

The cloud  
Introduction

CSCI E 45a: The Cyber World – part A

1 Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---


---

---

---

---

Learning goals



- Understand the key terms and concepts
- Cut through the hype to understand the benefits and pitfalls of the cloud

2 Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---


---

---

---

---

Introducing the cloud



- Confused terminology most recent “silicon snake oil”
- Mix of consumer and enterprise offerings
- From small local virtualization to lots of elastic stuff in the ether  
The line between simple virtualization and “the cloud” is fuzzy at best

3 Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---

### Introducing the cloud, contd.



- Putting yourself in someone else's hands
- **Not really cloud** - Managed services – 3<sup>rd</sup> party management of services (on or off premise)

4

Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---

### Topics



- Key terms and concepts - R  
From IaaS, to elastic, to private, and hybrid, etc.
- SaaS - R  
Exploring the world of Software as a Service for both consumers and enterprises
- IaaS - R  
Exploring the world of Infrastructure as a Service – creating datacenters in the cloud

5

Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---

### Image credits

All drawings and photos by Ben Gaucherin unless noted

Slide#	credit
4	ADP logo
5	OpenStack logo
5	Zitttrain – <a href="https://pbs.twimg.com/media/BeqpiGK1IAE9-3m.png:large">https://pbs.twimg.com/media/BeqpiGK1IAE9-3m.png:large</a>
5	Cloud cartoon – D. Fletcher cloudtweaks.com

6

Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---

The cloud  
Key terms and concepts

CSCI E 45a: The Cyber World – part A

1 Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---

A model for cloud: NIST SP800-145

Visual inspired by NIST SP800-145

The diagram illustrates the NIST SP800-145 cloud model. It is organized into three horizontal layers. The top layer, labeled 'Essential characteristics', contains a box with four sub-items: 'Broad network access', 'Rapid elasticity', 'Measured service', and 'On-demand self-service'. Below this is a box for 'Resource pooling'. The middle layer, labeled 'Service models', contains three boxes: 'Software as a Service (SaaS)', 'Platform as a Service (PaaS)', and 'Infrastructure as a Service (IaaS)'. The bottom layer, labeled 'Deployment models', contains four cloud-shaped boxes: 'Public', 'Private', 'Hybrid', and 'Community'.

2 Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---

Service models

- Software as a Service – **SaaS**  
“Rented” software accessible over the Internet
- Platform as a Service – **PaaS**  
Deployment space for specific application stacks (e.g. PHP/MySQL, Django/MySQL, etc.)
- Infrastructure as a Service – **IaaS**  
Virtual datacenter with virtual machines, storage, etc.

3 Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---

### Essential characteristics



- **Broad network access**  
Resources are available anywhere there is network connectivity
- **Rapid elasticity**  
Resources can be increased or decreased as the demand changes
- **Measured services**  
Resource utilization is measured so you only pay for what you use

4

Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---

### Essential characteristics



- **On-demand self-service**  
No (visible) humans involved in the provisioning or management of resources
- **Resource pooling**  
Resources are highly leveraged across large numbers of users
- **Not explicitly stated in the NIST document:**  
Resiliency/Disaster Recovery

5

Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

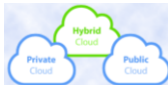
---

---

---

---

### Deployment models



- **Public or community cloud**  
Cloud where multiple “tenants” share resources
- **Private cloud**  
Running your own cloud on your own infrastructure, or through a managed service
- **Hybrid cloud**  
Combination of private and public/community cloud

6

Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---

### Some challenges – from ITU-TX.1600



- **Responsibility ambiguity**  
Who is in charge of what
- **Loss of trust**  
Hard to gage trustworthiness of service
- **Loss of governance**  
At mercy of cloud provider's business plans
- **Loss of privacy**  
Dependent on security level of cloud provider

7

Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---

### Some challenges – from ITU-TX.1600



- **Service unavailability**  
Business or technical failure of service provider
- **Cloud provider lock-in**  
Hard to move to a new provider
- **Misappropriation of intellectual property**  
Must trust service provider's employees
- **Loss of software integrity**  
Software under control of service provider

