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Notre Dame's Journey to the Cloud

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January 28, 2015

@mchapple
@snijim

Agenda

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- Notre Dame’s Journey to the Cloud
- Case Studies
- Organizational Considerations
- Collegial Conversation

What are we doing?

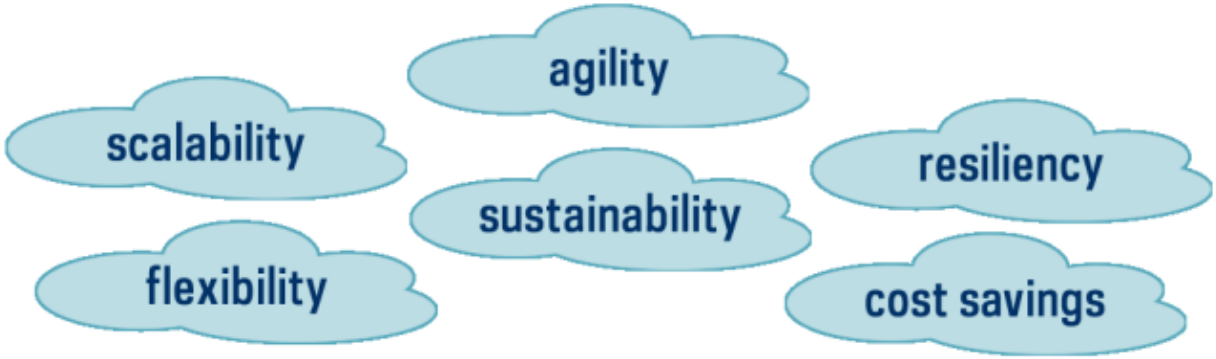
We will move 80% of Notre Dame IT services into the cloud by Dec 31 2017

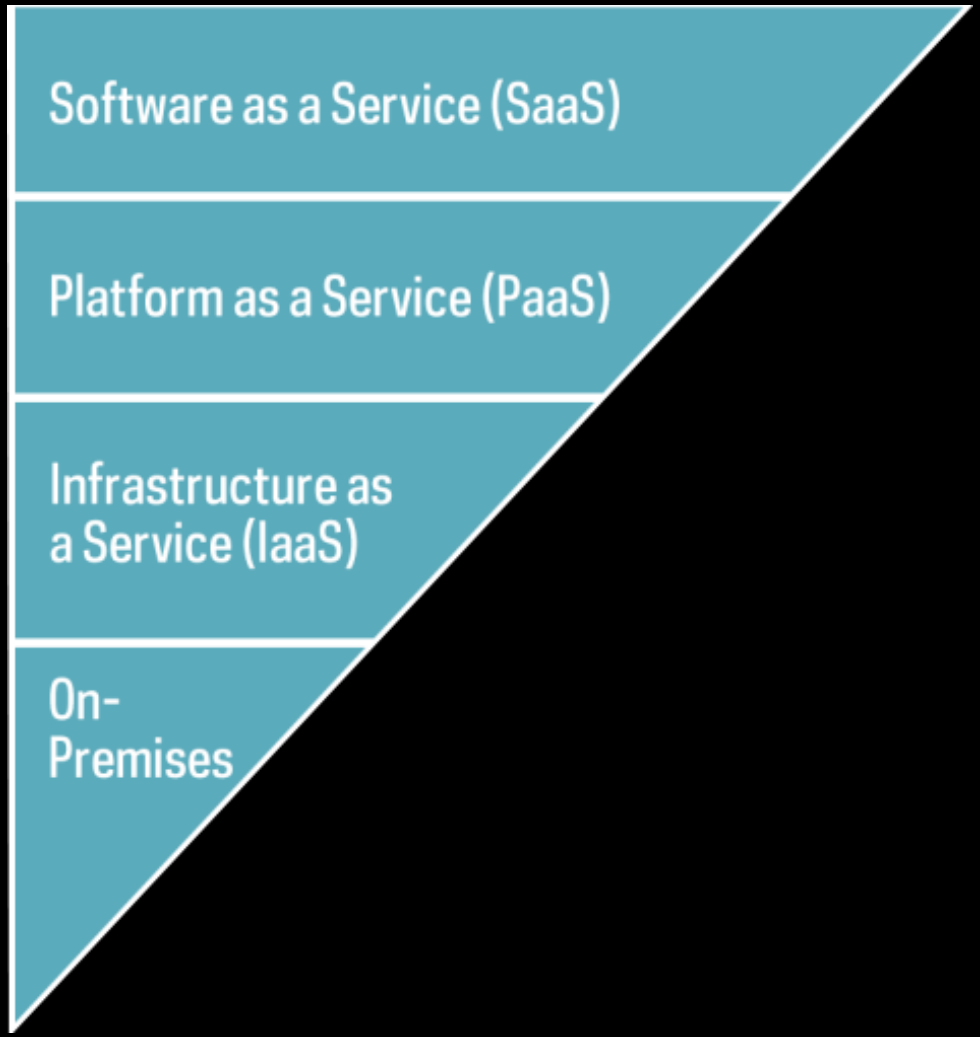
Creating Notre Dame's IT future

CLOUD FIRST

WE NEED WHAT THE CLOUD OFFERS

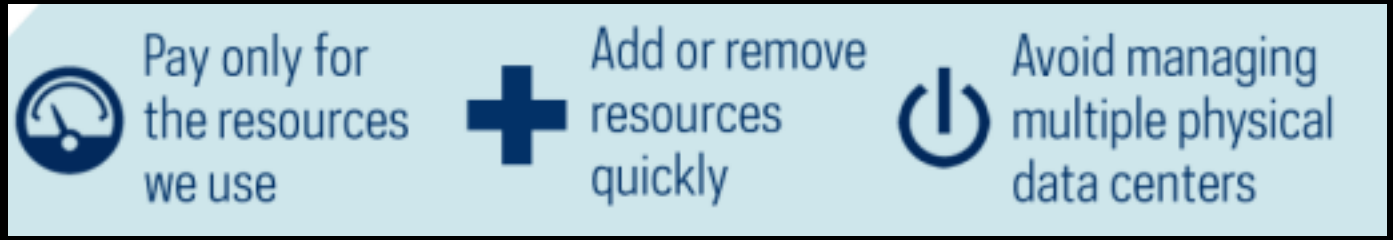
- Demand for IT services will continue **INCREASING**
- Funding and staffing remain **CONSTANT**
- We must find **NEW WAYS TO EXCEL** in delivering IT services

