ENABLING HIGHLY AVAILABLE GRID SITES

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Grid Computing and High Availability

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Current State of High Availability in Grids

Site-level HA-Grid Resources and Services

Using HA-OSCAR for Fault-tolerant Grids

Current State of High Availability in Grids

- High Availability (HA) is more common among clusters, servers, and mission-critical applications.
- The complexity of grids prevent the use of common HA techniques on the grid-level (site-to-site failovers).
  - Each grid site has a different infrastructure (hardware, networks, policies, et cetera…)
  - Grids connect over WANs
    - Short network timeouts possible (triggering false replication)
    - IP failover techniques don't work (different subnets)

So, are highly available grids even possible?

Most certainly.

Site-level HA-Grid Resources and Services

- Our approach is to remove single points of failure on cluster-based grid sites by component redundancy and self-healing capabilities.
  - A site refers to an organization, such as an institution or corporation, that lends its computing **resources** to a grid.
  - These resources are accessible through **grid services** setup at the site.
- By eliminating single points of failure, we can make the grid resources and services of a particular site highly available.
  - Single points of failure include:
    - A site's headnode
    - Compute nodes
    - Hardware equipment (hard drives, memory, switches, cables, etc)
- We should distinguish our work from "grid-level" HA. When a site becomes completely unavailable, we don't:
  - failover idle/running jobs to designated grid sites (too complex), and
  - allow for new jobs to be submitted to other sites (fault-tolerant grid resource selector).

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Using HA-OSCAR for Fault-tolerant Grids

- Underneath, HA-OSCAR uses two main components:
  - *mon* – "is a general-purpose scheduler and alert management tool used for monitoring service availability and triggering alerts upon failure detection." (http://www.kernel.org/software/mon/)
  - *Net-SNMP* – "is a widely used protocol for monitoring the health and welfare of network equipment (eg. routers), computer equipment and even devices like UPSs." (http://net-snmp.sourceforge.net)
- Failover mechanism for HA-OSCAR (simplified):
  1. Net-SNMP is used to detect single points of failure.
  2. Once a failure has been detected, mon calls a set of alert scripts that are used to confirm and act on the failure.
  3. At this time the IP of the standby headnode is switched over to the primary headnode and resumes all services that were running.
- Using the pre-existing HA functionality in HA-OSCAR, we can quickly develop the needed extensions to enable highly available grid sites.

Thus, if grid sites are made
highly available,
it is then possible to have
a grid that is
highly available.

Goals for DOSAR Workshop

Current HA-OSCAR Grid Projects **+** Condor's High Availability Daemons **=** Basic HA-Grid Site (non-OSG)

Combining the Available Pieces

Current HA-OSCAR Grid Projects + **Condor's High Availability Daemons**

- Multi-headnode failover/failback (stable)
- Failover of the PBS/Torque job queue (beta)
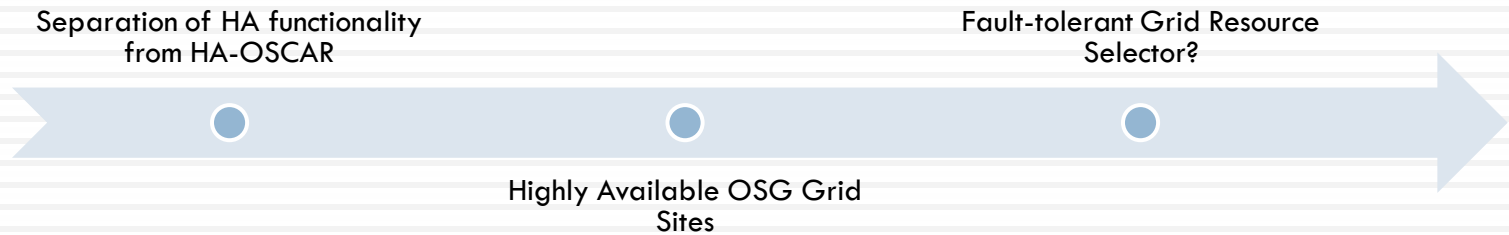- Failover of PBS/Torque jobs on the worker nodes (beta)

- Condor has built-in HA functionality for the Central Manager and job queue daemons.
  - CM: condor_negotiator and condor_collector
  - Job queue: condor_schedd
- More details can be found here:
  http://www.cs.wisc.edu/condor/manual/v6.8/3_11High_Availability.html

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Basic HA-Grid Site (non-OSG)

- We plan to setup a basic HA-Grid site for the DOSAR workshop using the grid projects of HA-OSCAR and Condor's HA daemons.

- Goals of HA-Grid site:
  - Job submission after a headnode failure
  - Idle and running jobs will remain in the job queue after a headnode failure
  - Job migration from a failed compute node to another available node

- Hopefully, we'll have an interactive demonstration at the DOSAR workshop!

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Future Work

Separation of HA functionality from HA-OSCAR

Fault-tolerant Grid Resource Selector?

Highly Available OSG Grid Sites

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Questions/Comments?