



**PERVASIVE
TECHNOLOGY INSTITUTE**



RESEARCH TECHNOLOGIES
UNIVERSITY INFORMATION TECHNOLOGY SERVICES

Jetstream2: Accelerating science and engineering on-demand

Jeremy Fischer – Indiana University

Research Cloud Infrastructure Manager

Midwest Research Computing & Data Consortium – 3 March 2023



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!

Jetstream2

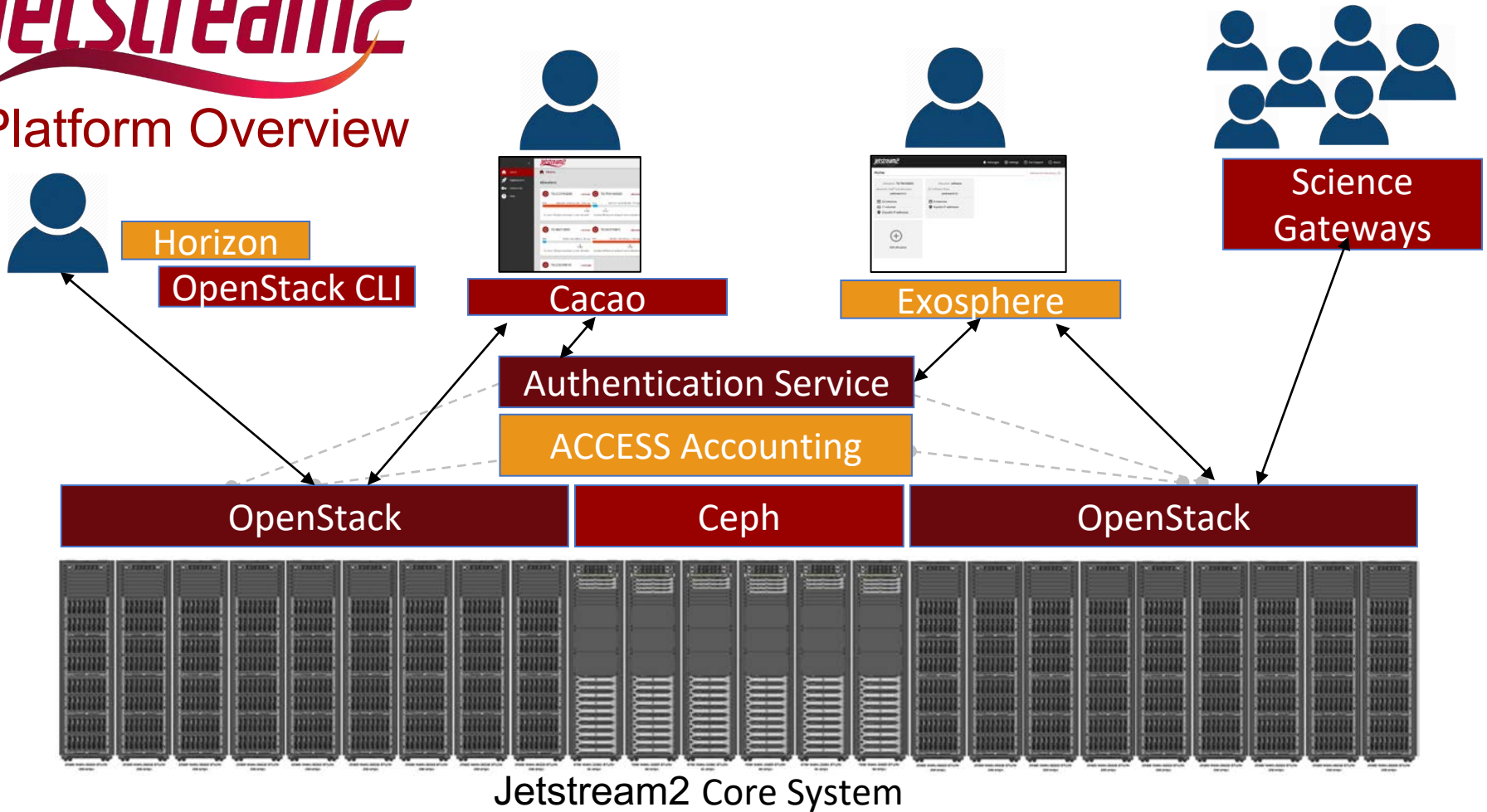


Differences from Jetstream[1] GUI

- 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

Jetstream2

Platform Overview



Exosphere



Home > Project TG-CCR190024

iu.jetstream-cloud.org - TG-CCR190024

Remove Allocation Create

Instances

Instances used 11 of 25 total Cores used 26 of 132 total RAM used 100 of 388 GB

Select All

Ready formally_trusty_urchin

Shelved optionally_certain_longhorn with GUI

Ready wildly_united_mite

Hiding 8 instances created by other users

Show

Volumes

Volumes used 2 of 10 total Storage used 279 of 1,100 GB



Home > Project TG-CCR190024 > Instances > Instance formally_trusty_urchin

iu.jetstream-cloud.org - TG-CCR190024

Remove Allocation Create

Instance formally_trusty_urchin

Created 19 minutes ago / by user tg836338 / from image JS-API-Featured-CentOS8-Latest

Status Ready
UUID 2bc77f59-73bf-470f-95b6-51dc31d7577f
Flavor m1.small
SSH Public Key Name smart
IP addresses
Public IP Address 149.165.157.3
Unassign

IP Details

Volumes Attached

(none)

Attach volume

Interactions

- Web Shell
- Web Desktop
- Native SSH: exouser@149.165.157.3
- Console

Password

Try logging in with username "exouser" and the following password:

Show password

Actions

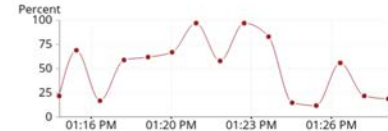
- Lock Prevent further instance actions until it is unlocked
