



CloudLab

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Why We're Building CloudLab

- Clouds are changing the way we look at a lot of problems
 - Giving us new ideas of what's possible
 - Impact goes far beyond computer science
- ... and have broader impacts with much more potential
 - Transformational for IT-based businesses – enables rapid startup
- ... but there's still a lot we don't know, from perspective of
 - Researchers (those who will transform the cloud)
 - Users (those who will use the cloud to transform their own fields)
- To investigate these questions, we need:
 - Flexible, scalable **scientific infrastructure**
 - That enables exploration of **fundamental** science in the cloud
 - Built **by** and **for** the research community



The CloudLab Team



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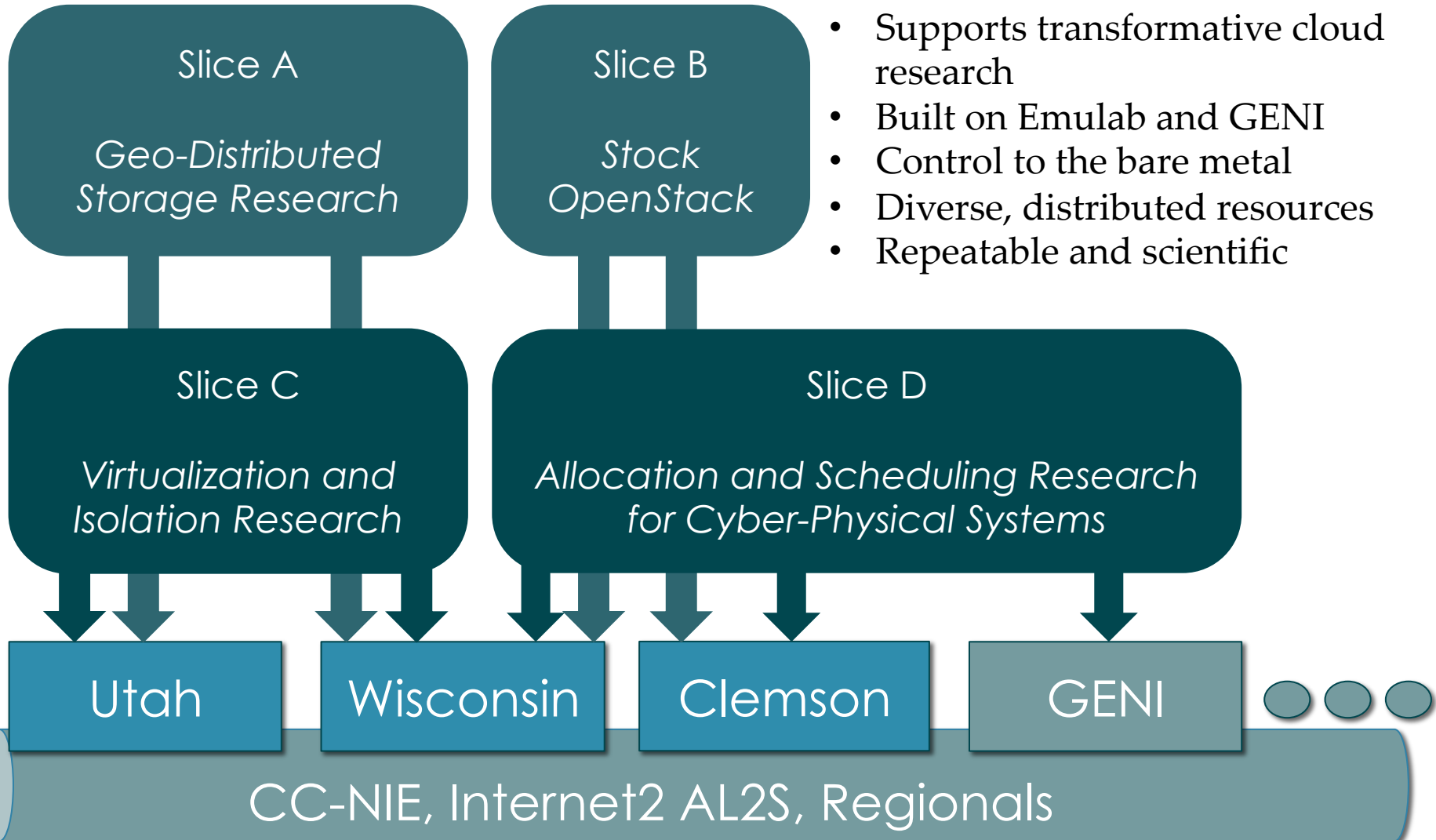
The CloudLab Vision

