New Ventures in Research, Engineering, and Educational Computing.

J. Michael Lowe, Lead Systems Programmer
High Performance Systems, UITS, Indiana University

George Turner, Chief Systems Architect
Research Technologies, UITS, Indiana University

DellHPC Conference, Austin, TX, 29 March 2017

funded by the National Science Foundation
Award #ACI-1445604
What is Jetstream?

- **User-friendly**, widely accessible cloud environment

- **User-selectable library** of preconfigured virtual machines; no need for system administration skills.

- **Programmatic API access** to implement modern cloud computing techniques
Platform Overview

- OpenStack API access
- Agave API access
- S3 access to Ceph (work in progress)

Indiana University
TACC

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Award #ACI-1445604
What is Jetstream?

• **Reproducibility**: store, publish via IU Scholarworks (DOI)

• **Cloudy**: clouds are more the just virtual machines (VM)
  • Old way: robust (expensive) infrastructure, weak (cheap) software
  • Cloudy way: commodity infrastructure, robust software
  • Cows, not pets: pets take great amount of care, feeding, and you name them; cows you intend to have high turnover and you give them numbers.

• **Primary goal** is to **expand the user base** of NSF’s eXtreme Digital (XD) program resources beyond the current community of users.

http://jetstream-cloud.org/
What is Jetstream? (cont)

“Long tail” of the Science

Large HPC systems requiring sophisticated programming skills

Problem size

Few

Capable users

Many

Everyone else

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What is Jetstream? (cont)

• Software layers
  • Atmosphere web interface
    • library of images, generic, domain specific
    • simplify VM administration
  • Openstack: software tools for building and managing cloud computing platforms for public and private clouds.
  • KVM hypervisor: what the VMs run on
  • Ceph: storage platform that stores data on a single distributed computer cluster, and provides interfaces for object-, block- and file-level storage.
  • Operating systems: CentOS, Ubuntu, Windows?
  • Applications; e.g. software developed by the domain specialist, gateways, etc.
# Production Cloud Hardware (per site)

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Number</th>
<th>Specifications</th>
<th>Function (IU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dell PowerEdge M630 blades</td>
<td>320</td>
<td>2X Intel E5-2680v3 “Haswell”</td>
<td>Compute hosts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24 cores @ 2.5 GHz</td>
<td>OpenStack services</td>
</tr>
<tr>
<td></td>
<td></td>
<td>128 GB RAM</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 TB local disk</td>
<td></td>
</tr>
<tr>
<td>Dell PowerEdge R630 1U server</td>
<td>7</td>
<td>2X Intel E5-2680v3 “Haswell”</td>
<td>Cluster management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24 cores @ 2.5 GHz</td>
<td>High Availability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>128 GB RAM</td>
<td>Databases</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 TB local disk</td>
<td>RabbitMQ</td>
</tr>
<tr>
<td>Dell PowerEdge R730xd 2U servers</td>
<td>20</td>
<td>2X Intel E5-2680v3 “Haswell”</td>
<td>~1 PB Ceph storage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24 cores @ 2.5 GHz</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>64 GB RAM</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>48 TB storage for Ceph pool</td>
<td></td>
</tr>
<tr>
<td>Dell S6000-ON network switches</td>
<td>9</td>
<td>32+2 40 Gb/s ports</td>
<td>Top of Rack</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Spine</td>
</tr>
</tbody>
</table>
VM Instance Sizes (Flavors)

<table>
<thead>
<tr>
<th>Instance Type</th>
<th>vCPUs</th>
<th>RAM(GB)</th>
<th>Storage(GB)</th>
<th>Instances/Node</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tiny</td>
<td>1</td>
<td>2</td>
<td>8</td>
<td>46</td>
</tr>
<tr>
<td>Small</td>
<td>2</td>
<td>4</td>
<td>20</td>
<td>23</td>
</tr>
<tr>
<td>Medium</td>
<td>6</td>
<td>16</td>
<td>60</td>
<td>7</td>
</tr>
<tr>
<td>Large</td>
<td>10</td>
<td>30</td>
<td>120/60*</td>
<td>4</td>
</tr>
<tr>
<td>X-Large</td>
<td>22</td>
<td>60</td>
<td>240/60*</td>
<td>2</td>
</tr>
<tr>
<td>XX-Large</td>
<td>44</td>
<td>120</td>
<td>480/60*</td>
<td>1</td>
</tr>
</tbody>
</table>

Node config: dual Intel E-2680v3 “Haswell”, 24 physical cores/node @ 2.5 GHz, 128 GB RAM, dual 1 TB local disks.

* Effective 29-Mar-2017
Jetstream’s Atmosphere Interface

(no login required at this point)

https://use.jetstream-cloud.org/
Jetstream’s Atmosphere Interface

Log in to use Jetstream Web App

Use your existing organizational login
e.g., university, national lab, facility, project

XSEDE

Didn't find your organization? Then use Globus ID to sign in. (What's this?)

