TOPIC 10
Introduction to Cloud Computing

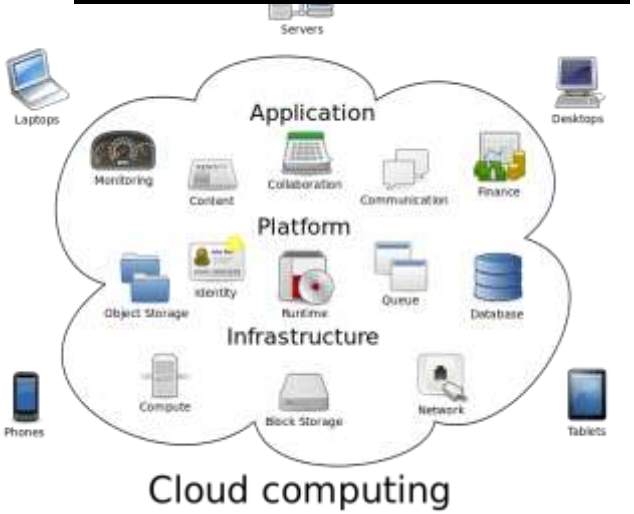
CLOU , FOR
ENA CES
(SUCH AS COMPUTER NETWORKS, SERVERS, STORAGE, APPLICATIONS AND
SERVICES), WHICH CAN BE RAPIDLY PROVISIONED
WITH MINIMAL MANAGEMENT EFFORT, OFTEN OVER THE INTERNET

[1][2]

deprovision

What is Cloud Computing?

Cloud computing is the on-demand delivery of compute power, database storage, applications, and other IT resources through a cloud services platform via the internet with pay-as-you-go pricing.



Cloud Computing Basics

Whether you are running applications that share photos to millions of mobile users or you're supporting the critical operations of your business, a cloud services platform provides rapid access to flexible and low cost IT resources. With cloud computing, you don't need to make large upfront investments in hardware and spend a lot of time on the heavy lifting of managing that hardware. Instead, you can provision exactly the right type and size of computing resources you need to power your newest bright idea or operate your IT department. You can access as many resources as you need, almost instantly, and only pay for what you use.

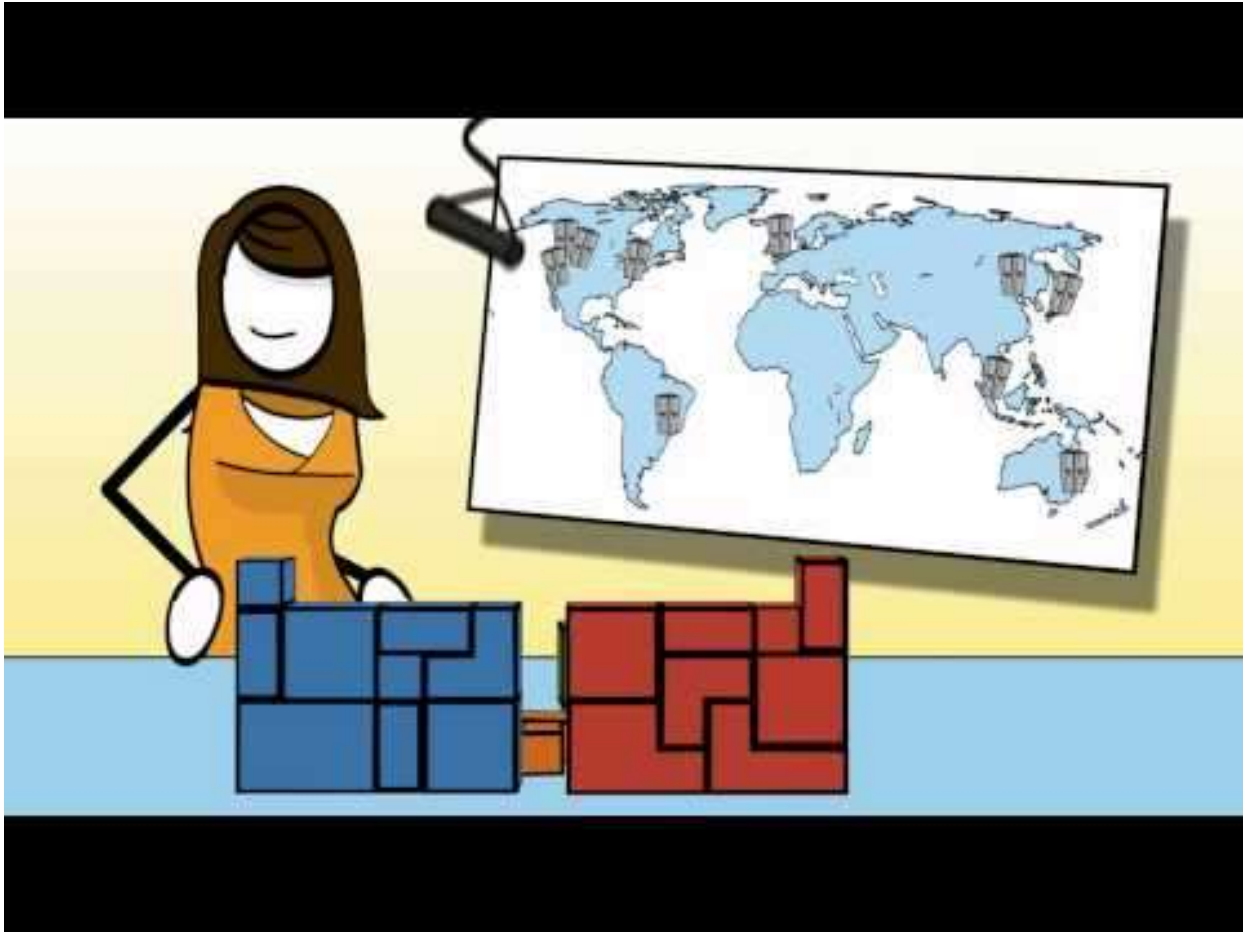
https://aws.amazon.com/what-is-cloud-computing/