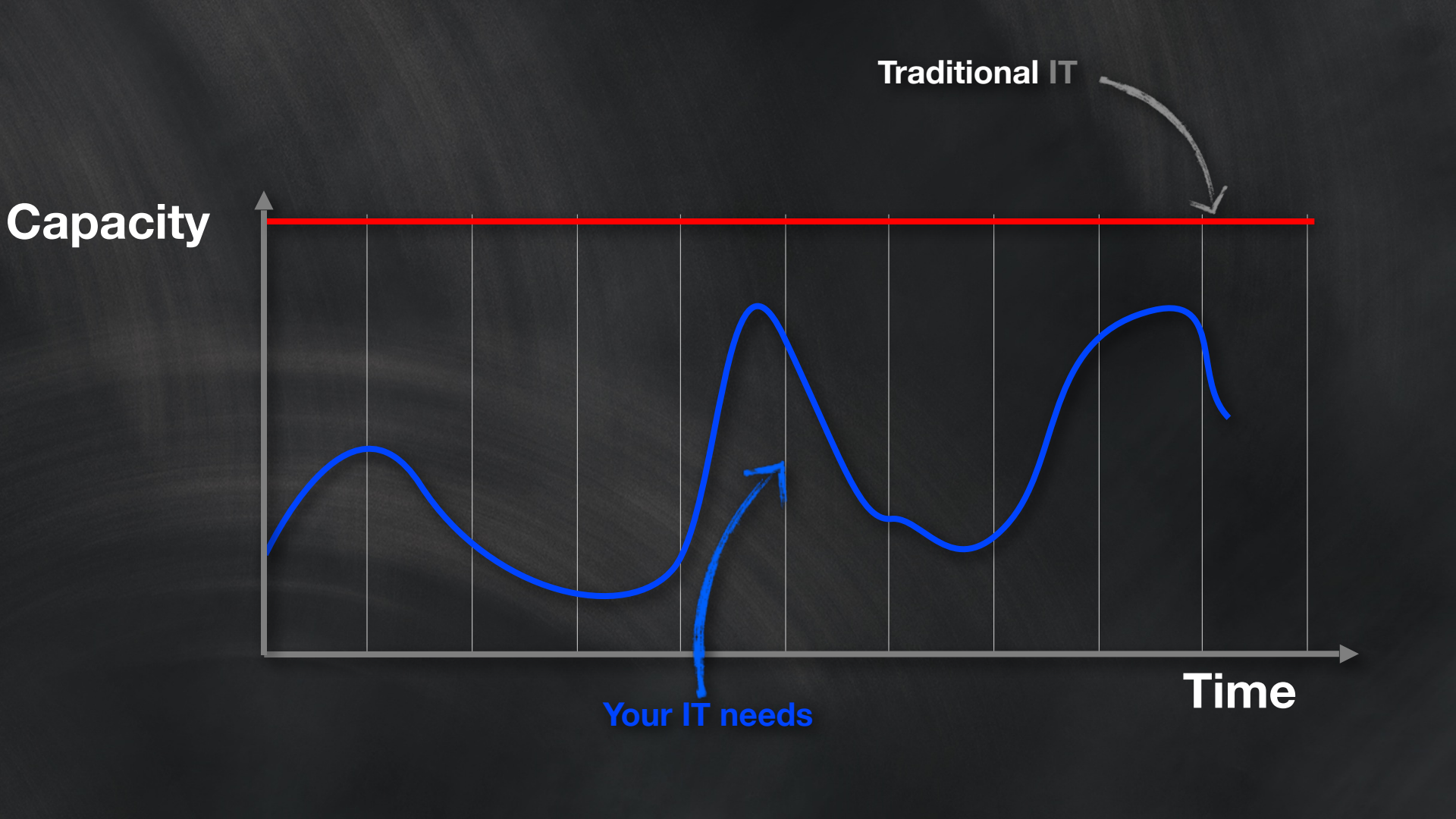


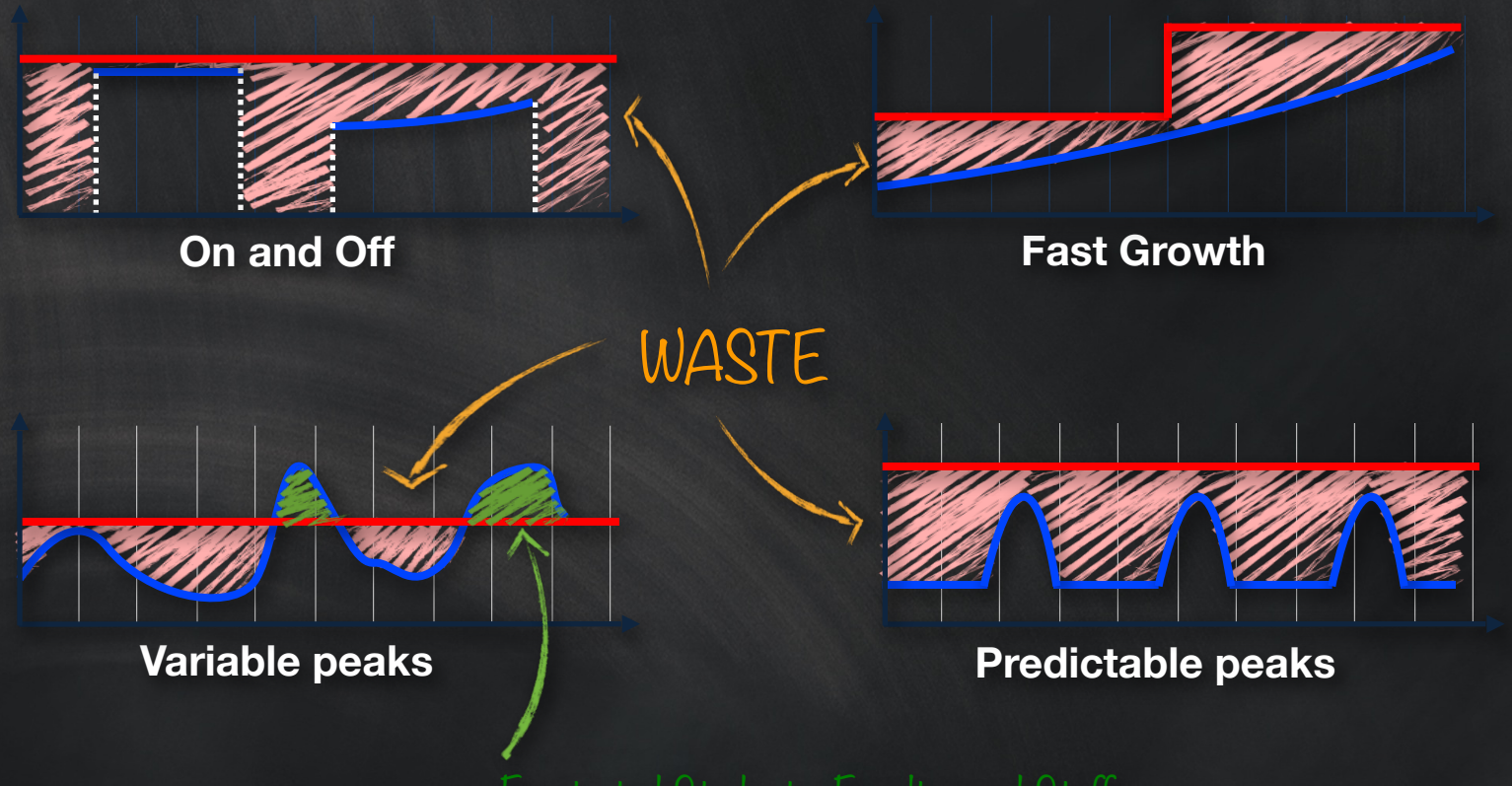

Software as a Service (SaaS)
Platform as a Service (PaaS)
Infrastructure as a Service (IaaS)
On-Premises