- A “meta-cloud” for building clouds
- Build your own cloud on our hardware resources
- Agnostic to specific cloud software
 - Run existing cloud software stacks (like OpenStack, Hadoop, etc.)
 - ... or new ones built from the ground up
- Control and visibility all the way to the bare metal
- “Sliceable” for multiple, isolated experiments at once

With CloudLab, it will be as easy to get a cloud tomorrow as it is to get a VM today



What Is CloudLab?





CloudLab's Hardware

One facility, one account, three locations

- About 5,000 cores each (15,000 total)
- 8-16 cores per node
- Baseline: 8GB RAM / core
- Latest virtualization hardware
- TOR / Core switching design
- 10 Gb to nodes, SDN
- 100 Gb to Internet2 AL2S
- *Partnerships with multiple vendors*

Wisconsin

- **Storage and net.**
- Per node:
 - 128 GB RAM
 - 2x1TB Disk
 - 400 GB SSD
- Clos topology
- *Cisco*

Clemson

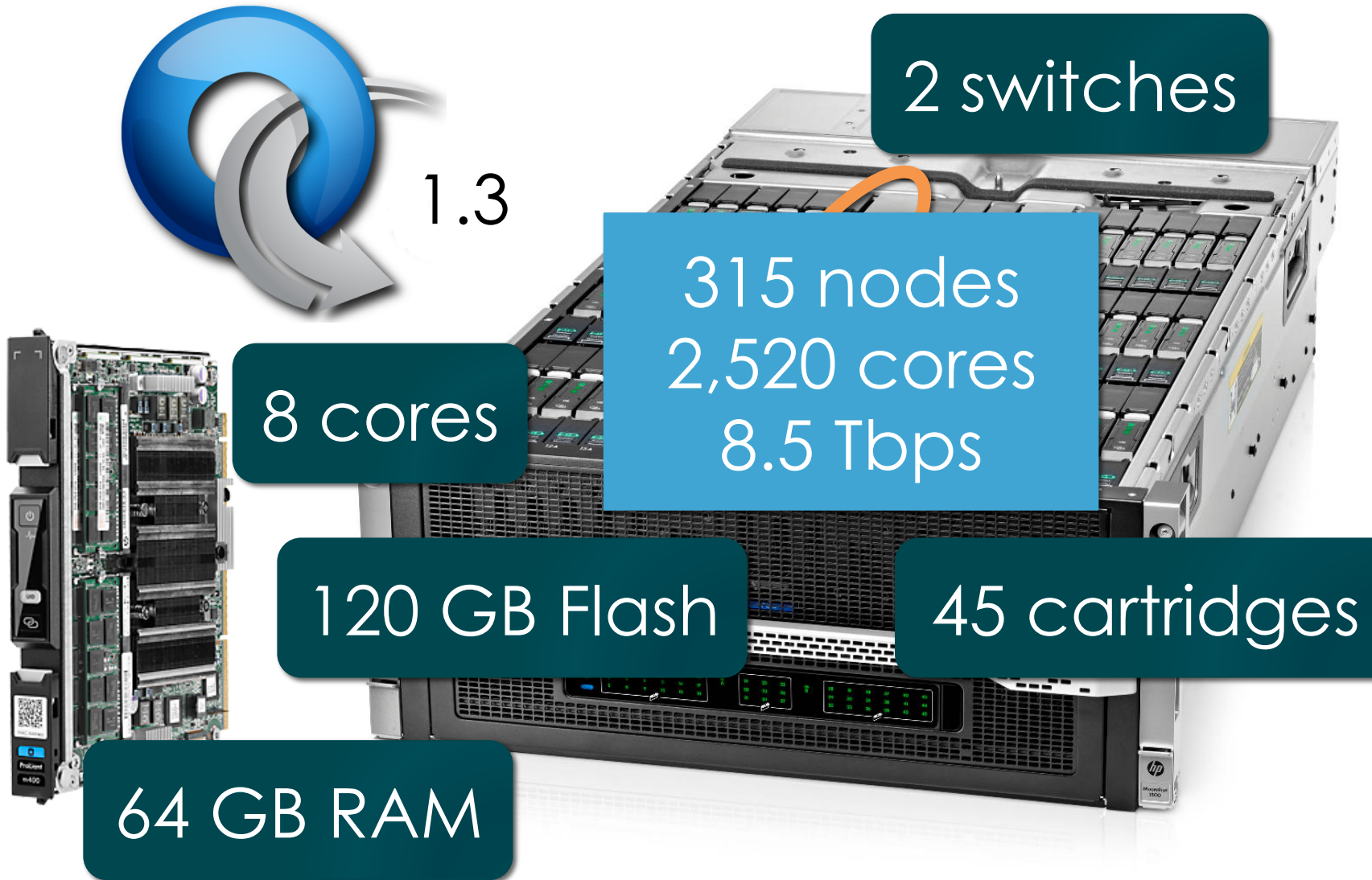
- **High-memory**
- 16 GB RAM / core
- 16 cores / node
- Bulk block store
- Net. up to 40Gb
- High capacity
- *Dell*