8

Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---

### Image credits

All drawings and photos by Ben Gaucherin unless noted

- | Slide# | credit   |
|--------|--|
| 2      | NIST SP800-145 visual<br><a href="http://www.ibm.com/developerworks/cloud/library/cl-extenddevtocloudbigdata/nist-cloud.gif">http://www.ibm.com/developerworks/cloud/library/cl-extenddevtocloudbigdata/nist-cloud.gif</a> |
| 3      | OpenStack logo   |
| 4      | The Goodies -<br><a href="http://www.bbc.co.uk/staticarchive/5818ce79436800703ded903477f8e2437eb71e07.jpg">http://www.bbc.co.uk/staticarchive/5818ce79436800703ded903477f8e2437eb71e07.jpg</a>                             |
| 5      | The Goodies -<br><a href="http://www.bbc.co.uk/staticarchive/5818ce79436800703ded903477f8e2437eb71e07.jpg">http://www.bbc.co.uk/staticarchive/5818ce79436800703ded903477f8e2437eb71e07.jpg</a>                             |
| 6      | Public, Private, Hybrid cloud<br><a href="http://cdn.business2community.com/wp-content/uploads/2014/09/hybrid-cloud-600x343.png">http://cdn.business2community.com/wp-content/uploads/2014/09/hybrid-cloud-600x343.png</a> |
| 7, 8   | ITU logo   |

9

Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---

The cloud  
Software as a Service (SaaS)

CSCI E 45a: The Cyber World – part A

1 Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---

SaaS – For consumers



- Lots of them  
Twitter, Facebook, Google Apps, etc.
- Provide seemingly reliable, broadly accessible software services
- But remember:  
if the product is free, you are the product
- Raises some interesting questions...



2 Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---

SaaS – For the enterprise



- Many people in enterprises, use consumer services!? (e.g. Google Docs)
- Many consumer services offer enterprise versions  
Sometimes offer contracts with different data management practices/expectations
- Enterprise software increasingly available as a service: HR, Finance, etc.

3 Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---

### SaaS – For the enterprise



- Some Business Process Outsourcing (BPO) offerings, Starting to be called Business as a Services (BaaS)
- Raise the same interesting questions as for consumer services

4

Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---

### SaaS – Some interesting questions



- What does the service contract say about what the service provider can do with your data?
- What happens to the meta-data, or the data about your activities on the service?
- What about meeting Service Levels?
- What if your provider goes out of business?

5

Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---

### SaaS – Some interesting questions



- When you delete data, is it truly deleted?
- How do you get your data out if you decide to no longer use a service?  
And where do you go to make this data work? in another SaaS provider's software?

6

Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---

## Image credits

All drawings and photos by Ben Gaucherin unless noted

Slide# credit

2 Facebook, Twitter, Google Apps logos

2 Ztttrain – [https://pbs.twimg.com/media/BeqpiGKIIAE9-](https://pbs.twimg.com/media/BeqpiGKIIAE9-3m.png:large)

3m.png:large

3 Office 365, Google Apps, Workday, Salesforce logos

4 Amazon Fulfillment services logo

6 History of vendor lock-in

<http://www.sacatech.com/images/blogimages/Vendor%20Lock-In.jpg>

7

Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---



The cloud  
Infrastructure as a Service (IaaS)

CSCI E 45a: The Cyber World – part A

1 Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---

Infrastructure as a Service

- On premise private cloud IaaS  
Running your own IaaS offering  
Brings the value of IaaS to locally managed infrastructure
- All other models are off-premise  
Private cloud IaaS through Managed Service,  
Public/Community IaaS cloud services

2 Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---

Providers



- Many, wanting to capitalize on a potentially huge market  
Everyone wants to get out of the server business
- Some, way ahead of the pack  
Not great for the competition  
Good and bad for customers  
More advanced tools and services  
More opportunity for vendor lock-in

3 Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

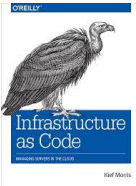
---

---

---

---

### Infrastructure as code



- As opposed to “Infrastructure as kittens”
- Infrastructure can be created and destroyed at a whim
- Key aspects
  - Provisioning and some management tasks can be programmed/scripted
  - Ability to trigger scripts on system triggers (e.g. high load)

4

Copyright © Scott Bradner & Ben Gaucher in 2015

---

---

---

---

---

---

---

---

### Connectivity

- **Option #1**  
Virtual datacenter is just another site connected through PPVPN or direct connections
- **Option #2**  
Your cloud infrastructure is a stand-alone structure that services customers directly over the public Internet and has no ties back to your on premise infrastructure

5

Copyright © Scott Bradner & Ben Gaucher in 2015

---

---

---

---

---

---

---

---

### Using IaaS services



- Number and scale of “datacenters”, no longer a hard constraint
  - Providers allow you to setup as many virtual datacenters as you want
  - Allows for better design, management
  - Different virtual datacenters, in different availability zones
  - And different size datacenters

