographically distributed sites. This infrastructure will consist of several pieces. A network instrumentation module, based on Network Weather Services (NWS), will collect monitoring information about end-to-end network performance. A prediction module, based on performance history, will estimate the available network bandwidth. A data mover module, based on GridFtp and BBFTP, will transfer large amounts of data across the Internet. The Storage Resource Management (SRM) module will be used to manage the distributed data caches, and a scheduler module will use a maximum network flow algorithm to arrange the data replication from a data depot to a destination site. This paper will provide the details of integrating these five modules into a well-defined framework. We will target the creation of an unprecedented collaborative working environment for the Relativistic Heavy Ion Collider (RHIC) experiments at Brookhaven National Laboratory.

Network Weather Service Functionality

- **The Network Weather Service (NWS)**
Developed at UCSD. Monitoring and forecast the performance of Network
 - **Monitors** the deliverable performance available from a distributed resource set.
 - **Forecasts** future performance levels using statistical forecasting models.
 - **Reports** monitor and forecast data to interested client schedulers, applications, visual interfaces, etc.
- **Generally available Grid service**
 - portable, extensible, robust, scalable, etc-able

Storage Resource Manage



GridFtp

- **ANL, U of Chicago, and ISI.**
- **FTP protocol is defined by several IETF RFCs**
- **Start with most commonly used subset**
 - Standard FTP: get/put etc., 3rd-party transfer
- **Implement standard but often unused features**
 - GSS binding, extended directory listing, simple restart
- **Extend in various ways, while preserving interoperability with existing servers**
 - Striped/parallel data channels, partial file, automatic & manual TCP buffer setting, progress monitoring, extended restart

Maximum Network Flow

- A flow of a network is an assignment of an integer value to each edge at a network that satisfies the following properties:
 - capacity rule
 - Conservation rule
- The maximum flow problem is to find the flow with the largest value of all flows for a network
- Applications:
 - Traffic movements
 - Freight Transportation

