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# Jetstream2: Accelerating cloud computing via Jetstream

by Jeremy Fischer

NSF Ecosystem Lightning Talks

March 2, 2022
CI Compass Cyberinfrastructure for NSF
Major Facilities Workshop

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# Jetstream2: Accelerating cloud computing via Jetstream

**Jeremy Fischer – Indiana University**

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Cyberinfrastructure for Major Facilities Workshop - Mar 2, 2022

Jetstream2

# What is “the” Jetstream?

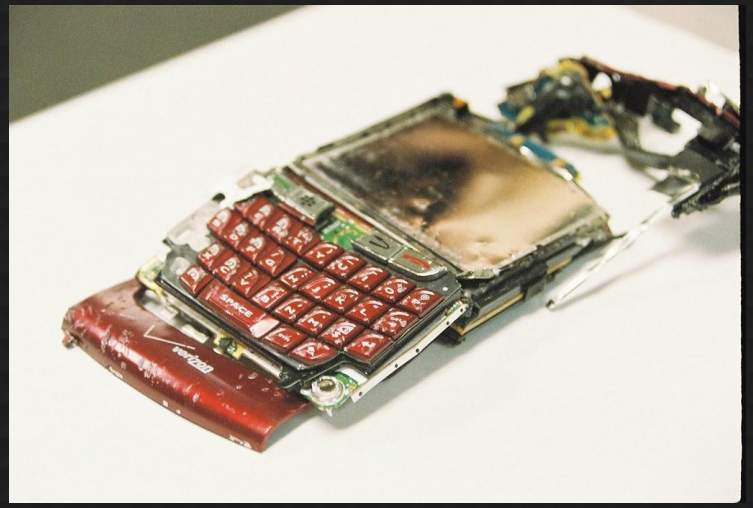
- Fast moving air currents
- Hot/Cold air boundaries
- An NSF-funded cloud environment
- A project that brought new resources to US researchers via the national cyberinfrastructure, continuing into Jetstream2

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

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# 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

