
Grid Aware HA-OSCAR

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Outline

- Introduction
- Traditional & Dual head Architectures.
- Proposed Framework
- Smart Failover framework
- Experiment
- Planned & unplanned downtime
- Conclusion
- Future work

Introduction

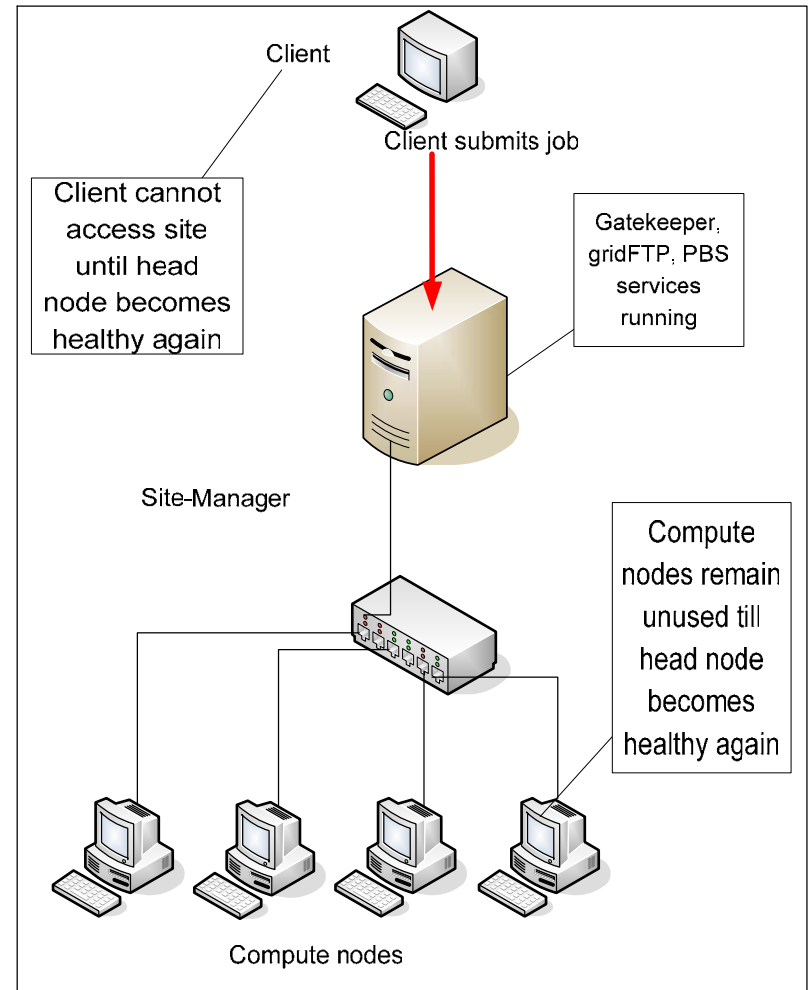
- Scientists across the world have employed Grid Computing to overcome various resource level hurdles.
- Clusters are favored job sites in grids.
- Rendering High availability becomes increasingly important as critical applications shift to grid systems.
- Though Grid is distributed , inevitable errors can make a site unusable leading to reduced overall resources and slowing down the speed of computation.

Introduction – continued...

