



A Canada-Wide Computational and Storage Grid

Grid Canada

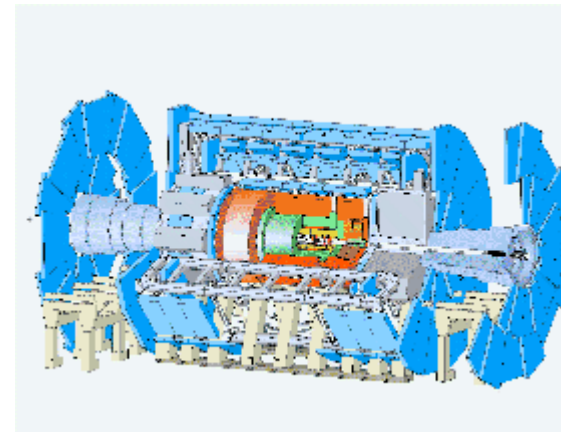
Alberta, CANARIE, NRC, Pacific Forestry Centre, Victoria

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GC Computational Grid



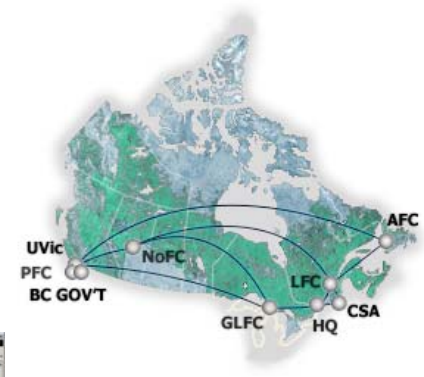
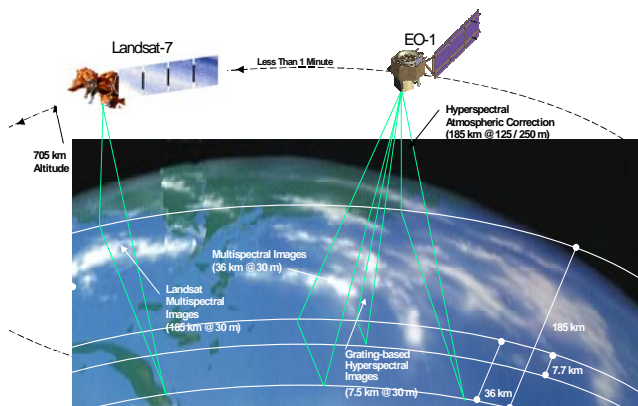
- Motivated by the need for a Grid for the ATLAS Particle Physics Experiment at CERN
- ATLAS will begin recording high energy proton-proton collisions in 2007 collecting 1 PB/year
- ATLAS will use a Grid of computational and storage resources around the globe
- ATLAS-Canada will centre on a TRIUMF Facility together with a Grid of University Computing resources



Forestry Data Grid



Canadian Forest Service's Pacific Forestry Centre



Landsat/Radarsat images of Canada made available to forestry researchers via a Web-based DataGrid

Outline



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- GC Certificate Authority
 - GC Computational Grid
 - Grid Information Service
 - User access
 - Job Submission
 - Grid/Job Monitoring
 - Grid Manager and Resource Broker
 - Plans

GC Certificate Authority



Darcy Quesnel, CANARIE (Grid Master)

