INTRODUCTION TO CHI@EDGE

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CHI@Edge Community Workshop
CHAMELEON IN A NUTSHELL

- We like to change: a testbed that adapts itself to your experimental needs
  - Deep reconfigurability (bare metal) and isolation – but also a small KVM cloud
  - power on/off, reboot, custom kernel, serial console access, etc.

- Balance: large-scale versus diverse hardware
  - Large-scale: ~large homogenous partition (~15,000 cores), ~6 PB of storage originally distributed over 2 sites (UC, TACC) connected with 100G network
  - Diverse: ARMs, Atoms, FPGAs, GPUs, Corsa switches, etc.
  - CHI-in-a-Box sites at Northwestern, coming soon: IIT, UIC, and other places

- Cloud++: CHameleon Infrastructure (CHI) via mainstream cloud tech
  - Powered by OpenStack with bare metal reconfiguration (Ironic) + “special sauce”
  - Blazar contribution recognized as official OpenStack component

- Standing on the shoulders of giants: packaging for repeatability and sharing
  - Packaging, sharing, discovering, and publishing experiments
OPEN TESTBED – BY THE NUMBERS

300+ Papers published

45 Countries

160+ Institutions

5,900+ Users

700+ Projects

6+ Years Old

and 3 more years to grow!
WHAT DOES AN EDGE TESTBED LOOK LIKE?

A lot like a cloud just for edge devices!
All the features we know and love!

Not at all like a cloud!
Not server-class!
IoT: cameras, actuators, SDRs!
Location, location, location!
And many other challenges!

- CHI@Edge: all the features you know and love plus
  - Reconfiguration via container deployment
  - Support for peripherals based on an extensible plug-in model
  - Mixed ownership model via an SDK with devices available through a virtual site(s)
  - Still working on defining the capabilities: join the mailing list https://groups.google.com/g/chameleon-edge-users
CHI@EDGE EXPERIMENTAL WORKFLOW (PREVIEW)

**discover resources**
- Complete
- Up-to-date

**allocate resources**
- Allocatable resources: nodes, VLANs, IPs
- Advance reservations and on-demand
- Expressive interface
- Isolation

**configure and interact**
- Container
- Catalog of images
- Snapshotting
- Jupyter integration for orchestration

**monitor**

Authentication via federated identity, accessed via GUI, CLI and python/Jupyter
SHARING DEVICES THROUGH CHI@EDGE

- CHI@Edge SDK: fully automate the process of enrolling a device into CHI@Edge
- Support for restricted leases
  - You operate your device for your community and leverage our expertise on sharing
  - Your users get seamless access to the devices you operate for them + Chameleon + partnerships
- Access reasonable hardware properties e.g., GPUs
- Peripheral devices
  - Standard camera modules, GPIO, SDR
  - Extensible framework for integrating new devices
- Temporarily suspended: in the process of refactoring, hoping to bring it back by end of Q1/Q2 of 2022
- Alternative: adding your device to Chameleon network (available in Q4)
WHAT DOES AN EDGE TESTBED LOOK LIKE?

- In-network processing
- Network/compute heterogeneity
- Network Function Virtualization
- Network slicing
- Intelligent edge algorithms
- Edge to cloud workflows
- IoT and wireless multi-tenancy
- Latency-aware job placement
- Data management for edge
- Power management
- Job scheduling for edge
- Edge security and privacy
- Reliability and Availability

CHI@Edge

chameleon-owned devices

user-owned devices

www.chameleoncloud.org
BUILDING CHI@EDGE

From this…

…to this!
CHI AND CHI@EDGE SIDE BY SIDE

Chameleon for bare metal

- Advanced reservations for **bare metal machines**
- Bare metal reconfigurability
- Single-tenant isolation
- Heterogeneous collection of interesting hardware

- Isolated networking, public IP capability, **OpenFlow SDN**
- Composable cloud APIs (GUI, CLI, Python+Jupyter)
- **Owned and operated by Chameleon**

Chameleon for edge

- Advanced reservations for **IoT/edge devices**
- Container deployment
- Single-tenant isolation
- Heterogeneous collection of interesting hardware and **peripherals/locations**!

- Isolated networking, public IP capability
- Composable cloud APIs (GUI, CLI, Python+Jupyter)
- **Mixed ownership model via restricted sharing**
CHI@EDGE STATUS

- CHI@Edge is in **preview**!
  - Reasonably featureful and reliable core based on mainstream open source adaptation
  - More thinking: networking, different security/availability scenarios, centralized/decentralized, containers vs other modes of reconfiguration, and many others
  - More interesting hardware/peripherals via extensible framework
  - Implementation refactor
  - Scaling operationally

- General availability of CHI@Edge SDK is temporarily suspended
  - Focus on work with current partners
  - Hoping to restore it around Q1/Q2 of 2022

- CHI@Edge-in-a-Box in restricted availability, under evaluation
- Roadmap and technical partnerships
We’re here to change

www.chameleoncloud.org