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Jetstream2: Accelerating science and engineering on-demand

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Midwest Research Computing & Data Consortium – 3 March 2023

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What is “the” Jetstream(2)?

- NSF-funded production cloud environment
- Ease-of-use focus, rapid on-ramp to XSEDE/ACCESS
- On-demand interactive computing and persistent services for science gateways
- Enables configurable environments; programmable cyberinfrastructure

By Maria Morris: JS2 rear doors (lower) Banksy adaptation [non-commercial] (right)

Now with GPUs, large-memory, more faster PB!

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Differences from Jetstream[1] GUI

- Co-exists with other OpenStack interfaces, other research clouds
- Much easier collaboration between users on same allocation
- Choose an operating system instead of browsing a list of images
- Multi-instance create and delete
- Volume-backed instances ➡️ large, persistent root disks
- Live instance resize
- Central software repository instead of purpose-built images
- Push-button virtual clusters with elastic scaling
- Reproducible workbenches with Binder-compatible repositories

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Platform Overview

Horizon

OpenStack CLI

Cacao

Exosphere

Science Gateways

Authentication Service

ACCESS Accounting

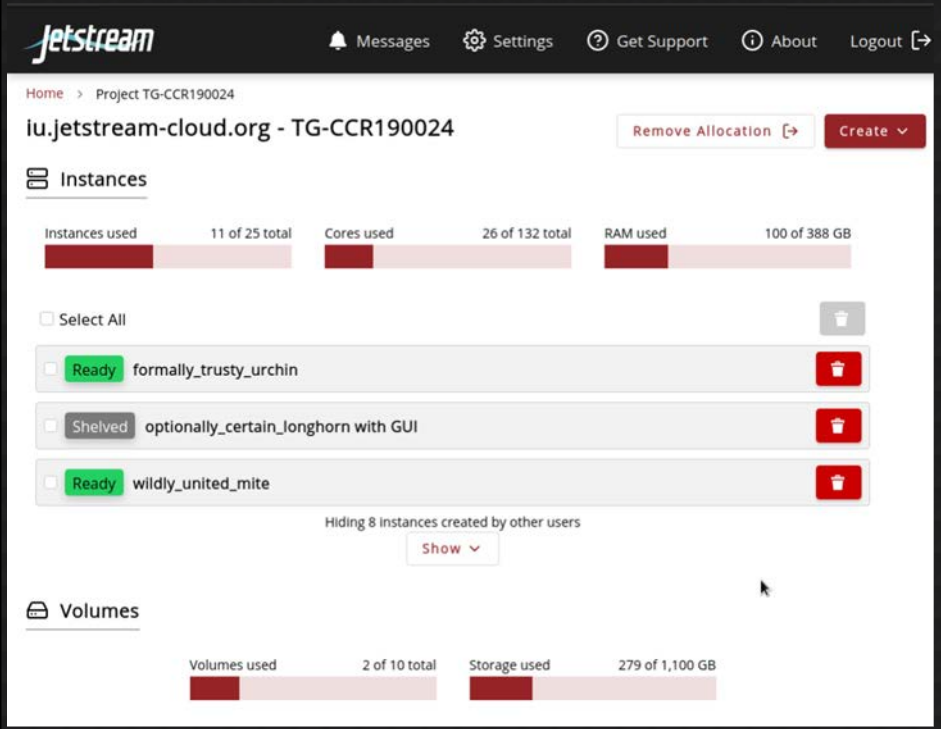
OpenStack

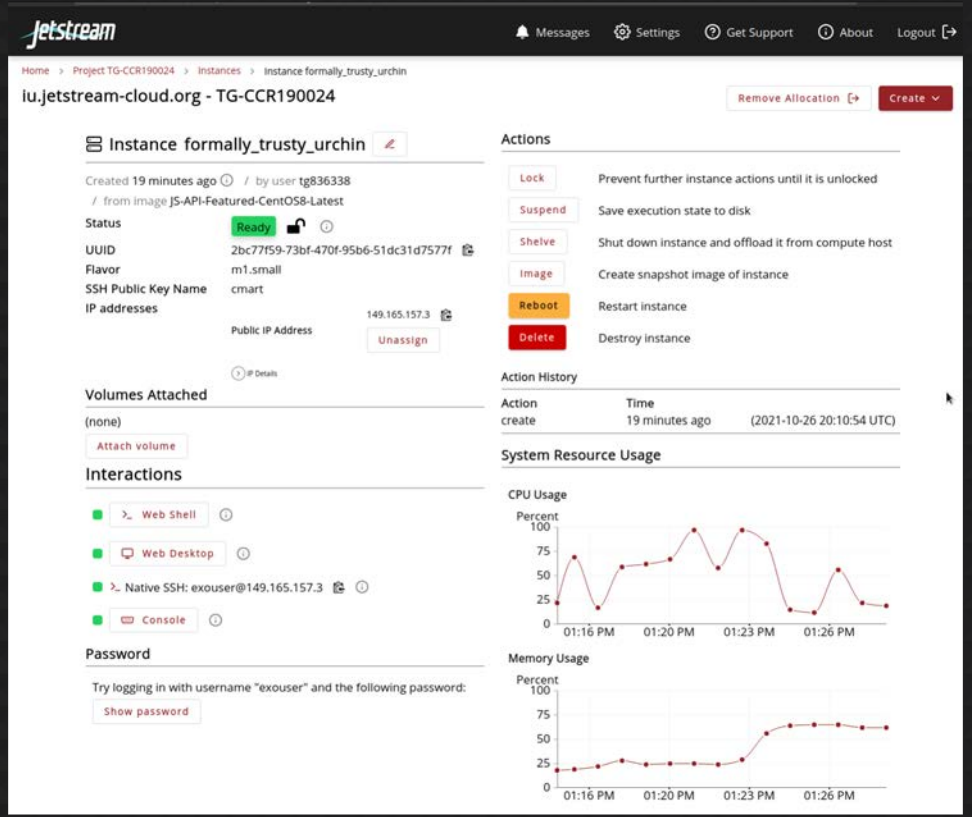
Ceph

OpenStack

Jetstream2 Core System

Exosphere





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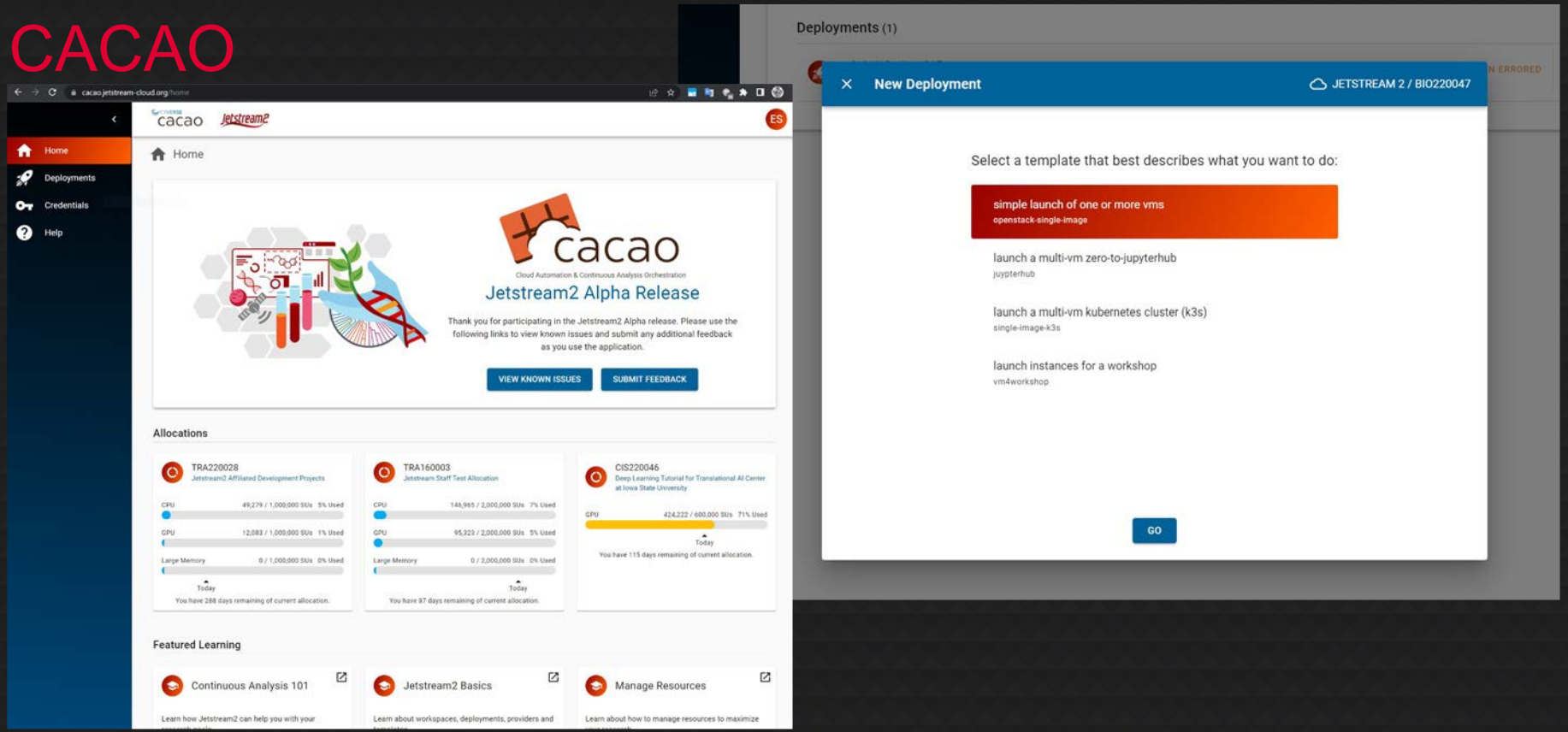
https://exosphere.Jetstream-cloud.org or try.exosphere.app

