Jetstream - Early Operations Performance, Adoption, and Impacts

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What is “the” Jetstream?

- Fast moving air currents
- Hot/Cold air boundaries
- An NSF-funded cloud environment

NASA’s Suomi NPP satellite collected this natural-color image using the VIIRS (Visible Infrared Imaging Radiometer Suite) instrument on Sept. 4, 2017. Actively burning areas are outlined in red. NASA image courtesy Jeff Schmaltz LANCE/EOSDIS MODIS Rapid Response Team, GSFC
National Science Foundation – Funding in HPC

• Traditionally concentrated on enabling peta-scale capability via track I/II programs
  – Blue Waters – 13.3 petaflops, 2012 (under re-compete)
  – Stampede – 9.6 petaflops, 2013 (extended to Stampede 2)
  – Comet – ~2.0 petaflops, 2014

• Have funded research into building clouds and computer science testbeds
  – CloudLab
  – Chameleon

• Now funding clouds to do research
  – Bridges (Hybrid system)
  – Jetstream
What is Jetstream and why does it exist?

• NSF’s first production cloud facility
• Focus on ease-of-use, broad accessibility
• Encourage collaboration and community development
• User-selectable library of preconfigured virtual machines
• Provides on-demand interactive computing and analysis or persistent services such as gateways (e.g. SEAGrid, Galaxy, GenApp, and others)
• Enables configurable environments and programmable cyberinfrastructure
• Reproducibility: Share VMs and then store, publish via IU Scholarworks (DOI)
Jetstream - Expanding NSF XD’s reach and impact

Around 350,000 researchers, educators, & learners received NSF support in 2015

- **Less than 2%** completed a computation, data analysis, or visualization task on XD/XSEDE program resources
- Less than 4% had an XSEDE Portal account
- **70%** of researchers surveyed* claimed to be resource constrained

Why are the people not using XD/XSEDE systems not using them?

- Perceived **ease of access** and use
- HPC resources – the traditional view of what XSEDE offers - are often **not well-matched** to their needs
- They just don’t need **that much** capability

*XSEDE Cloud Survey Report - http://hdl.handle.net/2142/45766
Who uses Jetstream?

- The researcher needing a handful of cores (1 to 44/vCPU)
- Software creators and researchers needing to create their own customized virtual machines and workflows
- Science gateway creators using Jetstream as either the frontend or processor for scientific jobs
- STEM Educators teaching on a variety of subjects
What Jetstream isn’t...

- It’s not traditional HPC
- There’s no shared filesystem (think cloudy!)
- There’s no high-end interconnect fabric (keep thinking cloudy!)
- There aren’t GPUs (yet...stay tuned)
- It isn’t Amazon, Azure, or GCE (similar, but...)

funded by the National Science Foundation Award #ACI-1445604
Jetstream and way of the cloud...

- **Cloudy Technologies**: clouds are more than just virtual machines (VM)
  - **Old way**: robust (expensive) infrastructure, weak (cheap) software
    - You expect the hardware to not fail
    - State in maintained in volatile data structures
  - **Cloudy way**: commodity infrastructure, robust software
    - Expect & plan for infrastructure to fail
    - Put intelligence into the software to handle infrastructure failure
- **And my favorite...**
Thinking about VMs...

- Cattle, not pets: pets take great amount of care, feeding, and you name them; cattle you intend to have high turnover and you give them numbers.

-- Mike Lowe (Jetstream architect)

** Some caveats for gateways, but...
Jetstream System Overview

IU Cyberinfrastructure
- Jetstream (production)
  - Compute: 320 Nodes, 7,680 Cores, 40 TB RAM, 640 TB local disk
  - Storage: 960 TB

TACC Cyberinfrastructure
- Jetstream (production)
  - Compute: 320 Nodes, 7,580 Cores, 40 TB RAM, 640 TB local disk
  - Storage: 960 TB

U of Arizona Cyberinfrastructure
- Jetstream (development)
  - Compute: 16 Nodes, 384 Cores, 2 TB RAM, 32 TB local disk

Connected to Internet2 and XSEDE, funded by the National Science Foundation Award #ACI-1445604

http://jetstream-cloud.org/
Platform Overview

- Atmosphere API
- Globus Auth
- Atmo Services
- XSEDE Accounting
- OpenStack
- Ceph

Indiana University

TACC
Jetstream usage highlights

As of October 2017:

• 360 active XSEDE projects covering 66 fields of science and **2180 active users** representing **191 institutions**
• **86%** of Jetstream users new to XSEDE (at end of PY1)
• >76 million CPU hours allocated to XSEDE projects since June 2016
• 9 science gateways
• 42 education/teaching allocations serving almost 800 students
• Averaging 816 concurrent VMs
• **100%** system availability, **99.4%** cap availability
• **97.7%** “job” completion (at end PY1)
<table>
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<tr>
<th>Discipline or area of interest</th>
<th>#of Jetstream allocations</th>
<th>SU#s allocated on Jetstream</th>
<th>% of SU#s allocated on Jetstream</th>
<th>% of all SU#s allocated on other XSEDE-supported systems</th>
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<tr>
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PY1 Challenges

- Outreach efforts largely funded by IU and partners
- Barriers to XSEDE adoption in general
- XRAC process cumbersome to intended audience
- User support needs are significant
- Can be intimidating to port traditional HPC workflows
Jetstream REU Program 2017

- NSF Supplement for 4 undergraduates
- Looking to recruit 4-6 students for 2018
- REU student videos on YouTube
  https://www.youtube.com/user/IUPTI
- News release describing their experiences
  https://itconnections.iu.edu/2017-august/jetstream.php

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http://jetstream-cloud.org/
Requesting access to Jetstream

- Trial allocations available **TODAY**
- You can request startup allocations anytime.
- You can request allocations for educational use anytime.
- Next submission period for large allocations is 15 December 2017 – 15 January 2018.
- We are happy to help you prepare a request and create a successful proposal.
- You do **not** have to have prior use of Jetstream to be successful.
- You **do** need a US-based collaborator.

http://jetstream-cloud.org/
PY2 Plans

- Enabling better Jupyter deployments for training and research
- Continue improving trial allocations
- More videos/training
- Encouraging orchestration for more communities
- Image build repository (proposed to XSEDE for funding)
PY2 plans continued...

• Partner with XSEDE Campus Champions and ACI-REF Facilitators to do tutorials for interested under-served researchers

• Explore better ways to communicate with the user community and to allow them to communicate with each other

• Develop additional domain science images with input from the Jetstream and XSEDE community

• Begin work on Windows VM adaptation for Jetstream API if licensing can be resolved

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http://jetstream-cloud.org/
Help / References


User guides: https://portal.xsede.org/user-guides

XSEDE KB: https://portal.xsede.org/knowledge-base

Email: help@xsede.org

Campus Champions: https://www.xsede.org/campus-champions

Paper describing Jetstream: Jetstream: A self-provisioned, scalable science and engineering cloud environment

Configuration management: https://github.com/jetstream-cloud/Jetstream-Salt-States
Questions?

Project website: http://jetstream-cloud.org/
Project email: help@jetstream-cloud.org Direct email: dyh@iu.edu

License Terms

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Things left behind...

Flickr user Oiluj Samall Zeid - Lejos de Yulín

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