

# Jetstream Overview

## A national research and education cloud

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# NSF Funding Areas in HPC

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Traditionally concentrated on enabling petascale capability

- Blue Waters – 13.3 petaflops, 2012
- Stampede – 9.6 petaflops, 2013
- Comet – ~2.0 petaflops, 2014

Has funded research into building clouds and computer science

- CloudLab
- Chameleon

Now funding clouds to do research

- Bridges (Hybrid system)
- Jetstream



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# Jetstream - Expanding NSF XD's reach and impact

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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



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# What is Jetstream and why does it exist?

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- NSF's first production cloud facility
- Part of the NSF eXtreme Digital (XD) program
- Provides on-demand *interactive* computing and analysis
- Enables *configurable* environments and architectures
- User-friendly, widely accessible cloud environment
- User-selectable library of preconfigured virtual machines



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# What is Jetstream, continued...

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- Focus on ease-of-use, broad accessibility
- Interactive computing and data analysis “on demand”
- Will support persistent gateways (iPlant, Galaxy, generic “SciGAP” build-a-gateway image)
- Reproducibility: Share VMs and then store, publish via IU Scholarworks (DOI)



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# Who uses Jetstream?

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- 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



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# 21<sup>st</sup> Century Workforce Development

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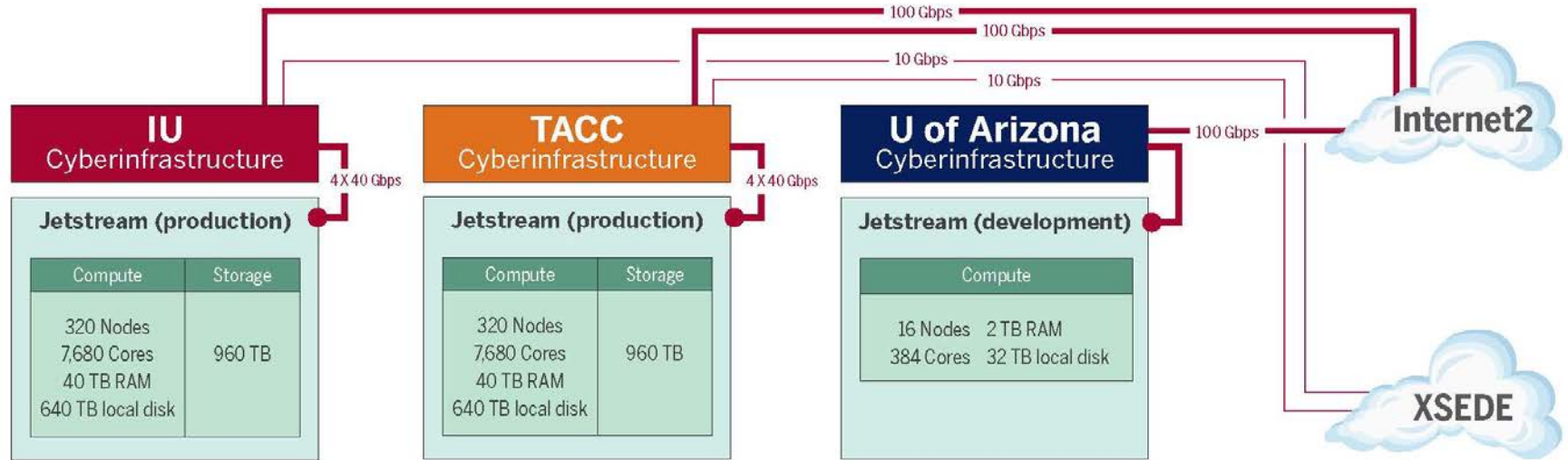
- Specialized virtual Linux desktops and applications to enable research and research education at small colleges and universities
- HBCUs (Historically Black Colleges and Universities)
- MSIs (Minority Serving Institutions)
- Tribal colleges
- Higher-education institutions in EPSCoR States