CACAO



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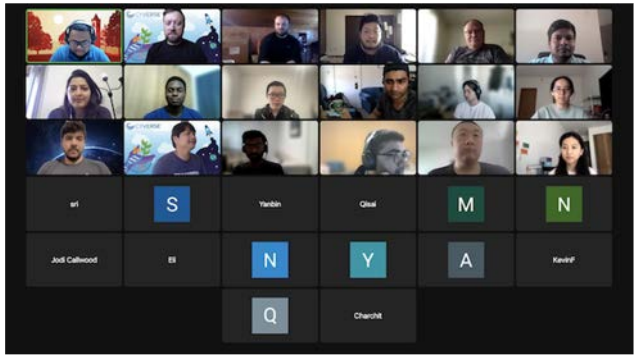
https://cacao.jetstream-cloud.org

Deep dive into DL – JS2 for Education/Training

- First-of-a-kind workshop to apply DL techniques to agricultural data sets in April 2022
- AIIRA, AI Institute for Resilient Agriculture, intends to distribute the digital twin built on JS2 for community re-use
- Allows community training and inference
- Provided via Terraform templates and customized UI through CACAO

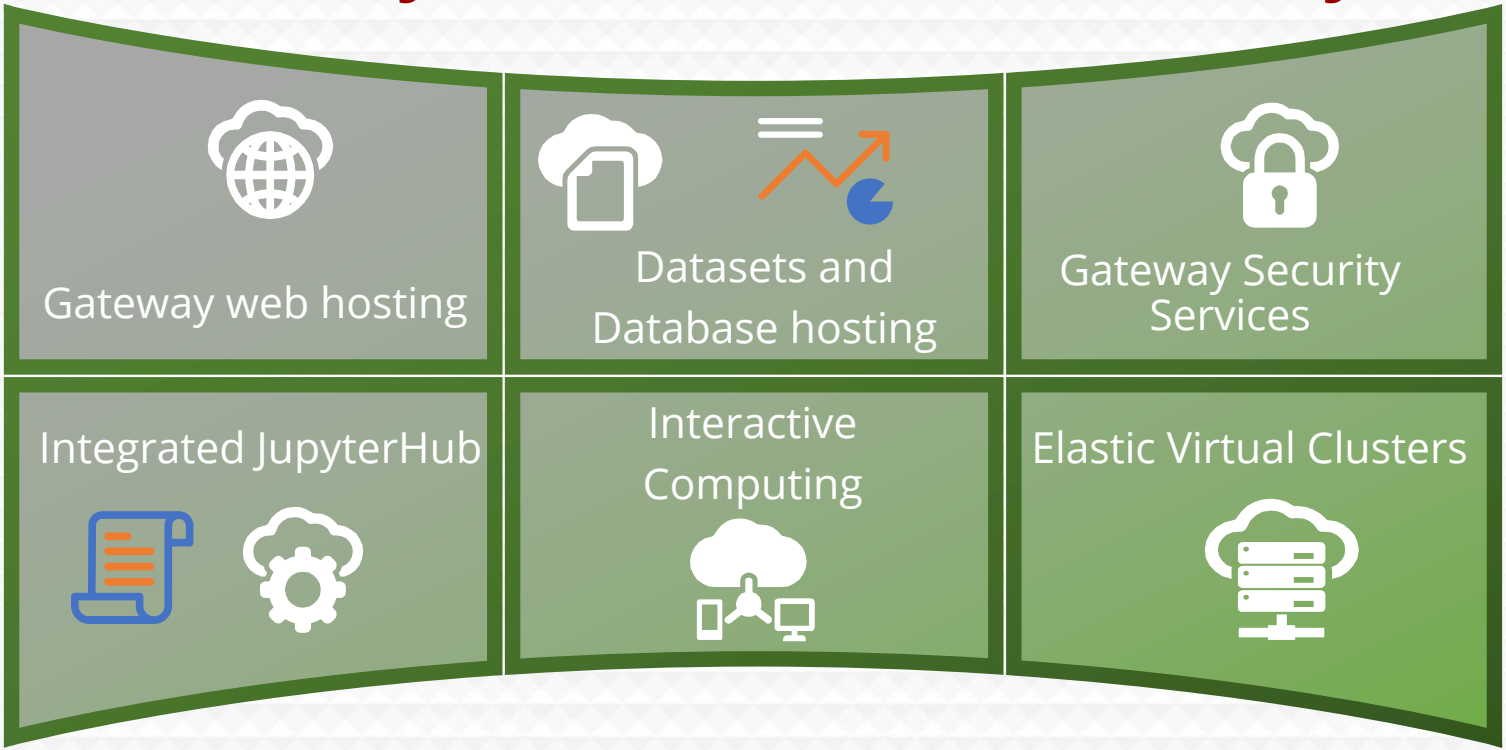


