CHAMELEON: BUILDING A RECONFIGURABLE EXPERIMENTAL TESTBED FOR CLOUD RESEARCH

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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”
  - From bare metal reconfiguration to clouds
  - 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

Switch
Standard Cloud Unit
42 compute
4 storage
x2

Core Services
Front End and Data Mover Nodes

Chameleon Core Network
100Gbps uplink public network (each site)

Core Services
3.6 PB Central File Systems, Front End and Data Movers

Heterogeneous Cloud Units
Alternate Processors and Networks

504 x86 Compute Servers
48 Dist. Storage Servers
102 Heterogeneous Servers
16 Mgt and Storage Nodes

Chicago
Austin

SCUs connect to core and fully connected to each other

To UTSA, GENI, Future Partners

www.chameleoncloud.org
EXPERIMENTAL WORKFLOW

discover resources

provision resources

configure and interact

monitor

design the experiment

analyze, discuss, and share
CHI: 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)

- Grid’5000 Registry
  - Automated resource description, automated export to RM
- G5K-checks
  - Run at boot, acquire information, compare with resource catalog description
CHI: PROVISIONING RESOURCES

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

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

OpenStack Ironic, Glance, and meta-data servers
CHI: 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

- OpenStack Ceilometer
PROJECT TIMELINE

- **Started 09/2014**
- **Currently:**
  - FutureGrid@Chameleon (OpenStack KVM cloud)
  - Chameleon Technology Preview (bare metal)
  - Early Users: homogenous hardware available to Early Users
  - Overall: 57 projects, 102 users, 40 institutions
- **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
PARTING THOUGHTS

- Work on your next research project @ www.chameleoncloud.org!
  *The most important element of any experimental testbed is users and the research they work on*
- Building operations for long-term sustainability
- Potential for extending operations
- Creating a forum for collaboration between research community and practitioners
  - Workshops, traces, funding opportunities and other forms of engagement