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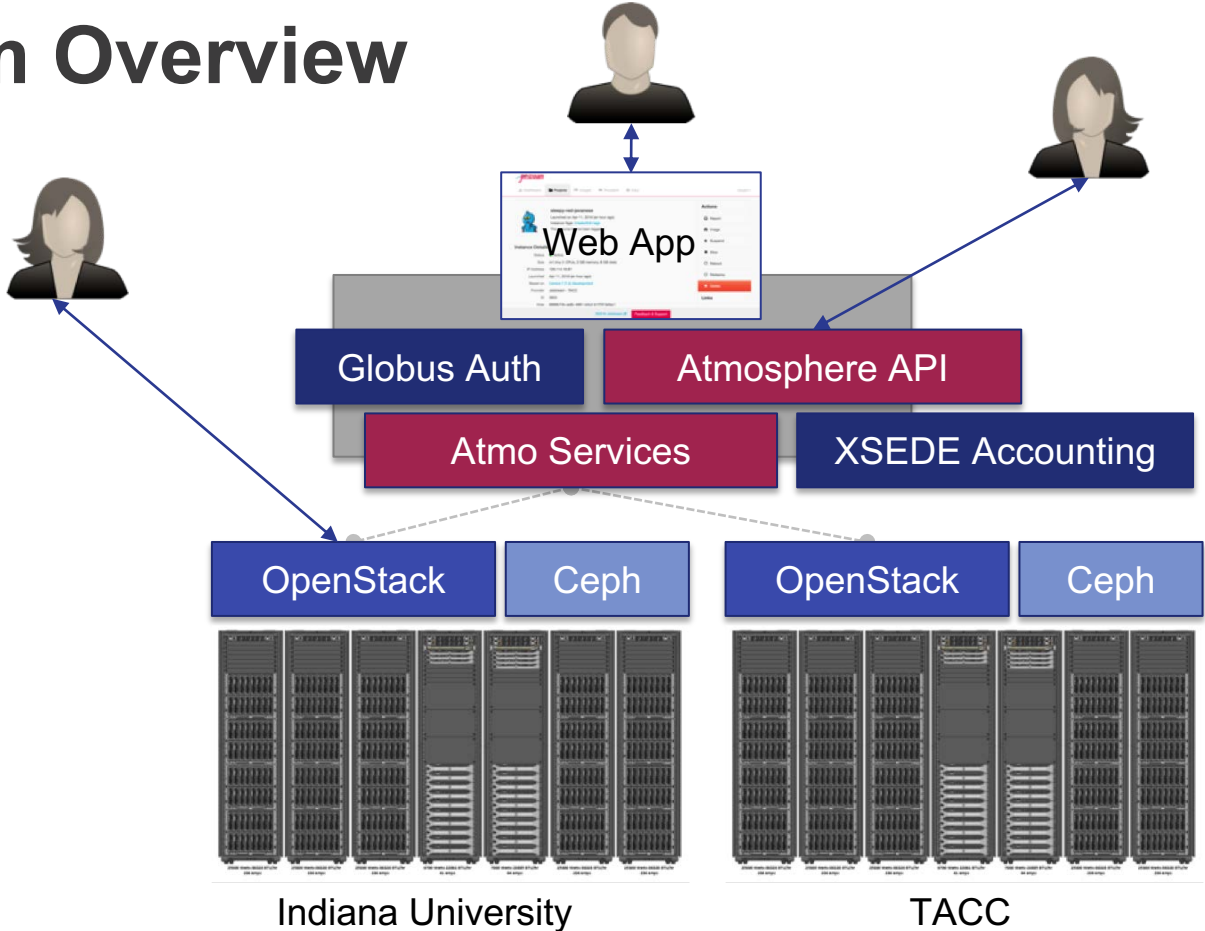