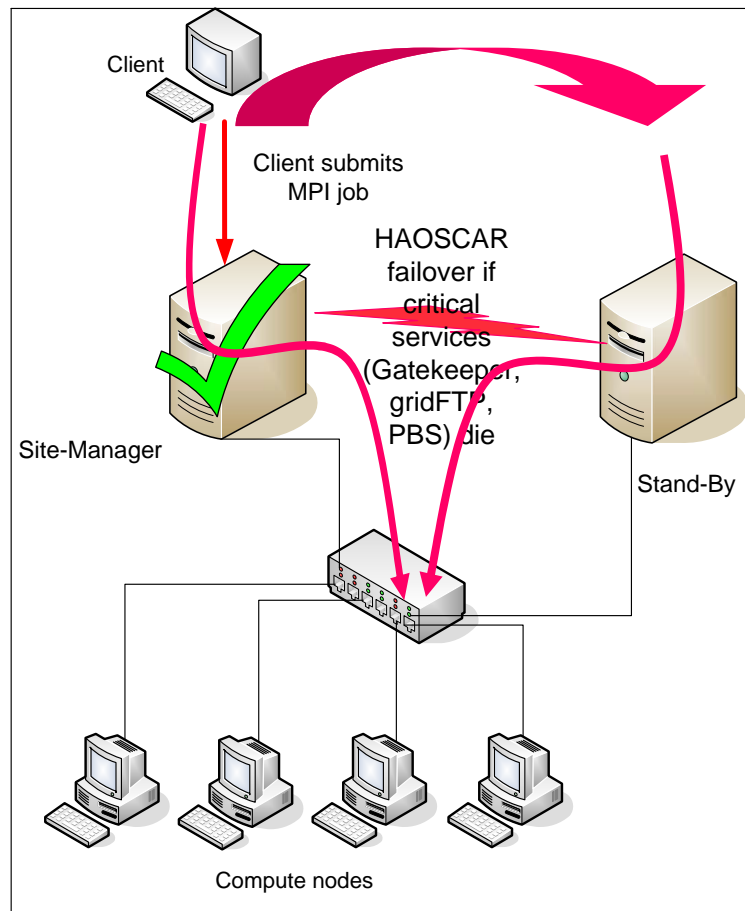
- Efforts need to concentrate on making critical systems highly available and eliminate single point of failures in grids and clusters.
- HA-OSCAR removes single point of failure of cluster based job site (Beowulf) by component redundancy and self-healing capabilities.
- Smart Failover feature tries to make failover mechanism graceful in terms of job management.

Traditional Intra site cluster configuration

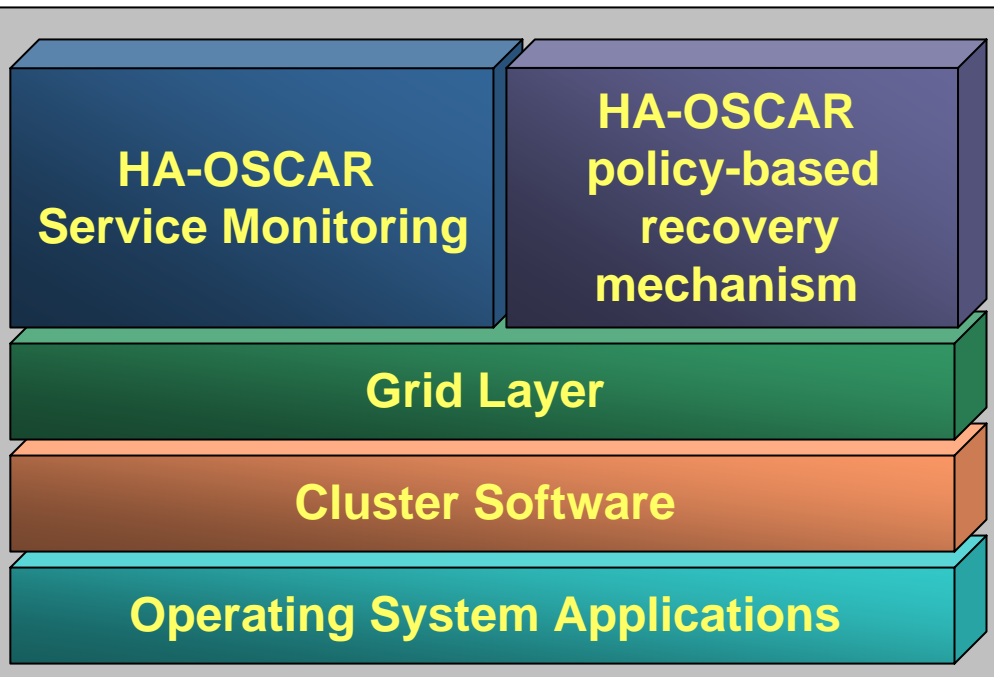
- Site-Manager is (cluster head node having Globus Services) the node acting as the gateway between the cluster and the grid.
- Site-manager is critical from point of site being used to its full potential.
- Failure of Site-Manager causes whole site to go unused till it becomes healthy.
- Outages are non-periodical and unpredictable and hence measures should be taken to guarantee high availability of services. Hence the proposed architecture.



