Cloud & DevOps Program
January Big Group

Jan. 21, 2015
Thursday
1:00-2:00 p.m.
Science Center, Hall C
Agenda

• Program Status Update (5 min)
  ○ Progress Against the Plan: FY16 Goals
  ○ Progress Against the Plan: Accomplishments

• Collaboration Working Group Update (5 min)

• Spotlight: ATS Migration (15 min)

• Overview: Billing in the Cloud (25 min)

• Questions (10 min)
Progress Against the Plan: FY16 Goals

Since we met in December, we’ve been working toward FY16 goals.

26 of 50 apps are in progress and/or migrated to an external provider
  ● Remaining applications for FY16 have been identified and/or scheduled

We have made big strides in advancing our DR goals
  ● Critical 1 and 2 applications (non-Level 4) for Campus Services have been identified for DR implementation as part of FY16

Crimson Cloud is progressing
  ● We are working to have a defined, approved vision and roadmap March 1
  ● PaaS PoC:
    ○ Working to define requirements
    ○ Evaluating vended solutions, including Deis, Cloud Foundry, and Oracle
Progress Against the Plan: Accomplishments

And we have program news and other accomplishments to share!

Our new Cloud Liaisons are collaborating to achieve our goals

- Jean Pfeifer, ATS and HAM
- Colin Murtaugh, AcTs and TLT
- Sharon Bayer, LTS
- Evgeny Platonov, IAM
- Jerry Larviee, CS
- Mike Rowe, UC
- Sean McCarty, Infra (SOC)

Held new AWS training programs, with plans for more in the near future

- Completed AWS Architecture Training Jan. 13
- AWS Essentials Feb. 9
- AWS SysOps targeted for March 8

Cloud firewall project to support Level 4 data is in progress

- Firewall implementation plan reviewed and updates made to improve delivery schedule — target completion end of FY16
Progress Against the Plan: Accomplishments

Cloud Connect is coming Friday, Feb. 19!

- Create awareness and share info on future roles and opportunities as we transition to cloud and DevOps

- Features:
  - Information and vendor stations
  - Special interest group sessions
  - Seminars led by industry experts
  - Q&A panel
  - Cloud-inspired fun, food, and games
  - “Walking on Clouds” social hour

Initiatives based on your feedback:

- Defining migration services to align the needs of projects and project teams
- Comprehensive planning with SOC underway to create plan and timeline for expanding operational support of migrated apps to SOC resources
- Collaboration Working Group
Collaboration Working Group
Collaboration Working Group Update

Our collaboration working group brings together existing expertise and cloud knowledge to ask, answer, and propose solutions to HUIT cloud architectural questions through breakout meetings in the following areas:

- Networking and security
- Systems and storage
- Application designs
- DR and high availability

Teams have decided upon charters and key deliverables, and will be providing critical input for the larger Working Group the first week of each month.

Contact Xenia Sibova for information on how to get involved!
Spotlight: ATS Migration
Spotlight: ATS Migration

The Office of the President and Provost recently collaborated with the Cloud & DevOps program to migrate the University Course Catalog and Cross Registration applications to the AWS cloud.

This discussion covers:

- Application overview
- Why move to the cloud?
- Key benefits of moving to the cloud
- Challenges and lessons learned from migrations
About the University Course Catalog and Cross Registration applications:

- Course Catalog lists more than 13,000 Harvard courses across 10 Schools, including descriptions, faculty, meeting times, and links to location and textbook information.
- Cross Registration is used by students, faculty, and staff to manage cross-registration workflow between Schools.

Spotlight: ATS Migration
Spotlight: ATS Migration

Why move to the AWS cloud now?

Top FY16 projects:

1. Migrate off iSites platform
2. Migrate to the cloud
3. MIT Integration: MIT course feeds and secure API will enable Harvard students to submit online petitions to cross-register for MIT courses

Reasons for moving to the cloud:

- Agility of Cloud & DevOps reduced time to deliver
- Eliminates the need for a separate “lift and shift” project
Spotlight: ATS Migration

Key benefits of moving to the AWS cloud:

● Increased resiliency and elasticity of infrastructure
  ○ Automated recovery
  ○ Automatic scale up/down in response to load

● Ephemeral resources; infrastructure as code
Existing Architecture: Cross Reg & Course Catalog
AWS Architecture: Cross Reg

crossregistration.harvard.edu
api.crossregistration.harvard.edu

1. Direct Connect
2. Application Servers
3. Oracle
   iSiteProd (dbnode3)
   XReg and Course Manager Data
4. Secure S3 Bucket
5. ATS ETL
6. ETL Server
7. CC API Users
   SIS
   HKS

External ELB
/api Calls

Availability Zone #1
Availability Zone #2
xreg
api.xreg

60 Ox Data Center
AWS Architecture: Course Catalog
Spotlight: ATS Migration

Migration has presented us with valuable challenges and lessons learned.