How Does Cloud Computing Work?

Cloud computing provides a simple way to access servers, storage, databases and a broad set of application services over the Internet. A Cloud services platform such as Amazon Web Services owns and maintains the network-connected hardware required for these application services, while you provision and use what you need via a web application.

https://aws.amazon.com/what-is-cloud-computing/

TECHNOLOGIES THAT HELPED CREATE POKÉMON GO



Utility based model: SPI

In cloud computing delivery of ICT resources is, to some extent, outsourced to the cloud provider. Also some of the security tasks (such as monitoring, patching, incident response) are outsourced. Depending on the type of cloud service some tasks remain under the responsibility of the customer, while other tasks remain under the responsibility of the provider. Division of responsibilities can some times be a major source of problems as it was based on assumptions and poorly documented, leading to overlaps and gaps. This however seem to become extinct since SLAs have become more sophisticated documents and specify this information. For example, in IaaS/PaaS the customers run their own code on top of the cloud service, and often remain responsible for this (application) software. In SaaS, on the other hand, the application software is usually[8] under control of the provider. In the diagram below we illustrate how the division of certain security tasks can be different for different cloud services (IaaS, PaaS, SaaS).

Figure 2: Outsourcing of tasks is different for different types of services

Note that this diagram is for illustration and does not provide an exhaustive list of security processes at the providers side or the customers side. In specific settings there may be specific agreements about the outsourcing of security tasks. An IaaS provider, for example, might have a service for patching the Operating System (OS) of customers. Sometimes such services are offered by a third-party (and this is also known as SECurity-As-A-Service). See the next section about opportunities. See also the annex for examples of security tasks in two fictitious scenarios.

In practice for SMEs, it is important to carefully assess which security tasks are outsourced to the provider and which security tasks remain under their own responsibility. It is not uncommon for SMEs to be confused about their responsibilities concerning security, for example, who makes backups of data or software, which type of failover/redundancy is offered by the provider and what needs to be done still by the customer.

[8] Barring cases where customers have some liberty to run additional software, on top-of-the service, like third-party apps, add-ons, or self-created code.

Amazon History

1994: Jeff Bezos incorporated the company.

1995: Amazon.com launched its online bookstore.

2005: Amazon Publishing was launched.

2006: Amazon Web Services (AWS) was launched.

2007: Kindle was launched.

2011: Amazon Fresh was launched.

2012: Amazon Game Studios was launched.

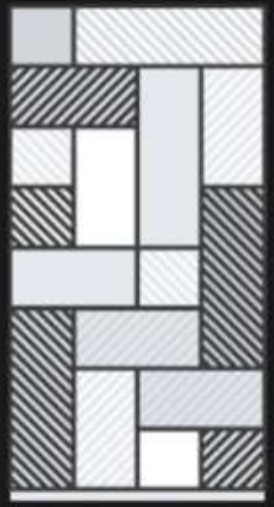
2013: Amazon Art was launched.

2014: Amazon Prime Now was launched.

2015: Amazon Home Services and Amazon Echo were launched.

