Jetstream2: Accelerating cloud computing via Jetstream

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Is Jetstream2 a “testbed?”

- No, but it’s a great place to test!
- 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

Now with GPUs and large-memory!
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

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
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

>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]
Advanced capabilities

• Focusing on enabling several advanced capabilities:
  • ”Push button” virtual clusters (Slurm-based)
  • Using Terraform for programmable cyberinfrastructure (infrastructure as code)
  • Simplifying container orchestration with Kubernetes
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/
## VM CPU Instance Configurations

<table>
<thead>
<tr>
<th>Instance Type</th>
<th>vCPUs (128 total)</th>
<th>RAM (500GiB available)</th>
<th>Ephemeral Storage (in GB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>m3.tiny</td>
<td>1</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>m3.small</td>
<td>2</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
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<td>4</td>
<td>15</td>
<td>20</td>
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<tr>
<td>m3.medium</td>
<td>8</td>
<td>30</td>
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<tr>
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<tr>
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<td>32</td>
<td>125</td>
<td>60</td>
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<tr>
<td>m3.2xl</td>
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<td>250</td>
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</tr>
<tr>
<td>m3.3xl</td>
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<td>500</td>
<td>60</td>
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## VM GPU Instance Configurations

<table>
<thead>
<tr>
<th>Instance Type</th>
<th>vCPUs (128 total)</th>
<th>vGPUs (5 slices)* + GPU RAM</th>
<th>RAM (500GiB available)</th>
<th>Ephemeral Storage (in GB)</th>
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<td>60</td>
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<tr>
<td>g3.medium</td>
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<td>2 / 10gb</td>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td>g3.large</td>
<td>16</td>
<td>4 / 20gb</td>
<td>60</td>
<td>60</td>
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<tr>
<td>g3.xl</td>
<td>32</td>
<td>5 / 40gb</td>
<td>125</td>
<td>60</td>
</tr>
</tbody>
</table>

*5 GPU slices = 1 NVIDIA 40GB Ampere A100 GPU  
** 5 Slices max per GPU

## Large Memory Instance Configurations

<table>
<thead>
<tr>
<th>Instance Type</th>
<th>vCPUs (128 total)</th>
<th>RAM (1000GB available)</th>
<th>Ephemeral Storage (in GB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>r3.large</td>
<td>64</td>
<td>500GB</td>
<td>60</td>
</tr>
<tr>
<td>r3.xl</td>
<td>128</td>
<td>1000GB</td>
<td>60</td>
</tr>
</tbody>
</table>
How do I access Jetstream2?

https://docs.jetstream-cloud.org/overview/overview-doc/
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.
Making the jump to Jetstream2

- Almost 12,000 users over the span of Jetstream1
- Early Jetstream2 invitations out to PIs February 2022
- First projects added 7-February-2022
- July 1 2022: 265 projects and 1102 individuals
- Followed push for all projects to migrate in May – July.
- Includes multiple science gateways and education/training allocations
Timeline

• Jetstream ends operations on July 31 for XSEDE
• JS1 hardware will live on for internal usage
• Jetstream2
  • Early operations started in February 2022
  • Migrating from Jetstream1 now!
  • Production pending NSF approval
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