



www.chameleoncloud.org

INTRODUCTION TO CHI@EDGE

Kate Keahey, Jason Anderson

University of Chicago, Argonne National Laboratory

`{keahey,jasonanderson}@uchicago.edu`

September 13, 2021



CHAMELEON IN A NUTSHELL

- ▶ NSF-funded testbed for CS research, education, and emergent/innovative applications
- ▶ Large-scale and diverse hardware
 - ▶ Large-scale: ~large homogenous partition (~15,000 cores), ~6 PB of storage originally distributed over **2 sites** (UC/ALCF, 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
- ▶ Deeply reconfigurable
 - ▶ Requirements: power on/off, custom kernel, serial console access, network stitching, SDN support, etc.
 - ▶ Deep reconfigurability (bare metal), supplemental by a small KVM cloud + edge testbed
- ▶ Implementation: CHameleon Infrastructure (CHI) via mainstream cloud tech (OpenStack)
 - ▶ OpenStack+Blazar, doni, network stitching, BYOC, identity federation, Jupyter integration, account+project management, snapshotting, etc.
- ▶ Packaging, sharing, and content
 - ▶ Experiment packaging via Jupyter, integration with Zenodo, catalogues of images and notebooks

OPEN TESTBED – BY THE NUMBERS

300+

Papers
published

45

Countries

700+

Projects

5,900+

Users

160+

Institutions

6+

Years Old

and 3 more
years to grow!

WHAT DOES AN EDGE TESTBED LOOK LIKE?



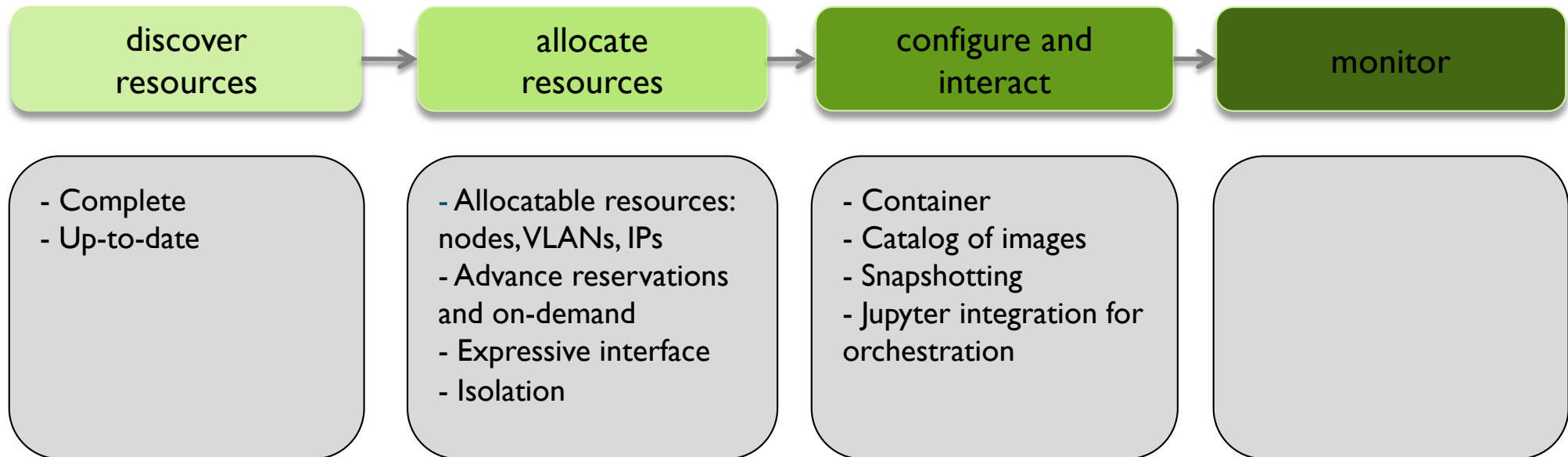
A lot like a cloud just for
edge devices!
All the features we know
and love!

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 (though now looking at bare metal as well)
 - ▶ Support for peripherals based on an extensible plug-in model
 - ▶ Mixed ownership model via an SDK with devices available through a virtual site(s)
 - ▶ Rapidly evolving through the summer, plateauing now – lots of room to grow

CHI@EDGE EXPERIMENTAL WORKFLOW (PREVIEW)

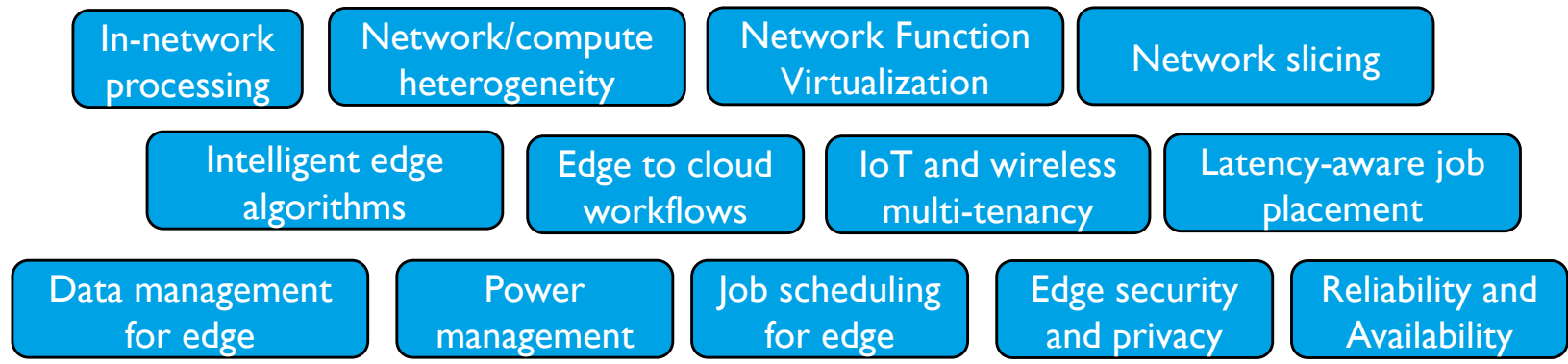


Authentication via federated identity, accessed via GUI, CLI and python/Jupyter

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)

SUPPORT FOR ADDITIVE INNOVATION



CHI@Edge



chameleon-owned devices



user-owned devices

STATUS, FUTURE WORK, AND PARTNERSHIPS

- ▶ CHI@Edge is in **preview**

- ▶ Reasonably featureful and reliable core based on mainstream open source adaptation
- ▶ More work/thinking: networking, different security/availability scenarios, centralized/decentralized, containers vs other modes of reconfiguration, peripherals, implementation refactor, operations support, and many others
- ▶ CHI@Edge-in-a-Box in restricted availability, under evaluation

- ▶ Partnerships

- ▶ FABRIC: networking testbed, core reconfigurability
- ▶ PAWR testbeds: wireless testbeds (4 funded so far)



We're here to change

www.chameleoncloud.org