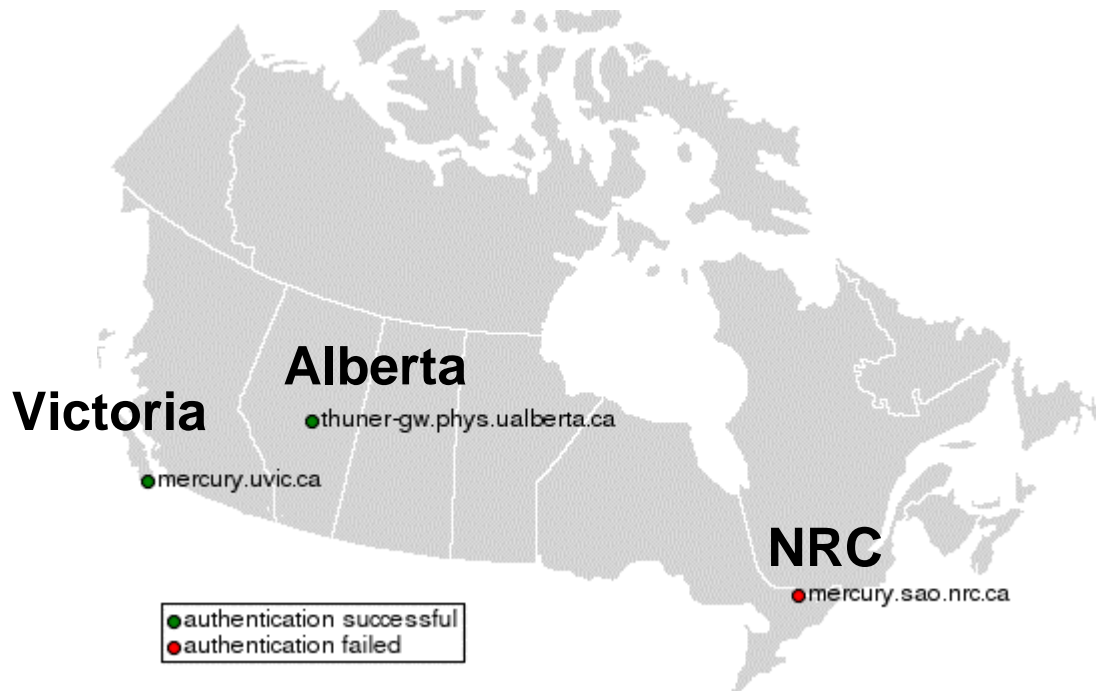
- GC must abide by international CA agreements (EU DataGrid, GGF)
 - GC Certificates are internationally recognized
 - Each resource has a Host Certificate
 - Each users has a User Certificate (*passport*)
 - An organization/person must vouch for the user
 - Users create a time-limited User Proxy which is passed to a resource
 - A Certificate does not allow users to access any resource (*visa*)
 - User must have permission to use the resource
 - GC Computational Grid has a Gridmap File containing the User Certificates of authorized users
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GC Testbed



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- GC Testbed (2001-present)
 - Early tests of Grid concepts and technology
 - Approximately 50 computers at 12 sites across Canada
 - Particle Physics Applications
 - BaBar (SLAC) and ATLAS (CERN)
 - Results presented at the CHEP Conference 2003 (San Diego)
 - Currently used as a development platform
 - eg. new releases of the Globus middleware
 - GC Computational Grid (2003)
 - Goal is to establish a Grid using Production-level resources
 - Initial focus on a Computational Grid with DataGrid aspects to be incorporated at a later date
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GC Computational Grid



Victoria 108 CPUs
Alberta 120 CPUs
NRC 50 CPUs

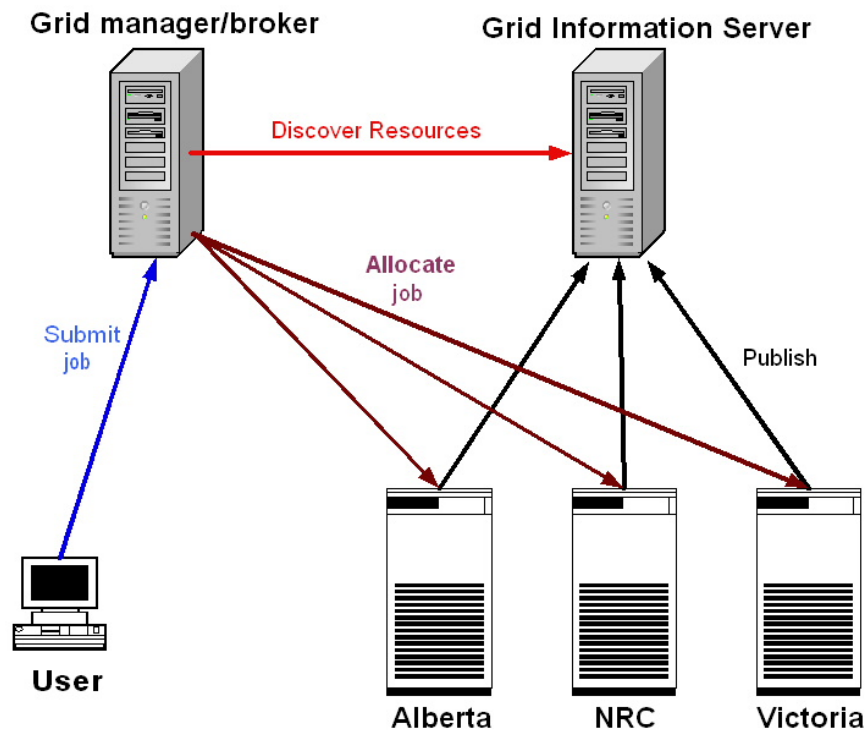
Intel CPUs with Linux OS
Globus Toolkit V2.4
OpenPBS/Maui scheduler

