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Jetstream2: Accelerating cloud computing via Jetstream

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RT All Team Updates – August 11, 2022



What is “the” Jetstream?

- Fast moving air currents
- Hot/Cold air boundaries
- An NSF-funded cloud environment
- A project that brought new resources to US researchers via the national cyberinfrastructure, continuing into Jetstream2

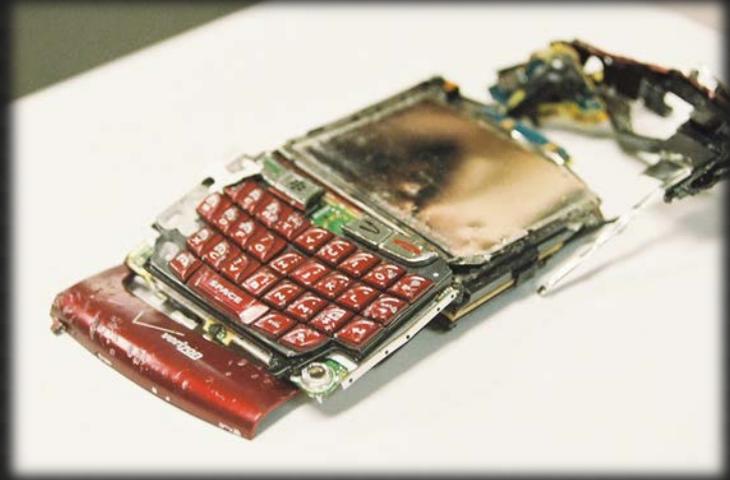


Jetstream2

Jetstream1

What worked?

- Allowing API access and full control (root privileges)
- “Indefinite workflows” – allowing instances to run continuously – providing PIs renew their allocations
- Development of trial allocations



Flickr user MattHurst – Broken Blackberry

What didn't work?

- Forcing small allocations into the research allocation process
- Lack of multi-year allocations
- Lack of shared data set storage

Lessons learned

Challenges -> Inspired changes

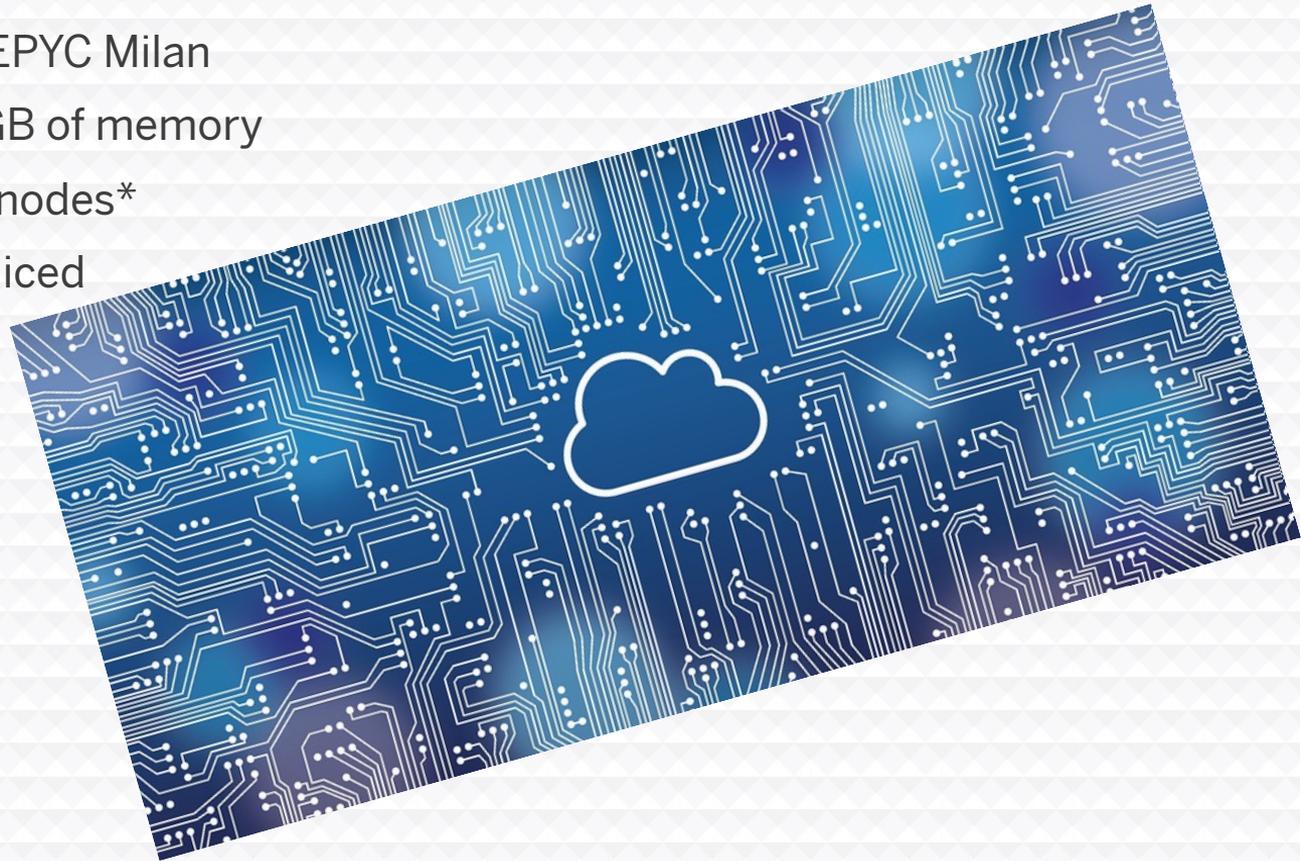
- Storage capacity -> Larger HDD pool and new flash storage
- Homogeneous hardware -> Inclusion of NVIDIA GPUs (w/MIG or vGPU) and memory diversity
- Separate OpenStack domains -> Unification of “Atmosphere” domain
- Virtual networking architecture/maintenance -> Increase offload capabilities via Cumulus Networks software and Mellanox hardware (NAT & simulation)
- Acceptance & integration into national CI ecosystem -> Changes to our metrics/KPIs & accounting processes
- Deployment diversity -> Leverage single technology for config management

