

AWS Concepts and Lab Intro

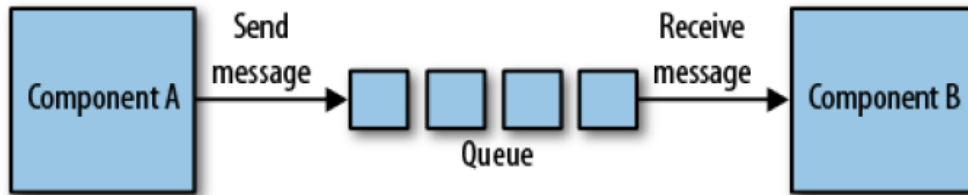
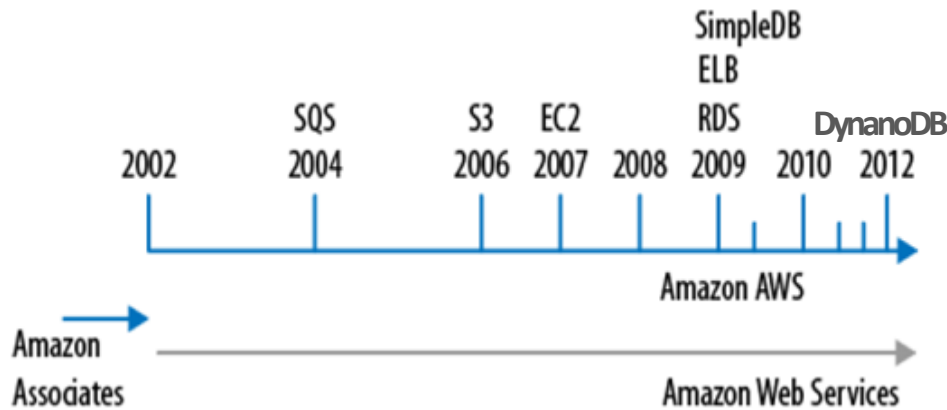
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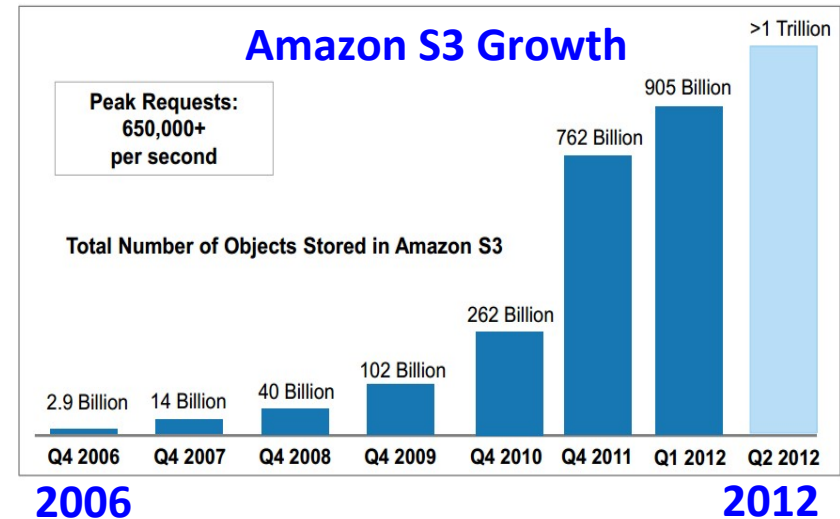
*Slides adapted from Hwang, Fox, Dongarra
&
Programming Amazon EC2, Vliet, Paganelli*

Growth of AWS

1.3 Trillion in 2013



Scale: Amazon S3 Growth



- AWS “Simple Queue Service” fosters ‘decoupled’ service oriented architecture message passing
 - “Developers can move data between distributed components of their applications that perform different tasks, without losing messages or requiring each component to be always available”
- S3 Storage, EC2 Compute, ELB Load Balancing, RDS Relational Database, SimpleDB