# Jetstream System Overview





# Platform Overview



# Hardware and Instance "Flavors"

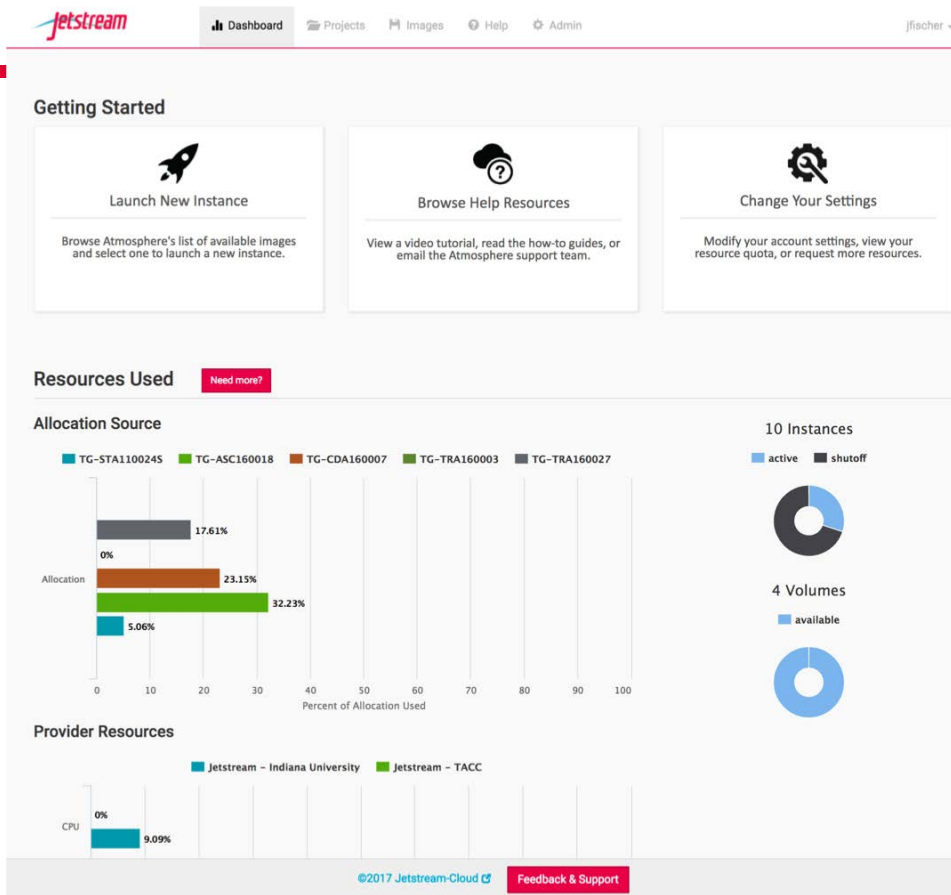
## VM Host Configuration

- Dual Intel E-2680v3 "Haswell"
- 24 physical cores/node @ 2.5 GHz (Hyperthreading on)
- 128 GB RAM
- Dual 1 TB local disks
- 10GB dual uplink NIC
- Running KVM Hypervisor

Flavor	vCPUs	RAM	Storage	Per Node
m.tiny	1	2	8	46
m.small	2	4	20	23
m.medium	6	16	60	7
m.large	10	30	120	4
m.xlarge	24	60	240	2
m.xxlarge	44	120	480	1

- Short-term storage comes as part of launched instance
- Long-term storage is XSEDE-allocated
- Implemented on backend as OpenStack Volumes
- Each user gets 10 volumes up to 500GB total storage
- Piloting object storage as well after recent update

# 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 dashboard icon, and links for 'Dashboard', 'Projects', 'Images', and 'Help'. A user profile 'jffest' is visible in the top right corner. Below the navigation bar is a search bar and several filters: 'SEARCH', 'FAVORITES (0)', 'MY IMAGES (0)', 'MY IMAGE REQUESTS', and 'TAGS'. The main content area is titled 'Image Search' and contains a search input field with the placeholder text 'Search across image name, tag or description'. Below the search bar, it indicates 'Showing 57 of 57 Images'. A section titled 'Featured Images' lists six featured image entries, each with a thumbnail icon, title, author, date, description, and a set of tags. The tags are represented by red rounded rectangles with white text. The entries are: 1. 'Centos 7 (7.2) Development GUI' by jfischer, 'Imported Application - Centos 7 (7.2) Development GUI', tags: CentOS, development, Featured, gui, iRODS. 2. 'BioLinux 8' by jfischer, 'Based on Ubuntu 14.04.3 -Trusty Tahr - server - cloudimg', tags: bioinformatics, desktop, Featured, gui, m1\_small, Ubuntu, x2go. 3. 'Ubuntu 14.04.3 Development GUI' by jfischer, 'Based on Ubuntu 14.04.3 Development Patched up to date as of 12/15/16 Base Ubuntu 14.04.3 ...', tags: desktop, development, Featured, gui, iRODS, Ubuntu, vnc. 4. 'Intel Development (CentOS 7)' by jfischer, 'Intel compilers and development environment', tags: CentOS, desktop, development, Featured, gui, intel, m1\_small, vnc. 5. 'R with Intel compilers (CentOS ...)' by jfischer, 'R with Intel compilers built on CentOS 7 (7.3)', tags: CentOS, desktop, development, Featured, gui, intel, m1\_small, vnc. 6. 'Galaxy Standalone' by admin, 'Galaxy 16.01 Standalone - based on Ubuntu 14.04.4 LTS', tags: 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.