No root access at UVic and NRC

Victoria
Grid Manager/Broker

CANARIE
Grid Information Server

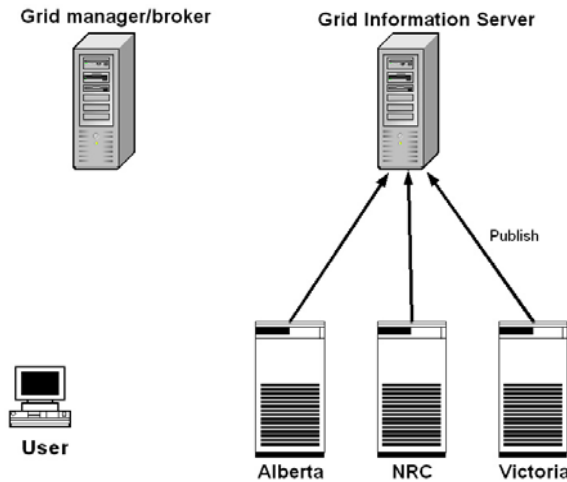
Grid Overview



Services

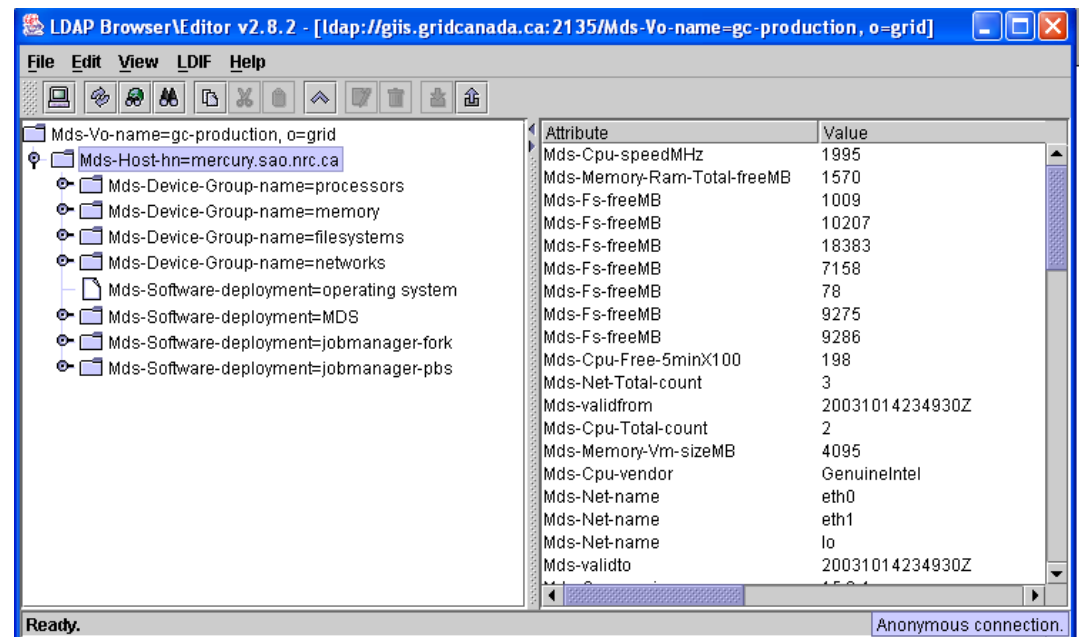
- information services
- user access
- resource broker
- monitoring

