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Jetstream2: Accelerating cloud computing via Jetstream

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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

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

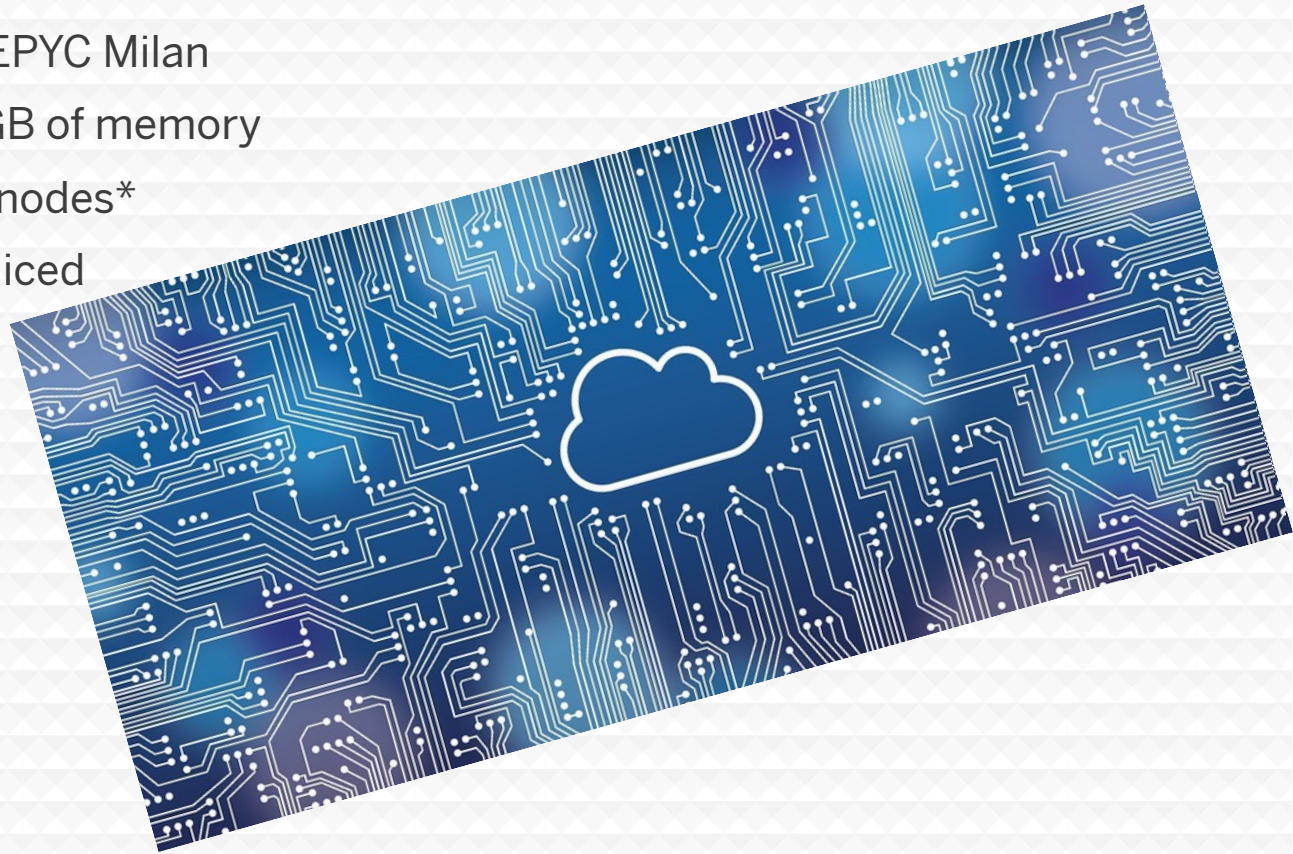


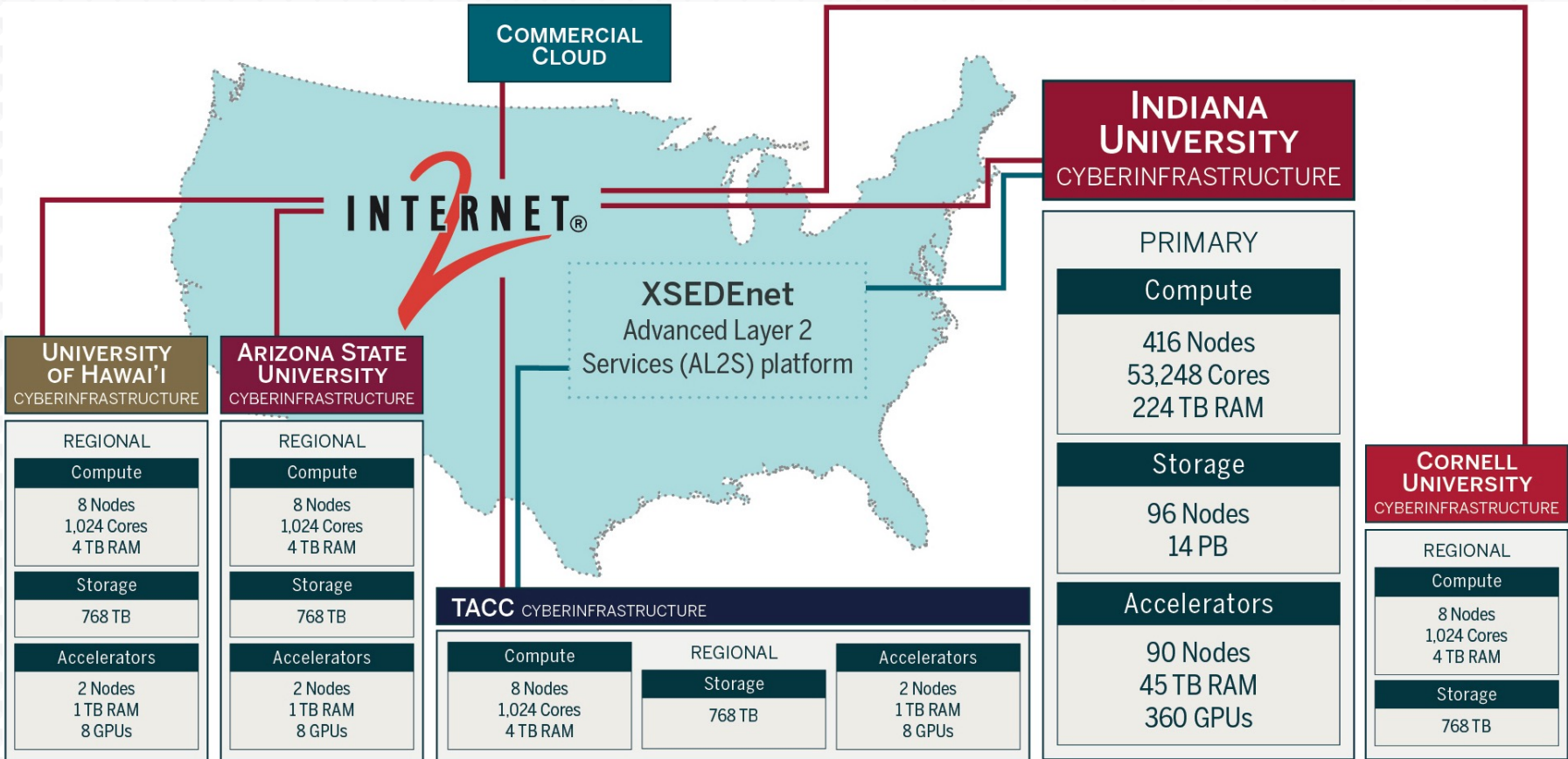
Feb 12, 2019 – Jet stream region called “Jet N6”
NASA/JPL-Caltech/SwRI/MSSS/Kevin M. Gill

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

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





Allocatable Resources

- Primary cloud (IU) only
 - Jetstream (CPU Only)
 - 1 core hour = 1 SU
 - Jetstream LM (1TB Large Memory nodes)
 - 1 core hour = 2 SUs, 128 SU/hr minimum based on proposed flavors
 - Jetstream GPU (NVIDIA A100 GPU nodes)
 - 1 core hour = 4 SU, 16 SU/hr minimum based on proposed flavors
 - Jetstream Storage
 - Only with CPU/GPU/LM allocation
- Regional cloud access by invitation or request from provider



Startup Defaults

- Primary cloud (IU) only
 - Jetstream (CPU Only) – 200,000 SU
 - 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
- Regional clouds have no default startup values as you must have a primary cloud account first – quotas are determined by cloud provider if access is granted and may be significantly smaller than primary cloud



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 |



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

XRAC Limits

