



[www.chameleoncloud.org](http://www.chameleoncloud.org)

## CHAMELEON: DEMO

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*Washington, DC*

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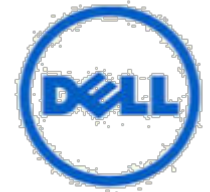
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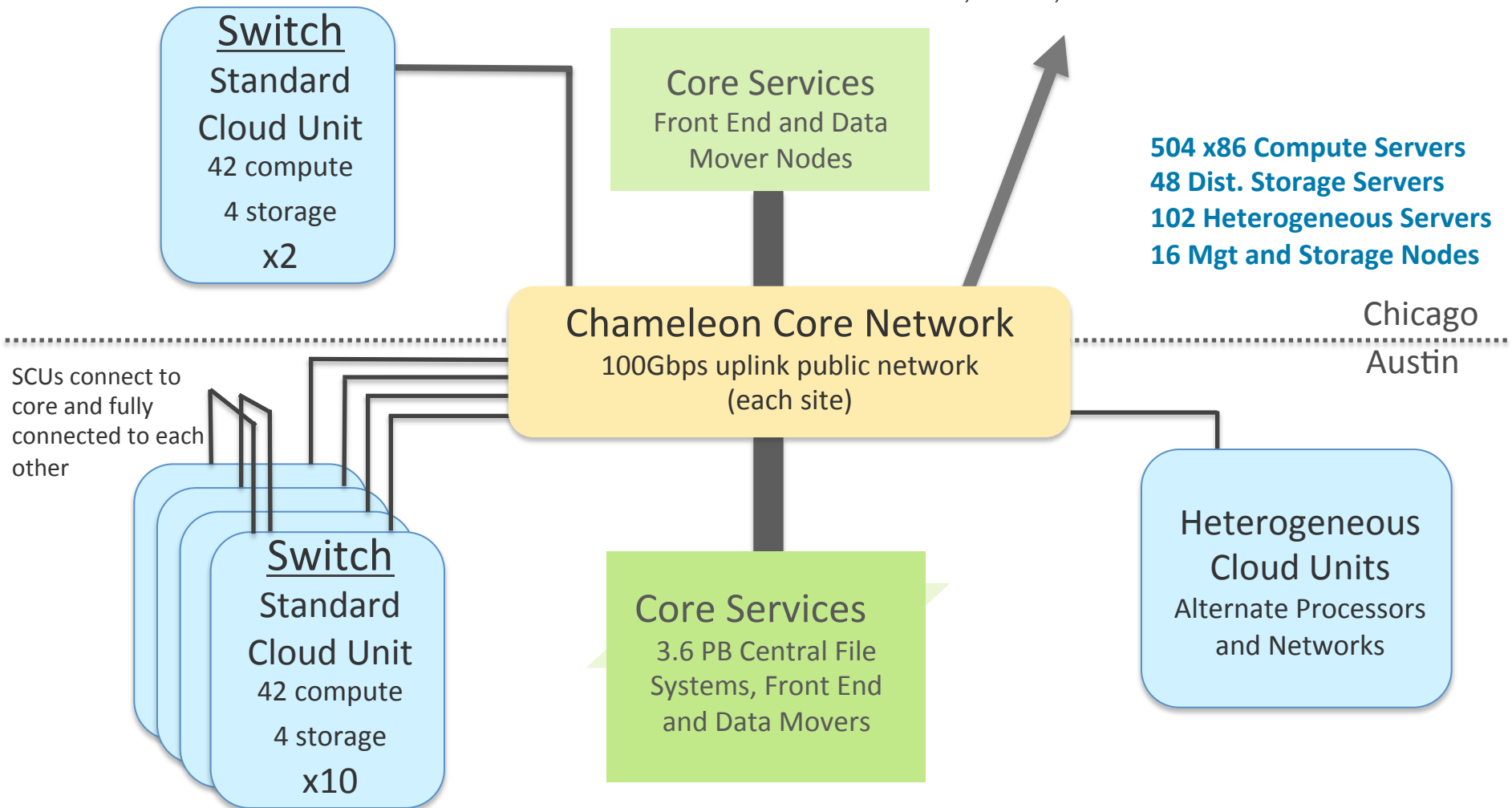
# CHAMELEON: A FLEXIBLE AND POWERFUL EXPERIMENTAL INSTRUMENT

- ▶ **Large-scale:** “Big Data, Big Compute, Big Instrument research”
  - ▶ ~650 nodes (~14,500 cores), 5 PB disk over two sites, 2 sites connected with 100G network
- ▶ **Reconfigurable:** “As close as possible to having it in your lab”
  - ▶ Bare metal reconfiguration, single instrument, Chameleon appliances
  - ▶ Support for repeatable and reproducible experiments
- ▶ **Connected:** “One stop shopping for experimental needs”
  - ▶ Workload and Trace Archive
  - ▶ Partnerships with production clouds: CERN, OSDC, Rackspace, Google, and others
  - ▶ Partnerships with users
- ▶ **Complementary:** “Can’t do everything ourselves”
  - ▶ Complementing GENI, Grid’5000, and other experimental testbeds

# CHAMELEON HARDWARE



To UTSA, GENI, Future Partners



# CAPABILITIES AND SUPPORTED RESEARCH

Development of new models, algorithms, platforms, auto-scaling HA, etc., innovative application and educational uses

*Persistent, reliable, shared clouds*

Repeatable experiments in new models, algorithms, platforms, auto-scaling, high-availability, cloud federation, etc.

