# Jetstream Overview
# Gateways Conference

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# What is Jetstream and why does it exist?

- NSF's first production cloud facility, part of the NSF eXtreme Digital (XD) program
- 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)

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http://jetstream-cloud.org/

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# 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

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# 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…)

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# Jetstream and way of the cloud…

- **Cloudy Technologies**: clouds are more the 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…**

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# 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…

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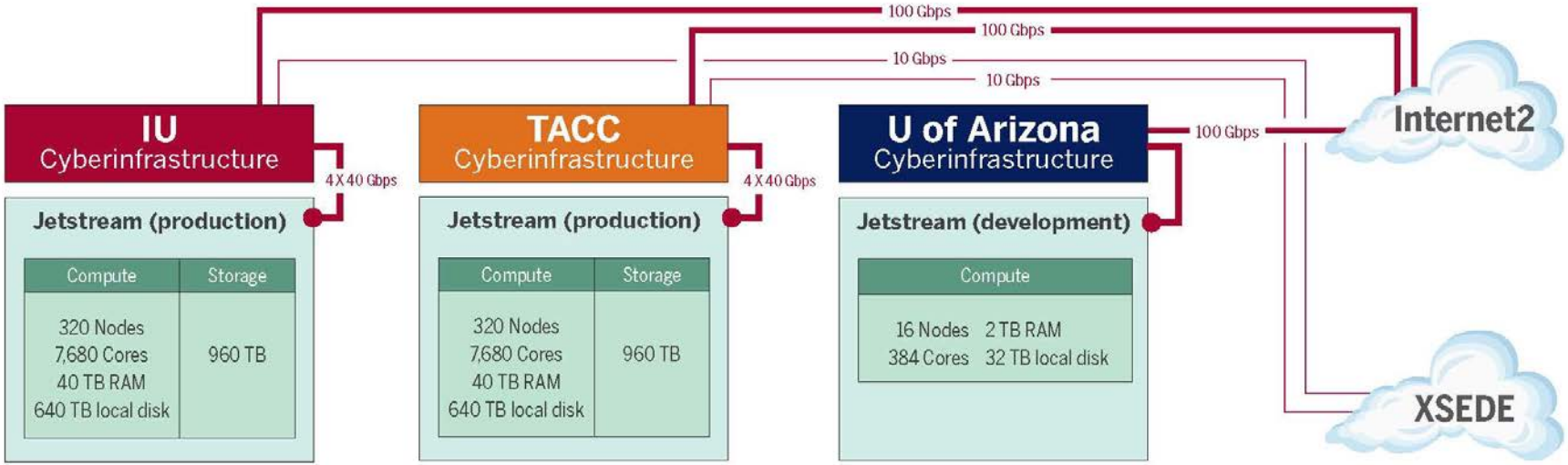
# Jetstream System Overview