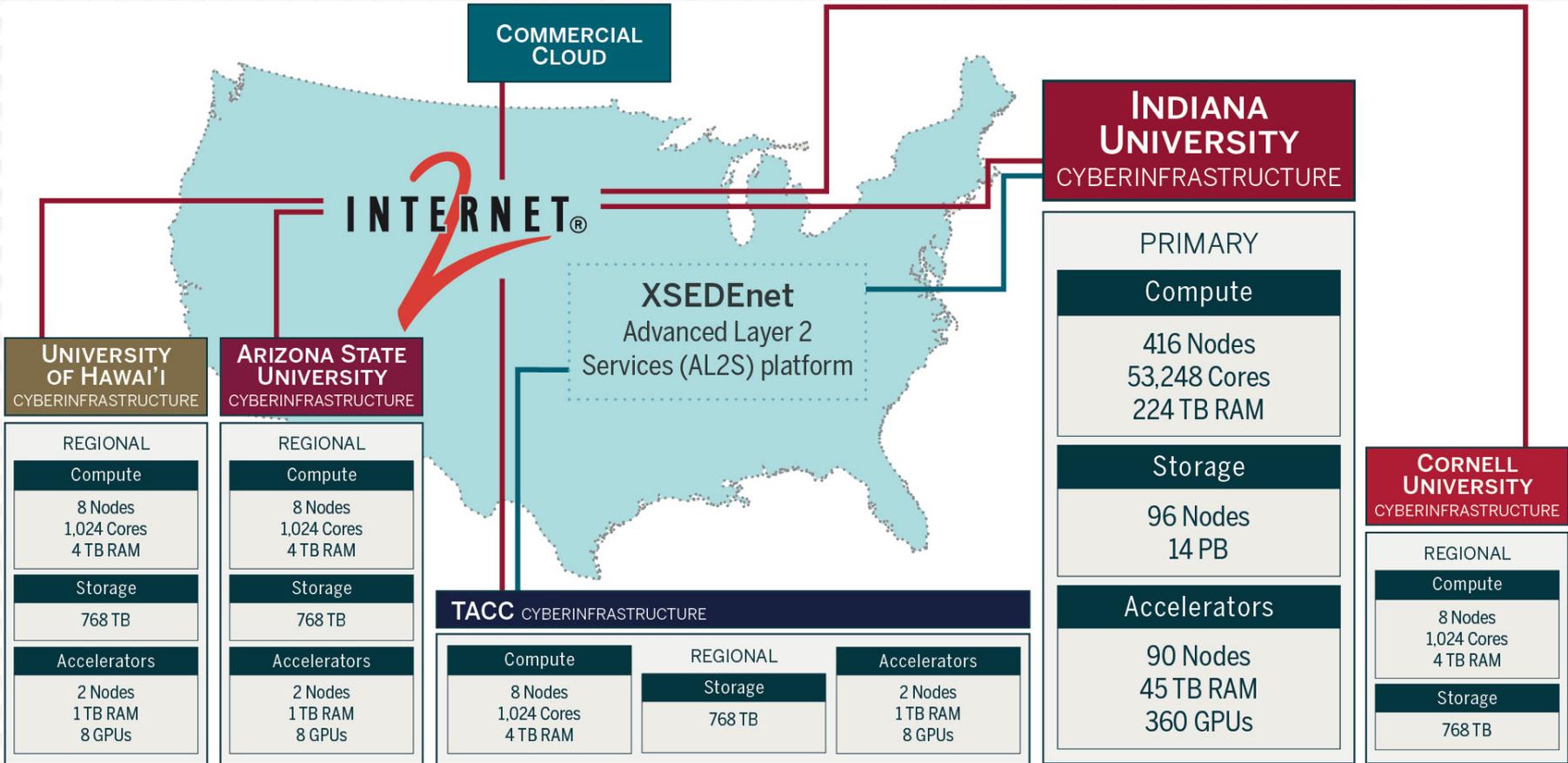


D.Y. Hancock – Castello di Nipozzano 2017

Big Memory, Larger Instances, GPUs

- 128 core nodes – AMD EPYC Milan
- Smallest node has 512GB of memory
- 32 Larger 1TB memory nodes*
- A100 GPUs sliced and diced





Jetstream2 Capabilities

Enhancing IaaS model of Jetstream:

- Improved orchestration support
- Elastic virtual clusters
- Federated JupyterHubs
- Ease storage sharing (CephFS w/Manilla)

Commitment to >99% uptime

- Critical for science gateway hosting
- Hybrid-cloud support

Revamped User Interface

- Unified instance management
- Multi-instance launch



Feb 12, 2019 – Jet stream region called “Jet N6”
NASA/JPL-Caltech/SwRI/MSSS/Kevin M. Gill

- >57K cores of next-gen AMD EPYC processors
- >360 NVIDIA A100 GPUs will provide vGPUs via NVIDIA's MIG/vGPU feature
- >17PB of storage (NVMe and disk hybrid)
- 100GbE Mellanox network

Some sample use cases

- Science gateways
- Research-supporting infrastructure / Infrastructure as a service
- Education support – compute and desktops for courses, workshops, tutorials
- Domain science interactive compute
- Domain science long running compute
 - Small core counts, "pleasingly parallel", etc
- Jupyter notebooks and Hubs
- Research software development
- Machine learning – training and workflow development and data analysis
- [Your use case here]