AWS Free-Tier

Amazon Web Services





Compute

-  **EC2**
Virtual Servers in the Cloud
-  **Lambda** PREVIEW
Run Code in Response to Events




Storage & Content Delivery

-  **S3**
Scalable Storage in the Cloud
-  **Storage Gateway**
Integrates On-Premises IT Environments with Cloud Storage
-  **Glacier**
Archive Storage in the Cloud
-  **CloudFront**
Global Content Delivery Network

Database

-  **RDS**
MySQL, Postgres, Oracle, SQL Server, and Amazon Aurora
-  **DynamoDB**
Predictable and Scalable NoSQL Data Store
-  **ElastiCache**
In-Memory Cache
-  **Redshift**
Managed Petabyte-Scale Data Warehouse Service





Networking

-  **VPC**
Isolated Cloud Resources
-  **Direct Connect**
Dedicated Network Connection to AWS
-  **Route 53**
Scalable DNS and Domain Name Registration




Administration & Security

-  **Directory Service**
Managed Directories in the Cloud
-  **Identity & Access Management**
Access Control and Key Management
-  **Trusted Advisor**
AWS Cloud Optimization Expert
-  **CloudTrail**
User Activity and Change Tracking
-  **Config** PREVIEW
Resource Configurations and Inventory
-  **CloudWatch**
Resource and Application Monitoring







Deployment & Management

-  **Elastic Beanstalk**
AWS Application Container
-  **OpsWorks**
DevOps Application Management Service
-  **CloudFormation**
Templated AWS Resource Creation
-  **CodeDeploy**
Automated Deployments




Analytics

-  **EMR**
Managed Hadoop Framework
-  **Kinesis**
Real-time Processing of Streaming Big Data
-  **Data Pipeline**
Orchestration for Data-Driven Workflows

Application Services

-  **SQS**
Message Queue Service
-  **SWF**
Workflow Service for Coordinating Application Components
-  **AppStream**
Low Latency Application Streaming
-  **Elastic Transcoder**
Easy-to-use Scalable Media Transcoding
-  **SES**
Email Sending Service
-  **CloudSearch**
Managed Search Service

Mobile Services

-  **Cognito**
User Identity and App Data Synchronization
-  **Mobile Analytics**
Understand App Usage Data at Scale
-  **SNS**
Push Notification Service

Enterprise Applications

-  **WorkSpaces**
Desktops in the Cloud
-  **Zocalo**
Secure Enterprise Storage and Sharing Service

Free Usage Restrictions

AWS Free Tier (Per Month):

Elastic Compute Cloud (EC2)

- 750 hours of [Amazon EC2](#) Linux t.2 micro instance usage (1 GiB of memory and 32-bit and 64-bit platform support) – enough hours to run continuously each month*
- 750 hours of [Amazon EC2](#) Microsoft Windows Server† t.2 micro instance usage (1 GiB of memory and 32-bit and 64-bit platform support) – enough hours to run continuously each month*
- 750 hours of an [Elastic Load Balancer](#) plus 15 GB data processing*
- 30 GB of [Amazon Elastic Block Storage](#) in any combination of General Purpose (SSD) or Magnetic, plus 2 million I/Os (with EBS Magnetic) and 1 GB of snapshot storage*

Simple Storage Service (S3)

- 5 GB of [Amazon S3](#) standard storage, 20,000 Get Requests, and 2,000 Put Requests*

DynamoDB

25 GB of Storage, 25 Units of Read Capacity and 25 Units of Write Capacity – Enough to handle up to 200M requests per month with [Amazon DynamoDB](#).**

Relational Database Service (RDS)

- 750 hours of [Amazon RDS](#) Single-AZ Micro DB Instances, for running MySQL, PostgreSQL, Oracle BYOL or SQL Server (running SQL Server Express Edition) – enough hours to run a DB Instance continuously each month*
- 20 GB of database storage, in any combination of RDS General Purpose (SSD) or Magnetic storage
- 10 million I/Os (for use with RDS Magnetic storage; I/Os on RDS General Purpose (SSD) storage are not separately billed)
- 20 GB of backup storage for your automated database backups and any user-initiated DB Snapshots