Utah

- **Power-efficient**
- ARM64 / x86
- Power monitors
- Flash on ARM64s
- Disk on x86
- Very dense
- *HP*



Utah/HP: Low-power ARM64





Wisconsin/Cisco: Net., Storage

16 cores/node

128 GB RAM/node

Haswell

SSD in every server



CLOS topology

2x 10 GbE OF/node





Clemson/Dell: High Memory, IB

20 cores/node

1 x 40 Gb IB/node

8 nodes/chassis

2*x 10 GbE OF/node

10 chassis/rack

2*x 1 GbE OF/node



256 GB RAM/node

2 x 1 TB drive/server

* 1 NIC in 1st build



Availability and Schedule

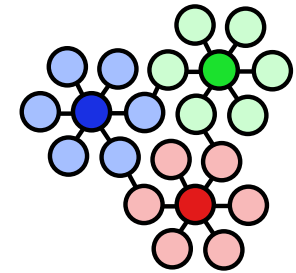
- Availability:
 - ✓ **Open and in use!**
- Hardware being deployed in stages:
 - ✓ Fall 2014: Utah / HP cluster
 - ✓ Winter 2015: Wisconsin / Cisco cluster (alpha status)
 - Spring 2015: Dell / Clemson cluster
- Hardware refreshes in 2015 and 2016

- As of March 2015:
 - 65 projects
 - 150 users
 - 1,500 experiments

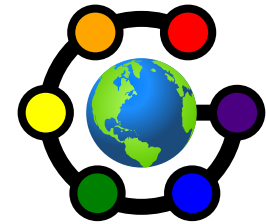


Technology Foundations

- Built on Emulab and ProtoGENI
- Provisions, then gets out of the way
 - “Run-time” services are optional
- Controllable through a web interface and GENI APIs
- *Scientific instrument for repeatable research*
 - Physical isolation for most resources
 - *Profiles* capture everything needed for experiments
 - Software, data, and hardware details
 - Can be shared and published (eg. in papers)



emulab



protogeni



Federated with GENI

- *CloudLab can be used with a GENI account*
- GENI Racks around the country
- Programmable wide-area network
 - Openflow at dozens of sites
 - Connected in one layer 2 domain
- Large clusters (100s of nodes) at several sites
- Wireless and mobile
 - WiMax at 8 institutions
 - LTE / EPC testbed (“PhantomNet”) at Utah
- International partners
 - Europe (Fed4FIRE), Brazil, Japan





Your Own Cloud in One Click

The screenshot shows a web browser window with the URL `cloudlab.us`. The navigation bar includes links for `Home`, `Manual`, and `Actions`, along with a user profile `rpruser logged in` and a `Logout` button. The main content area features the heading `What is CloudLab?` and `Run an Experiment`. A profile selection box displays `Selected Profile: ARM64OpenStack` and describes it as `An ARM64 OpenStack instance with a controller, network manager, and three compute nodes.` Below this are `Copy Profile` and `Change Profile` buttons. A `Cluster:` dropdown menu is set to `Utah Cloudlab`. A large green `Create!` button is positioned at the bottom of the form.





use your GENI account

Learn more, ~~sign up:~~

stay for the tutorial

www.CloudLab.us



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