Jetstream2 in the IU Research ecosystem

IU cloud resources:

- Intelligent Infrastructure (II)
- IU Anywhere

--> Different types of use cases and functions

- Research cloud resources – RED / HPC virtual desktops (uses Jetstream!)
- Future IU research cloud? Maybe!



Getting access to Jetstream2

- National resource hosted at IU (vs being an IU resource)
- XSEDE (and soon ACCESS) allocation system
- XSEDE allocation types: startup/Champion, education, research
- ACCESS changes things up!
- Easy to get a startup allocation!

Allocations

- Primary cloud (IU) only Startup Limits
 - Jetstream (CPU Only) – 200,000 SU (core hours)
 - Jetstream LM (1TB Large Memory nodes) – 400,000 SU
 - Jetstream GPU (NVIDIA A100 GPU nodes) – 600,000 SU
 - Jetstream Storage (requires one of the compute resources) – 1TB
- Reference: <https://docs.jetstream-cloud.org/general/resources/>
- Who can get an allocation?
 - Applying: <https://docs.jetstream-cloud.org/alloc/startup/>
 - For courses/workshops: <https://docs.jetstream-cloud.org/alloc/education/>
- IU (RT) Staff allocation for *testing*



VM flavors

VM CPU Instance Configurations

Instance Type	vCPUs (128 total)	RAM (500GiB available)	Ephemeral Storage (in GB)
m3.tiny	1	3	20
m3.small	2	6	20
m3.quad	4	15	20
m3.medium	8	30	60
m3.large	16	60	60
m3.xl	32	125	60
m3.2xl	64	250	60
m3.3xl	128	500	60