MetricStream

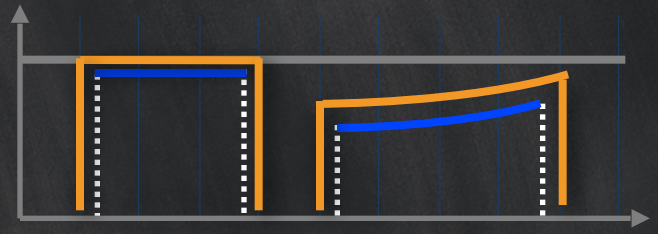
Why IaaS?


Pay only for the resources we use
Add or remove resources quickly
Avoid managing multiple physical data centers

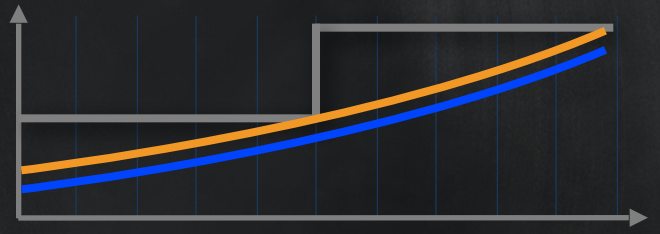

Traditional IT
Capacity
Time
Your IT needs


On and Off
Fast Growth
WASTE
Variable peaks
Predictable peaks
Frustrated Students, Faculty, and Staff

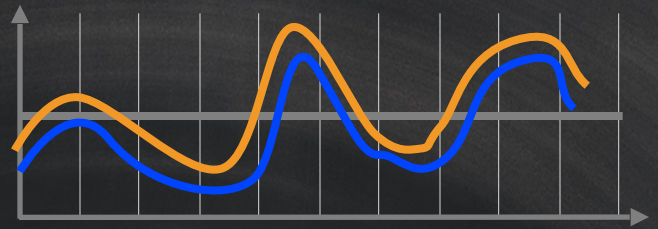
The IaaS Value Proposition



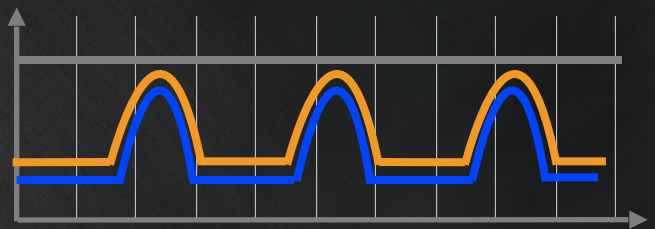
On and Off



Fast Growth



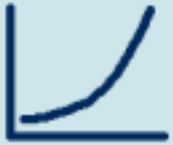
Variable peaks



Predictable peaks

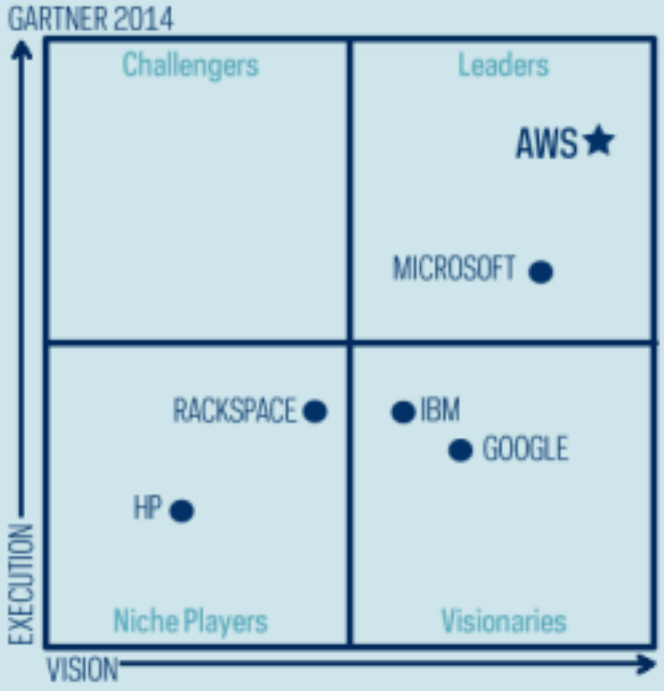
Why AWS?

Most advanced data centers in the world



Proven pace of innovation

Relentless focus on customer success



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How Did We Start?

Fall 2012: Catalyst

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emergency.ND.edu

Search

Emergency Contacts
ND Alert
Resources
Business Continuity

Office of Campus Safety
Risk Management and Safety
ND Security Police
ND Fire Department

Home // Emergency

Notre Dame Emergency Information

Emergency updates are available on Facebook and @nd_news on Twitter.

Current Status

There is no emergency at the University of Notre Dame. The campus is operating under normal conditions.

In the event of an emergency, this site will be updated with information about the nature of the incident, how to remain safe and, after the event, the point at which safety has been restored.

Reporting an emergency

- Dial 911 from any phone; or
- Pick up the receiver of any blue-light phone on campus

Introduction to AWS

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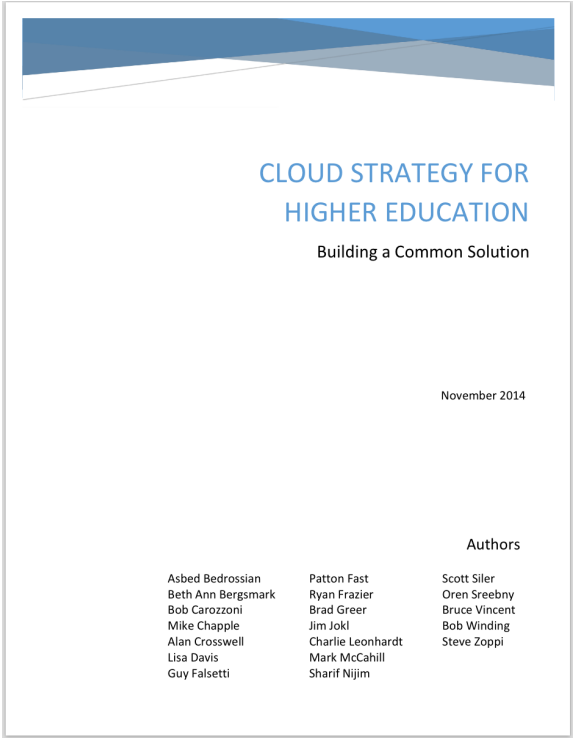
- Connected with Amazon Web Services
- Met in Michigan
- Built/configured CRM demo environment during the initial meeting
- ND staff impressed with AWS toolset