Technical:
- AWS SMTP rate limit
- SMTP relay
- SQL query performance from AWS to on-prem database
- API whitelisting
- PIN/CAS integration with anonymous access
- Quartz scheduler clustering

Project:
- Testing in parallel environments with shared data — indicate source or shut down old processes
- Clear roles and responsibilities — AWS team supported all things AWS, and project team supported application dev and testing
- Hands-on collaboration with team and partners (MIT and Harvard)
- Provided opportunity to review release management process
- Need to engage impacted teams early and communicate often!
Billing in the Cloud
Billing in the Cloud: Overview

There are three major types of cloud billing:

- Unmanaged cloud (direct pass-through)
- Managed cloud, dedicated account
- Managed cloud, shared account
# Billing in the Cloud: Example Statement

Let’s break down a sample monthly statement.

![Harvard University Information Technology Monthly Statement](image)

**Account Level Charges**

<table>
<thead>
<tr>
<th>Service</th>
<th>Quantity</th>
<th>Rate</th>
<th>Net Charge</th>
<th>GL Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>CALISTS</td>
<td>1.00</td>
<td>$3.80</td>
<td>$3.80</td>
<td>175.11250.8071.000001.520007.0000.0000</td>
</tr>
<tr>
<td>Total Account Level Charges</td>
<td></td>
<td></td>
<td></td>
<td>$3.80</td>
</tr>
</tbody>
</table>

**Asset Charges**

<table>
<thead>
<tr>
<th>Asset</th>
<th>Service</th>
<th>Quantity</th>
<th>Rate</th>
<th>Net Charge</th>
<th>GL Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Asset Charges</td>
<td></td>
<td></td>
<td></td>
<td>$0.00</td>
<td></td>
</tr>
</tbody>
</table>

**Vendor/Pass Through Charges**

<table>
<thead>
<tr>
<th>Asset</th>
<th>Service</th>
<th>Quantity</th>
<th>Unit Price</th>
<th>Net Charge</th>
<th>GL Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlassian-AWS</td>
<td>MSO-AMAZON-REALLOC</td>
<td>1.00</td>
<td>$4,086.29</td>
<td>$4,086.29</td>
<td>175.11250.8250.000001.520007.0000.0000</td>
</tr>
<tr>
<td>Total Vendor/Pass-through Charges</td>
<td></td>
<td></td>
<td></td>
<td>$4,086.29</td>
<td></td>
</tr>
</tbody>
</table>

Total Charges: $4,090.09
Billing in the Cloud: Unmanaged Billing

Direct pass-through of AWS charges; matches an AWS account with a Slash account to enable payment using a Harvard billing code.

<table>
<thead>
<tr>
<th>Asset</th>
<th>Service</th>
<th>Quantity</th>
<th>Unit Price</th>
<th>Net Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMAZON-428700087581</td>
<td>MSO-AMazon-BLENDED</td>
<td>1.00</td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>AMAZON-428700087581</td>
<td>MSO-AMazon-BLENDED</td>
<td>1.00</td>
<td>$0.07</td>
<td>$0.07</td>
</tr>
<tr>
<td>AMAZON-485363461672</td>
<td>MSO-AMazon-DEBLEND</td>
<td>1.00</td>
<td>$0.06</td>
<td>$0.06</td>
</tr>
<tr>
<td>AMAZON-485363461672</td>
<td>MSO-AMazon-UNALLOC</td>
<td>1.00</td>
<td>$82.22</td>
<td>$82.22</td>
</tr>
<tr>
<td>AMAZON-485363461672</td>
<td>MSO-AMazon-FREEZE</td>
<td>1.00</td>
<td>$40.00</td>
<td>$40.00</td>
</tr>
</tbody>
</table>
Billing in the Cloud: Managed, Dedicated Account

These include the fee for Cloud & DevOps services (architecture migration, ops), as well as charges for Direct Connect.

<table>
<thead>
<tr>
<th>Asset Charges</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Asset</td>
<td>Service</td>
<td>Quantity</td>
<td>Rate</td>
</tr>
<tr>
<td>AMAZON-009817842927</td>
<td>CLOUD-OPS</td>
<td>1.00</td>
<td>$499.57</td>
</tr>
<tr>
<td>AMAZON-009817842927</td>
<td>NETWORK-CONNECT-AWS</td>
<td>1.00</td>
<td>$800.00</td>
</tr>
<tr>
<td>AMAZON-009817842927</td>
<td>NETWORK-CONNECT-AWS</td>
<td>1.00</td>
<td>$800.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vendor/Pass Through Charges</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Asset</td>
<td>Service</td>
<td>Quantity</td>
<td>Unit Price</td>
</tr>
<tr>
<td>AMAZON-009817842927</td>
<td>MSO-AMAZON-BLENDED</td>
<td>1.00</td>
<td>$2,497.83</td>
</tr>
<tr>
<td>AMAZON-009817842927</td>
<td>MSO-AMAZON-DEBLEND</td>
<td>1.00</td>
<td>$3.12</td>
</tr>
</tbody>
</table>
Billing in the Cloud: Managed, Shared Account

Allocate services and app costs using AWS tagging.