6

Copyright © Scott Bradner & Ben Gaucher in 2015

---

---

---

---

---

---

---

---

### Using IaaS services

- Virtual datacenter constructs use private IP addresses  
For large enterprises, pushes the use of private IP space beyond its original intent
  - especially if you've historically been sloppy in your use of private address spaceRouting public and private traffic in and out of a virtual datacenter can be tricky

7

Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---

### Using IaaS services

- Security controls different than on premise  
Proprietary authorization controls through security groups  
Network traffic filtering not easy, or can be expensive
- New interesting target for cyber attacks

8

Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---

### Looking at Amazon's AWS



- Popular IaaS service
- Large market share
- Interesting and large set of services
- Not an endorsement from Scott and I

As mentioned before, market leaders are both good and bad for customers

Great offerings  
But opportunity for vendor lock-in

9

Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---

### AWS overview

The screenshot shows the AWS Management Console interface. It features a navigation menu on the left with categories like 'Services', 'IAM', and 'IAM'. The main content area is divided into sections: 'Welcome' with a 'Get started' button, 'Amazon Web Services' with a grid of service icons (EC2, S3, IAM, CloudFormation, etc.), 'Announcements', and 'Service Health'. At the bottom, there is a copyright notice for Scott Badner & Ben Gaucherin 2015.

10 Copyright © Scott Badner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---

---

---

### AWS Service categories

The screenshot shows the 'Amazon Web Services' navigation menu. It lists various services grouped into categories like 'Compute & network', 'Storage & content delivery', and 'Database'.

- **Compute & network**  
Virtual servers and network structures
- **Storage & content delivery**  
File/block based storage, Content Delivery Network (CDN) services
- **Database**  
SQL, no-SQL, cache, multi-dimensional, etc.

11 Copyright © Scott Badner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---

---

---

### AWS Service categories

The screenshot shows the 'Amazon Web Services' navigation menu. It lists various services grouped into categories like 'Deployment & management', 'Analytics', and 'App Services'.

- **Deployment & management**  
Services to support "infrastructure as code"
- **Analytics**  
Tools for big data, or data driven workflow
- **App Services**  
Other useful application services: search, media transcoding, message queuing, etc.

12 Copyright © Scott Badner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---

---

---

### AWS and resiliency

- Virtual Private Clouds (VPCs) can be setup in different availability zones and regions
- Unlikely that...
  - Two availability zones in the same region will be down at the same time
  - And even less likely that two regions will be down at the same time

13

Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---

### AWS regions in 2015

AWS Global Regions Locations



14

Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---

### Image credits

All drawings and photos by Ben Gaucherin unless noted

Slide# credit

3 Amazon AWS, Google Compute Engine, VMWareCloudAir, Microsoft Azure logos

4 Kitten

[http://www.sfgov2.org/ftp/uploadedimages/acc/Adoption\\_Center/Foster%20Kitten%2012007.jpg](http://www.sfgov2.org/ftp/uploadedimages/acc/Adoption_Center/Foster%20Kitten%2012007.jpg)

4 Infrastructure as code cover - [http://infrastructure-as-code.com/images/infrastructure\\_as\\_code\\_medium.png](http://infrastructure-as-code.com/images/infrastructure_as_code_medium.png)

6 Cloud architecture patterns cover - <http://www.amazon.com/Cloud-Architecture-Patterns-Using-Microsoft/dp/1449319777>

9 Amazon AWS logo

10 AWS console

[https://d36cz9buwrn1t.cloudfront.net/console\\_federation\\_proxy\\_AWS\\_Management\\_Console.png](https://d36cz9buwrn1t.cloudfront.net/console_federation_proxy_AWS_Management_Console.png)

11, 12 AWS services

<http://static.iphonelife.com/sites/iphonelife.com/files/u31369/fig004AWSCoconsole.jpg>

14 AWS global regions locations

Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---

The cloud  
Conclusion

CSCI E 45a: The Cyber World – part A

1 Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---


---

---

---

---

In summary...



- IaaS, PaaS, and SaaS are revolutionizing both consumer and enterprise IT
- We are still in the early days and much is still likely to change:
  - Many people and companies are moving to the cloud
  - Cloud offerings are evolving, maturing, and will continue to do so for years to come
  - Many new opportunities to “shoot yourself in the foot”

2 Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---

Image credits

All drawings and photos by Ben Gaucherin unless noted

Slide#	credit
2	Cloud cartoon – D. Fletcher cloudtweaks.com

3 Copyright © Scott Bradner & Ben Gaucherin 2015

---

---

---

---

---

---

---

---