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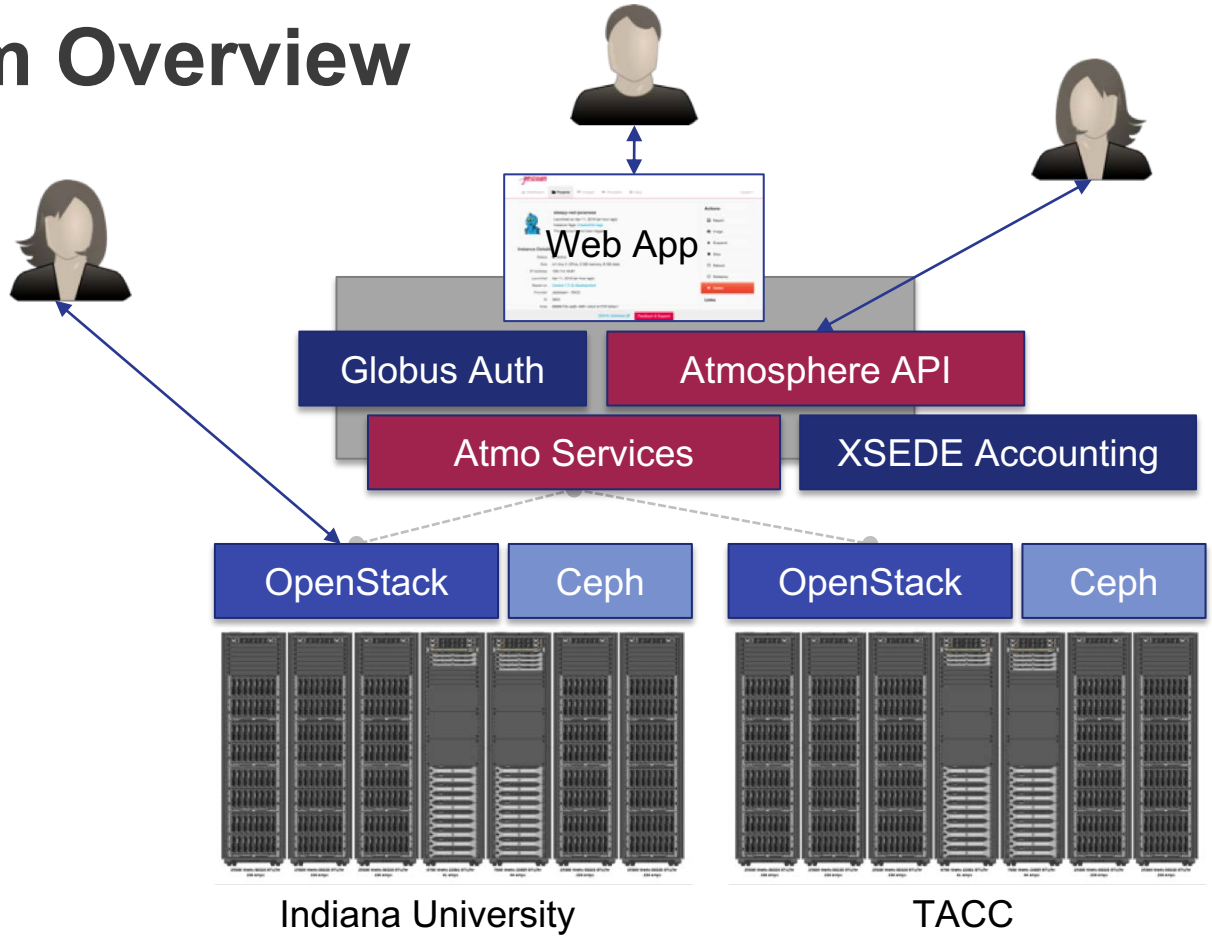
# Platform Overview



# 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

- Short-term *ephemeral* storage comes as part of launched instance
- Long-term storage is XSEDE-allocated
- Implemented as OpenStack Volumes
- Each user can get 10 volumes up to 500GB total storage*

| Flavor | vCPUs | RAM | Storage | Per Node |
|---|---|---|---|---|
| m1.tiny | 1 | 2 | 8 | 46 |
| m1.small | 2 | 4 | 20 | 23 |
| m1.medium | 6 | 16 | 60 | 7 |
| m1.large | 10 | 30 | 60 | 4 |
| m1.xlarge | 24 | 60 | 60 | 2 |
| m1.xxlarge | 44 | 120 | 60 | 1 |
| s1.large** | 10 | 30 | 120 | 4 |
| s1.xlarge** | 24 | 60 | 240 | 2 |
| s1.xxlarge** | 44 | 120 | 480 | 1 |