Common Strategy



CLOUD STRATEGY FOR HIGHER EDUCATION

Building a Common Solution

November 2014

Authors

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ECAR EDUCAUSE CENTER FOR ANALYSIS AND RESEARCH

http://www.educause.edu/library/resources/cloud-strategy-higher-education-building-common-solution

Case Studies

Case Study: moving www.nd.edu to AWS

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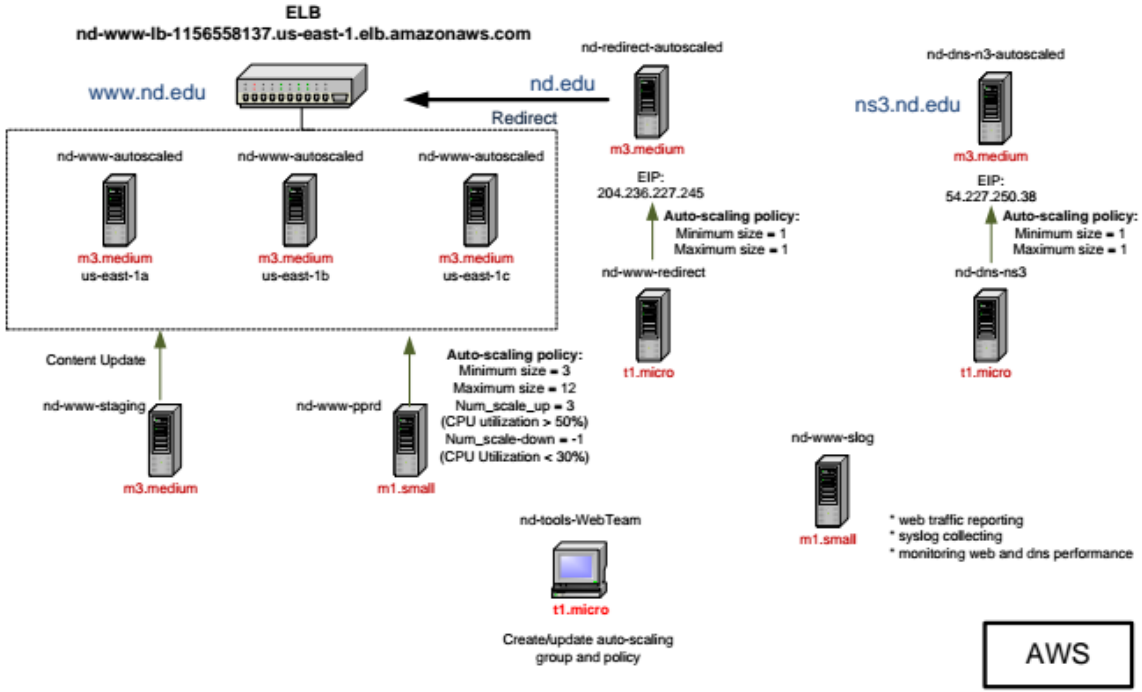
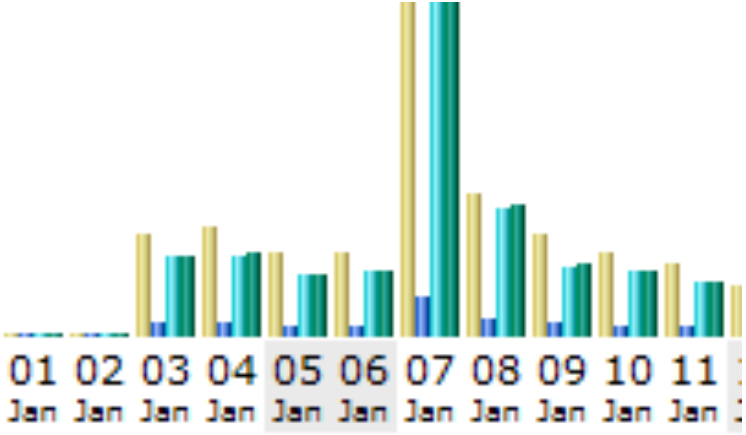
- Initial move/test took three days (10/2012)
- Performance/scalability test results exceeded expectations
- Reduced complexity/cost
- Site went live 1/2013

What did it take?



Success!

- Normal and emergency operation simplified
- Autoscaling handled BCS Championship
- To Do: CloudFront, better performance, lower cost



Day	Number of visits	Pages	Hits	Bandwidth
01 Jan 2013	456	2,854	31,614	923.76 MB
02 Jan 2013	406	2,735	29,648	789.09 MB
03 Jan 2013	45,690	328,049	1,868,453	44.10 GB
04 Jan 2013	49,685	335,960	1,853,714	45.84 GB
05 Jan 2013	38,205	222,781	1,432,841	33.43 GB
06 Jan 2013	37,459	233,688	1,505,032	35.96 GB
07 Jan 2013	150,848	936,571	7,729,762	181.90 GB
08 Jan 2013	63,970	408,588	2,960,622	71.42 GB
09 Jan 2013	45,940	276,955	1,615,684	38.56 GB
10 Jan 2013	37,524	247,983	1,475,446	35.43 GB

Lessons learned

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- Apex node nd.edu must be DNS A-Record
- Local URL path dependencies need to be fixed
- Sites coupled with campus needed to be relocated
- Support for multi-AZ
- CloudFront will require us to make design changes

Case Study: conductor.nd.edu

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- Conductor: ND-developed content management system
- 435+ web sites
- 4+ million views/month
- Hosted in RackSpace - plagued by unstable hardware issues

Approach

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- Employ Elasticache
- Switched from MySQL server to RDS
- Began process to enable scaling
- Externalize data in EBS … then … S3
- Use sub-account to simplify sysadmin permissions and billing

Success!