- Suspend Save execution state to disk
- Shelve Shut down instance and offload it from compute host
- Image Create snapshot image of instance
- Reboot Restart instance
- Delete Destroy instance

Action History

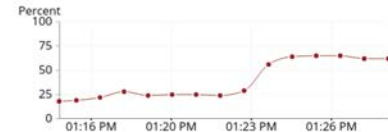
Action	Time
create	19 minutes ago (2021-10-26 20:10:54 UTC)

System Resource Usage

CPU Usage



Memory Usage



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

CACAO

Home

Deployments

Credentials

Help

Home

cacao **Jetstream2**

Home

cacao
Cloud Automation & Continuous Analysis Orchestration
Jetstream2 Alpha Release

Thank you for participating in the Jetstream2 Alpha release. Please use the following links to view known issues and submit any additional feedback as you use the application.

[VIEW KNOWN ISSUES](#) [SUBMIT FEEDBACK](#)

Allocations

Allocation ID	Project	CPU	GPU	Large Memory	Remaining Days
TRA220028	Jetstream2 Affiliated Development Projects	49,279 / 1,000,000 SUs 5% Used	12,083 / 1,000,000 SUs 1% Used	0 / 1,000,000 SUs 0% Used	288 days
TRA160003	Jetstream Staff Test Allocation	148,965 / 2,000,000 SUs 7% Used	95,323 / 2,000,000 SUs 5% Used	0 / 2,000,000 SUs 0% Used	87 days
CIS220046	Deep Learning Tutorial for Translational AI Center at Iowa State University	424,222 / 600,000 SUs 71% Used	-	-	115 days

Featured Learning

- Continuous Analysis 101
- Jetstream2 Basics
- Manage Resources

Deployments (1)

New Deployment

JETSTREAM 2 / BIO220047

Select a template that best describes what you want to do:

- simple launch of one or more vms
openstack-single-image
- launch a multi-vm zero-to-jupyterhub
jupyterhub
- launch a multi-vm kubernetes cluster (k3s)
single-image-k3s
- launch instances for a workshop
vm4workshop

