StorNet

Brookhaven National Laboratory
Lawrence Berkeley National Laboratory
People involved

- **BNL - TeraPaths**
  - Dantong Yu
  - Dimitrios Katramatos
  - Xin Liu

- **LBNL – BeStMan/SRM**
  - Arie Shoshani
  - Junmin Gu
  - Vijaya Natarajan
  - Alex Sim
StorNet Project Overview

• **Project Goals:**
  • Design and develop an integrated end-to-end resource provisioning system for high performance data transfers
  • Improve resource utilization by co-scheduling network and storage resources and ensure data transfer efficiency
  • Support end-to-end data transfers with a negotiated transfer completion timeline.

• **Impact of StorNet on Science**
  • Scheduling Network and Storage as a 1st Class Resource through Virtualization
  • Provide a holistic approach for DOE data-intensive applications to share data
  • Provide data management capabilities commensurate with exascale computing
1. Client submits data transfer request to BeStMan instance

2. BeStMan obtains storage parameters and inquire transfer requirements

3. BeStMan sends network bandwidth reservation parameters to TeraPaths

4. TeraPaths instances negotiate end-site LAN reservation parameters

5. TeraPath negotiates WAN reservation parameters with OSCARS

6. TeraPath gets back with best-effort bandwidth availability.
Enhancements Needed for StorNet

- **BeStMan enhancements to:**
  - Keep track of bandwidth commitments for multiple requests
    - Both storage and network bandwidths
    - Backend database support
  - Coordinate between source and target BeStMan instances for storage space and bandwidth
  - Support advanced reservation for future time window commitments
  - Communicate and coordination with underlying TeraPaths

- **TeraPaths enhancements to:**
  - Receive network bandwidth requests from BeStMan with inputs (volume, max-bandwidth, max-completion-time)
  - Negotiate with OSCARS for “best” time window
    - “best” can be earliest completion time, or shortest transfer time
  - If success, return to BeStMan and commit reservation if BeStMan desires.
  - If failure, find closest suggestion and return to BeStMan
BeStMan-TeraPaths API

• **Main functions:**
  - `reserveRequest()`
    - Input: flow specs (source/destination IPs and ports), bandwidth, start time, end time, transfer volume
    - Output: request token, reservation ids
  - `commitRequest()`
    - Commits the network reservation.
  - `cancelRequest()`

• **Auxiliary functions**
  - `statusRequest()`
  - `extendTimeoutRequest()`
    - Extends timeout if additional time is needed before committing
  - `modifyRequest()`
    - Modifies request parameters – primarily needed when flow specs are not known at time of reserve request
Workflow in StorNet

1. SRM Client submits the simple request to the target BeStMan for srmCopy.
2. Target BeStMan checks the local disks for the capacity and availability.
3. Target BeStMan communicates and negotiates with source BeStMan for the capacity and availability.
   3.1. Source BeStMan checks the local disks for the capacity and availability.
4. Target BeStMan communicates with target TeraPaths to check the bandwidth.
   4.1. Target TeraPaths communicates and negotiates with source TeraPaths for capacity and availability.
   4.2. Target TeraPaths communicates with OSCARS for the bandwidth capacity and availability.
5. Target BeStMan communicates with target TeraPaths to reserve the bandwidth.
   5.1. Target TeraPaths reserves network.
6. Target BeStMan initiates and completes GridFTP file transfer from the target disk to the source disk.
• Year 1:
  • Analysis of storage/network co-scheduling requirements
  • BeStMan/TeraPaths integration: design of StorNet API
  • Design and implementation of enhancements to BeStMan and TeraPaths
  • Implementation of StorNet API
  • Deployment and testing of basic functionality on the BNL and UMich TeraPaths testbed
Year 1 Accomplishments

• **LBNL Accomplishments**
  - Coordination and management of the end-to-end storage resource and bandwidth reservation
  - Coordination with network resource provisioning service (TeraPaths) for advanced network reservations
  - Management of the negotiated end-to-end storage and network resources

• **BNL Accomplishments**
  - Design and implementation of intelligent multi-domain bandwidth allocation algorithms
  - Management of the end-to-end network resource negotiation and configuration
Year 2 Plan

- **Implementation:**
  - Additional support required for aux. calls
    - Request modifications - modifyRequest()
    - Request status query - statusRequest()
    - Request timeout extension - extendTimeoutRequest()
  - Detection/resolution of flow spec conflicts
  - Reservation negotiation
  - Support for multiple-window requests

- **Testbed:**
  - Further deployment at LBNL

- **Testing:**
  - Multiple requests with overlapping windows
**Information**

- **StorNet**
  - [http://sdm.lbl.gov/stornet/](http://sdm.lbl.gov/stornet/)

- **E-mail**
  - [stornet@lbl.gov](mailto:stornet@lbl.gov)