D.Y. Hancock – Castello di Nipozzano 2017

- 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

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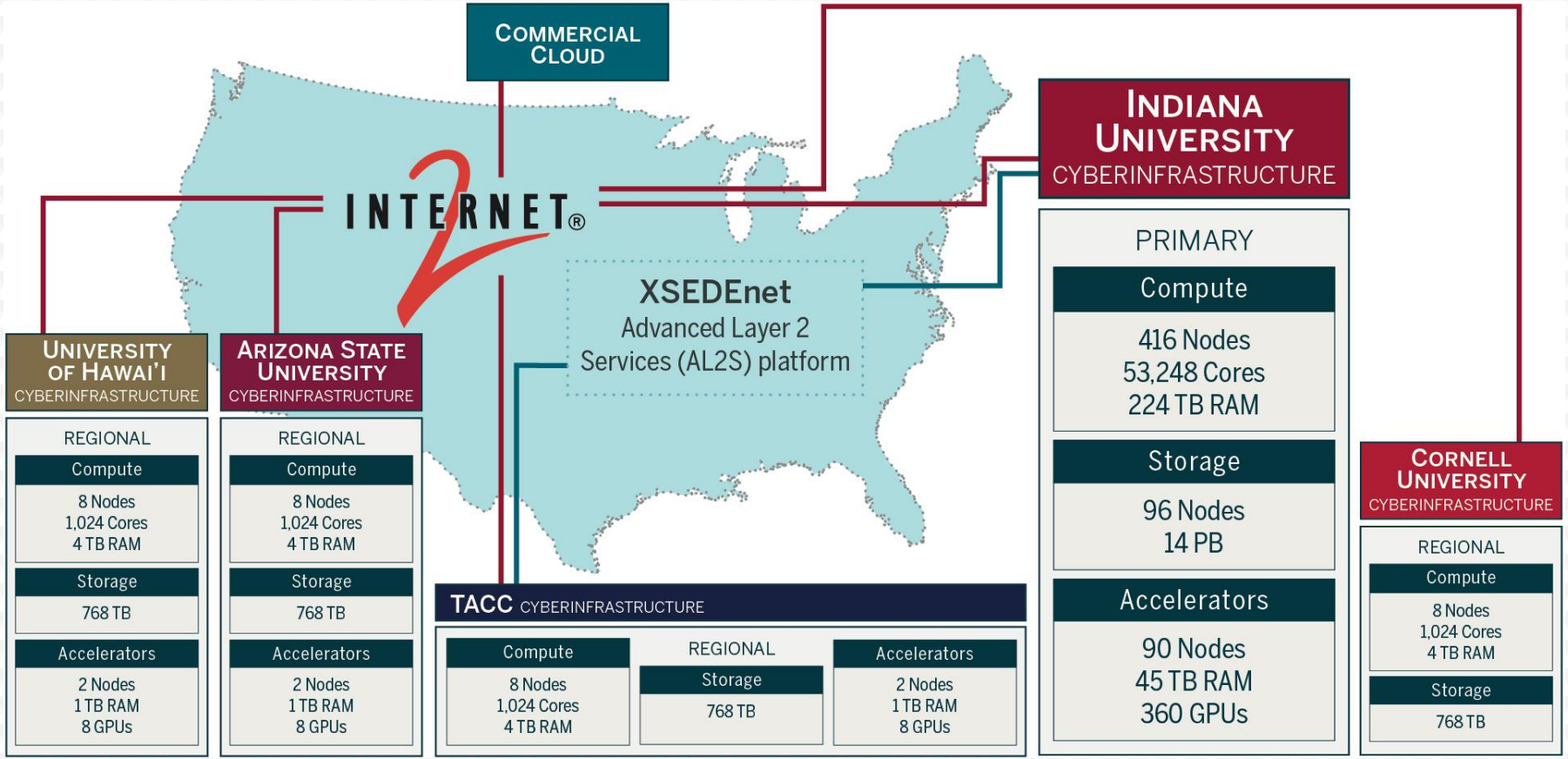
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Services (AL2S) platform
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CYBERINFRASTRUCTURE
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224 TB RAM
Storage
96 Nodes
14 PB
Accelerators
90 Nodes
45 TB RAM
360 GPUs
UNIVERSITY OF HAWAI'I
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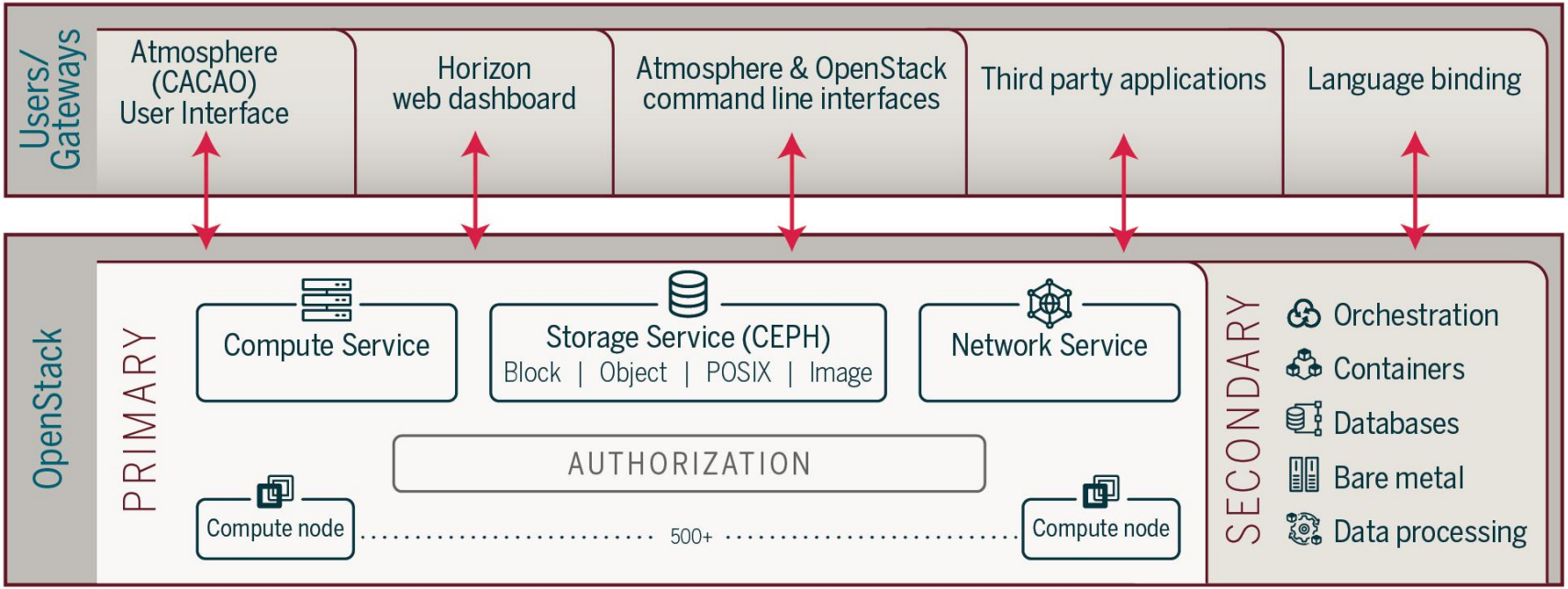
# Jetstream2 Architecture