GO

Jetstream2

<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



Gateway web hosting



Datasets and
Database hosting



Gateway Security
Services

Integrated JupyterHub



Interactive
Computing

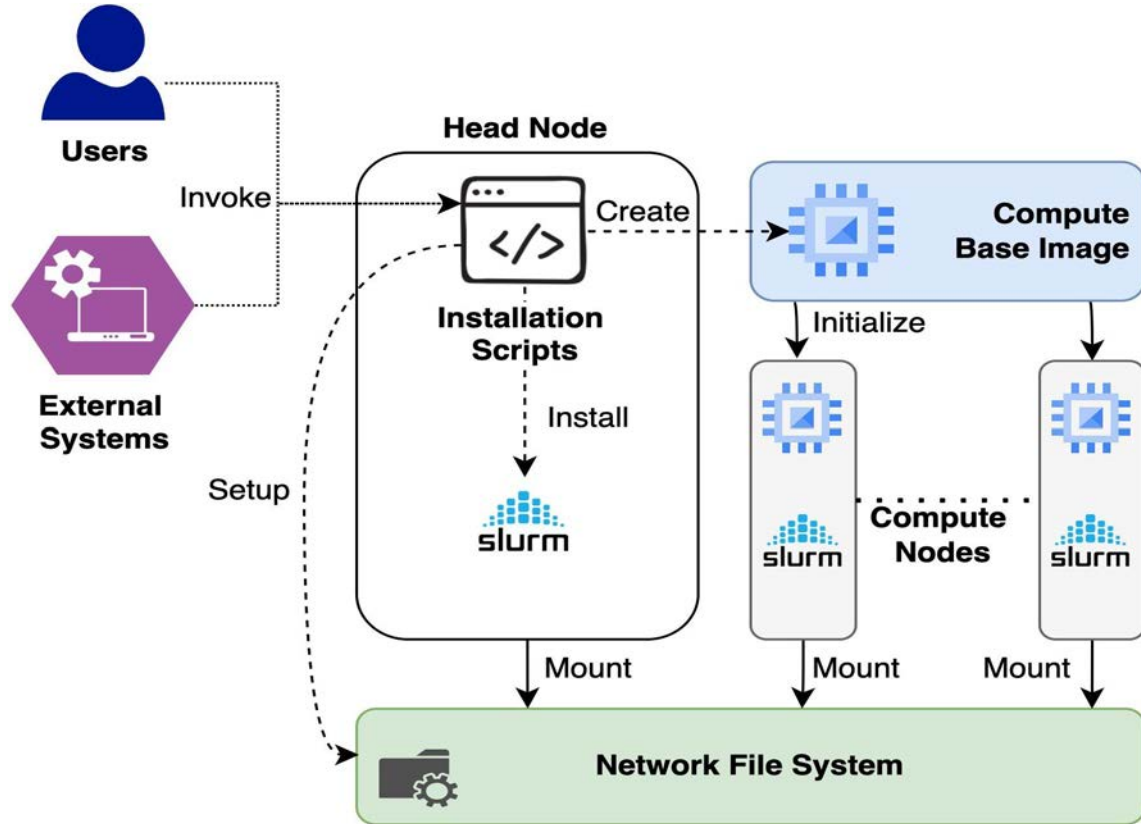


Elastic Virtual Clusters



Virtual Clusters Architecture

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




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**
UNA BANDA TRIBUTO A **BOB DYLAN**



DON'T BOO ME TOUR 2006
AGORA CAFE
C/ ORZAN, N. 27
JUEVES 20 JULIO - 23:00 H
www.thehighlights.es

"The Highlights" by Modesto del Río
Flickr CC BY 2.0

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
Flickr CC BY 2.0



**PERVASIVE
TECHNOLOGY INSTITUTE**



RESEARCH TECHNOLOGIES
UNIVERSITY INFORMATION TECHNOLOGY SERVICES

Acknowledgements

NSF Awards 1053575 & 1548562 (XSEDE), 1445604 (Jetstream) and 2005506 (Jetstream2)

This document was developed with support from the National Science Foundation. Any opinions, findings, conclusions, or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the NSF.

Special thanks to contributors & Jetstream2 partners

- David Hancock, J. Michael Lowe, Therese Miller, Maria Morris, Winona Snapp-Childs, George Turner, and Chris Martin.
- Vendors, particularly Dell and NVIDIA, also deserve recognition for their efforts



**PERVASIVE
TECHNOLOGY INSTITUTE**



RESEARCH TECHNOLOGIES
UNIVERSITY INFORMATION TECHNOLOGY SERVICES

Jetstream2 partners



JOHNS HOPKINS
UNIVERSITY



UCAR



<http://jetstream-cloud.org/>
National Science Foundation
Award #ACI-2005506