



RESEARCH TECHNOLOGIES

UNIVERSITY INFORMATION TECHNOLOGY SERVICES

Jetstream Overview: A national research and education cloud

A (Brief) Jetstream Overview – C2Exchange Resources for Teaching Panel
September 27, 2019 – Washington, D.C.

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Fischer, J. (2019). Jetstream Overview: A national research and education cloud. Washington, DC. Retrieved from <https://jetstream-cloud.org/research/publications.php>

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>



What is Jetstream and why does it exist?

- NSF's first production cloud facility
- Focus on ease-of-use, broad accessibility
- User-selectable library of preconfigured virtual machines
- Provides **on-demand** *interactive* computing and analysis or persistent services such as gateways
- Enables *configurable* environments; ***programmable cyberinfrastructure***



Who uses Jetstream?

- The researcher needing a handful of cores (1 to 44/vCPU)
- Software creators and researchers needing to create their own VMs 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...they're coming!)
- It isn't Amazon, Azure, or GCE (similar, but...)



HPC vs Cloud

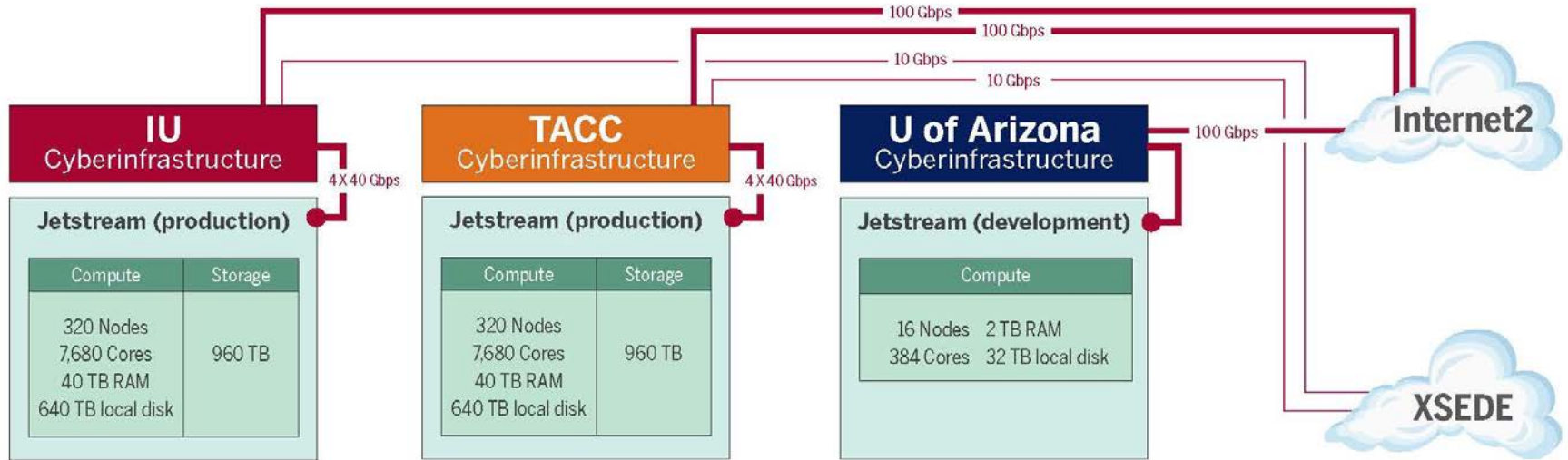
Adapting to a different environment:

- No reservations, no queueing – more interactive usage
- Being your own admin – hey, we have root!**
- You really can have almost any (linux) software you want**
- Users seem to like few/no scheduled downtimes