** s1.* based instances are not eligible to be saved into a customized image

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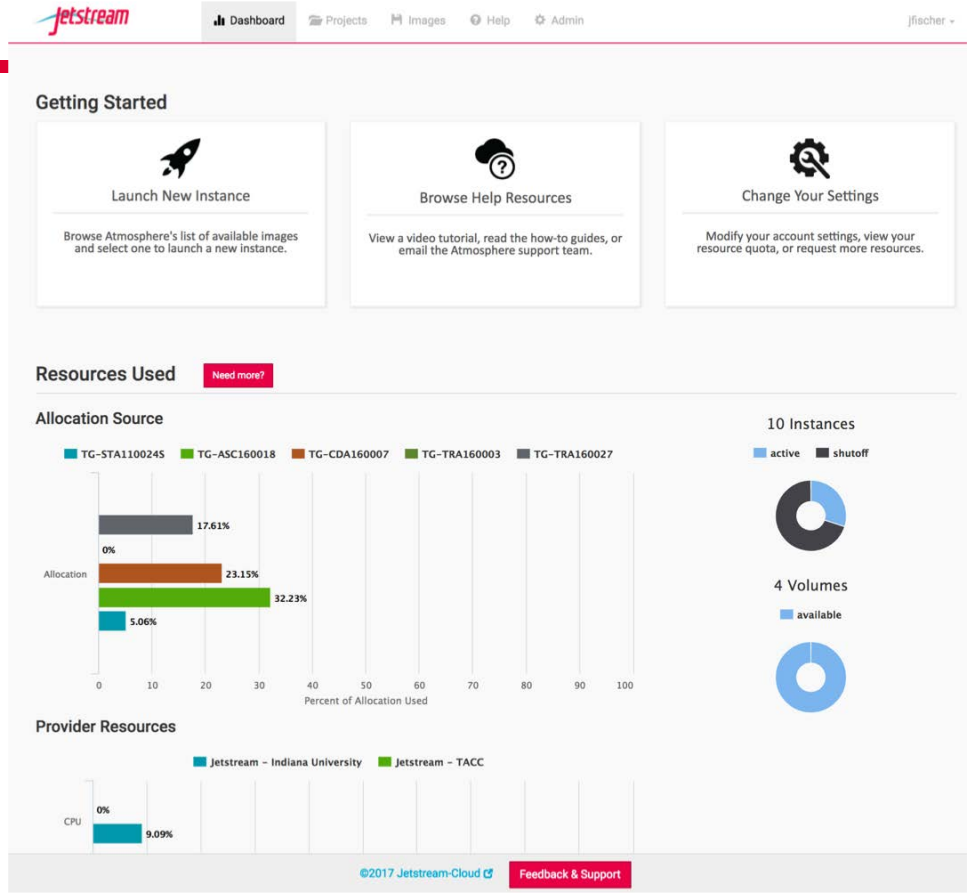
# The Jetstream Atmosphere web interface