Simple Workflow (SWF)

- 1,000 [Amazon SWF](#) workflow executions and a total of 10,000 activity tasks, signals, timers and markers, and 30,000 workflow-days.**

Simple Queue Service (SQS) and Simple Notification Service (SNS)

- 1,000,000 Requests of [Amazon Simple Queue Service](#)**
- 1,000,000 Requests, 100,000 HTTP notifications and 1,000 email notifications for [Amazon Simple Notification Service](#)**

Amazon Elastic Transcoder

- 20 minutes of SD transcoding or 10 minutes of HD transcoding**

CloudWatch

- 10 [Amazon Cloudwatch](#) metrics, 10 alarms, and 1,000,000 API requests**

Data Transfer

- 15 GB of bandwidth out aggregated across all AWS services*

Data Pipeline

- 3 low frequency preconditions running on AWS per month*
- 5 low frequency activities running on AWS per month*

ElastiCache

- 750 hours of [Amazon ElastiCache](#) - enough hours to run a Cache Node continuously each month.*

Amazon Mobile Analytics

- 100 million free events per month**

\$100 Promotional Code/Student Tier

You can access -

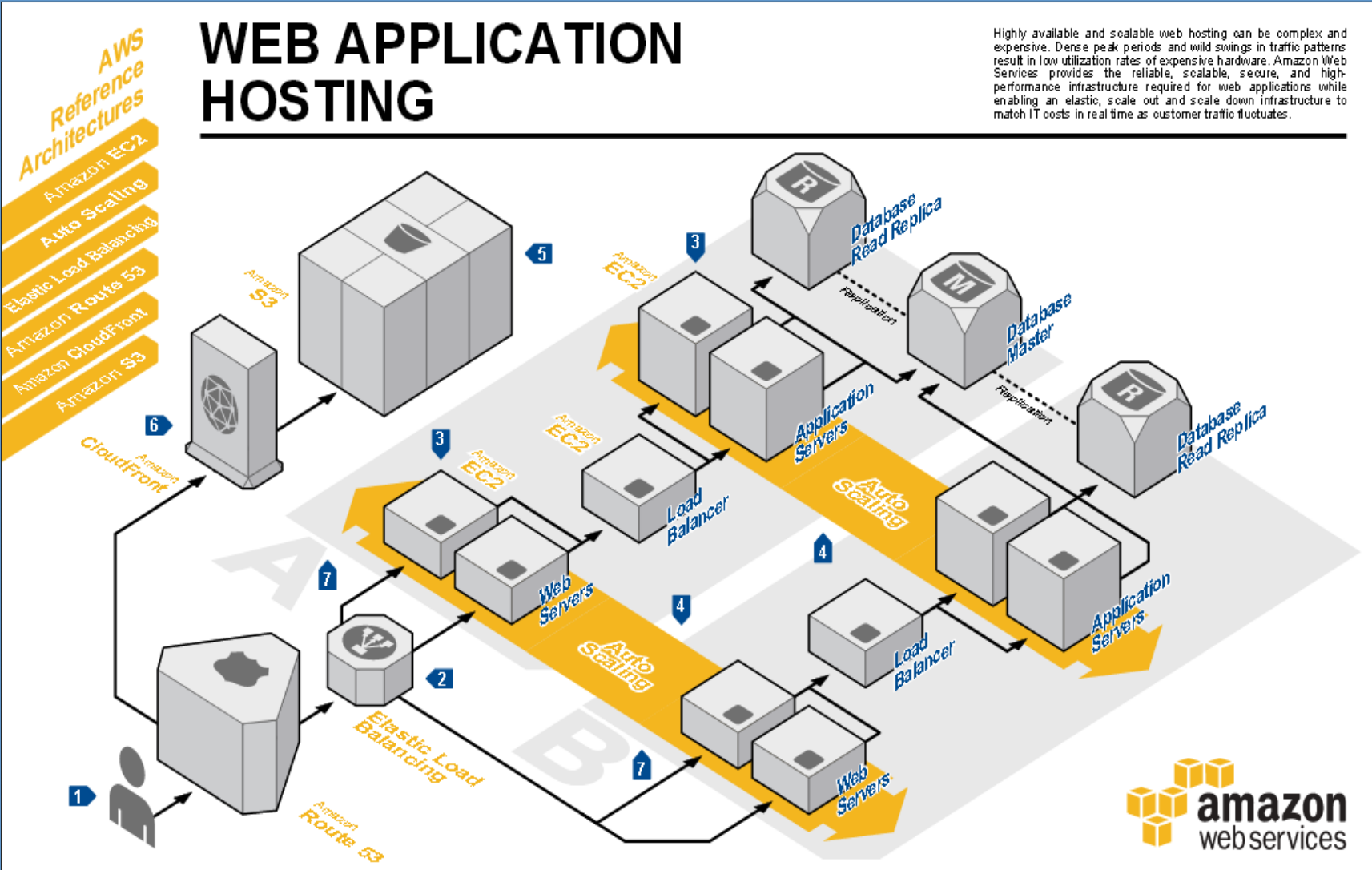
- AmazonRedshift
- **AWSDirectConnect**
- AmazonCloudcast
- AWSQueueService
- **AmazonVPC**
- AmazonElastiCache
- AmazonSES
- AmazonSIS
- AmazonCloudSearch
- AmazonSNS
- AmazonRoute53
- AWSStorageGateway
- **AmazonEC2**
- AmazonDynamoDB
- **ElasticMapReduce**
- Amazon ETS
- AmazonSimpleDB
- **AmazonRDS**
- AWSDataTransfer
- AWSSupportBasic
- **AmazonS3**
- **AmazonCloudFront**
- AWSElasticBeanstalk
- AmazonGlacier
- AWS Lambda
- AWS Key Management Service
- **CloudWatch**
- AWS cognito
- **Amazon ELB**

