



www.chameleoncloud.org

CHAMELEON: CHANGING THE WAY WE SHARE

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Virtual Café for Robust Science



CHAMELEON IN A NUTSHELL

- ▶ We like to change: a testbed that adapts itself to your experimental needs
 - ▶ Deep reconfigurability (bare metal) and isolation
 - ▶ 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 distributed over 2 sites (UC, TACC) connected with 100G network
 - ▶ Diverse: ARMs, Atoms, FPGAs, GPUs, Corsix switches, etc.
- ▶ Cloud++: leveraging mainstream cloud technologies
 - ▶ Powered by OpenStack with bare metal reconfiguration (Ironic) + “special sauce”
 - ▶ Blazar contribution recognized as official OpenStack component
- ▶ We live to serve: open, production testbed for Computer Science Research
 - ▶ Started in 10/2014, available since 07/2015, renewed in 10/2017, and just now!
 - ▶ Currently 5,300+ users, 700+ projects, 100+ institutions, 300+ publications



REPRODUCIBILITY BUILDING BLOCKS

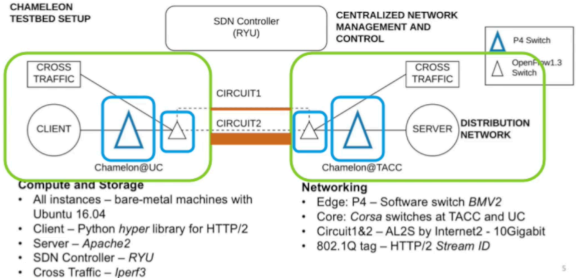
- ▶ Hardware
 - ▶ >105 hardware versions over 5 years
 - ▶ Expressive allocation
- ▶ Clouds: images and orchestration
 - ▶ >130,000 images, >35,000 orchestration templates and counting
 - ▶ Portability and federation
- ▶ Packaging and repeating: integration with JupyterLab
- ▶ Share, find, publish and cite: Trovi and Zenodo



SHARING EXPERIMENTS: PACKAGING



```
File Edit View Run Kernel Help
Trestle@fntb1a:~/jupyterhub$ cat LCNDemo2018.ipynb
Python 3
2. Start P4 switches
[111]: from chi_sdn import Reconfig
import time
from tdpn.tdpncontroller import tdpn
p4_uc = Reconfig(ip='129.114.188.127')
p4_uc = Reconfig(ip='192.3.87.182')
for switch in tdpn.get_tdpn_p4_uc():
    switch.run('p4ctl --if=chameleon')
    time.sleep(2)
    switch.run('p4ctl --if=chameleon -s 192.3.87.182 -s 192.3.87.182 -s 192.3.87.182 -s 192.3.87.182')
    tdpn.write('Switch {} restarted.'.format(switch.host))
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3. Start cross-traffic
[111]: from chi_sdn import Reconfig
import time
from tdpn.tdpncontroller import tdpn
p4_uc = Reconfig(ip='129.114.188.127')
p4_uc = Reconfig(ip='192.3.87.182')
for switch in tdpn.get_tdpn_p4_uc():
    switch.run('p4ctl --if=chameleon')
    time.sleep(2)
    switch.run('p4ctl --if=chameleon -s 192.3.87.182 -s 192.3.87.182 -s 192.3.87.182 -s 192.3.87.182')
    tdpn.write('Switch {} restarted.'.format(switch.host))
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*Experimental storytelling:
ideas/text, process/code, results*

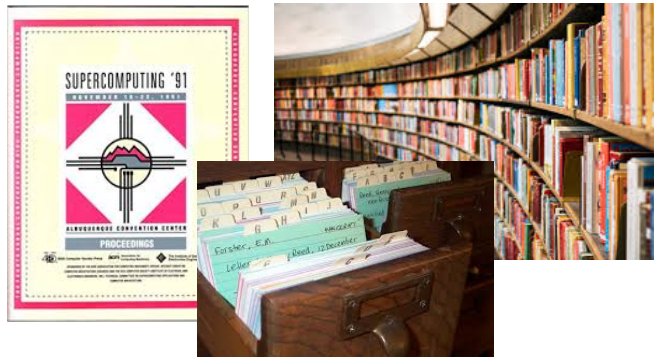
Complex Experimental containers

- ▶ Repeatability by default: Jupyter notebooks + Chameleon experimental containers
 - ▶ JupyterLab for our users: use jupyter.chameleoncloud.org with Chameleon credentials
 - ▶ Interface to the testbed in Python/bash + examples (see LCN'18: <https://vimeo.com/297210055>)
 - ▶ Named containers: a terminal multiplexer for various components of your experiment

Also see: "A Case for Integrating Experimental Containers with Notebooks", CloudCom 2019

SHARING EXPERIMENTS: PUBLICATION

Familiar research sharing ecosystem



Digital research sharing ecosystem



- ▶ Trovi: a digital sharing platform
 - ▶ Make your experiments sharable within a community of your choice with one click
 - ▶ A library of reproduced experiments from foundational papers for research and education (see e.g., Brunkan et al., “Future-Proof Your Research”, SC20 poster)
- ▶ Integration with Zenodo: make your experimental artifacts citable via Digital Object Identifiers (DOIs) (export/import)



PARTING THOUGHTS

- ▶ Time to reproduce is critical: much attention is being given to packaging experiments for repeatability/reproducibility – not as much to actually repeating them
- ▶ We need to create a “marketplace” for repeating research
 - ▶ Repeatability and reproducibility can be thought of as the same thing at different “price points”
 - ▶ Recognition for published digital artifacts (software, data, experiments, etc.)
 - ▶ Starting early: education is an unappreciated tool for fostering reproducible research
- ▶ Use what you have: leveraging testbeds, existing digital artifacts, frameworks, patterns, etc. has the potential to lower the “price” of reproducibility and make it affordable



We're here to change

www.chameleoncloud.org

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