Jetstream  
http://jetstream-cloud.org/

©2017 Jetstream-Cloud [Feedback & Support](#)



# Using Jetstream VMs

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Manipulating Jetstream VMs:

- Jetstream Atmosphere web interface
- Direct API access via OpenStack command line or Horizon access
  - API access enables Science Gateways and other always on services or on demand use cases; e.g. elastic compute techniques

Primary methods of logging into Jetstream VMs to work

- Interactive user access via web interface with VNC/SSH
- Direct VNC/SSH to individual instances



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# HPC vs Cloud

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Adapting to a different environment:

- No reservations, no queueing
- More interactive use and less/no batch queuing
- What? No parallel filesystem?!?
- Being your own admin – hey, we have root!
- You really can have almost any (linux) software you want\*\*
- Constantly getting new features (<https://www.openstack.org/software/project-navigator/>)

\*\* Here there be dragons...



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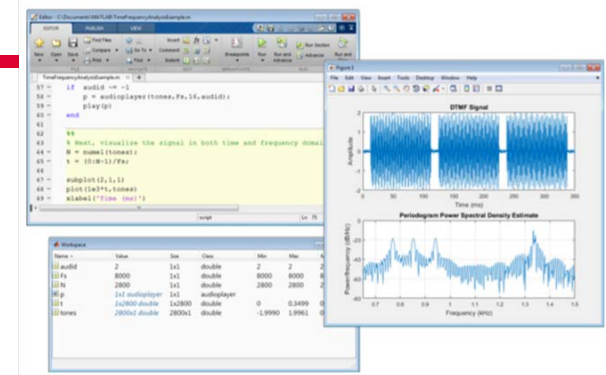
# Jetstream for engineering researchers (and others)

Matlab and the 52 standard 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 and one of the standard first 52 toolkits that come with MATLAB help you... you're ready to go!

If you are an engineering researcher, and you need other tools... Let us know – we are happy to consider other requests



# Jetstream for Education

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Jetstream has been used in multiple IU Informatics Graduate Courses

- INFO 535 – Management, Access, and Use of Big and Complex Data
- INFO 590 – Topics in Informatics

BlueWaters Workflow Workshop

Multiple Research Data Alliance Workshops

Upcoming workshops/classes on Galaxy, data analysis in finance using R, security and intrusion detection, and principles in cloud computing



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# Jetstream Timeline...what comes next?

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- Transitioned to full operations on September 1, 2016
- As of February 1, 2017: 272 XSEDE projects covering 51 fields of science and 870+ active users representing 154 institutions
- Soliciting Research allocation requests plus Startup and Education allocations – including Science Gateways!
- Adding services as deemed useful/mature (heat, ceilometer, magnum, trove, manila, etc)
- Atmosphere enhancements
- Working on partnerships with groups like HubZero and others to extend the value of Jetstream

# Requesting access to Jetstream

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- You can request startup allocations anytime. (Startups are simple!)
- You can request allocations for educational use anytime.
- Next submission period for large allocations is 15 March 2017– 15 April 2017.
- 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.

# Where can I get help?

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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](mailto:help@xsede.org)

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

Training Videos / Virtual Workshops (TBD)



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# Jetstream Fun: Happy cluster / Angry Cluster



# Jetstream Partners



INDIANA UNIVERSITY

PERVASIVE TECHNOLOGY INSTITUTE



JOHNS HOPKINS  
UNIVERSITY

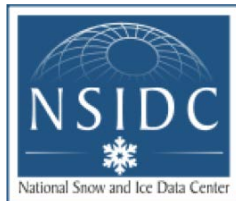
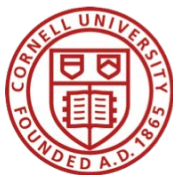


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# What are we going to cover today in the hands on portion? (The 40,000 foot view...)

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Getting on to Jetstream's web interface

The Dashboard – features, settings, options

Images on Jetstream today and in the future

Projects and the resources they contain

Launching an instance

Accessing, using, and customizing your instance

Talking about custom images

Preserving your image for publication



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# Questions?

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

Project email: [help@jetstream-cloud.org](mailto:help@jetstream-cloud.org) Direct email: [jeremy@iu.edu](mailto:jeremy@iu.edu)

## License Terms

- Fischer, Jeremy. January 18, 2017. Jetstream Overview – University of Texas San Antonio. Also available at: <http://jetstream-cloud.org/publications.php>
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- 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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