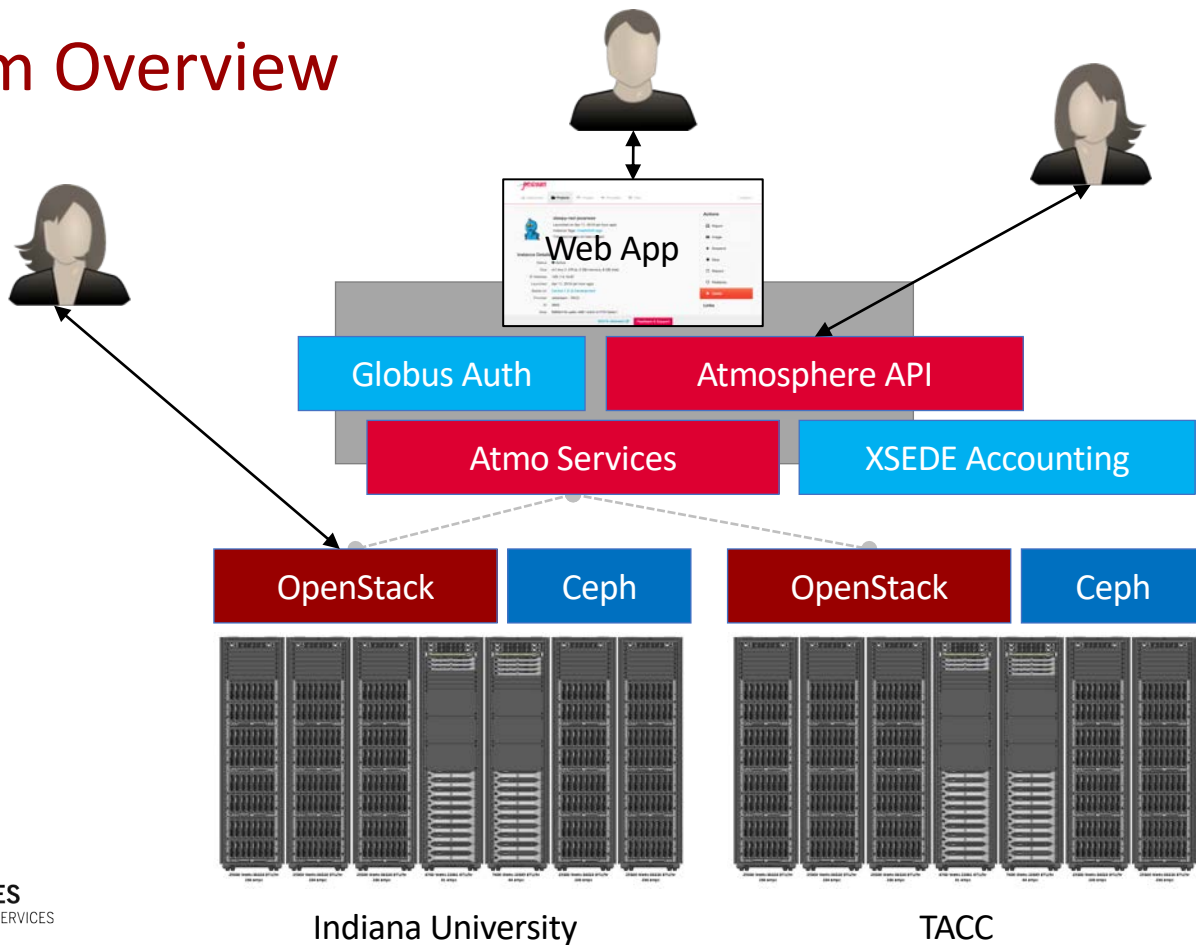
** Here there be dragons...



