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CHAMELEON: A LARGE-SCALE, RECONFIGURABLE EXPERIMENTAL ENVIRONMENT FOR CLOUD RESEARCH

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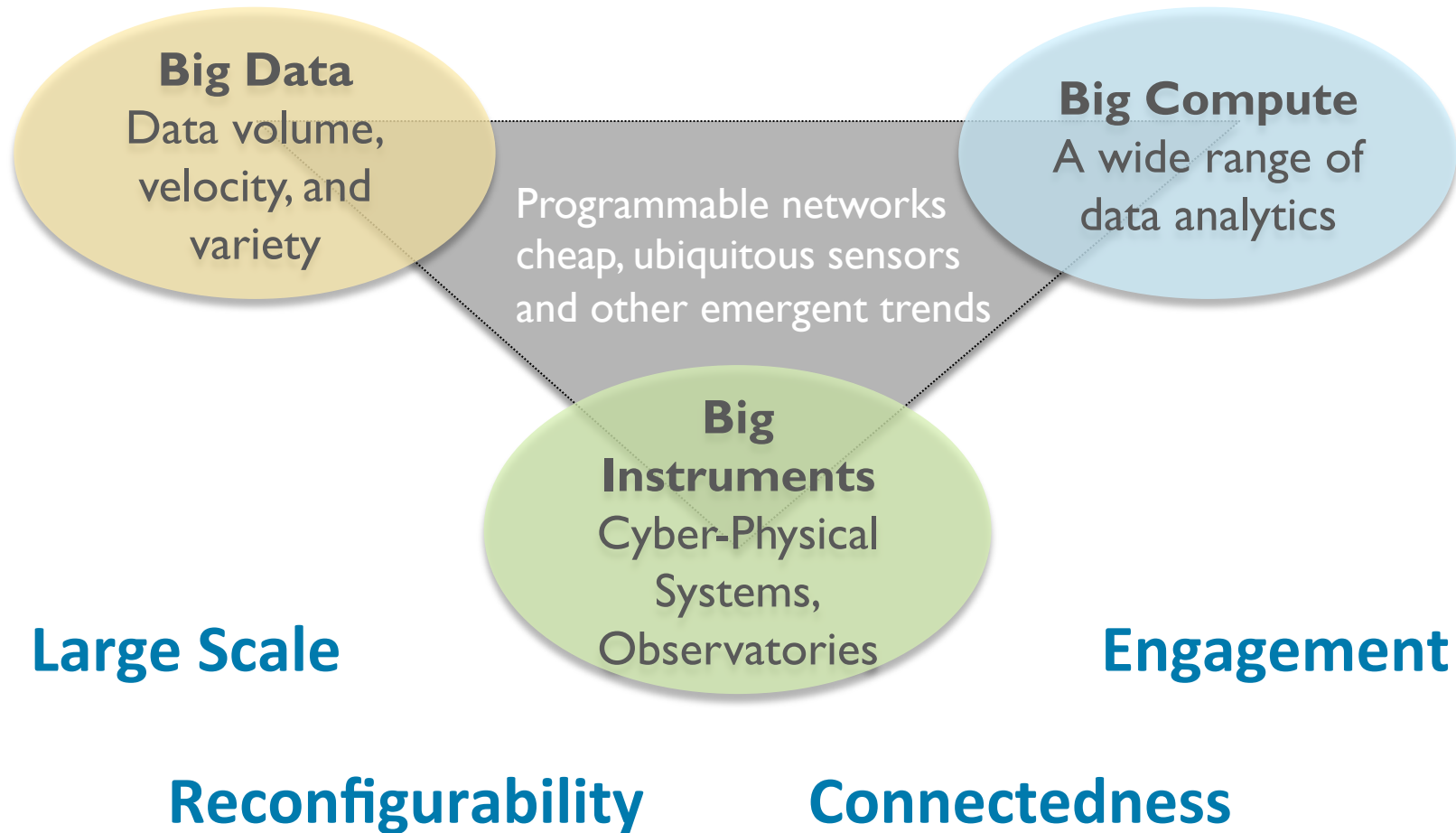
***2nd Joint Lab for Extreme Scale Computing (JLESC) Workshop
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Chicago, IL***

MARCH 10, 2015

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SCALING TO THE CHALLENGE



CHAMELEON: A POWERFUL AND FLEXIBLE EXPERIMENTAL INSTRUMENT

- ▶ Large-scale instrument
 - ▶ Targeting 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 instrument
 - ▶ Bare metal reconfiguration, operated as single instrument, graduated approach for ease-of-use
- ▶ Connected instrument
 - ▶ Workload and Trace Archive
 - ▶ Partnerships with production clouds: CERN, OSDC, Rackspace, Google, and others
 - ▶ Partnerships with users
- ▶ Complementary instrument
 - ▶ Complementing GENI, Grid'5000, and potentially other testbeds