Development transformation at Amazon: 2001-2009

2001



monolithic architecture +
hierarchical organization

2009

decoupled services +
2 pizza teams

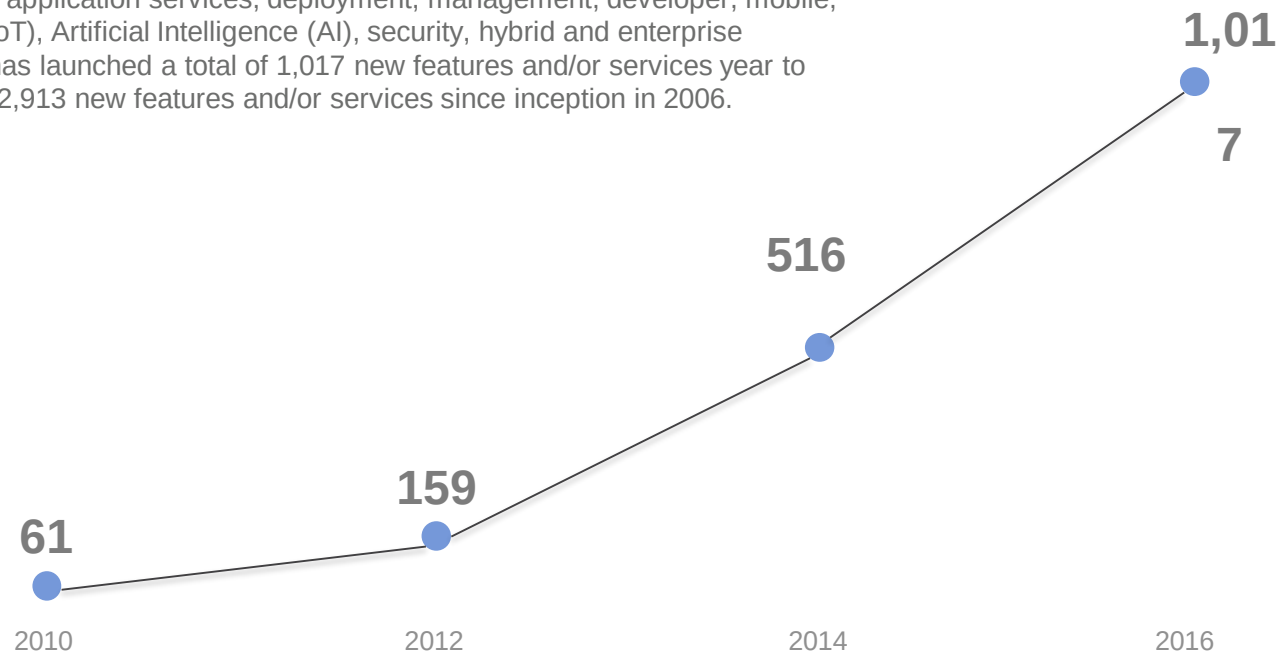
Amazon Web Services (AWS)

Enable businesses and developers to use web services to build scalable, sophisticated applications.