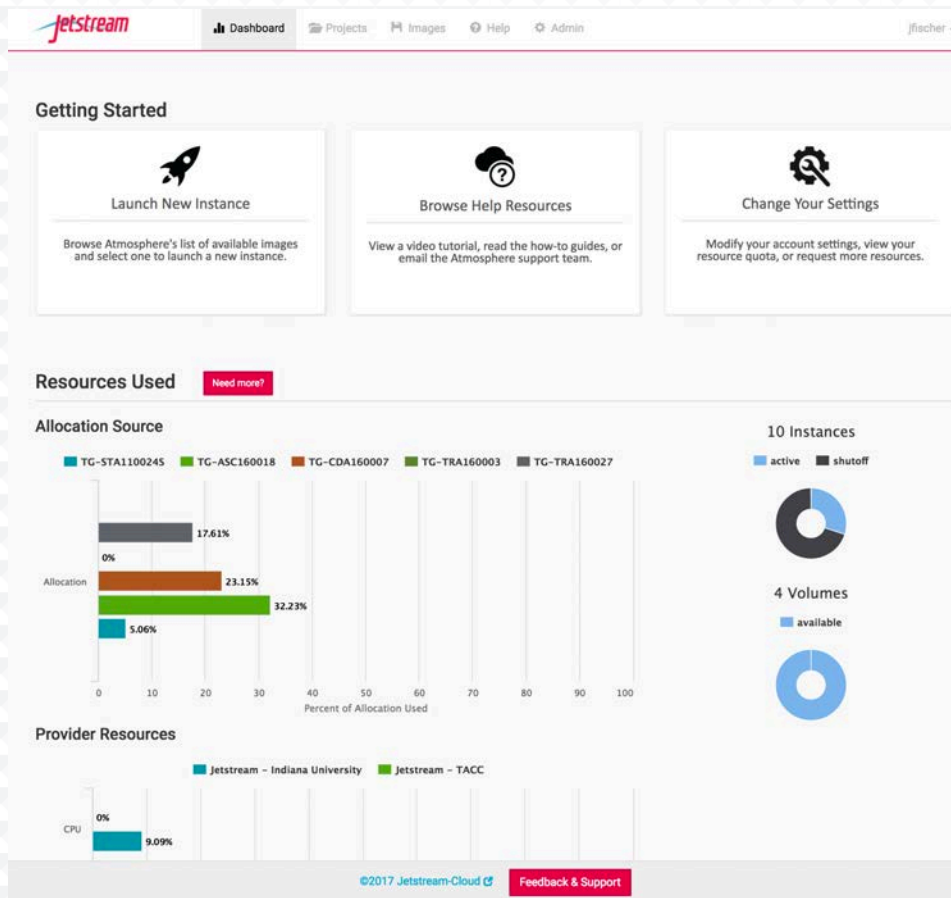
Jetstream System Overview



Platform Overview



The Jetstream Atmosphere web interface



The Jetstream Atmosphere web interface

The screenshot displays the Jetstream Atmosphere web interface. At the top, there is a navigation bar with the Jetstream logo, a search bar, and menu items for Dashboard, Projects, Images, and Help. Below the navigation bar, there are tabs for SEARCH, FAVORITES (0), MY IMAGES (0), MY IMAGE REQUESTS, and TAGS. The main content area is titled "Image Search" and features a search input field with the placeholder text "Search across image name, tag or description". Below the search field, it indicates "Showing 57 of 57 Images".

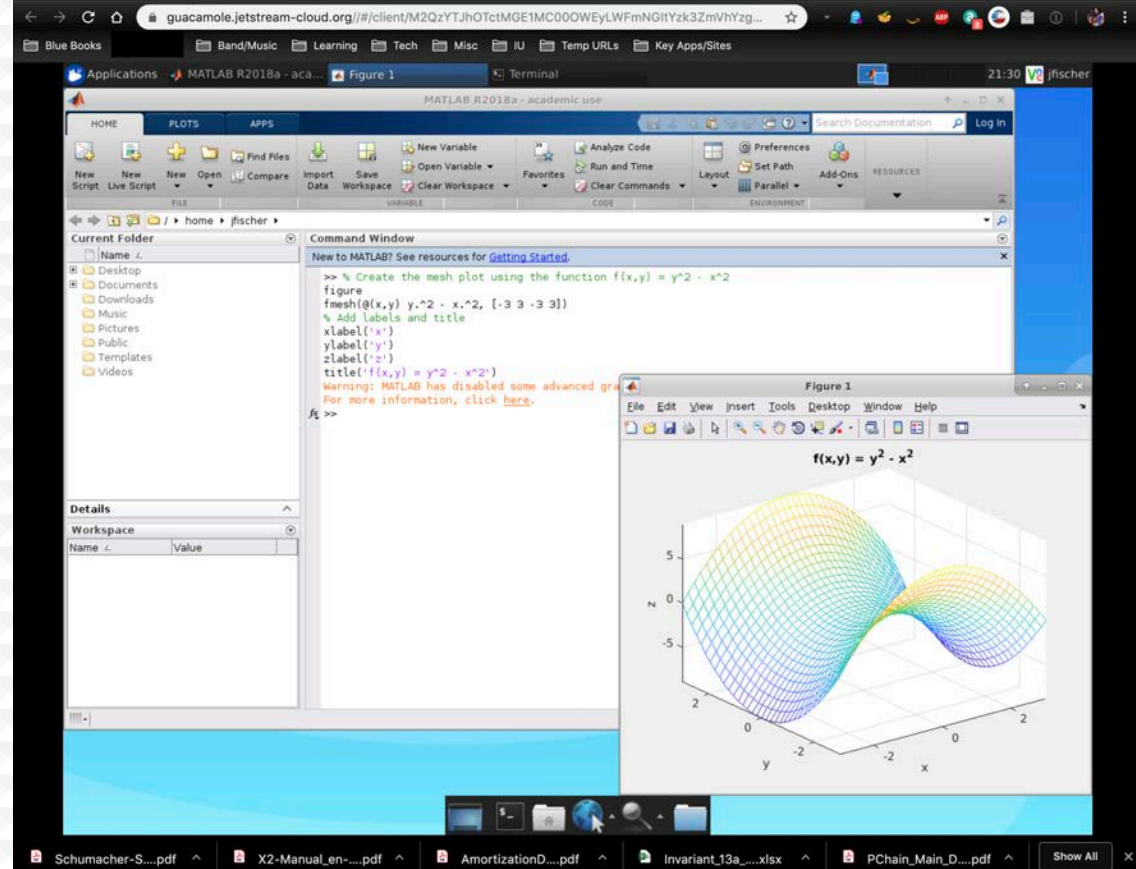
The "Featured Images" section lists several images with their details:

Image Icon	Image Name	Created Date	Created By	Description	Tags	Star
	Centos 7 (7.2) Development GUI	Jan 13th 17 03:21	by jfischer	Imported Application - Centos 7 (7.2) Development GUI	CentOS, development, Featured, gui, iRODS	☆
	BioLinux 8	Jan 2nd 17 03:34	by jfischer	Based on Ubuntu 14.04.3 -Trusty Tahr - server - cloudimg --**REQUIRES m1.small instance ...	bioinformatics, desktop, Featured, gui, m1_small, Ubuntu, x2go	☆
	Ubuntu 14.04.3 Development GUI	Jan 2nd 17 01:24	by jfischer	Based on Ubuntu 14.04.3 Development Patched up to date as of 12/15/16 Base Ubuntu 14.04.3 ...	desktop, development, Featured, gui, iRODS, Ubuntu, vnc	☆
	Intel Development (CentOS 7)	Nov 30th 16 12:04	by jfischer	Intel compilers and development environment *REQUIRES a m1.small or larger VM to la ...	CentOS, desktop, development, Featured, gui, Intel, m1_small, vnc	☆
	R with Intel compilers (CentOS ...)	Nov 30th 16 11:53	by jfischer	R with Intel compilers built on CentOS 7 (7.3) ** Requires m1.small or greater sized VM * ...	CentOS, desktop, development, Featured, gui, Intel, m1_small, vnc	☆
	Galaxy Standalone	Nov 15th 16 04:49	by admin	Galaxy 16.01 Standalone - based on Ubuntu 14.04.4 LTS This is a standalone Galaxy server ...	community-contributed, Featured, m1_large, Ubuntu	☆

At the bottom of the interface, there is a footer with the copyright notice "©2017 Jetstream-Cloud" and a "Feedback & Support" button.



The Jetstream Web Desktop



The screenshot displays a web browser window with the URL `guacamole.jetstream-cloud.org`. The browser shows a desktop environment with a MATLAB R2018a interface. The MATLAB window includes a Command Window with the following code and output:

```
>> % Create the mesh plot using the function f(x,y) = y^2 - x^2
figure
fmesh(@(x,y) y.^2 - x.^2, [-3 3 -3 3])
% Add labels and title
xlabel('x')
ylabel('y')
zlabel('z')
title('f(x,y) = y^2 - x^2')
Warning: MATLAB has disabled some advanced graphics.
For more information, click here.
ft >>
```

The Command Window also displays a warning: "Warning: MATLAB has disabled some advanced graphics. For more information, click here." The Figure window shows a 3D surface plot of the function $f(x,y) = y^2 - x^2$, which is a saddle-shaped surface. The plot is titled "Figure 1" and has a toolbar with standard MATLAB plotting tools. The axes are labeled x, y, and z, with the z-axis ranging from -5 to 5 and the x and y axes ranging from -2 to 2.



Not just the usual suspects...

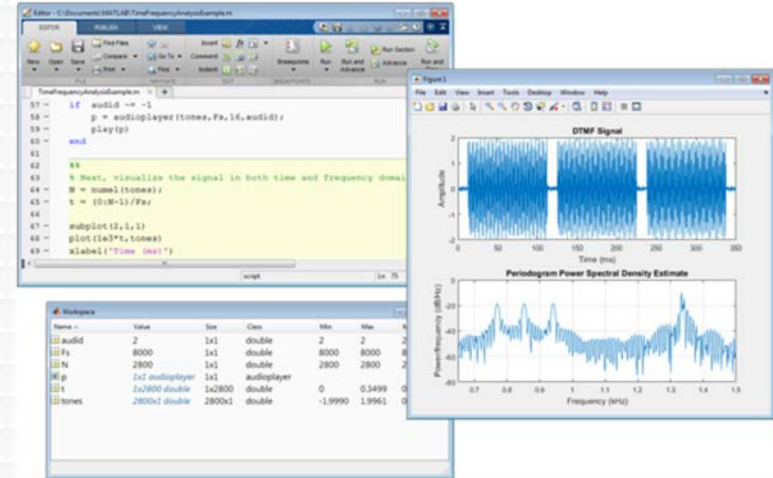
Physics, chemistry, and other “usual” HPC suspects are represented, but Jetstream also is home to projects on:

- Financial analysis / Economics
- Political science
- Humanities / Text analysis
- Network analysis
- Computer Science / Machine learning
- Satellite data analysis



Matlab for researchers and educators

- Matlab and SimuLink and additional toolkits are installed on Jetstream
- You do NOT need to have a local license to use MATLAB on Jetstream
- If you are a researcher, and MATLAB or SimuLink... you're ready to go!
- If you are an engineering researcher, and you need other tools... let us know!



Jetstream for Education

Jetstream has been used in multiple graduate and undergraduate courses

- Management, Access, and Use of Big and Complex Data
- Multiple informatics and general bioinformatics courses
- Business Intelligence (big data and analysis)
- Research Topics in Music
- Multiple genetics and sequencing courses
- Multiple information security and assurance courses

Research Data Alliance workshops, Galaxy workshops, data analysis in finance using R, security and intrusion detection, and principles in cloud computing...



Expanding the reach: Jetstream REU Program



NSF Supplement for undergraduates

- 4 students participated in 2017
- 6 students participated in 2018
- 7 students participated in 2019

- REU student videos on YouTube
<https://www.youtube.com/user/IUPTI>



Jetstream usage highlights – 1 August 2019

- 390 XSEDE projects covering 72 fields of science and over 2200 **active users** representing **213 institutions**
- **80%** of Jetstream users have **not used any other XSEDE system**
- >240M CPU hours allocated to XSEDE projects since June 2016
- 26 active science gateways
- 51 education/teaching allocations serving over 900 students
- 1438 mean active VMs in previous qtr, 1614 peak active VM count
- **Highest** user satisfaction in most recent XSEDE survey



Jetstream Timeline...what comes next?

- Completed our second year of operations with extension to November 2020
- Soliciting Research allocation requests plus Startup and Education allocations – including Science Gateways!
- Adding services as deemed useful/mature (Heat, Magnum, Trove, Manila, etc)
- Atmosphere enhancements on a regular cycle
- Working on partnerships with groups like HubZero and others to extend the value of Jetstream



Requesting access to Jetstream

- Trial allocations available **TODAY**
 - <http://wiki.jetstream-cloud.org/Jetstream+Trial+Access+Allocation>
- You can request **startup** allocations **anytime**. (Startups are simple!)
- <http://wiki.jetstream-cloud.org/Jetstream+Allocations>
- You can request allocations for **educational** use **anytime**.
- Next submission period for large allocations is 15 Sep 2019 – 15 Oct 2019
- Research allocation: Project desc (≤ 10 pages) and Scaling doc (≤ 5 pages)
 - **We can help!**

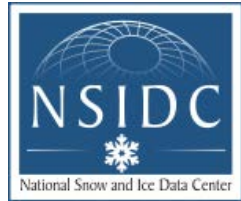
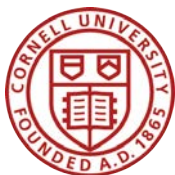


Where can I get help?

- **Wiki / Documentation:** <http://wiki.jetstream-cloud.org>
- 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>
- Introduction to Jetstream Virtual Workshop: <https://cvw.cac.cornell.edu/jetstream/>
- Jetstream Allocations Virtual Workshop: <https://cvw.cac.cornell.edu/JetstreamReq/>



Jetstream Partners



funded by the National Science Foundation
Award #ACI-1445604



Questions?

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

License Terms

- Fischer, Jeremy. Sep 27, 2019. Jetstream Overview – C2Exchange, Washington, DC. Also available at: <http://Jetstream-cloud.org/research/publications.php>
- Jetstream is supported by NSF award 1445604 (David Y. Hancock, IU, PI)
- XSEDE is supported by NSF award 1053575 (John Towns, UIUC, PI)
- This research was supported in part by the Indiana University Pervasive Technology Institute, which was established with the assistance of a major award from the Lilly Endowment, Inc. Opinions presented here are those of the author(s) and do not necessarily represent the views of the NSF, IUPTI, IU, or the Lilly Endowment, Inc.
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