- **Students will receive a \$100 AWS usage credit code from me/TA via e-mail**
- **Although each assigned lab session will only use free-tier resources**, the credit is helpful if there are accidental charges or if a student would like to experiment with any advanced AWS capabilities
- **If a student exceeds the \$100 usage credit, he/she will be responsible for payment of any overage charges**

Example Application Hosting in AWS

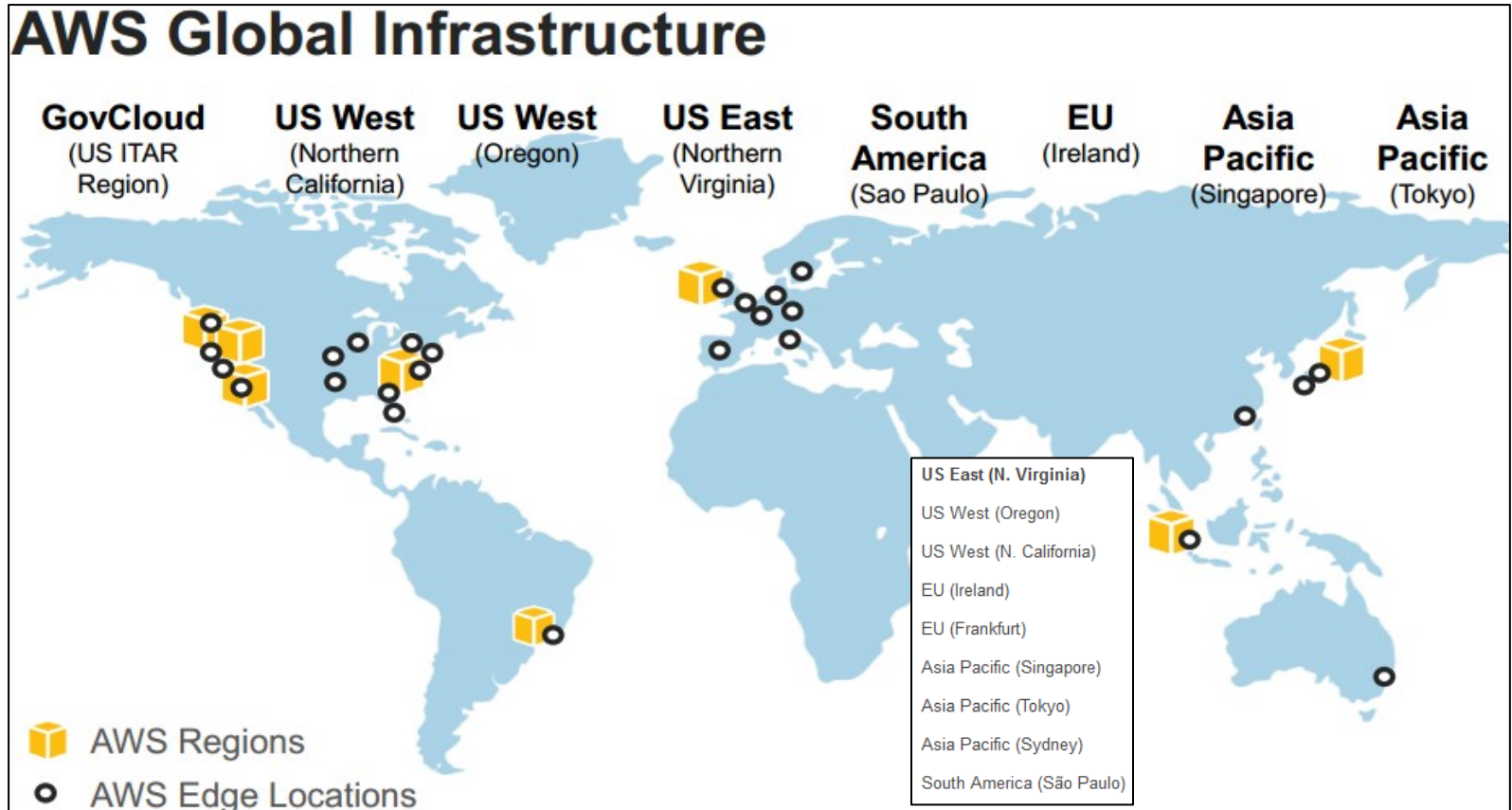
WEB APPLICATION HOSTING

Highly available and scalable web hosting can be complex and expensive. Dense peak periods and wild swings in traffic patterns result in low utilization rates of expensive hardware. Amazon Web Services provides the reliable, scalable, secure, and high-performance infrastructure required for web applications while enabling an elastic, scale out and scale down infrastructure to match IT costs in real time as customer traffic fluctuates.



AWS Regions

11 regions, 28 availability zones (1 to 6 data centers)...
~1.4 million servers worldwide!!



More Introduction Information about AWS at – (especially see different networking setups allowed by AWS including ‘Direct Connect’)

<http://www.slideshare.net/AmazonWebServices/03-introduction-to-aws>

Interesting must-read article...

