Introduction to NorduGrid

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What is NorduGrid?

• Initially a project funded by the Nordic Council of Ministers aiming at creating a grid infrastructure in the Nordic Countries (May 2001 – April 2003)
• Now, the project is continued as a scientific collaboration where work is distributed between the participating institutes
• The collaboration is responsible for maintaining and further developing the NorduGrid Toolkit
The NorduGrid Testbed

- Computing centres
  - NSC
  - HPC2N
  - Parallab
- University departments
  - UU, SU, LU
  - UiO, UiB
  - HIP, NBI
In order to build a grid from a set of geographically distributed clusters you need:

- Secure authentication and authorization
- Access to information about available resources
- Fast and reliable file transfers

These services are provided by the so-called middleware.

Most grid projects have built their middleware using the Globus Toolkit as a starting point.
The Globus Toolkit

• Middleware services provided by Globus Toolkit:
  • The Globus Security Infrastructure (GSI)
    • Authentication and authorization using certificates
    • Proxy certificates allow single sign-on
  • The Metadata Directory Service / The Monitoring and Discovery Service (MDS)
    • LDAP based information system with caching
  • The GridFTP protocol for fast file transfers
  • The Replica Catalog
    • LDAP based database that keeps track of where physical copies of a given logical file is available

• See Olle Mulmo’s talk tomorrow for details
The NorduGrid Toolkit

• The NorduGrid Toolkit is based on the services and protocols of the Globus Toolkit
• Information providers that publish information about the state of the available resources and jobs in the Globus MDS
• A user interface that uses the information to select a suitable cluster to submit the job to
• A grid-manager daemon that accepts the job at the cluster and submits it to the local resource management system
• A GridFTP server for file transfers
The NorduGrid User Interface

- The NorduGrid user interface provides a set of commands for interacting with the grid
- `ngsub` – for submitting jobs
- `ngstat` – for states of jobs and clusters
- `ngcat` – to see stdout/stderr of running jobs
- `ngget` – to retrieve the results from finished jobs
- `ngkill` – to kill running jobs
- `ngclean` – to delete finished jobs from the system
- `ngcopy` – to copy files to, from and between file servers and replica catalogs
- `ngremove` – to delete files form file servers and RC’s
The Information System

- Based on Globus MDS with NorduGrid specific information providers
- Each grid unit (cluster, storage element, ...) runs its own Grid Resource Information Server (GRIS)
- The GRIS’s register themselves to a national Grid Information Index Server (GIIS)
- The National GIIS’s register themselves to a set of top level GIIS’s, creating a hierarchal information system
The Information System (cont’d)

• There are several ways to access the information system:
  • the grid-info-search command (shows raw LDAP entries)
    • grid-info-search -h grid.quark.lu.se \ -b "mds-vo-name=sweden,o=grid" -x
  • the NorduGrid User interface commands
    • ngstat -a -d1
  • the Grid Monitor
    • http://www.nordugrid.org/ – click on “Grid Monitor”
• Job requests sent to the NorduGrid should be described using the XRSL language
• The Resource Specification Language (RSL) is defined by Globus. Some extensions have been added by NorduGrid – therefore it is called Extended RSL (XRSL)
• Simple “Hello World” example:
  • & (executable="/bin/echo") (arguments=""Hello World"") (stdout=""out.txt"") (gmlog=""debuginfo""")
An Example

User

GIIS

Storage Element

Storage Element

Grid Manager

Cluster

Grid Manager

Cluster

GIIS registrations

Replica Catalog
An Example

MDS queries

User

Grid Manager

Cluster

GIIS

Storage Element

Storage Element

Replica Catalog

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An Example

Input file size & location queries
An Example

Brokering and submission of XRSL
An Example

Input file upload

User
GIIS

Storage Element
Storage Element

Grid Manager
Cluster

Grid Manager
Cluster

Replica Catalog

Input file download
An Example

Run the job
An Example

Upload output files
An Example

Download remaining output files
Getting Started

• The following two documents are essential:
  • The User Interface Manual
  • The XRSL Manual
• Both can be found on the “Documentation” section of the NorduGrid web site http://www.nordugrid.org/