Nimbus Platform:
How Does Your Cluster Grow?

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- 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.

Lifecycle states

create, manage, destroy

Policy

Sensor Input

Domain Manager

Decision Engine

Provisioner

Image Library

IaaS

CTX

NIMBUS

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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

enter

OOI Process Dispatcher

lookup

Decision Engine

request to run process X

launch

VM Instance

PD agent

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Working with Process Management II

- Domain Manager
  - Provisioner
- IaaS
- VM Instance
- PD agent

Processes:
- Process Instance Registry
- Process Definition Registry

- OOI Process Dispatcher
  - Decision Engine
  - enter
  - lookup
  - request to activate process X
  - create instance
  - request instance
  - launch
Process Management with Swift

Phantom

Workflow

Process Dispatcher

Torque Scheduler

Condor Scheduler

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Using Nimbus Domains

- Application
- Phantom
- Cumulus/S3
- Message Queue
  - M subtask messages
  - queue\_length

Get task

Define tasks

Gather results

Results/Checkpoints

Infrastructure Compute Cloud

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CloudBurst!

[Diagram showing connections between Phantom, Workflow, Process Dispatcher, Torque Scheduler, and Condor Scheduler]
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
Mary, Mary, quite contrary
How does your cluster grow?

With power bills and server kills
And racks all in a row

As things come up, it is a snap
It goes where I want it to go