VM GPU Instance Configurations

Instance Type	vCPUs (128 total)	vGPUs (5 slices)* + GPU RAM	RAM (500GiB available)	Ephemeral Storage (in GB)
g3.small	4	1 / 5gb	15	60
g3.medium	8	2 / 10gb	30	60
g3.large	16	4 / 20gb	60	60
g3.xl	32	5 / 40gb	125	60

*5 GPU slices = 1 NVIDIA 40GB Ampere A100 GPU

** 5 Slices max per GPU

Large Memory Instance Configurations

Instance Type	vCPUs (128 total)	RAM (1000GB available)	Ephemeral Storage (in GB)
r3.large	64	500GB	60
r3.xl	128	1000GB	60



Reference: <https://docs.jetstream-cloud.org/general/vmsizes/>

How do I access Jetstream2?

Jetstream2

Messages Settings Get Support About

Home > Project TG-TRA160003

Jetstream2 IU - TG-TRA160003 (logged in as jfischer@xsede.org)

Allocation usage 0 of 1,000,000 SUs jetstream Staff Test Allocation

Remove Allocation Create

Instances

Instances used 10 of 100 total

No instances to preview and 10 more instances

Volumes

Volumes used 9 of 50 total

cmaaaaaaaaaart 10 GB

(Untitled volume) 20 GB

(Untitled volume) 20 GB

and 6 more volumes

Public IP Addresses

Public IP Addresses used 11 of 50 total

149.165.159.21

and 10 more public IP addresses

SSH Public Keys

SSH Public Keys used 1 of 100 total

jlf-ecc-key 23:90:df:ba:a2:e6:f9:5d:3b:4d:24:21...

```
Openstack Admin - IU -- -bash -- 94x26
(openstack5) [JS2 IU Admin] [Entropy] jeremy ~-->openstack flavor list
+-----+-----+-----+-----+-----+-----+-----+
| ID | Name | RAM | Disk | Ephemeral | VCPUs | Is Public |
+-----+-----+-----+-----+-----+-----+-----+
| 1 | m3.tiny | 3072 | 20 | 0 | 1 | True |
| 13 | g3.xl | 128000 | 60 | 0 | 32 | False |
| 2 | m3.small | 6144 | 20 | 0 | 2 | True |
| 3 | m3.quad | 15360 | 20 | 0 | 4 | True |
| 4 | m3.medium | 30720 | 60 | 0 | 8 | True |
| 5 | m3.large | 61440 | 60 | 0 | 16 | True |
| 7 | m3.xl | 128000 | 60 | 0 | 32 | True |
| 8 | m3.2xl | 256000 | 60 | 0 | 64 | True |
+-----+-----+-----+-----+-----+-----+-----+
(openstack5) [JS2 IU Admin] [Entropy] jeremy ~-->
```

Project / Compute / Overview

Overview

Limit Summary

Compute

- Instances Used 10 of 100
- VCPUs Used 25 of 12,800
- RAM Used 84GB of 48.8TB

Volume

- Volumes Used 9 of 50
- Volume Snapshots Used 0 of 10
- Volume Storage Used 180GB of 1000GB

Network

- Floating IPs Allocated 11 of 50
- Security Groups Used 10 of 100
- Security Group Rules Used 62 of 100
- Networks Used 1 of 100
- Ports Used 23 of 500
- Routers Used 1 of 10

Usage Summary



Brief demo here if time permits...



Using and preserving VMs

- You can install just about anything*
 - But generally limited to Linux**
- Snapshots are fairly simple and easily shared with your allocation
- One general practice is often to pull from Git(hub/lab) or pull a container

* Standard warnings about licensed software here.

** Here there be dragons.



Timeline

- Jetstream1 ended operations on July 31 for XSEDE
- JS1 hardware will live on for internal usage
- Jetstream2
 - Early operations started in February 2022
 - Production pending NSF approval



Flickr user Oiluj Samall Zeid - Lejos de Yulín



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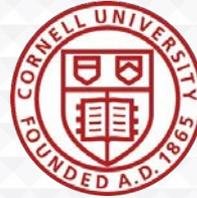


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Jetstream2 partners



JOHNS HOPKINS
UNIVERSITY



UCAR



<http://jetstream-cloud.org/>
National Science Foundation
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