Grid Information Service



Resources publish information on system information and load to the GC GIIS
<http://giis.gridcanada.ca>

A resource broker can query the GIIS to find available resources

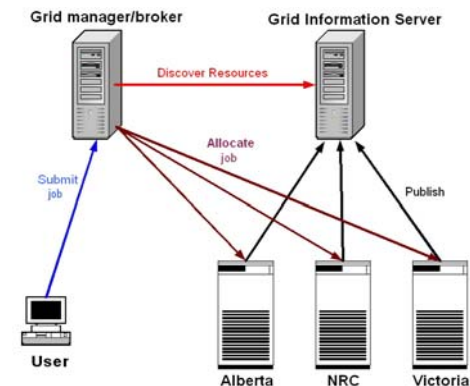


User access



- Generic accounts have been set up at each site
 - gcprod01, gcprod02, gcprod03, ... gcprod20
- Users create a Grid Proxy based on their User Certificate
- Users are mapped on a 1:1 basis into one of these accounts
 - Gridmap File contains a copy of the User Certificate
 - Identical at all 3 sites

- Users have no log in privileges
 - Software and data transfer via grid copy
 - Software compilation/linking done in batch
 - Job execution via batch scheduler



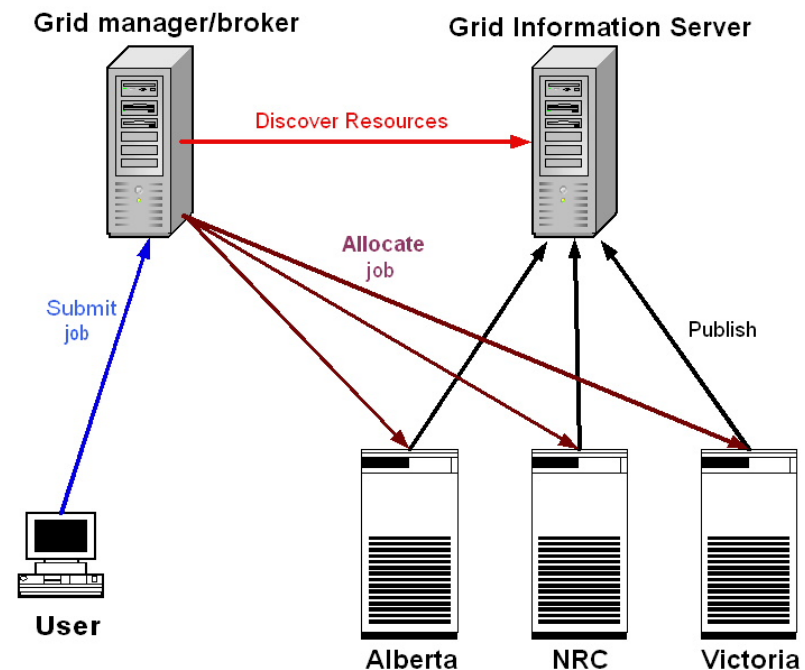
Job Submission



Globus Toolkit provides the means to discover resources and run applications on those resources.

It does not provide utilities to determine where the job will run

- **grid-proxy-init**
 - create Grid Proxy
- **gcsb <parameters>**
 - job is sent to Grid Manager/Broker
- **GC Manager/Broker**
 - identifies the user
 - locates resources open to the user
 - randomly submits job to the available resources



Grid Monitoring



Ganglia is used to monitor the status and load of the resource

mercury.uvic.ca

ALBERTA • CANARIE • NRC • VICTORIA • PFC

Located at the University of Victoria in Victoria, BC

Current Status	
CPU's Total: 200	Cluster Load Percentages <ul style="list-style-type: none">100+ (1.85%)75-100 (70.37%)50-75 (5.56%)0-25 (22.22%)
Hosts up: 54	
Hosts down: 0	Globus Gatekeeper: Pass
Avg Load (15, 5, 1m): 90%, 90%, 89%	GRIS: Pass
Localtime: 2003-10-11 20:17	GridFTP: Pass
	Batch Job Submission: Pass
	GIIS: Pass
	Time of Last Test: 2003-10-11 20:02:04
	Test Descriptions