Continue

Or

Sign in with Google

http://jetstream-cloud.org/

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Jetstream’s Atmosphere Interface

Authenticate
Jetstream’s Atmosphere Interface

(user’s home space)
Jetstream Production Hardware
Just for fun: Happy Cluster – Mad Cluster
Infrared image of Jetstream
OpenStack Organization

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http://jetstream-cloud.org/
OpenStack Projects

http://www.openstack.org/software/project-navigator/

Jetstream
http://jetstream-cloud.org/

funded by the National Science Foundation
Award #ACI-1445604
Openstack Projects  ...the core services

<table>
<thead>
<tr>
<th>Service</th>
<th>Name</th>
<th>Adoption</th>
<th>Maturity</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identity</td>
<td>Keystone</td>
<td>96%</td>
<td>7/8</td>
<td>5 yrs</td>
</tr>
<tr>
<td>Images</td>
<td>Glance</td>
<td>95%</td>
<td>6/8</td>
<td>7 yrs</td>
</tr>
<tr>
<td>Block device</td>
<td>Cinder</td>
<td>88%</td>
<td>7/8</td>
<td>5 yrs</td>
</tr>
<tr>
<td>Networking</td>
<td>Neutron</td>
<td>93%</td>
<td>7/8</td>
<td>5 yrs</td>
</tr>
<tr>
<td>Compute</td>
<td>Nova</td>
<td>95%</td>
<td>8/8</td>
<td>7 yrs</td>
</tr>
<tr>
<td>Object device</td>
<td>Swift</td>
<td>52%</td>
<td>7/8</td>
<td>7 yrs</td>
</tr>
</tbody>
</table>

https://www.openstack.org/software/project-navigator/
Openstack Projects  ...some other services

<table>
<thead>
<tr>
<th>Service</th>
<th>Name</th>
<th>Adoption</th>
<th>Maturity</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dashboard</td>
<td>Horizon</td>
<td>87%</td>
<td>6/8</td>
<td>5 yrs</td>
</tr>
<tr>
<td>Telemetry</td>
<td>Ceilometer</td>
<td>55%</td>
<td>1/8</td>
<td>4 yrs</td>
</tr>
<tr>
<td>Database</td>
<td>Trove</td>
<td>13%</td>
<td>3/8</td>
<td>3 yrs</td>
</tr>
<tr>
<td>Orchestration</td>
<td>Heat</td>
<td>67%</td>
<td>6/8</td>
<td>4 yrs</td>
</tr>
<tr>
<td>Provisioning</td>
<td>Ironic</td>
<td>17%</td>
<td>2/8</td>
<td>3 yrs</td>
</tr>
</tbody>
</table>

https://www.openstack.org/software/project-navigator/
# Openstack Projects

...some other services

<table>
<thead>
<tr>
<th>Service</th>
<th>Name</th>
<th>Adoption</th>
<th>Maturity</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Map/Reduce</td>
<td>Sahara</td>
<td>10%</td>
<td>3/8</td>
<td>3 yrs</td>
</tr>
<tr>
<td>Shared Filesystems</td>
<td>Manila</td>
<td>14%</td>
<td>5/8</td>
<td>3 yrs</td>
</tr>
<tr>
<td>DNS Service</td>
<td>Designate</td>
<td>16%</td>
<td>3/8</td>
<td>3 yrs</td>
</tr>
<tr>
<td>Containers</td>
<td>Magnum</td>
<td>11%</td>
<td>2/8</td>
<td>2 yrs</td>
</tr>
<tr>
<td>Application Catalog</td>
<td>Murano</td>
<td>11%</td>
<td>1/8</td>
<td>2 yrs</td>
</tr>
</tbody>
</table>

https://www.openstack.org/software/project-navigator/
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http://jetstream-cloud.org/
Load Balancer 1

Keep Alive

Load Balancer 2

DNS Round Robin
IP1 – IP2

IP1

IP2

IP2

IP1

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http://jetstream-cloud.org/
High Availability layout for the databases
Glance - Cinder - Ceph

Monitor → Client

OSD 1 ↔ OSD 2 ↔ ... ↔ OSD N

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OpenStack Overview

Client → Keystone

Client → Nova

Keystone → Token

Keystone → Glance

Nova → Ceph

Nova → Cinder

Glance → Compute

Ceph → Compute

Cinder → Compute

http://jetstream-cloud.org/

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VXLAN Packet

Ethernet

IP/UDP

Ethernet

IP
Network Topology (cont.)

Sixteen blades per chassis
Two switches per chassis
Network Topology (cont.)

Chassis to Top of Rack

Four chassis per rack

Two switches per chassis

40 Gb/s

LAG

http://jetstream-cloud.org/
Network Topology (cont.)

100 Gb/s uplink to Internet2

Two spines tie into two network blades in the datacenter switch

Seven racks tie into the two spine switches

40 Gb/s LAG

http://jetstream-cloud.org/
How do we onboard users onto Jetstream?

• An XSEDE User Portal (XUP) account is required. They are free! Get one at https://portal.xsede.org

• Read the Allocations Overview - https://portal.xsede.org/allocations-overview

• Write a successful allocation request – start with a Startup or Education request - https://portal.xsede.org/successful-requests
Jetstream Information Sources

- Jetstream: [https://use.jetstream-cloud.org/](https://use.jetstream-cloud.org/)

- XSEDE User Portal is required to actually login: [https://portal.xsede.org](https://portal.xsede.org)


- Configuration management: [https://github.com/jetstream-cloud/Jetstream-Salt-States](https://github.com/jetstream-cloud/Jetstream-Salt-States)
Jetstream Partners

funded by the National Science Foundation
Award #ACI-1445604

http://jetstream-cloud.org/
Questions?

Project website: http://jetstream-cloud.org/
Project email: jethelp@iu.edu
Direct email: jomlowe@iu.edu, turnerg@iu.edu

License Terms

• Jetstream is supported by NSF award 1445604 (Craig Stewart, IU, PI)
• XSEDE is supported by NSF award 1053575 (John Towns, UIUC, PI)
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