...we were able to easily provide so many students with a GPU-enabled container so quickly. Normally, getting GPU resources on an HPC scheduler, like OnDemand, takes time, and the high demand for GPUs makes finding 40 or more unoccupied resources an impossibility.

– Tyson Swetnam, CyVerse Co-PI and workshop instructor

https://cyverse.org/deep_learning_workshop

Gateways use JS2 in several ways



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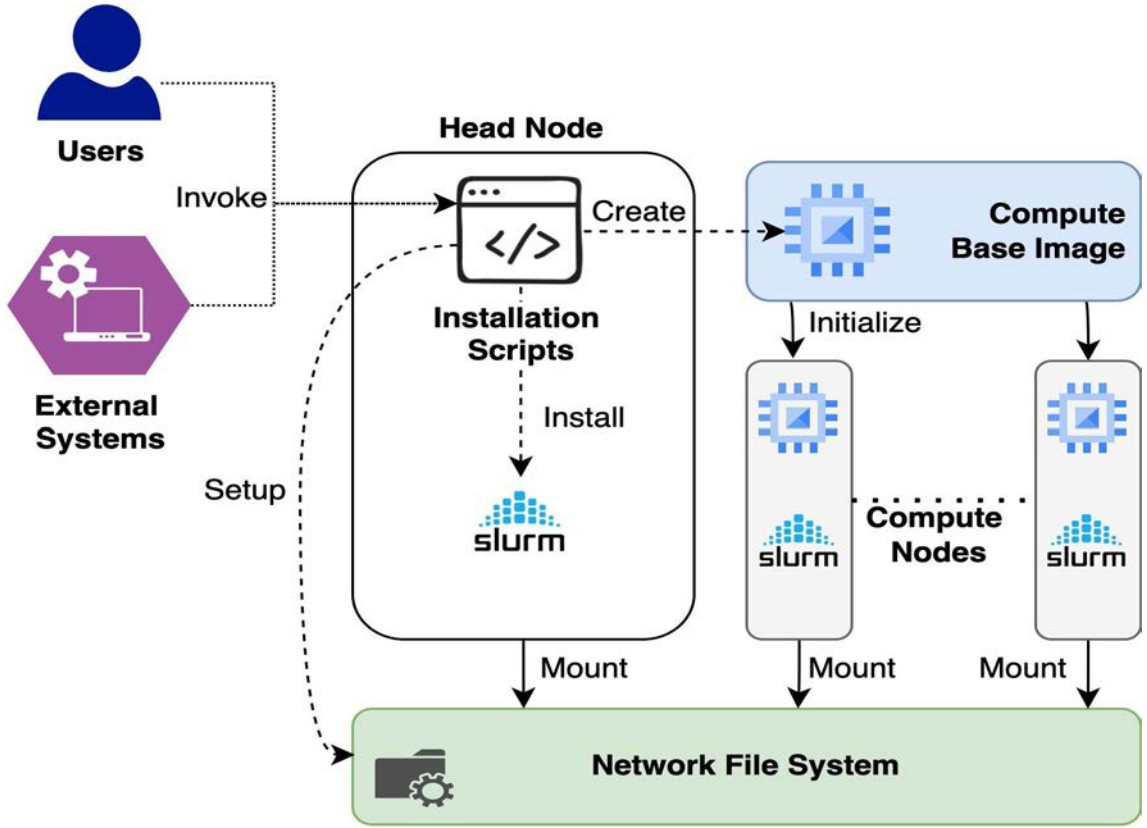
Virtual Clusters Architecture