Critical Service Monitoring & Failover-Failback capability for site-manager



Proposed Framework



Most of the current efforts have focused on task-level fault tolerance as in retrying the job on an alternate site.

There is dearth of solutions for fault detection and recovery at the site level.

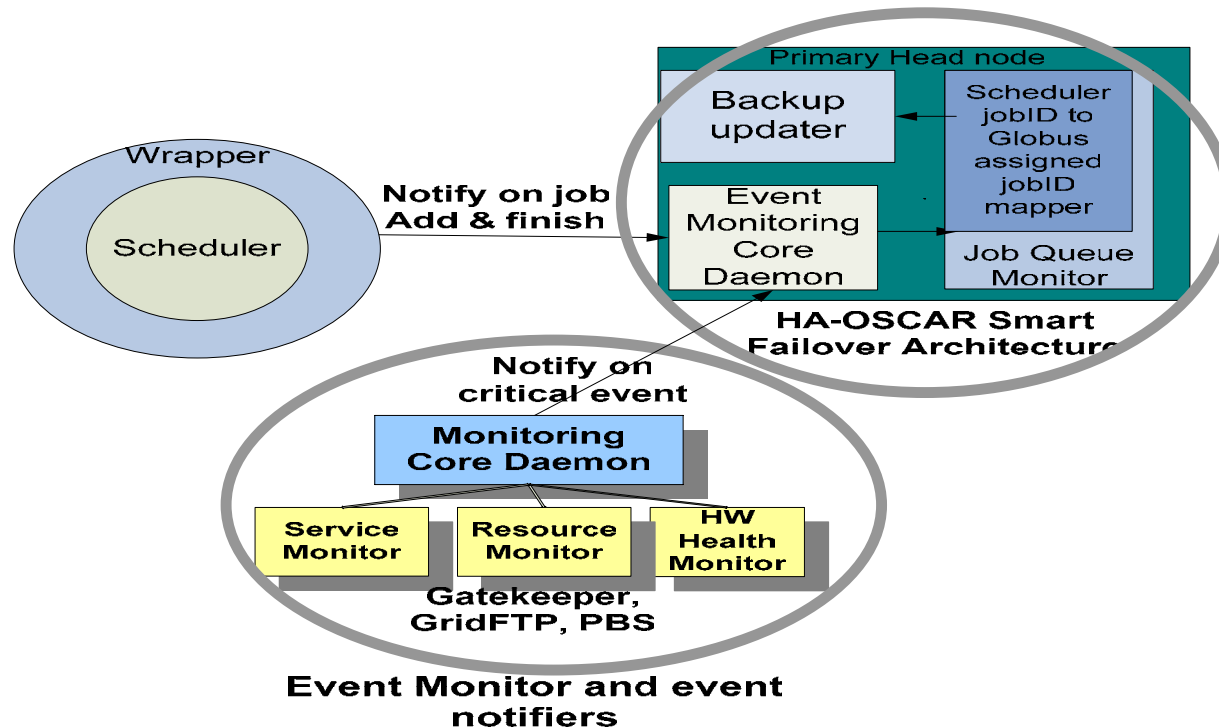
We monitor Gatekeeper & gridFTP services in the Service monitoring sublayer and failover & failback in irreparable situations.

Grid Enabled HA service

- The HA-OSCAR monitors the gatekeeper and gridFTP services every 3 seconds.
- When a service fails, to start after 3 attempts, failover happens.
- Standby also monitors Primary every 3 seconds to check whether it is alive.

