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INTRODUCTION TO CHI@EDGE

Kate Keahey, Jason Anderson

University of Chicago, Argonne National Laboratory

{keahey,jasonanderson}@uchicago.edu

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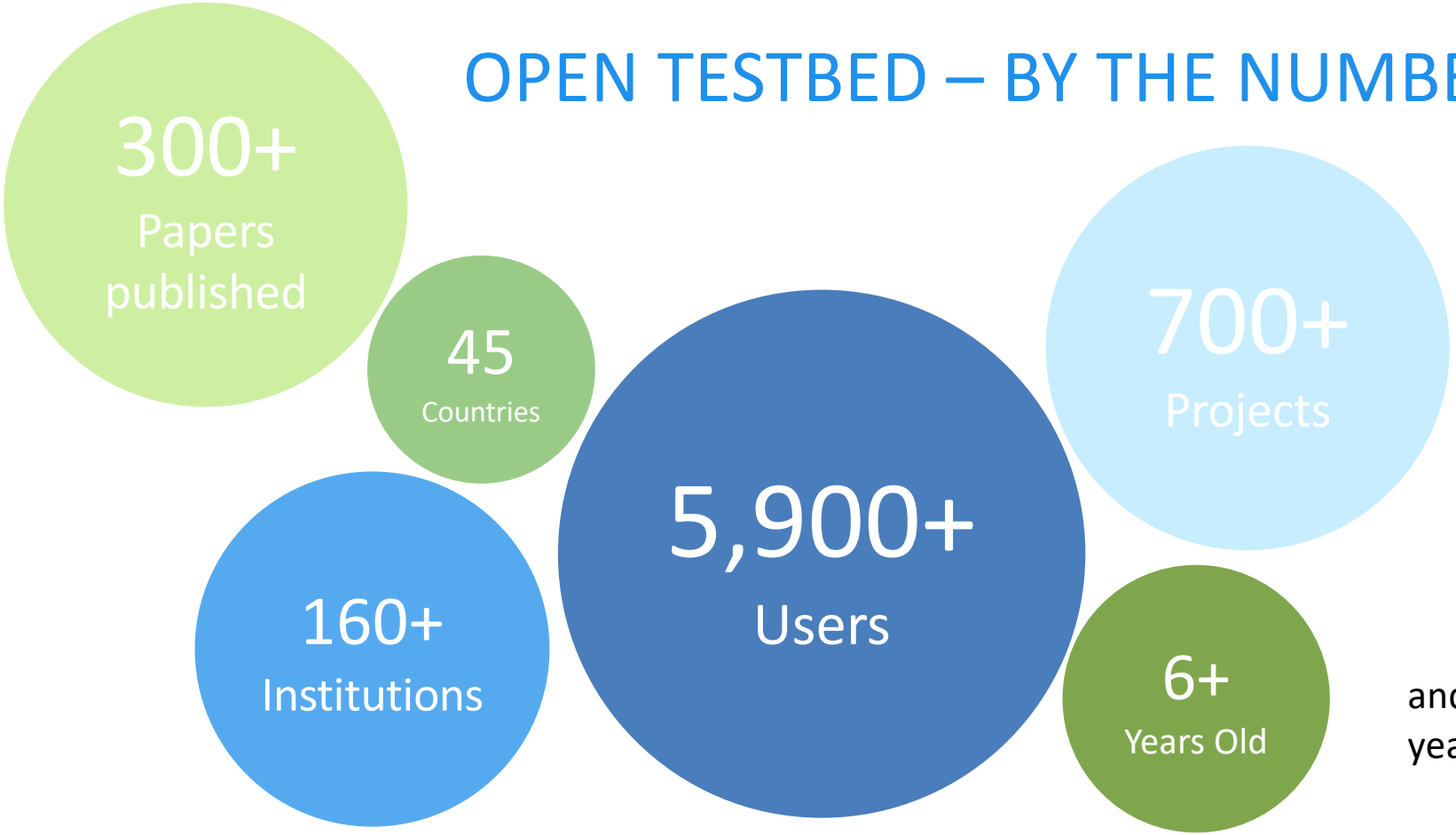
CHAMELEON IN A NUTSHELL

- 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



and 3 more years to grow!

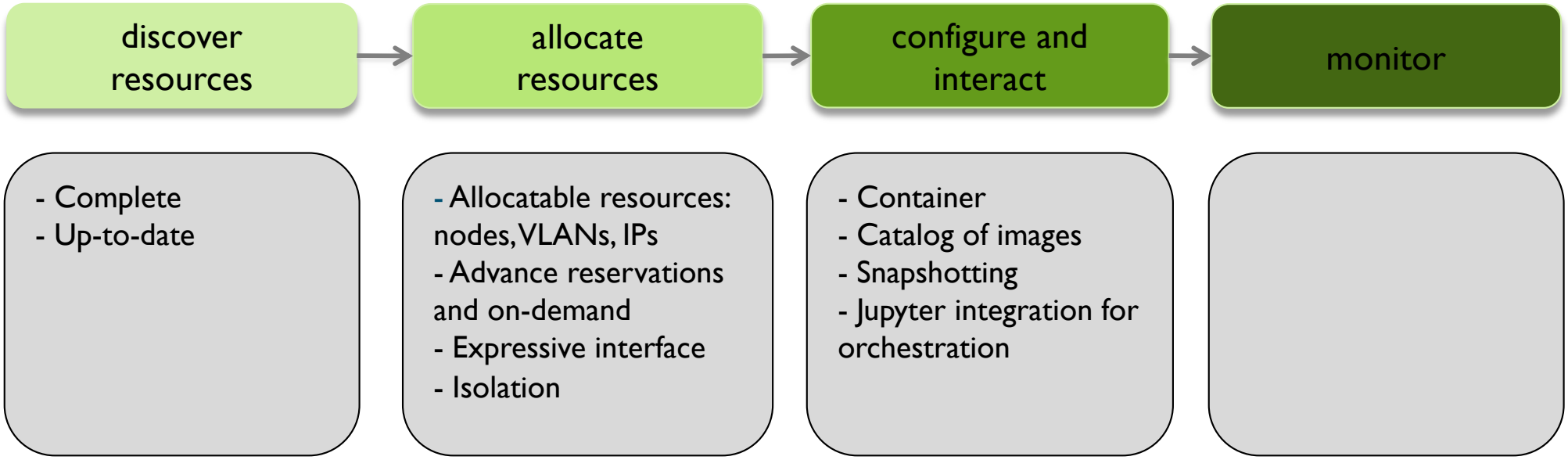
WHAT DOES AN EDGE TESTBED LOOK LIKE?

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

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

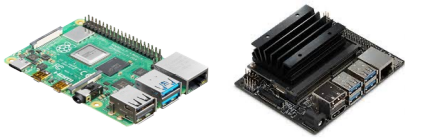
Power management

Job scheduling for edge

Edge security and privacy

Reliability and Availability

CHI@Edge



chameleon-owned devices

user-owned devices

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

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