<table>
<thead>
<tr>
<th>Asset</th>
<th>Service</th>
<th>Quantity</th>
<th>Unit Price</th>
<th>Net Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlassian-AWS</td>
<td>MSO-AMAZON-REALLOC</td>
<td>1.00</td>
<td>$4,086.29</td>
<td>$4,086.29</td>
</tr>
<tr>
<td><strong>Total Vendor/Pass-through Charges</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>$4,086.29</strong></td>
</tr>
</tbody>
</table>
Billing in the Cloud: Managed, Shared Account

It’s possible to allocate a portion of the cloud ops charge by application using AWS tagging.

<table>
<thead>
<tr>
<th>Asset Charges</th>
<th>Service</th>
<th>Quantity</th>
<th>Rate</th>
<th>Net Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>App 1 - AWS</td>
<td>CLOUD-OPS</td>
<td>1.00</td>
<td>$53.07</td>
<td>$53.07</td>
</tr>
<tr>
<td><strong>Total Asset Charges</strong></td>
<td></td>
<td></td>
<td></td>
<td>$53.07</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vendor/Pass Through Charges</th>
<th>Service</th>
<th>Quantity</th>
<th>Unit Price</th>
<th>Net Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>App 1 - AWS</td>
<td>MSO-AMAZON-REALLOC</td>
<td>1.00</td>
<td>$265.33</td>
<td>$265.33</td>
</tr>
<tr>
<td><strong>Total Vendor/Pass-through Charges</strong></td>
<td></td>
<td></td>
<td></td>
<td>$265.33</td>
</tr>
</tbody>
</table>
“Freeze” revenue for a fixed period, absorbing early transition costs and stabilizing later volume loss, until a new model is created in FY18.

*NOTE: Relative size of costs and savings are not yet known*
# Billing in the Cloud: Financing Matrix

<table>
<thead>
<tr>
<th>Migrations (Freeze-Eligible)</th>
<th>DR</th>
<th>New Applications (Not Freeze-Eligible)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replatform to shared AWS account (e.g. CrossReg)</td>
<td>“Lift and shift” to shared AWS account (e.g. ADP.FAS)</td>
<td>DR to dedicated account (e.g. Aleph)</td>
</tr>
</tbody>
</table>

## Who pays AWS costs (including 20% cloud ops fee)?

<table>
<thead>
<tr>
<th></th>
<th>Migrations (Freeze-Eligible)</th>
<th>DR</th>
<th>New Applications (Not Freeze-Eligible)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paid by SOC funds until end of migration program</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paid for by application funds [1]</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

## Who pays on-premises hosting costs?

<table>
<thead>
<tr>
<th></th>
<th>Migrations (Freeze-Eligible)</th>
<th>DR</th>
<th>New Applications (Not Freeze-Eligible)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frozen at current level and paid for by application funds until end of migration program</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Paid for by operational application funds until on-premises assets are decommissioned</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

## Who pays Direct Connect costs (and other AWS account-level costs)?

<table>
<thead>
<tr>
<th></th>
<th>Migrations (Freeze-Eligible)</th>
<th>DR</th>
<th>New Applications (Not Freeze-Eligible)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paid by SOC funds until end of migration program</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Paid for by application funds [1]</td>
<td></td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

## Who pays FTE costs for DevOps engineer?

<table>
<thead>
<tr>
<th></th>
<th>Migrations (Freeze-Eligible)</th>
<th>DR</th>
<th>New Applications (Not Freeze-Eligible)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paid by SOC funds until embedding occurs and end of migration program [2]</td>
<td>X</td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>Paid for by application/project funds [1]</td>
<td></td>
<td>N/A</td>
<td>X</td>
</tr>
</tbody>
</table>

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[1] If application is FAS-funded, costs will be covered by FAS funds, not specific application budget
[2] Upon embedding, application operations budgets must include funds for DevOps engineer
[3] If application is project-funded, DevOps engineer funding needs to be included in project budget
Billing in the Cloud: What Am I Actually Paying For?

AWS pass-through costs:
- Metered usage — pay as you go
- Inbound data is free
- Outbound data is charged

Direct Connect (NETWORK-CONNECT-AWS):
- Access from AWS to Harvard-internal IP space
- Necessary prerequisite for Level 4 data (also requires Cloud Firewall)

CloudOps fee:
- Managed migration
- Cloud infrastructure support
- Managed relationship with AWS
- Architecture
- Cost engineering support
Upcoming Events

Cloud Connect will be held in place of the Feburary Big Group.

We look forward to seeing you again in March for our next Big Group!

As always, don’t forget to watch our Web site: http://cloud.huit.harvard.edu
Questions?
Thank you!
Existing Architecture: Cross Reg