Smart Failover Framework

- Event monitor triggers Job Queue monitor on events such as JOB_ADD, JOB_COMPLETE and system events
- On sensing change in job queue, job queue monitor triggers backup updater to update backup.



HA-OSCAR in a cluster based Grid environment

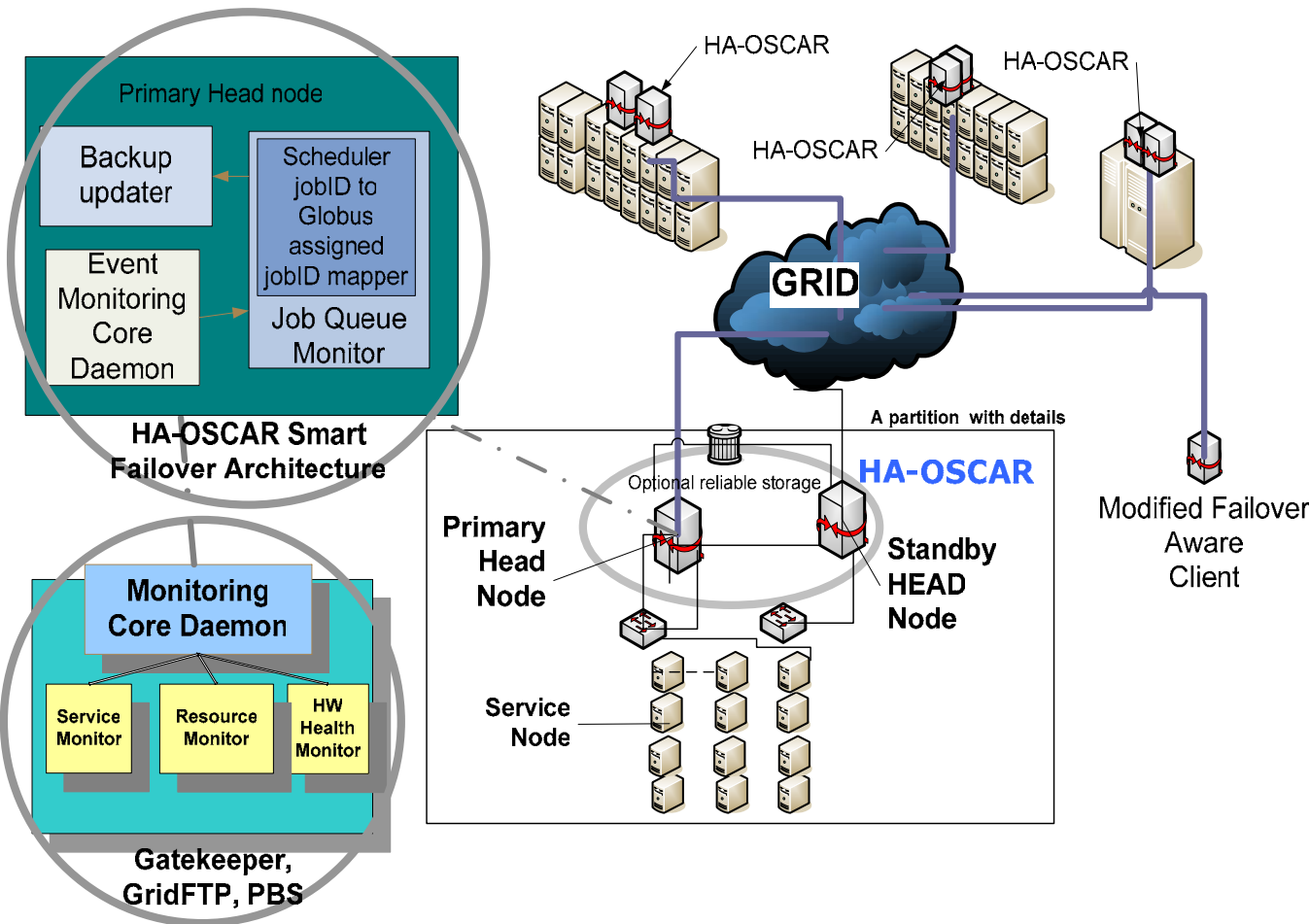
- Production-quality Open source Linux-cluster project