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Alec Hipshear @xionon · Mar 25

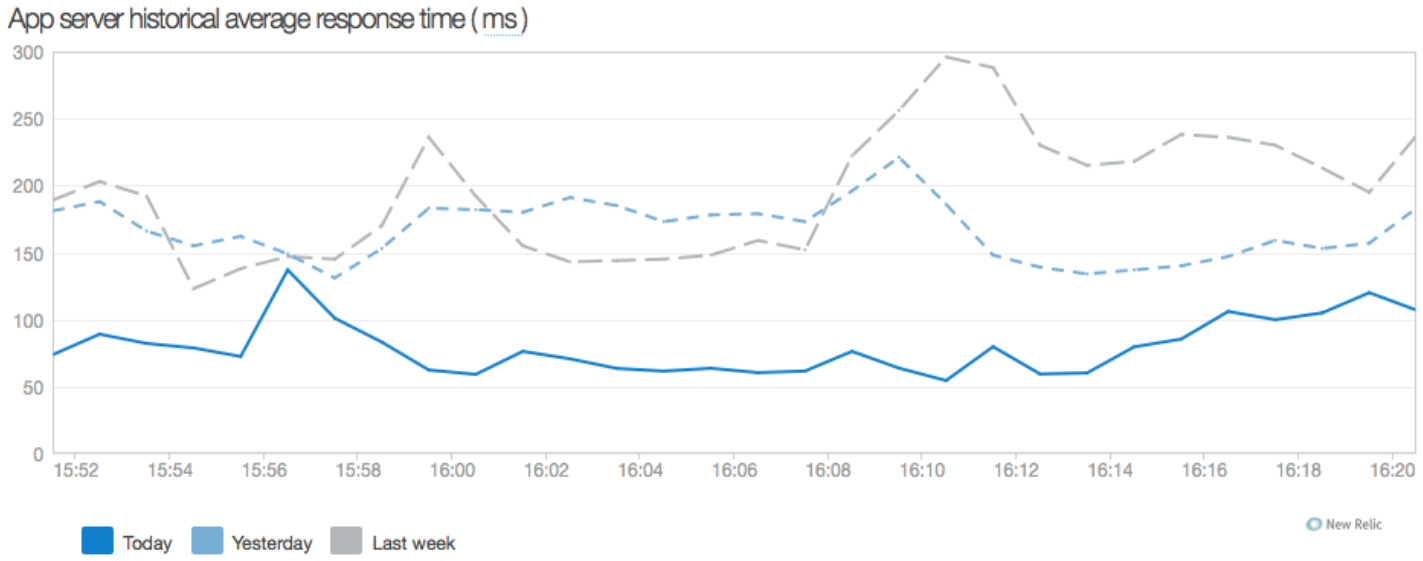
Conductor is so much faster i'm actually afraid it's broken and nobody noticed

dropbox.com/s/h4v4a2ctqpzk...

/cc @snijim @BrandonRich #DevOpsND

View photo Reply Retweeted Favorited

Success!



It may be faster, but now its half the cost☺

Case Study: Server Backups

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- Netbackup to manage 300 TB of backups
- Chose Panzura as cloud storage gateway partner
- Backing up to S3
- Any server restore since summer 2014 being retrieved through Panzura device
- Able to avoid augmenting/replacing NetApp on premises footprint

Other ND/AWS Successes

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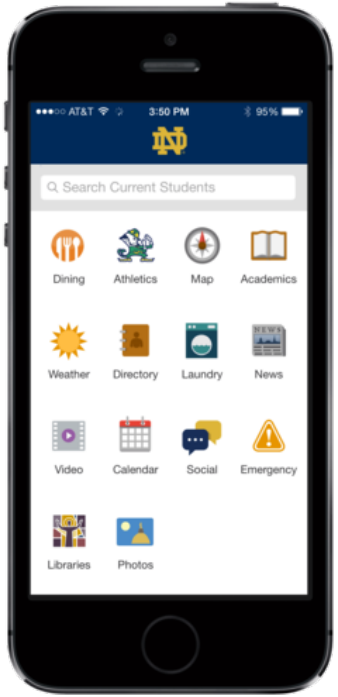