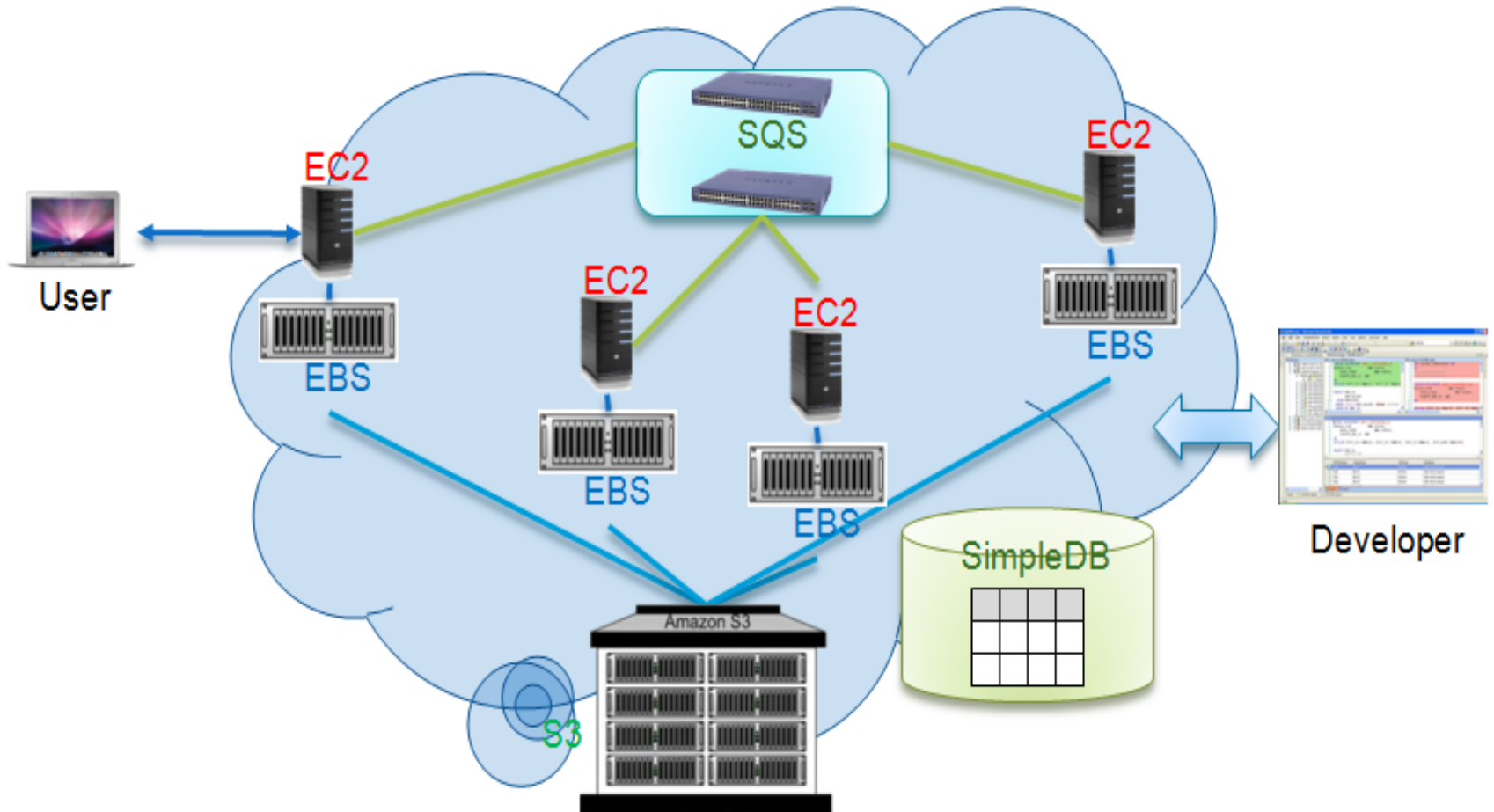
- T. Morgan, “A Rare Peek Into The Massive Scale of AWS”, Nov. 2014
 - <http://www.enterprisetech.com/2014/11/14/rare-peek-massive-scale-aws/>