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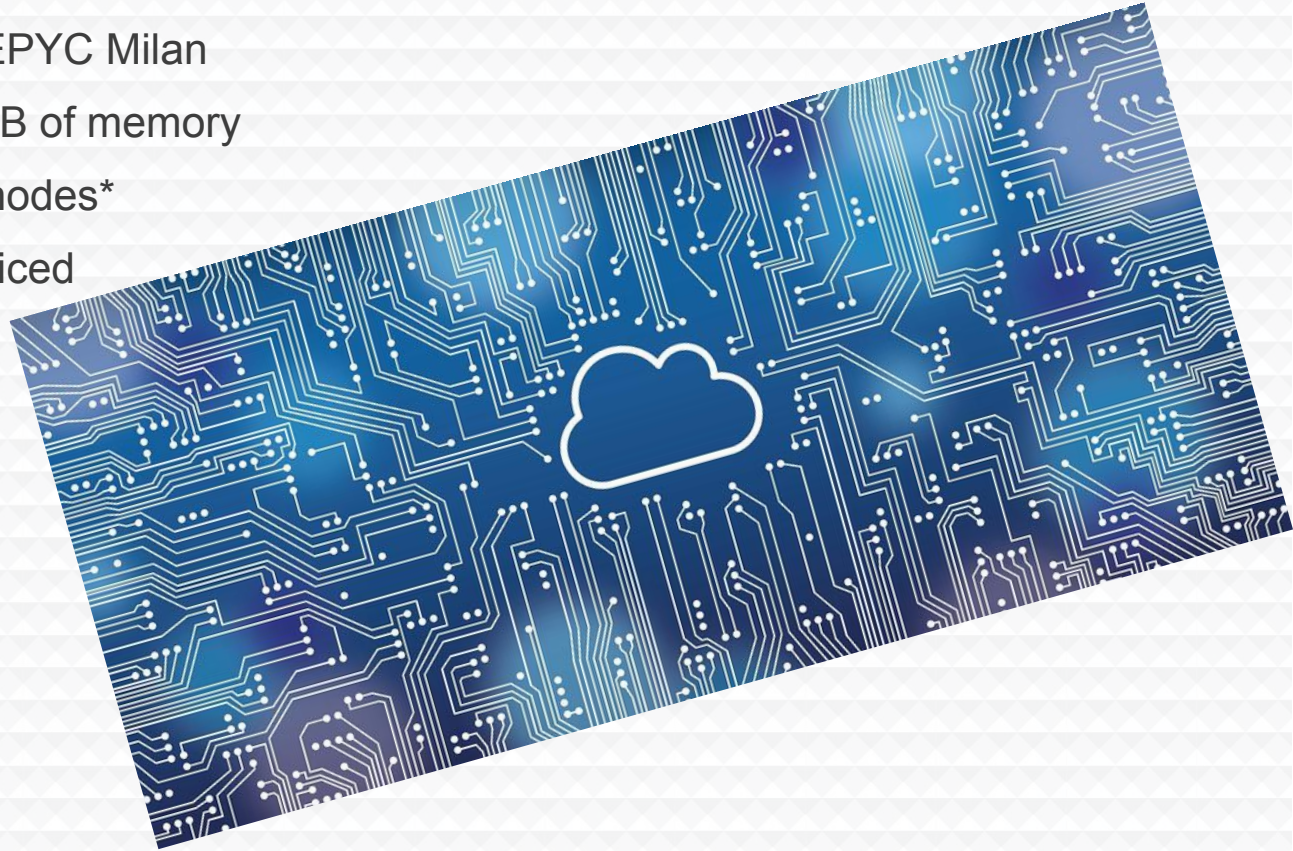
# Big Memory, Larger Instances, GPUs