*Isolated partition, Chameleon Appliances*

Virtualization technology (e.g., SR-IOV, accelerators), systems, networking, infrastructure-level resource management, etc.

*Isolated partition, full bare metal reconfiguration*

# SOFTWARE: CORE CAPABILITIES

**Persistent Clouds**  
(OpenStack)

**Persistent Cloud**

**User Clouds**

## **Chameleon Appliance Catalog**

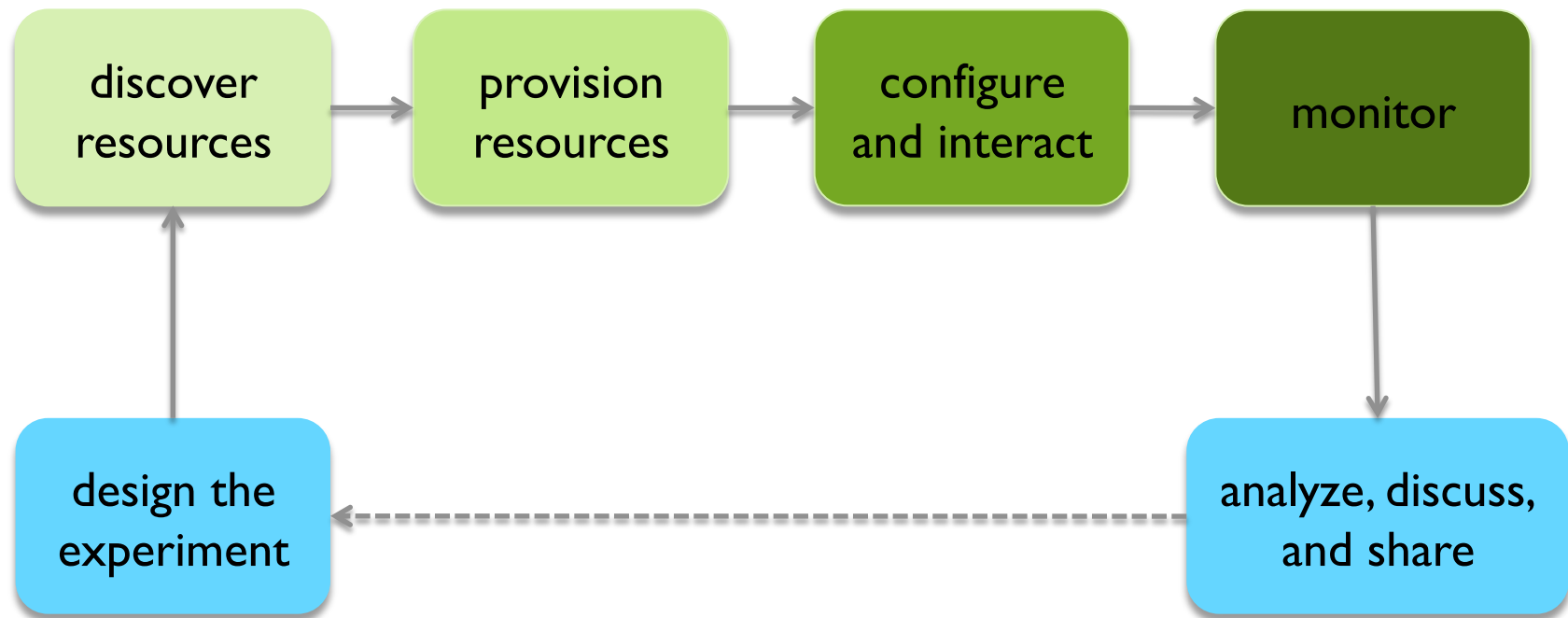
A library of generic, special-purpose, and educational appliances

## **Discovery, Provisioning, Configuration, and Monitoring**

New Chameleon Infrastructure combining:

- Testbed representation and discovery (Grid'5000)
- Provisioning, configuration, image management, monitoring (OpenStack)

