

Cloud Computing for HPC



William Lu Platform Computing

Platform Trends

- Increasing demand for compute power in simulation, analysis, and research
 More Data, More Compute, More Analysis
 - More Data, More Compute, More Analysis
- Organizations are searching for an integrated management stack to further improve user service level and simplify HPC operations

Platform Plans to Deploy Private Cloud in 2009



Source: International Supercomputing Conference 2009 attendee survey

Platform Motivations for Private Cloud



Source: International Supercomputing Conference 2009 attendee survey

Platform Barriers to Private Cloud



Source: International Supercomputing Conference 2009 attendee survey

Platform Challenges in HPC grid/clusters

- Job interference
 - Memory leak
 - Run time environment (OS+tools)
- Security
- "One fits all" scheduler
 - Fair share with history vs. current resource allocation

Platform Reality Behind Resource Allocation

• Static (advance) Allocation vs. Real



Time

Realities

- Lacking of visibility of real workload
- This delivers SLA/QoS
- But... real utilization is low

Platform Elastic vs. Traditional Scheduling



Time

Platform Resource Scavenging

• Scavenging resources in desktop, labs, external data centers, public cloud...



Platform Different job environment



Time

• Job runtime environment needs to be dynamically scheduled together with the job

Platform[®] Moving from Cluster/Grid to Cloud Multiple Apps /Multiple Clusters Dynamic and elastic Single App Grid Cluster Cloud

Platform Management of Private Cloud for HPC



Platform Software Stack from Platform Computing

Platform MPI

Platform LSF

Platform ISF Platform ISF HPC Cluster

VM management	Provisioning
Internal Data center	External Data Center/ Public Cloud

Platform Large Research Institute

Profile	Problems	Solution			
HPC center with thousands of servers used by multiple user groups for data analysis	 Application environment set up is too long Job fails due to application environment conflicts on the same server Scheduling policy conflicts across multiple user groups causing user dissatisfaction 	 Elastic and autonomous Platform LSF clusters scheduled by Platform ISF for each user group When workload changes, Platform ISF dynamically add and remove resources from individual clusters VM is used as job container to reduce job interference 			



	Before	After
User support incidence	15/day	2/day
Job failure due to app environment conflict	5/day	~0
App env set up time	1 weeks	1 day

Platform Reservation & On-Demand Allocations

- On-Demand: First-come, first server capacity
 - Pay-per-use for non-critical or burst workloads

Guaranteed Reservation:

- Reserve resources for critical workloads
- Optimization utilization, guaranteed capacity



Platform Resource-Aware Allocation Policies

Packing	 Pack workload on fewest number of physical servers Maximizes usable capacity, reduces fragmentations, reduce energy consumption 	
Striping	 Spread workload across as many physical servers as possible Reduce impact of host failures, higher application performance 	
Load-Aware	 Allocate physical servers with lowest load to new workloads Higher application performance 	
HA-Aware	 Allocate HA-enabled resources to critical workloads Match availability levels to service requirements and costs 	Production datacenter HA datacenter
Energy-Aware	 Place workload according to energy indices and datacenter hot spots Reduce energy consumption 	
Affinity-Aware	 Place workload close to critical resources such as storage Higher application performance 	
Server Model- Aware	 Allocate resource to workload according to model types Maximize utilization of higher performing & more expensive resources 	
Topology-Aware	 Allocate resources on the same interconnect to the same application Improve application performance 	Rack 1 Rack 2

Platform[®] **Reporting and Accounting**

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Platform User Access Point – LSF Web Portal

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Platform User Access Point – LSF Web Portal

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Platform Summary

- Cloud is happening due to its superior SLA
- Cloud is to add dynamics and elasticity to grid and cluster environment
- Platform ISF delivers elastic logical clusters in a shared HPC infrastructure. It transforms cluster and grid to cloud

Platform Thank You

The Power of Sharing

www.platform.com