Shibboleth

CAS

Windows Active Directory

box

Google apps

InCommon

amazon web services™

ND Authentication in AWS

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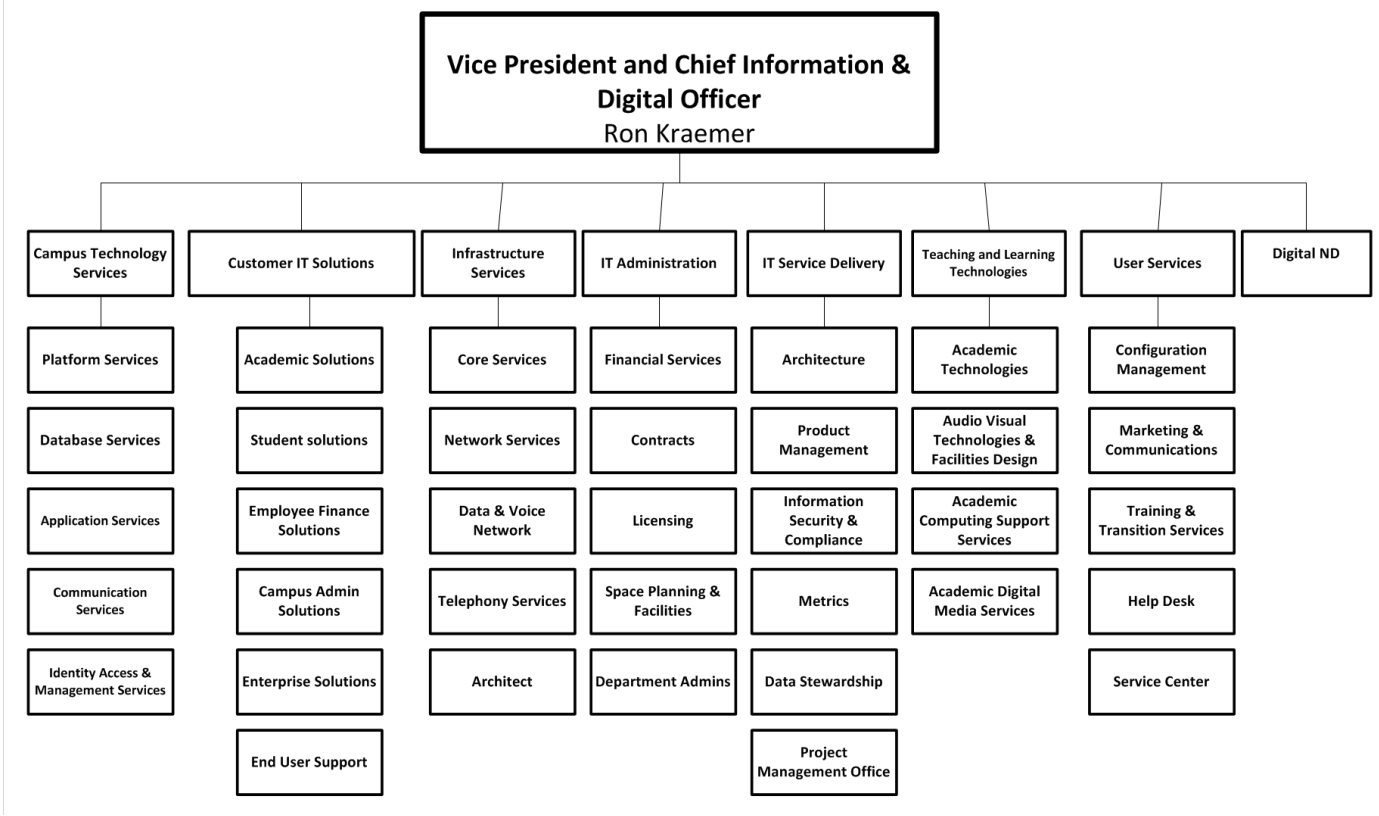
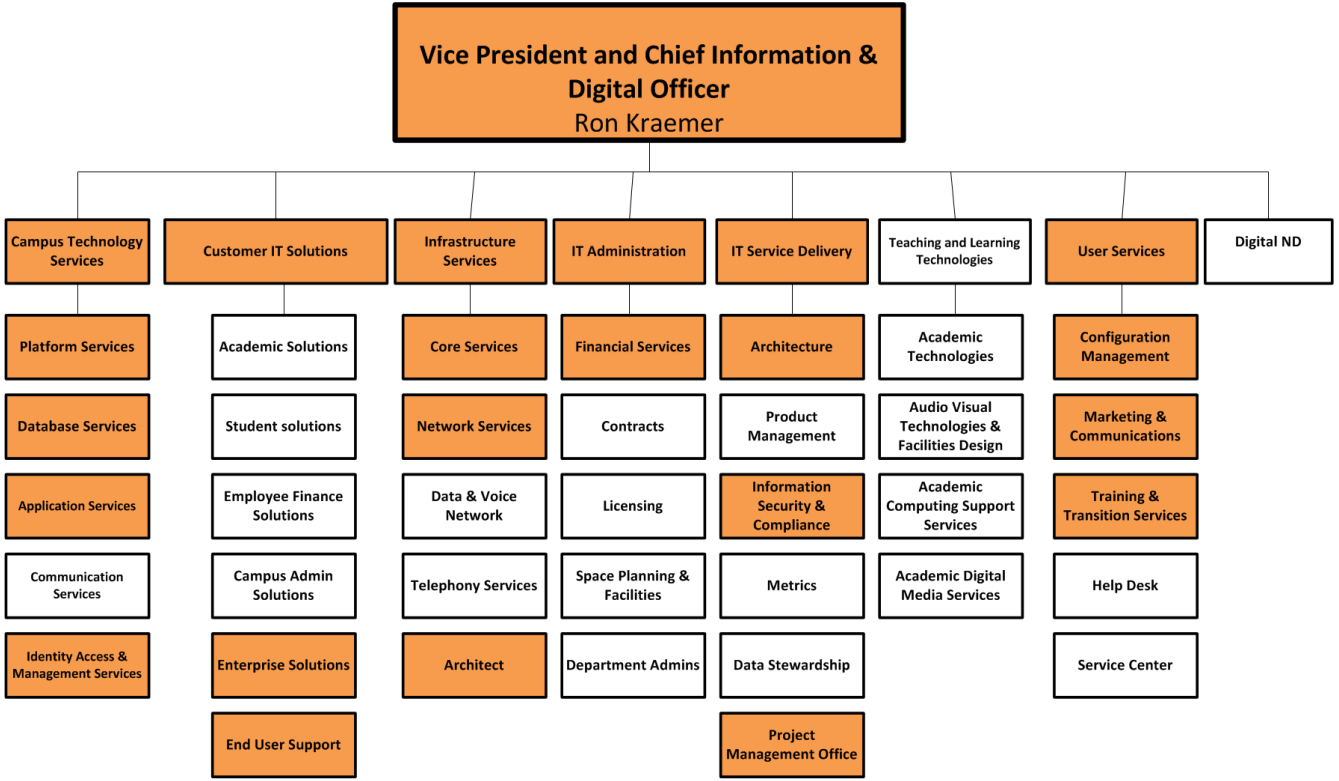
- High availability for off-campus students, faculty, and staff
- Auto failover with Route 53
- Client Gateway VPN for Domain Controller sync