Lab Steps

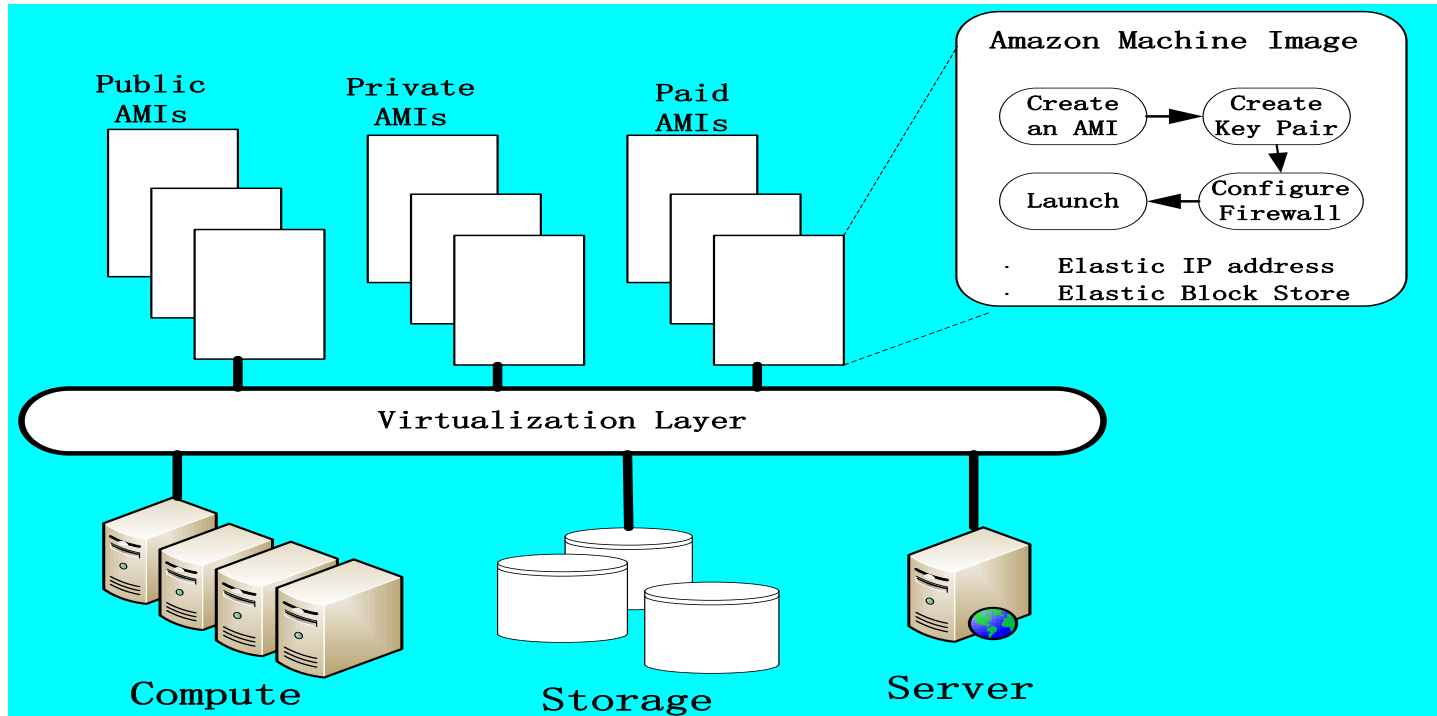


- **Lab – AWS Account Setup, Services Overview, Resource Discovery, and Instance Setup**
- **Purpose of the Lab**
 - Understand definitions of various Amazon Web Services (AWS) and their use in cloud computing based web applications that are accessible over the Internet through an AWS account
 - Use the AWS account for the discovery, reservation and access of virtual compute/storage infrastructure instances