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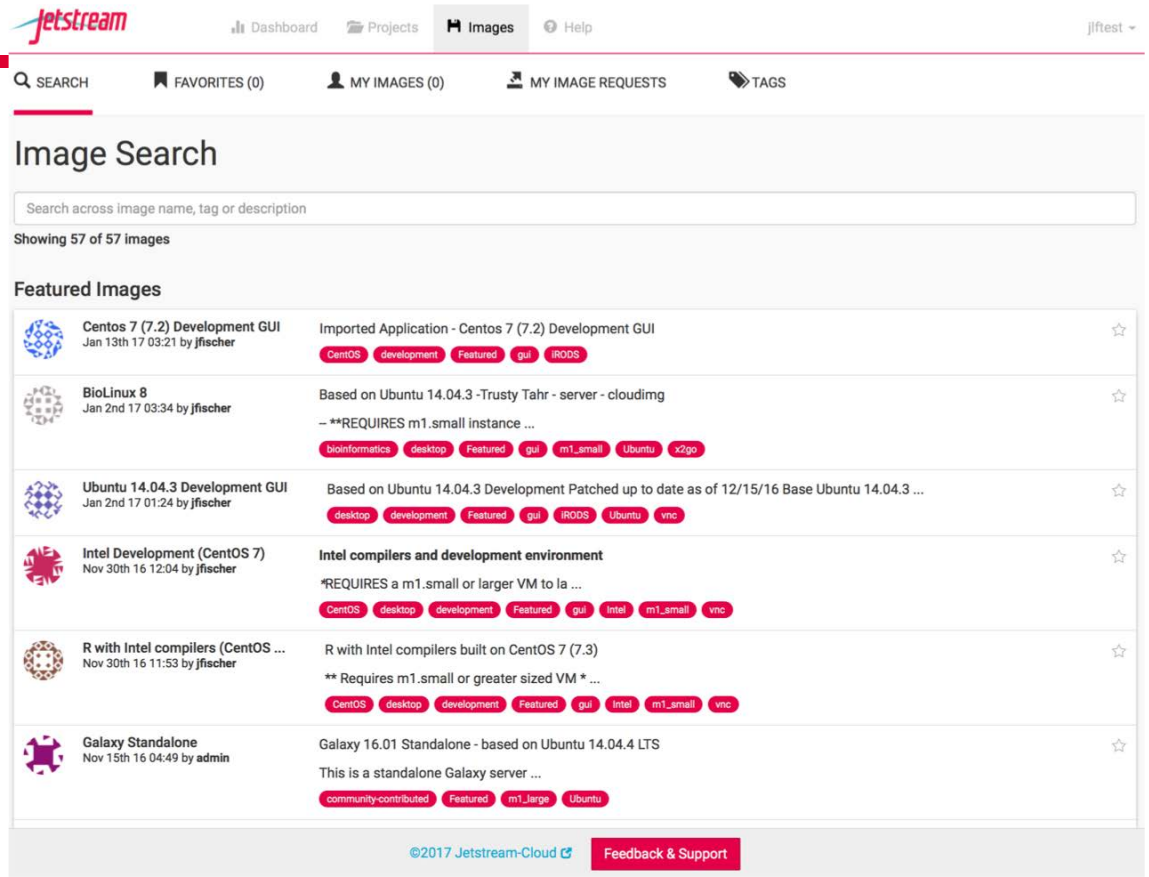
# The Jetstream Atmosphere web interface

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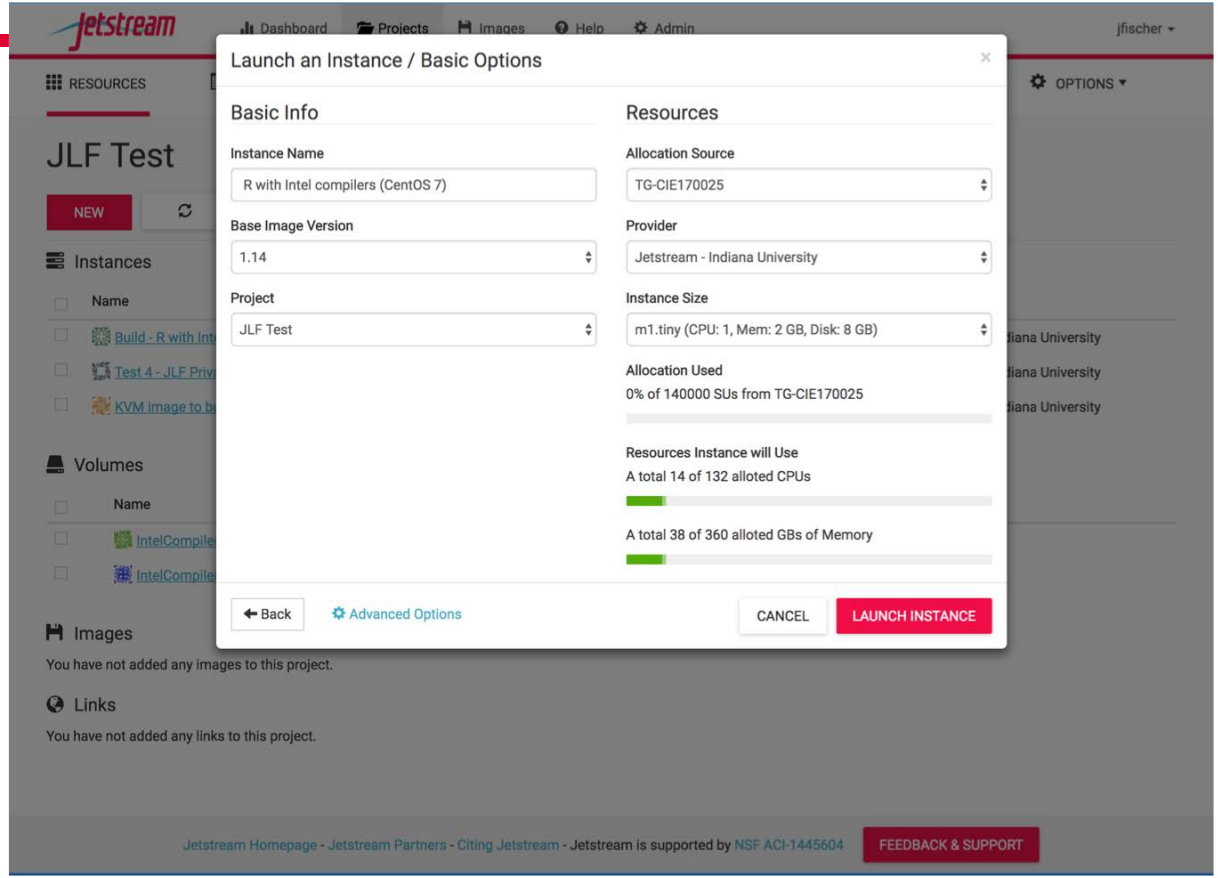
# Look! It's more Jetstream web interface!