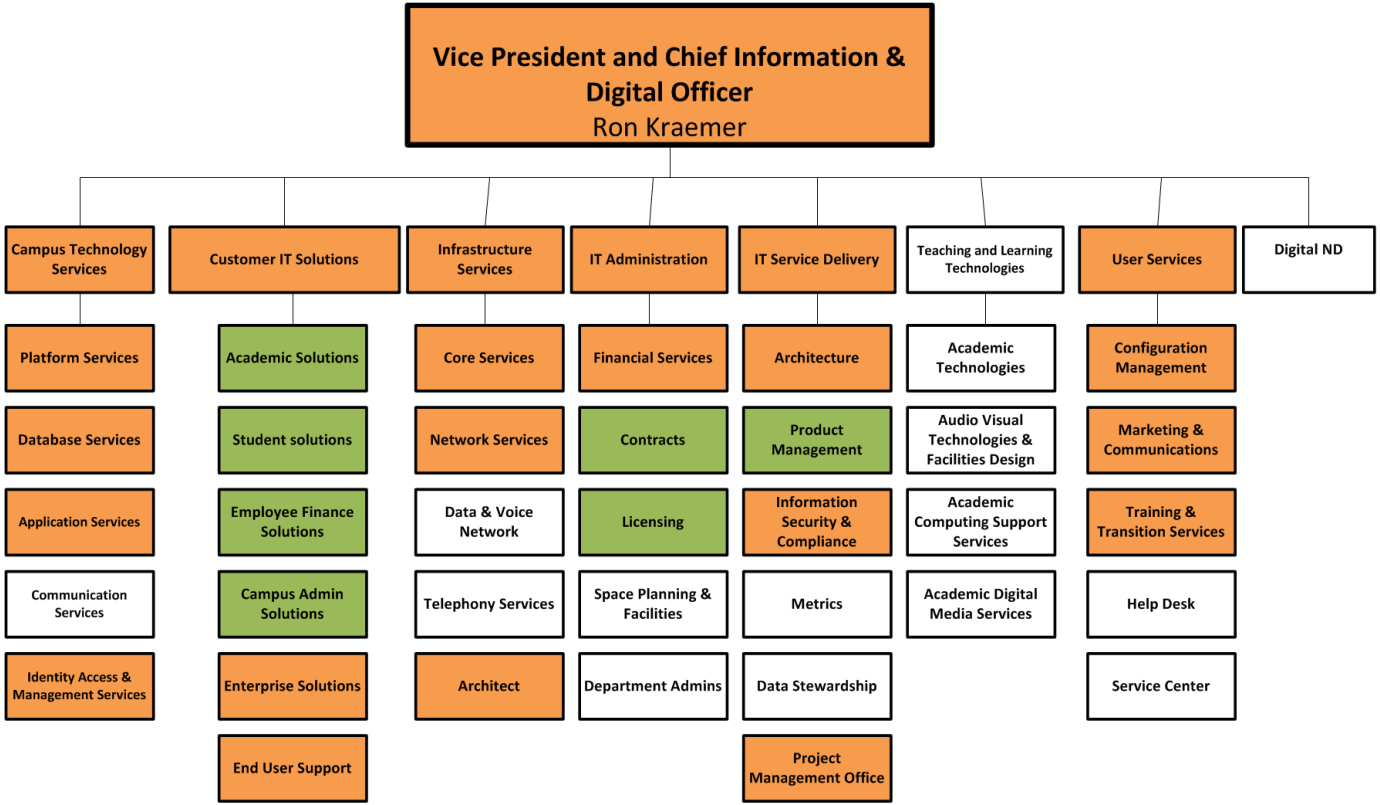
Dedicated Team…



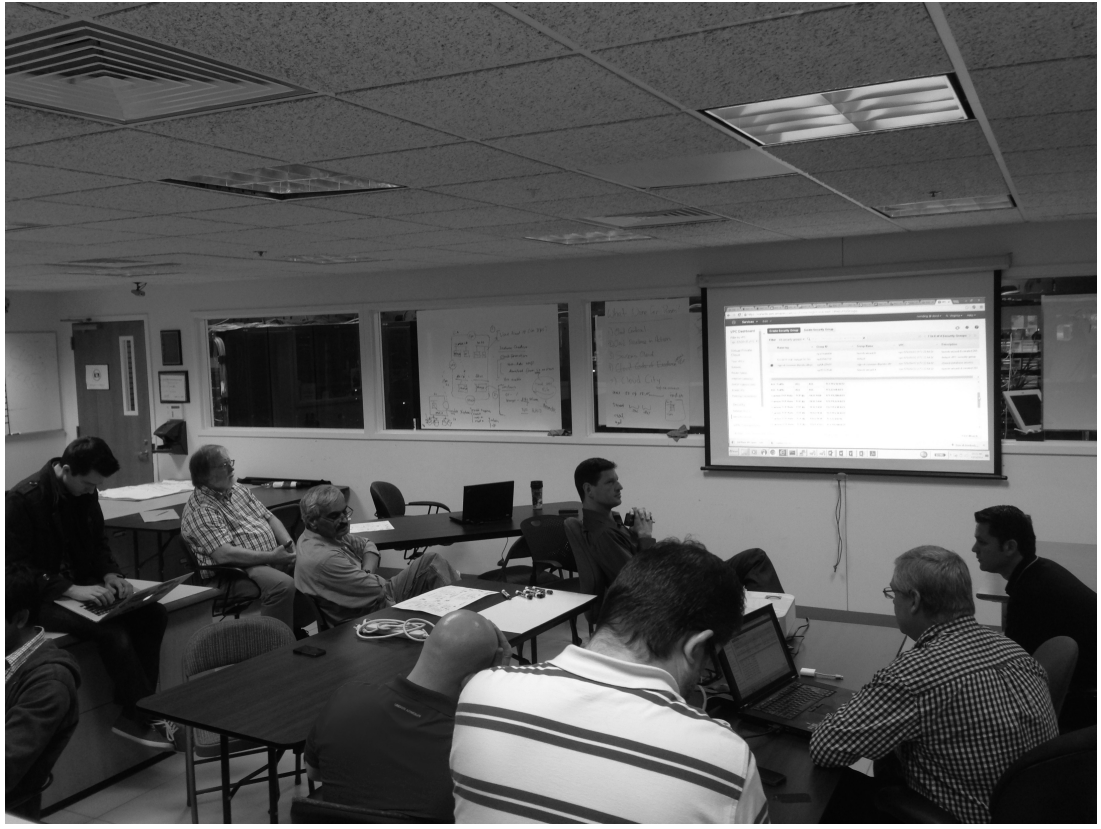
…from across the organization…



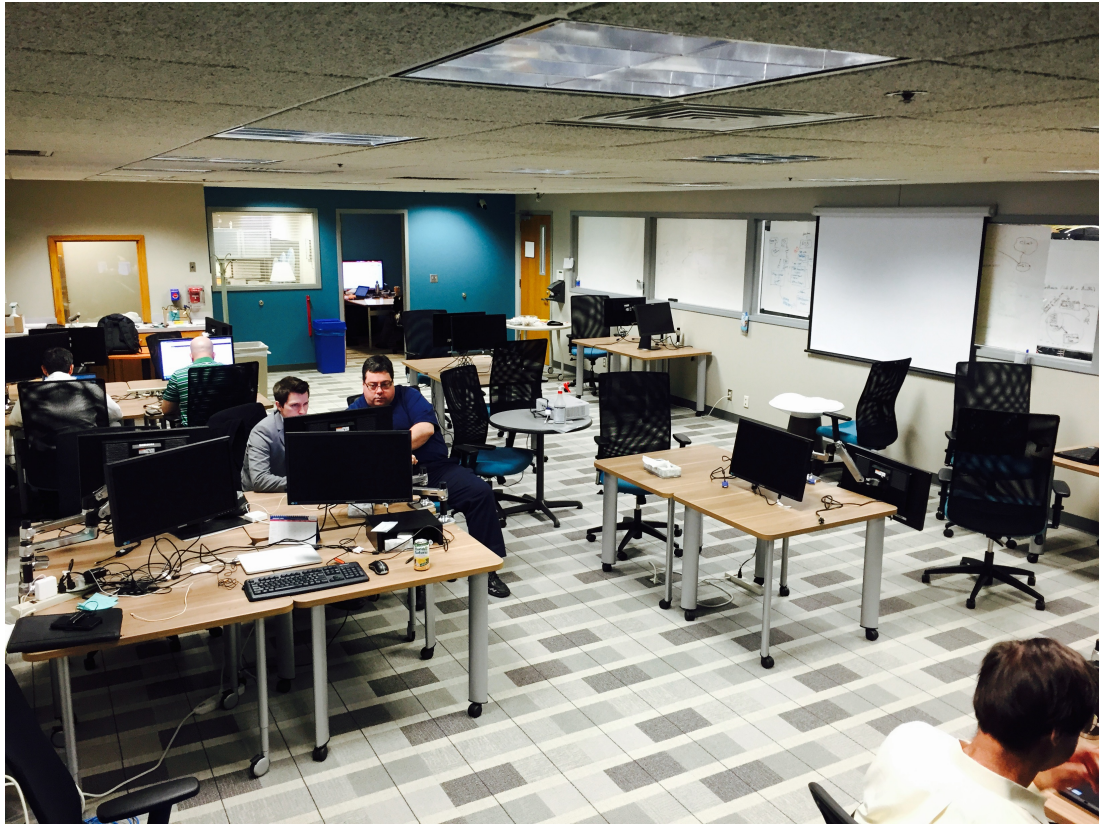
…expanding as necessary



Dedicated space…



…evolved to be habitable



Shared Mission: #NDCloudFirst

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80% of IT service portfolio to be cloud based in 3 years