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



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# 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

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# Startup Defaults

- Primary cloud (IU) only
  - 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/
- Research allocations have no set limits – potentially millions of core hours at the cost of a quality proposal submission

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# VM flavors

**Table 1. VM CPU Instance Configurations**

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

**Table 2. VM GPU Instance Configurations**

| Instance Type | vCPUs (128 total) | vGPUs (7 slices)* + GPU RAM | RAM (500GiB available) | Ephemeral Storage (in GB) | Instances/Node |
|---|---|---|---|---|---|
| g3.small | 4 | 1 / 5gb | 15 | 60 | 28** |
| g3.medium | 8 | 2 / 10gb | 30 | 60 | 16 |
| g3.large | 16 | 3 / 20gb | 60 | 60 | 8 |
| g3.xl | 32 | 7 / 40gb | 125 | 60 | 4 |

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

** https://docs.nvidia.com/datacenter/tesla/mig-user-guide/#a100-profiles - 7 slices max

**Table 3. Large Memory Instance Configurations**

| Instance Type | vCPUs (128 total) | RAM (1000GB available) | Ephemeral Storage (in GB) | Instances/Node |
|---|---|---|---|---|
| r3.large | 64 | 500GB | 60 | 2 |
| r3.xl | 128 | 1000GB | 60 | 1 |

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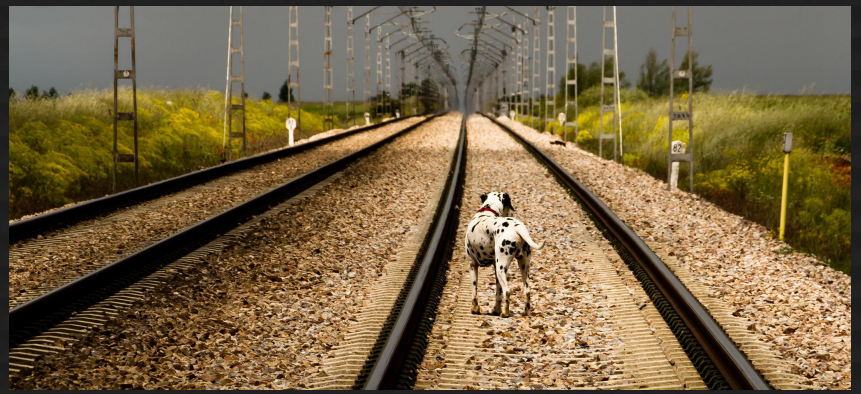
Reference: https://docs.jetstream-cloud.org/general/vmsizes/

# Timeline

- Jetstream now in 5th year of operations
- Jetstream extension granted by the NSF through November 2021
- Extension through end of March 2022 in process
- Jetstream2
  - Early operations in progress as of February 2022
  - Production operations by end of March 2022



Flickr user Oiluj Samall Zeid - Lejos de Yulín

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# Jetstream2 partners

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http://jetstream-cloud.org/
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