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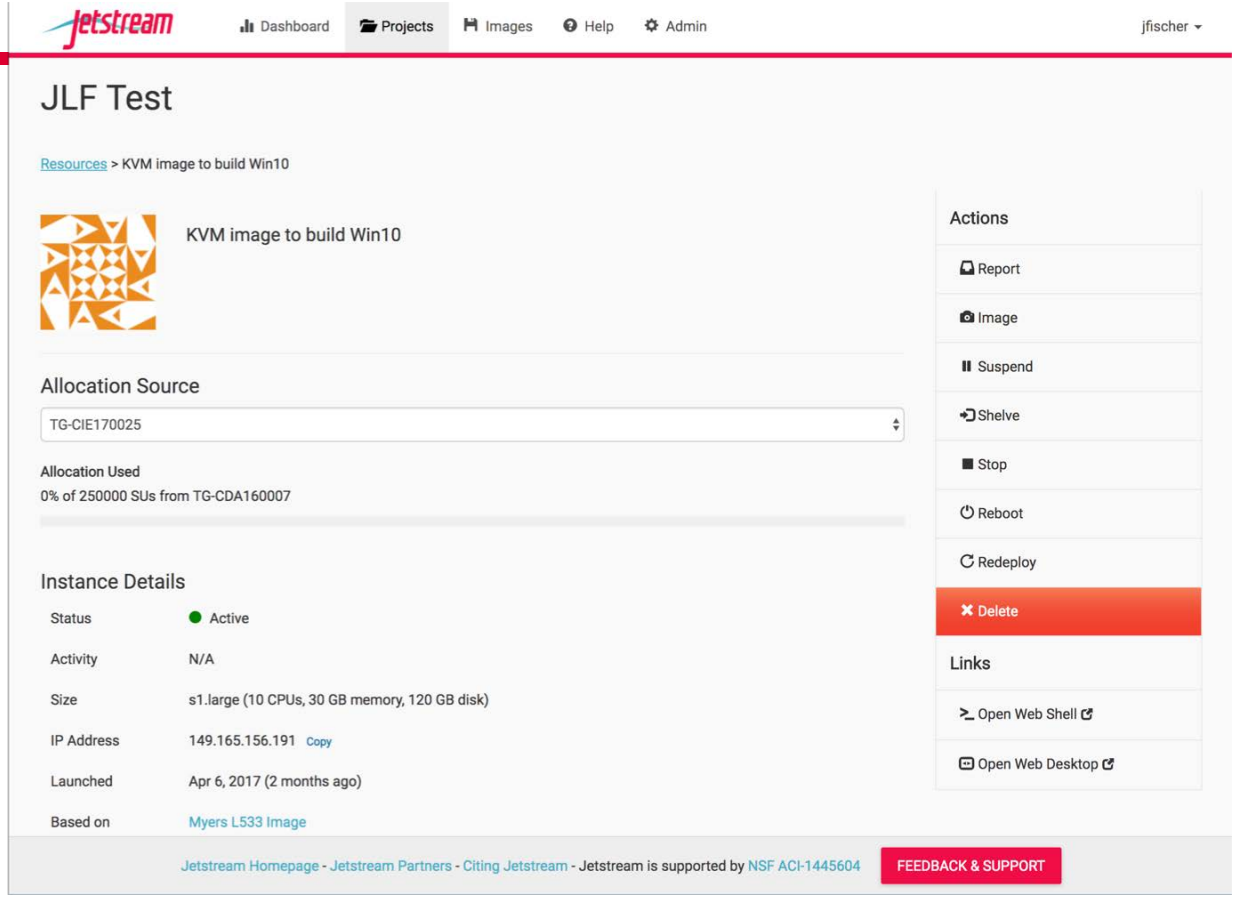
# Even more Jetstream web interface…