TEAM

Kate Keahey
Chameleon PI
Science Director



Paul Rad
Industry Liason



Joe Mambretti
Programmable networks



Warren Smith
Director of Operations

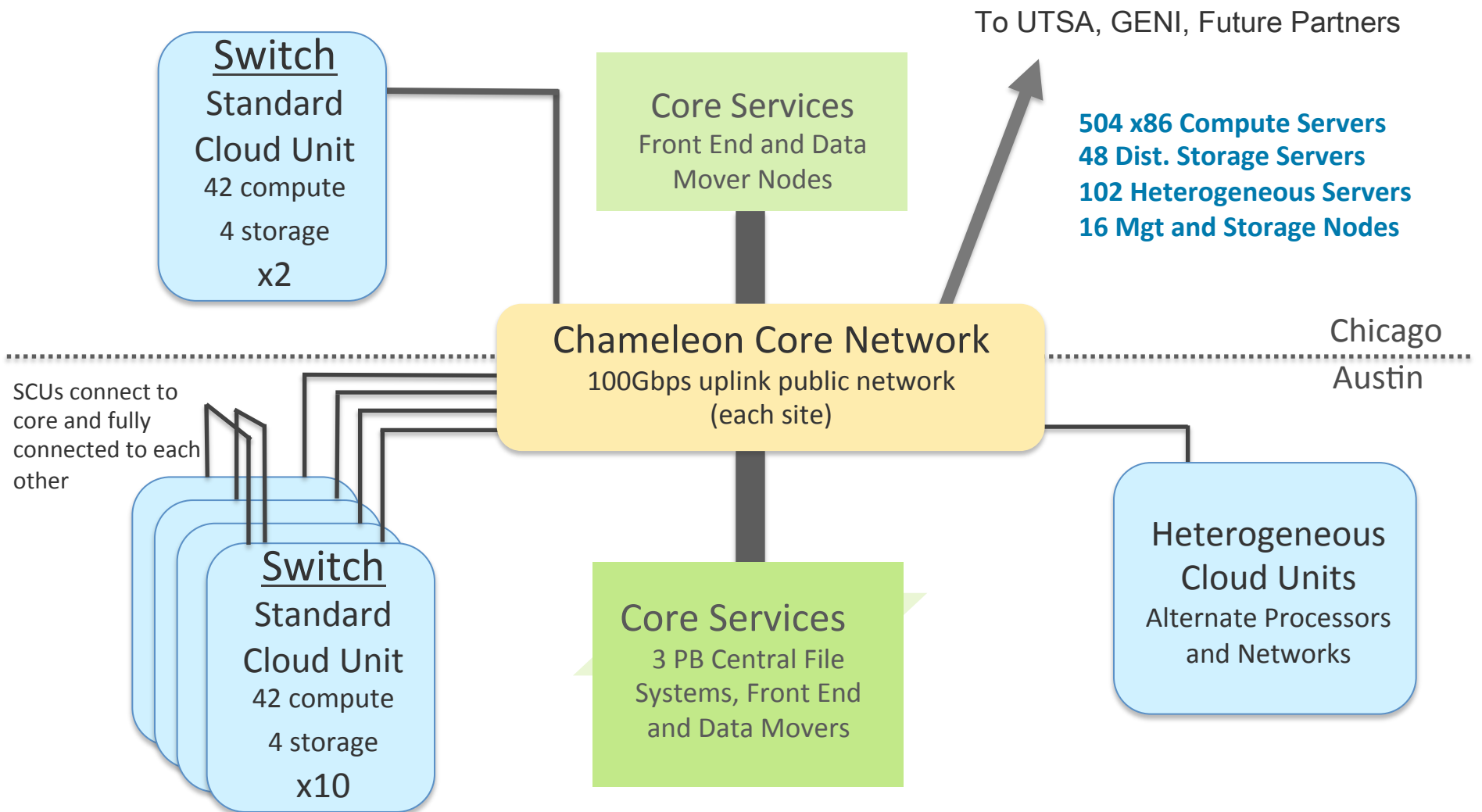
DK Panda
High-performance
networks



Dan Stanzione
Facilities Director



CHAMELEON HARDWARE



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, pre-configured environments

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

User-Deployed Clouds

Pre-configured Image Catalog
Bare metal images

Provisioning, Network, Scheduling and Orchestration

KaDeploy, KaVLAN, OAR2, (Grid'5000)

Ironic, Neuron, Nova (OpenStack, Rackspace OnMetal)

Orchestration: Nimbus, Interactive Experiment Management

EXPERIMENT WORKFLOW

- ▶ User interface: log in, manage profile
- ▶ Find Resources
 - ▶ Machine-parsable, fine-grained description
 - ▶ Versioning (hardware upgrades, etc.)
 - ▶ Verification (maintenance, failures, etc.)
- ▶ Reserve Resources (browsing vs matching)
- ▶ Reconfigure testbed
- ▶ Shape experimental conditions
- ▶ Monitoring and metrics
 - ▶ Including fine-grain and energy monitoring
- ▶ Integration with workload generators, simulation, etc.

OUTREACH AND ENGAGEMENT

- ▶ Early User Program
 - ▶ Committed users, driving and testing new capabilities, enhanced level of support
- ▶ Chameleon Workshop
 - ▶ Annual workshop to inform, share experimental techniques solutions and platforms, discuss upcoming requirements, and showcase research
- ▶ Advisory Bodies
 - ▶ Research Steering Committee: advise on capabilities needed to investigate upcoming research challenges
 - ▶ Industry Advisory Board: provide synergy between industry and academia

PROJECT SCHEDULE

- ▶ Fall 2014: FutureGrid resources at UC and TACC (Hotel and Alamo) available as OpenStack clouds
- ▶ Spring 2015: Initial bare metal reconfiguration capabilities available on FutureGrid UC&TACC resources for Early Users
- ▶ 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

PARTING THOUGHTS

- ▶ Large-scale, responsive experimental testbed
 - ▶ Targeting critical research problems at scale
 - ▶ Evolve with the community input
- ▶ Reconfigurable environment
 - ▶ Support use cases from bare metal to production clouds
 - ▶ Support for repeatable and reproducible experiments
- ▶ One-stop shopping for experimental needs
 - ▶ Trace and Workload Archive, user contributions, requirement discussions
- ▶ Engage the community
 - ▶ Network of partnerships and connections with scientific production testbeds and industry
 - ▶ Partnerships with existing experimental testbeds
 - ▶ Outreach activities
- ▶ Come visit us at www.chameleoncloud.org!