- All these steps are bundled into the Ansible orchestrion.
- The entire system is a single click invoked from Exosphere.



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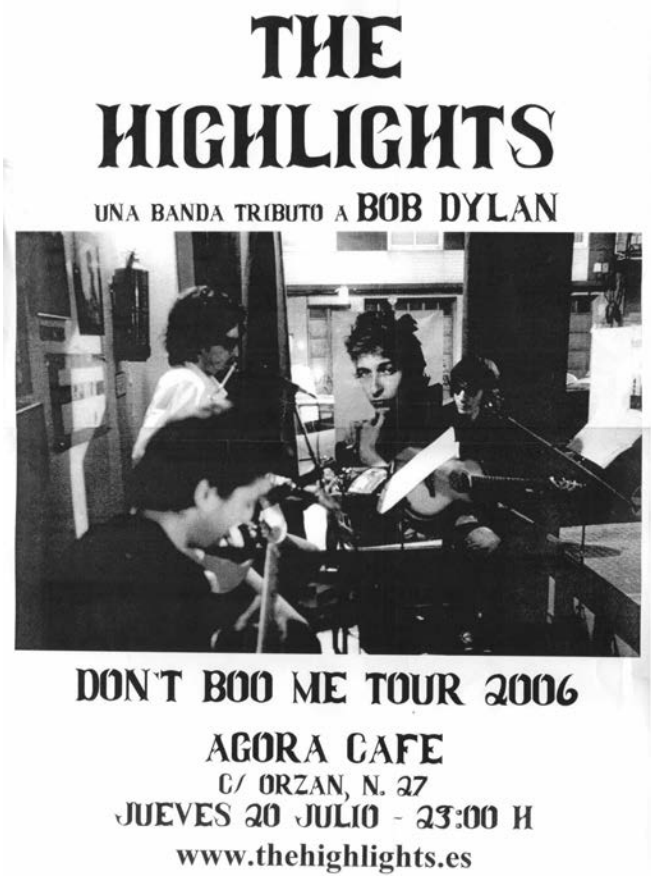
Operations highlights

- OpenStack upgrades x4 Wallaby -> Zed
- Shared storage availability (Manila)
- DNSaaS for instances (Designate)
- Only 17.2 hrs downtime (<0.2%) 4Q22
- 96.4% of instances started in <5 min
- Using CI/CD for image build pipeline
  - Weekly updates (vs periodic)
  - Allows more flavors (currently 7)
  - Allows reuse of our pipeline for others



"The Highlights" by Modesto del Río
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Developments to come

- LBaaS (load balancing)
- Secret storage (OpenStack Barbican)
- Managed Kubernetes (via OpenStack)
- IPV6
- Addition of a new partner
- Continued/evolving outreach
- Increased Cacao use / features
- Exploring direct-use Jupyter interface without launching/managing VMs

Exosphere specific

- Shared storage integration
- GPU-accelerated desktops
- Education / workshop features

"Work in progress" by Alexander Baxevanis
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