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# Using Jetstream as a gateway developer

Manipulating Jetstream VMs:

- Direct API access via OpenStack CLI or Horizon access
- Log in via ssh (or gui if you install X and a VNC server– but that's up to you)

Why:

- Programmatic access – Programmable cyberinfrastructure
- Reserved IP pools
- Ability for true cloud benefits like elastic computing are available via the API

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# The basics that Jetstream provides

- Base images to start from
- A basic network space (some DIY required)
- An IP pool
- Isolated project space for your team (on two clouds)
- A blank canvas (to some degree) – you can truly install just about anything you want – and you can BYOLicense if needed

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# Jetstream storage

Storage built into the VM flavors = ephemeral (replicated, but…)

Volume storage = persistent (erasure coded, 4 data 2 recovery)

Valuable data should be on volumes (and backed up elsewhere)



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# Some of the possibilities on Jetstream…

- True elastic computing
  - OpenStack Heat
  - OpenStack Magnum
  - Your own creation?
- Virtual clusters
  - Several gateways using virtual clusters
  - Working on a bigger and better long-term solution
  - Workshop at PEARC17 – (link in the tutorial walkthrough)
- Other possibilities
  - https://www.openstack.org/software/project-navigator/
  - Mistral (OSG) – cron as a service
  - Senlin (a coming attraction for making virtual clusters elastic-ness easier)
  - other additions like Manila (filesystems as a service), etc

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# Left Twix, Right Twix

- Having two clouds = some semblance of fault tolerance
- Making that work for your gateway
    - Fail over possibilities
    - Load distribution/performance
    - Maximizing simultaneous VMs (VM/IP limits per cloud)

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# But what about big data sets and such?

- At IU, Wrangler is nearby
- Jetstream wired to Wrangler's switch and vice versa
- Dedicated NFS node(s) on Wrangler for Jetstream
- Dedicated vlan built for projects that need access (still in beta, but working!)
- Hoping to replicate at TACC soon-ish

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# Jetstream Fun: Happy cluster / Angry Cluster



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# 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

Training Videos / Virtual Workshops (TBD)

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# Jetstream Partners

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PERVASIVE TECHNOLOGY INSTITUTE

JOHNS HOPKINS UNIVERSITY

THE UNIVERSITY OF ARIZONA

TACC

THE UNIVERSITY OF CHICAGO

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# Discussion -

- What images would gateway developers like to see?

  - Is there a distribution and standard set of packages that would benefit many gateway developers?

- What features would gateway developers like to see?

- Other things?

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# Questions?