- HA and HPC clustering techniques to enable critical HPC infrastructure Self-configuration Multi-head Beowulf system

- HA-enabled HPC Services: Active/Hot Standby

- Self-healing with 3-5 sec automatic failover time

- The first known field-grade open source HA Beowulf cluster release

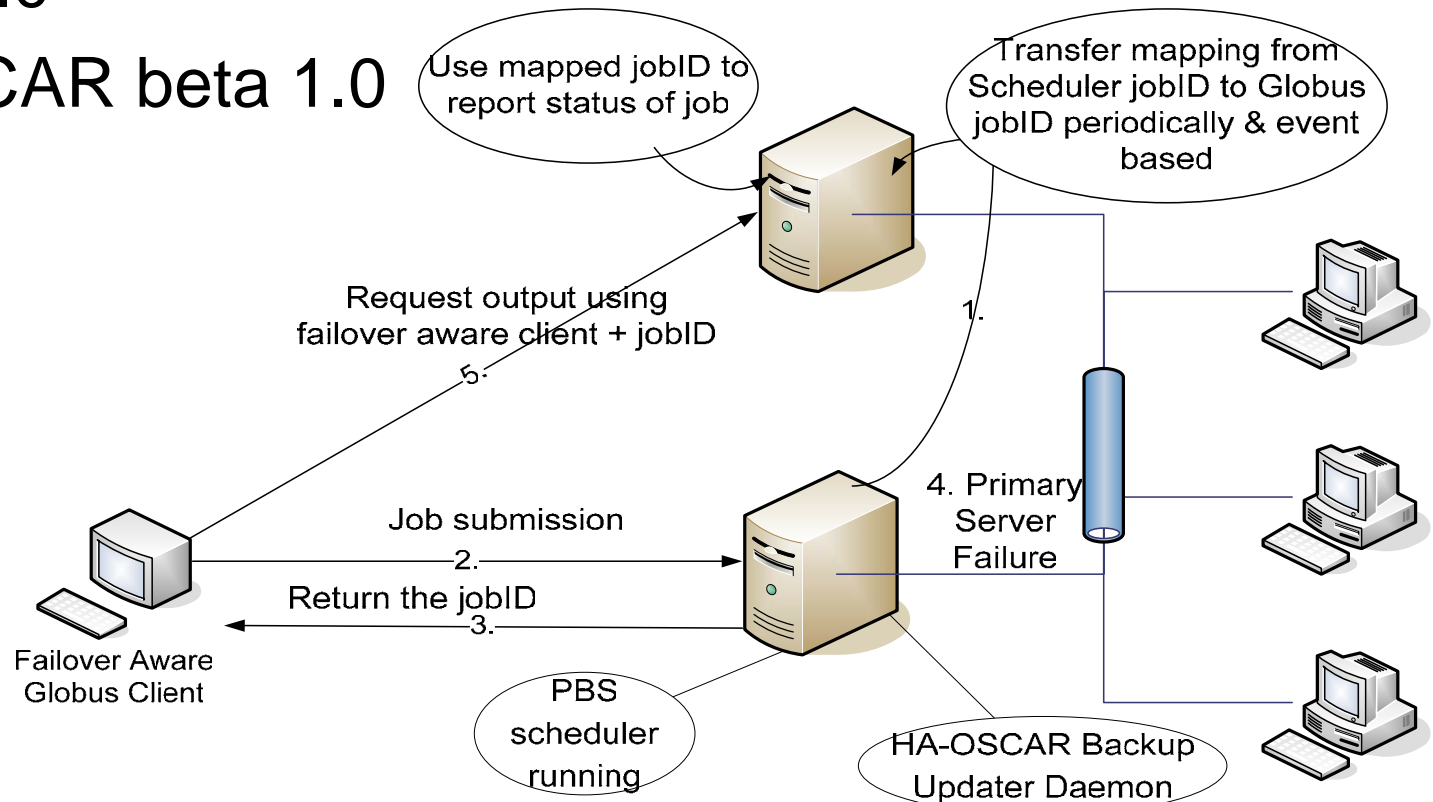


Experiment

- Globus Toolkit 3.2

- Oscar 3.0

- HA-OSCAR beta 1.0



Rainy Day Scenario

Observations

- Average Failover time was 19 seconds and average failback time was 20 seconds.

	Group	Service	Type	Time	Alert
1	Service_mon	Gate keeper	Alert	Sun Nov 21 09:10:30 2004	Xinetd.alert
2	Service-mon	Gate keeper	Up alert	Sun Nov 21 09:10:33 2004	Mail.alert

- Services were restarted in between 1-3 seconds depending on when last monitoring was done.

	Group	Service	Type	Time	Alert
1	Primary_server	Ping	Alert	Sun Nov 21 09:30:20 2004	Server-down Alert
2	Primary_server	Ping	Up alert	Sun Nov 21 09:35:39 2004	Server-up .alert

Time needed for jobs to complete with/without “Smart Failover”