# EXPERIMENTAL WORKFLOW

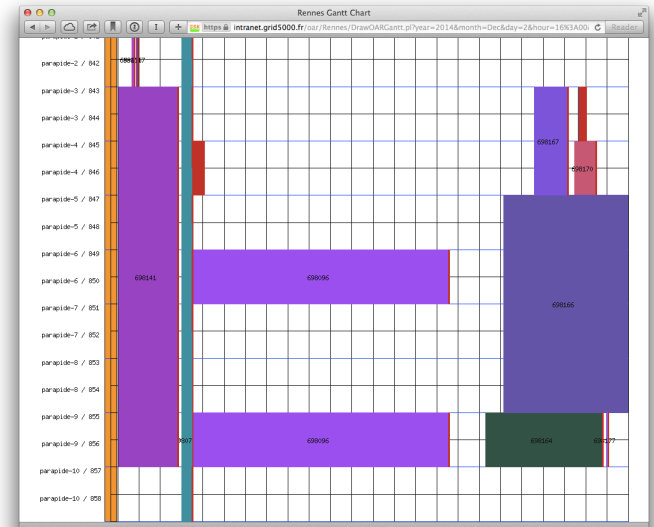


# SELECTING AND VERIFYING RESOURCES

- ▶ Complete, fine-grained and up-to-date representation
  - ▶ Machine parsable, enables match making
  - ▶ Versioned
    - ▶ “What was the drive on the nodes I used 6 months ago?”
  - ▶ Dynamically Verifiable
    - ▶ Does reality correspond to description? (e.g., failures)
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- ▶ Grid’5000 Registry
    - ▶ Automated resource description, automated export to RM
  - ▶ G5K-checks
    - ▶ Run at boot, acquire information, compare with resource catalog description

# PROVISIONING RESOURCES

- ▶ Resource leases
- ▶ Advance reservations (AR)
  - ▶ Sharing resources across time
- ▶ Multiple environments in one lease
- ▶ Allocating a range of resources
  - ▶ Different node types, switches, etc.
- ▶ Eventually: Gantt chart displays, match making



- ▶ OpenStack Nova/Blazar
- ▶ Extensions to support working with more resources, match making, and displays



# CONFIGURE AND INTERACT

- ▶ Map multiple appliances to a lease
- ▶ Allow deep reconfiguration (incl. BIOS)
- ▶ Snapshotting
- ▶ Efficient appliance deployment
- ▶ Handle complex appliances
  - ▶ Virtual clusters, cloud installations, etc.
- ▶ Interact: reboot, power on/off, access to console
- ▶ Shape experimental conditions

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- ▶ OpenStack Ironic, Glance, and meta-data servers

# RESERVATION AND CONFIGURATION

## Resource Provisioning



# MONITORING

- ▶ Enables users to understand what happens during the experiment
- ▶ Types of monitoring
  - ▶ User resource monitoring
  - ▶ Infrastructure monitoring (e.g., PDUs)
  - ▶ Custom user metrics
- ▶ High-resolution metrics
- ▶ Easily export data for specific experiments

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- ▶ OpenStack Ceilometer

# INTERACTION

Running experiments



# REACHING OUT

- ▶ Federation: GENI, Grid'5000, and other testbeds
- ▶ Education
  - ▶ Courses with new content, multi-media, CH appliances
  - ▶ Reaching out to the MSI network
  - ▶ General education and training (MOOCs, etc.)
- ▶ Industry
  - ▶ Industry Board: synergy between industry and academia
  - ▶ Industry-sponsored research projects
- ▶ Advisory bodies: science and industry boards
- ▶ Early User Program
- ▶ Annual Chameleon Workshop

# PROJECT SCHEDULE

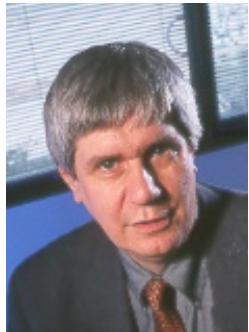
- ▶ Now: FutureGrid@Chameleon
  - ▶ 38 projects, 76 users, 27 institutions
- ▶ April 2015: Technology Preview: Initial bare metal reconfiguration capabilities available on FutureGrid UC&TACC resources for Early Users: demo later today
- ▶ Summer 2015: New hardware: large-scale homogenous partitions available to Early Users
- ▶ Fall 2015: Large-scale homogenous partitions and bare metal reconfiguration generally available
- ▶ 2015/2016: Refinements to experiment management capabilities, higher level capabilities
- ▶ Fall 2016: Heterogeneous hardware available

# TEAM

Kate Keahey  
Chameleon PI  
Science Director,  
Software Development



Paul Rad  
Industry Liason



Joe Mambretti  
Programmable networks



Warren Smith  
Director of Operations

DK Panda  
High-performance  
networks



Dan Stanzone  
Facilities Director



# THE TESTBED IS THERE – “JUST” ADD RESEARCH!

- ▶ Large-scale, responsive experimental testbed
  - ▶ Targeting critical research problems at scale
- ▶ Reconfigurable environment
  - ▶ Support use cases from bare metal to production clouds
- ▶ One-stop shopping for experimental needs
  - ▶ Trace and Workload Archive
- ▶ Engage the community
  - ▶ *The most important element of any experimental testbed is users and the research they work on*