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

Project email: help@jetstream-cloud.org Direct email: jeremy@iu.edu

## License Terms

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# And onward…



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# Cloud Computing Terms…simplified

**Image:** a file on a disk. It will be booted to create an…

**Instance**: a running virtual server; i.e. something you can log into.

**Running:** the *instance* is up & running

**Suspended:** the *instance* is memory resident but not running

**Stopped:** the *instance* is shutdown akin to powering down

**Shelved:** the *instance* is shutdown, backedup, and stored

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# Cloud Computing Terms…simplified

**Flavor**: the size of a running instance; i.e. #core, RAM, disk

**Hypervisor**: the thing the instance runs on; something akin to a software defined hardware compute server.

**Snapshot**: the process of taking an instance and turning it to an image.

**State**: something worth remembering; i.e. the state of the system



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# Cloud Computing Terms…simplified (Cont.)

**Object store**: a blob of bits; it has a starting address & a size. There may be metadata associated with the object. The data is consumed in a streaming manner.

**Block store**: a software defined entity akin to an unformatted hardware disk drive.

**Filesystem**: hierarchical in nature, directories & files, ability to open, seek, read, write.

**Persistent storage**: If you pull the plug, it will still exist when power is restored. Safe to store data or state here.

**Ephemeral storage**: If you pull the plug, it no longer exists. (Don't put your data here!!!)

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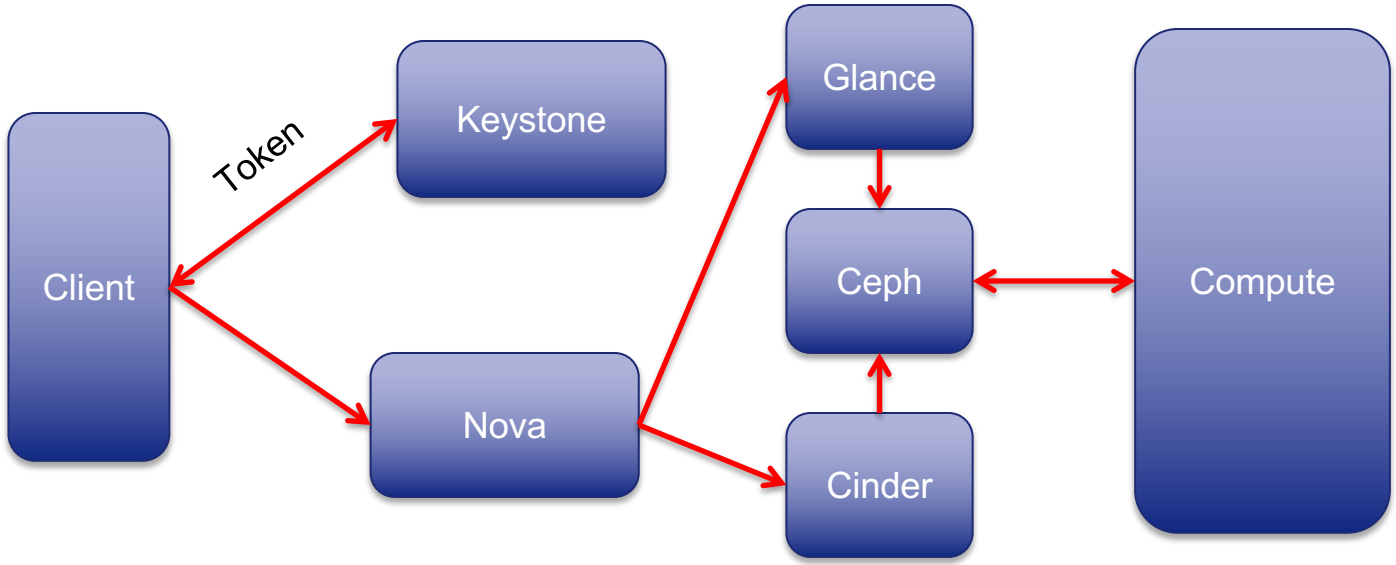


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# Getting into the hands on part -

Open https://goo.gl/8ke2fu in your browser

You'll be connecting to a prepped host…but you might want to wait until I tell you something key first. ☺

ssh *trainXX@tutorial.jetstream-cloud.org*



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