AWS Platform Example Deployment



AWS Execution Environment

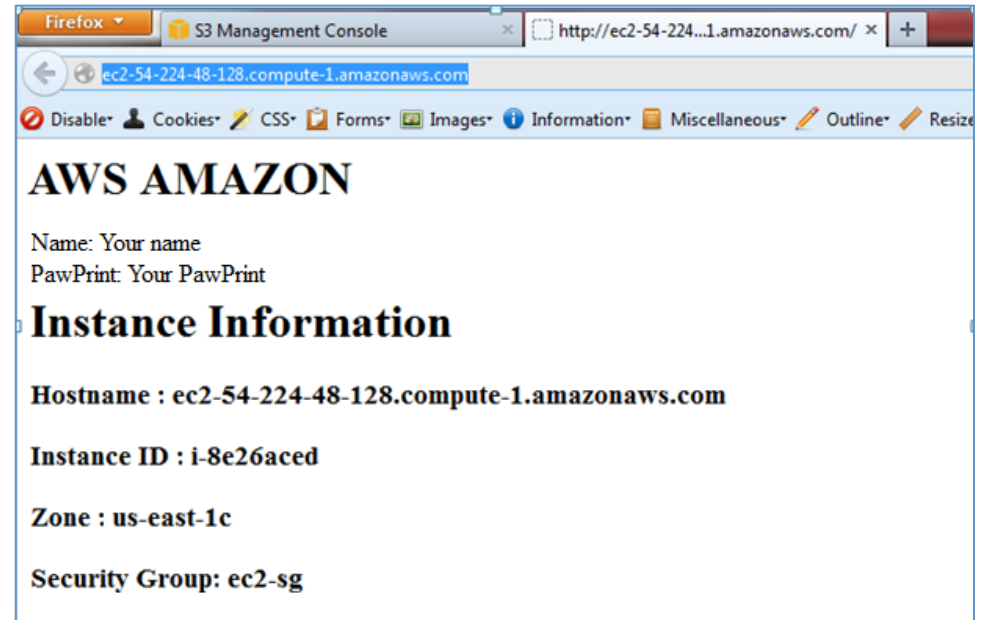


- **Private AMI:** Images created by you, which are private by default; you can grant access to other users to launch your private images
- **Public AMI:** Images created by users and released to the community, so anyone can launch instances based on them and use them any way they like
- **Paid AMI:** You can create images providing specific functions that can be launched by anyone willing to pay you per each hour of usage on top of AWS charges

AWS Access Credentials

- Credential type you use depends on the type of AWS API
 - **Access Keys**
 - To make secure REST or Query protocol requests to any AWS service API
 - Parts and Usage
 - *Access Key ID*—Your Access Key ID identifies you as the party responsible for service requests; you include it in each request, so it's not a secret
 - *Secret Access Key*—Each Access Key ID has a Secret Access Key associated with it; This key is used to calculate the digital signature that you include in the request; Your Secret Access Key is a secret, and only you and AWS should have it
 - **X.509 Certificates**
 - To make secure SOAP protocol requests to AWS service APIs
 - Parts and Usage
 - *X.509 Certificate* – holds the public key and related metadata; You include it in each service request, so it's not a secret
 - *Private Key*—Each certificate has a private key associated with it; Use the private key to calculate the digital signature to include in the request; Your private key is a secret, and **only you should have it and AWS doesn't keep a copy**
 - **Key Pairs**
 - To launch and then securely access your Amazon EC2 instances
 - You can make as many as you like by giving friendly names (can't replace any particular key pair)
 - Private key that you keep with you; Public key that AWS keeps to allow access

Install your first AWS-hosted Web App!



- Install HTTP, PHP and MySQL – LAMP package in your instance
- Read Hostname, Instance ID, Zone and Security Group from Instances Data from metadata set and show it on the web page
- Clean-up resources – remove snapshot, detach/remove volume

Cost Saving Considerations in AWS

- **On-Demand Instances**
 - Pay for compute capacity by the hour with no long-term commitments
- **Reserved Instances**
 - Make a low, one-time payment for each instance you want to reserve and in turn receive a significant discount on the hourly charge for that instance
- **Spot Instances**
 - Bid on unused EC2 capacity and run those instances for as long as their bid exceeds the current Spot Price

Other Best Practices...

- AWS Lab Reading
 - http://media.amazonwebservices.com/AWS_Cloud_Best_Practices.pdf
 - Design for failure and nothing will fail
 - Decouple your components
 - Implement elasticity
 - Think parallel
 - Keep dynamic data closer to compute and static data closer to user
 - Know security and performance tradeoffs
- Another great link for high scalability, architecture case studies
 - <http://highscalability.com> - 'Building bigger, faster, more reliable websites'
 - YouTube Architecture
 - <http://highscalability.com/youtube-architecture>
 - Good Dashboard Example:
 - <http://stackexchange.com/performance>