- Assuming jobs start running after reboot on clusters.
- TLR = Time to complete last running jobs.

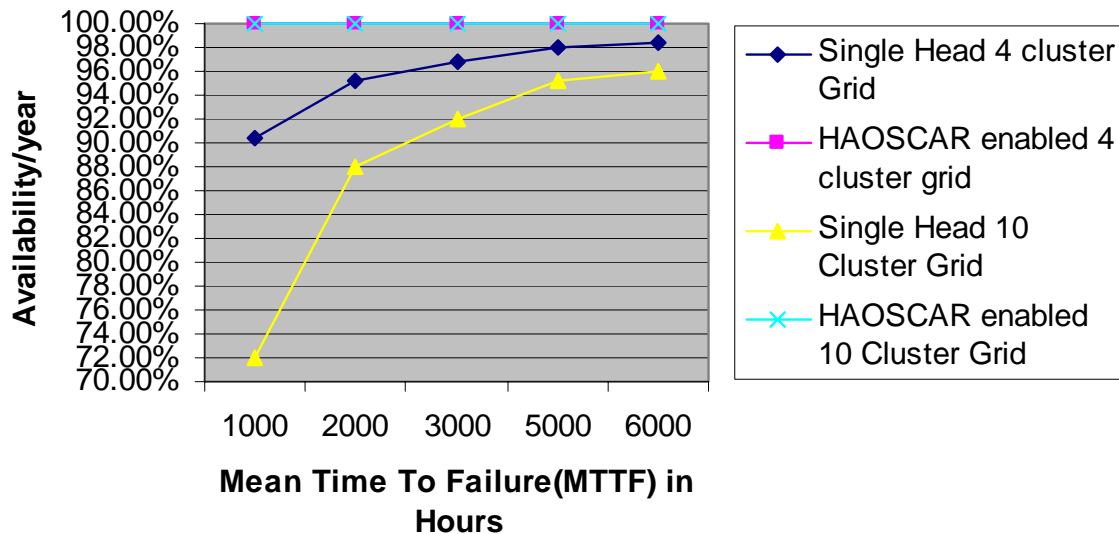
MTTR (seconds)	Total Time needed without Smart Failover feature	Total time needed with smart Failover feature
120 (2 min)	120 + run time of predecessors – TLR (running jobs lost)	20 + run time of predecessors + TLR
600 (10 min)	600 + run time of predecessors – TLR (running jobs lost)	20 + run time of predecessors + TLR
3600 (60 min)	3600 + run time of predecessors – TLR (running jobs lost)	20 + run time of predecessors + TLR
7200 (2 hours)	7200 + run time of predecessors – TLR (running jobs lost)	20 + run time of predecessors + TLR

Planned Downtime

- Time taken to setup and configure software adds to the planned downtime.
- We have developed an easy Globus Toolkit configuration helper package.
- Also helps installation of side packages, such as schedulers, MPI(s), etc.
- This will help reduce planned downtime by automating the process.

