Nimbus Platform: How Does Your Cluster Grow?

Kate Keahey
keahey@mcs.anl.gov
Argonne National Laboratory
Computation Institute, University of Chicago
Ocean Observatory Initiative (OOI)

- Towards Observatory Science
- Sensor-driven processing
  - Real-time event-based data stream processing capabilities
  - Highly volatile need for data distribution and processing
  - An “always-on” service
- Nimbus team building platform services for integrated, repeatable support for on-demand science
  - High-availability
  - Auto-scaling
- From regional Nimbus clouds to commercial clouds
What’s New About Clouds

• Cloud computing benefits…
  – On-demand access (manage peaks)
  – Pay-as-you-go (manage valleys)
  – Virtualization (custom environments)
  – Outsourcing (convenience, articulation)

• …enabling scenarios
  – Support of sensor-based processing
  – Support for “brainstorming” scenarios
  – Support for community/processing growth
If Wishes Were Fishes...
Managing Domains

Domain Management
Monitor and regulate domain properties
based on system-specific and application-specific metrics
Phantom: Domain Management

Application-specific qualities: e.g., workload queALiEn, PBS, AMQP, and others

Generic/system qualities: deployment status, load, bank account, etc.

create, manage, destroy

Sensor Input

Domain Manager

Decision Engine

Provisioner

IaaS

CTX

Image Library

Lifecycle states

Policy

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Sensor Information

- Sensor Information:
  – Lifecycle states
  – Contextualization
  – Heartbeat
  – Special process monitoring
  – System sensors
    • TSDB
    • CloudWatch
  – Application-specific sensors

- Extensible set
Phantom Interfaces and Clients

• Web application
• Scripting
  – Amazon autoscale API, boto-compatible
• AMQP interface
Working with Process Management I

- Process Instance Registry
- Process Definition Registry
- OOI Process Dispatcher
  - Decision Engine
- VM Instance
  - PD agent

request to run process X
Working with Process Management II

- Domain Manager
  - create instance
  - request instance

- Provisioner

- IaaS

- VM Instance
  - PD agent

- OOI Process Dispatcher
  - Decision Engine
  - enter
  - lookup
  - launch

- Process Instance Registry
- Process Definition Registry

request to activate process X
Process Management with Swift

Phantom

- Workflow
- Process Dispatcher
- Torque Scheduler
- Condor Scheduler

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Using Nimbus Domains

Message Queue
- M subtask messages

queue\texttt{length}

Application

Define tasks

Gather results

Phantom

Get task

Infrastructure
Compute Cloud

Results/Checkpoints

Cumulus/S3

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CloudBurst!

- Phantom
- Workflow
- Process Dispatcher
- Torque Scheduler
- Condor Scheduler

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Adventures in Availability

Mean time between failures

\[ A = \frac{MTBF}{MTBF + MTTR} \]

Mean time to repair

- Time to repair (TTR)
  - Diagnosis
  - Time to scale (TTS)
    - PENDING (request)
    - STARTED (deployment)
    - RUNNING (contextualization)

TTS: preliminary results for 2,000 VMs provisioned on AWS EC2
Parting Thoughts

• Our world used to be bounded by the size of a cluster -- this is no longer the case
• Phantom is bridging the old and the new
• Tell us what you could do with an elastic cluster!

Get on FutureGrid and give it a whirl!
www.nimbusproject.org/phantom
Nimbus Team

Kate Keahey
Argonne National Lab
University of Chicago

Patrick Armstrong
University of Chicago

David LaBissoniere
University of Chicago

Pierre Riteau
University of Chicago