No established limits for any resource except storage. Awards will be based on merit as determined by XRAC and availability.

Jetstream2 Storage is limited to 50TB unless explicitly approved by JS2 allocations staff



Scaling and Code Performance on JS2

- Continuing the trend with JS1
 - Traditional code gets measured in the normal ways, paying attention to cores and memory usage
 - As scaling generally doesn't span nodes, it's attention to single node (or less) performance and choosing the best VM flavor and length of running VM
 - For startups and education, internally we often allow for VM management time (10 to 20% as VMs don't automatically shut down when the runs complete)
 - Infrastructure allocations like gateways, Kubernetes deployments, or other support VMs are measured differently
 - General equation for an "always on" service VM:
 - # of cores * 24 hours/day * 365 days = VM cost in SUs
 - Will use the appropriate multiplier for LM or GPU
 - Providing a table of VMs, purpose, and SUs along with the detailed description is desirable for infrastructure allocations

Anticipated SUs available for XRAC for each of the first three quarters of allocations

- Jetstream (CPU Only) – 60,000,000 SUs
- Jetstream LM (1TB Large Memory nodes) – 9,000,000 SUs
- Jetstream GPU (NVIDIA A100 GPU nodes) – 12,000,000 SUs



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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<http://jetstream-cloud.org/>
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