Unplanned Downtime

HAOSCAR enabled Grid Vs Traditional Grid



HA-OSCAR enabled Grid Vs Traditional Grid

Assumptions:

Package used: **SPNP**

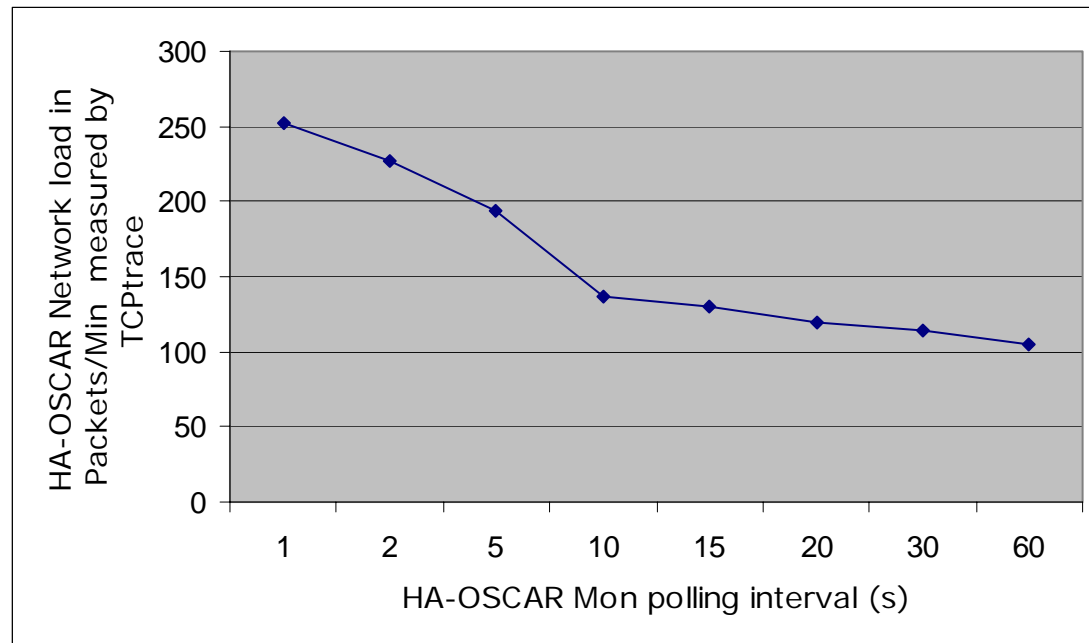
Availability for grid having traditional cluster as intra site solution : **0.968 i.e. 11.68 days downtime per year.**

Availability for grid having HA-OSCAR enabled cluster as intra site solution: **0.99992 i.e. 2 minutes downtime per year**

Hence the obvious availability gain.

Polling Overhead Measurement

- 20 sec failover time
- 0.9% CPU usage at each monitoring interval



Comparison of network usages for HA-OSCAR different polling sizes

Summary

- Institutions have significant investment in resources and that needs to be guaranteed.
- “Smart Failover” HA-OSCAR makes failover graceful in terms of job management.
- “Smart Failover” HA-OSCAR with Failover Aware solution for site-manager provides better availability, self healing and fault tolerance.
- HA-OSCAR ensures service and job level resilience for clusters and grids.

Current status

- Smart failover feature tested with Oscar 3.0, OpenPBS as the scheduler.
- Failover Aware client written to achieve resilience for jobs submitted through grid.
- Lab grade automated Globus installation package ready.

Future Work

- Develop the wrapper around scheduler for per job add/complete events.
- Testing of Smart failover feature with the event monitoring system.
- Integration of “Smart Failover” in next release of HA-OSCAR
- Research into lazy failback mechanism.

Thank You