System properties

Status of site

Current load on the system

Job Monitoring



Web-based monitor of job status

Grid Status

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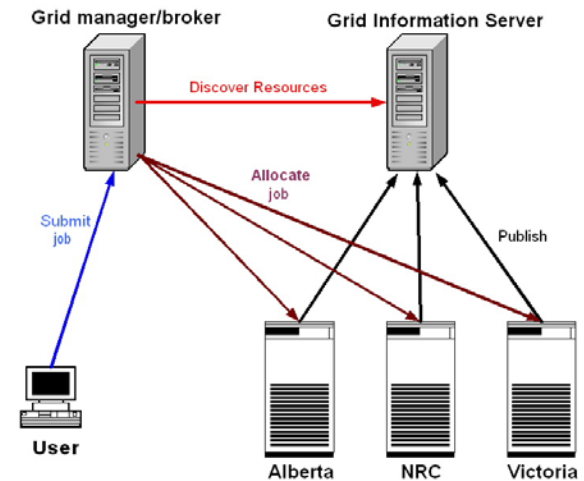
Status of Globus Job Queue

User	Filename	Arguments	Staged	Time Submitted	Status	Time Started	Resource	Globus Job ID
lmk	/usr/bin/whoami		no	2003-10-09 10:41:36	pending	2003-10-09 10:43:11	mercury.uvic.ca	https://mercury.uvic.ca:40001/9210/1065721366/
lmk	/usr/bin/whoami		no	2003-10-09 10:19:42	done	2003-10-09 10:20:22	mercury.uvic.ca	https://mercury.uvic.ca:40001/3066/1065719996/
dvanders	/homes/dvanders/test.sh		yes	2003-10-09 10:19:15	done	2003-10-09 10:20:13	mercury.sao.nrc.ca	https://mercury.sao.nrc.ca:17279/12893/1065720011/
dvanders	/homes/dvanders/test.sh		yes	2003-10-09 10:14:20	done	2003-10-09 10:16:17	mercury.sao.nrc.ca	https://mercury.sao.nrc.ca:17247/11864/1065719776/

Grid Manager/Broker



- Reviewing our current model for the Grid Manager/Broker
 - Some grids avoid the use of a central Grid Manager and put the intelligence into the client application (such as *gcsb*)
 - We see advantages in a Grid Manager for job monitoring, error recovery and job management
- Next step is to utilize the GIIS information
 - Workqueue (WQ) scheduler
 - Send jobs to free resources that meets specs
 - CPU, memory, disk space
- Looking at more sophisticated brokers
 - Optimize jobs on faster resources
 - Jobs on slow resources are replicated



Short-term Plans



- System is currently operational with simple applications
 - Installing ATLAS “Data Challenge” software and data using Grid tools
 - Software will be pre-installed but goal is to “grid-enable” the installation
 - Plan to increase size and scope of tests
 - Error handling and recovery
 - Recognize this as one of the more challenging areas based on our experience with the Grid Testbed
 - Resource Broker research
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Long-term plans



- Incorporate DataGrid components
 - Grid Manager will move jobs and/or data
 - Need network monitor
 - High speed network connections between the sites
 - Establish on-demand network connectivity
 - Additional sites
 - Expand to other sites across Canada
 - Link to the international grid projects
 - Grid-enable other applications
 - BaBar (SLAC) simulation production
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Summary



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- Grid Canada operates the Canadian Grid Certificate Authority
 - Grid Canada has established a production-level Computational Grid
 - Prototype service under test using realistic applications
 - Reviewing our model for the management of the Grid
 - Improve monitoring and error handling
 - Plans to add DataGrid capability and dedicated network connections
 - Goal is to use the GC Computational Grid for the 2004 ATLAS Data Challenge
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