Join the conversation

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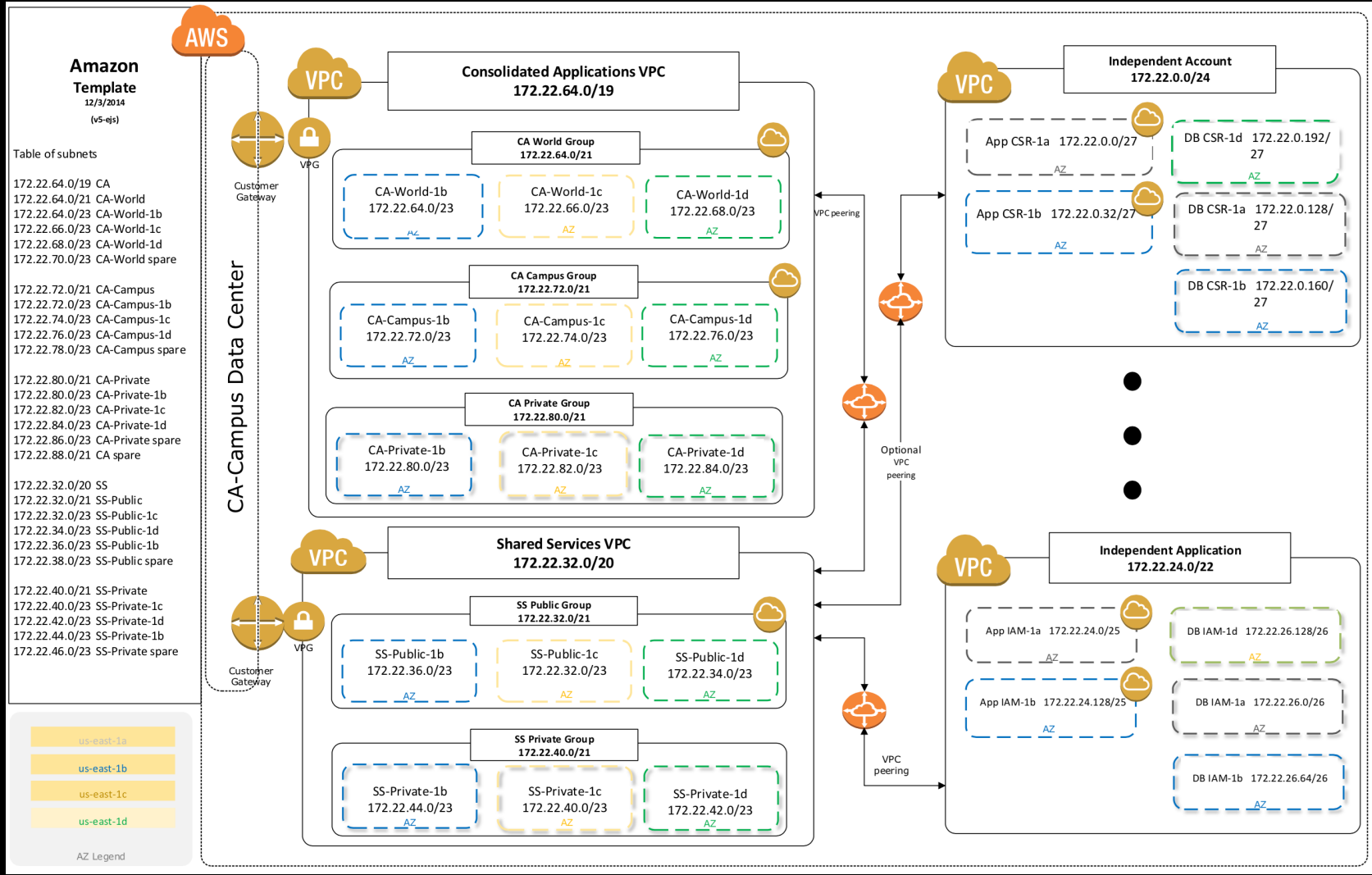
- Twitter: #NDCloudFirst
- Web: http://oit.nd.edu/cloud-first/
- Blog: https://blogs.nd.edu/devops/


Amazon
Template
12/3/2014
(v5-ejs)
Table of subnets
172.22.64.0/19 CA
172.22.64.0/21 CA-World
172.22.64.0/23 CA-World-1b
172.22.66.0/23 CA-World-1c
172.22.68.0/23 CA-World-1d
172.22.70.0/23 CA-World spare
172.22.72.0/21 CA-Campus
172.22.72.0/23 CA-Campus-1b
172.22.74.0/23 CA-Campus-1c
172.22.76.0/23 CA-Campus-1d
172.22.78.0/23 CA-Campus spare
172.22.80.0/21 CA-Private
172.22.80.0/23 CA-Private-1b
172.22.82.0/23 CA-Private-1c
172.22.84.0/23 CA-Private-1d
172.22.86.0/23 CA-Private spare
172.22.88.0/21 CA spare
172.22.32.0/20 SS
172.22.32.0/21 SS-Public
172.22.32.0/23 SS-Public-1c
172.22.34.0/23 SS-Public-1d
172.22.36.0/23 SS-Public-1b
172.22.38.0/23 SS-Public spare
172.22.40.0/21 SS-Private
172.22.40.0/23 SS-Private-1c
172.22.42.0/23 SS-Private-1d
172.22.44.0/23 SS-Private-1b
172.22.46.0/23 SS-Private spare
AWS
CA-Campus Data Center
VPC
Consolidated Applications VPC
172.22.64.0/19
Customer Gateway
VPG
CA World Group
172.22.64.0/21
CA-World-1b
172.22.64.0/23
CA-World-1c
172.22.66.0/23
CA-World-1d
172.22.68.0/23
CA Campus Group
172.22.72.0/21
CA-Campus-1b
172.22.72.0/23
CA-Campus-1c
172.22.74.0/23
CA-Campus-1d
172.22.76.0/23
CA Private Group
172.22.80.0/21
CA-Private-1b
172.22.80.0/23
CA-Private-1c
172.22.82.0/23
CA-Private-1d
172.22.84.0/23
AZ
VPC peering
Optional VPC peering
Shared Services VPC
172.22.32.0/20
SS Public Group
172.22.32.0/21
SS-Public-1b
172.22.36.0/23
SS-Public-1c
172.22.32.0/23
SS-Public-1d
172.22.34.0/23
SS Private Group
172.22.40.0/21
SS-Private-1b
172.22.44.0/23
SS-Private-1c
172.22.40.0/23
SS-Private-1d
172.22.42.0/23
Independent Account
172.22.0.0/24
App CSR-1a 172.22.0.0/27
App CSR-1b 172.22.0.32/27
DB CSR-1d 172.22.0.192/27
DB CSR-1a 172.22.0.128/27
DB CSR-1b 172.22.0.160/27
Independent Application
172.22.24.0/22
App IAM-1a 172.22.24.0/25
App IAM-1b 172.22.24.128/25
DB IAM-1d 172.22.26.128/26
DB IAM-1a 172.22.26.0/26
DB IAM-1b 172.22.26.64/26
us-east-1a
us-east-1b
us-east-1c
us-east-1d
AZ Legend