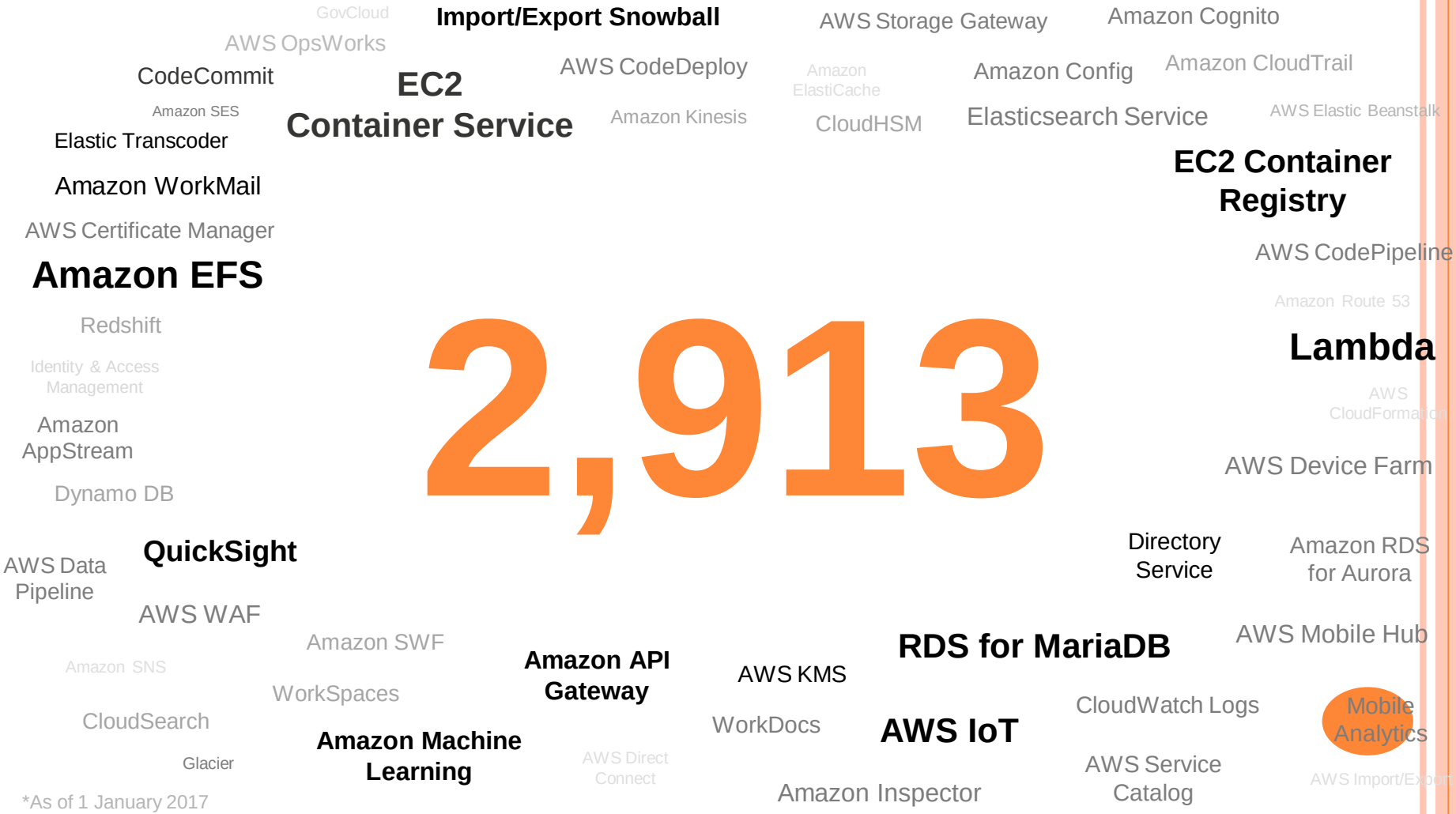
amazon web services

AWS Pace of Innovation

AWS has been continually expanding its services to support virtually any cloud workload, and it now has more than 90 services that range from compute, storage, networking, database, analytics, application services, deployment, management, developer, mobile, Internet of Things (IoT), Artificial Intelligence (AI), security, hybrid and enterprise applications. AWS has launched a total of 1,017 new features and/or services year to date* - for a total of 2,913 new features and/or services since inception in 2006.



* As of 1 January 2017


GovCloud
Import/Export Snowball
AWS Storage Gateway
Amazon Cognito
AWS OpsWorks
CodeCommit
EC2
Container Service
AWS CodeDeploy
Amazon ElastiCache
Amazon Config
Amazon CloudTrail
Amazon SES
Amazon Kinesis
CloudHSM
Elasticsearch Service
AWS Elastic Beanstalk
Elastic Transcoder
Amazon WorkMail
EC2 Container Registry
AWS Certificate Manager
AWS CodePipeline
Amazon EFS
Amazon Route 53
Redshift
2,913
Lambda
Identity & Access Management
AWS CloudFormation
Amazon AppStream
AWS Device Farm
Dynamo DB
QuickSight
Directory Service
Amazon RDS for Aurora
AWS Data Pipeline
AWS WAF
AWS Mobile Hub
Amazon SWF
RDS for MariaDB
Amazon SNS
Amazon API Gateway
AWS KMS
WorkSpaces
CloudWatch Logs
Mobile Analytics
CloudSearch
WorkDocs
AWS IoT
Amazon Machine Learning
Glacier
AWS Direct Connect
AWS Service Catalog
Amazon Inspector
AWS Import/Export
*As of 1 January 2017

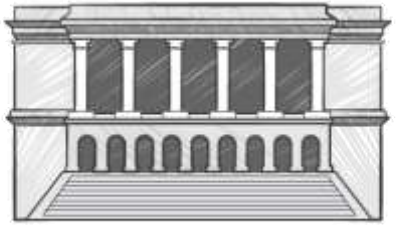
AWS Customers

Enterprise Customers

Amazon Web Services delivers a mature set of services specifically designed for the unique security, compliance, privacy, and governance requirements of large organizations.

Public Sector

Paving the way for innovation and supporting world-changing projects in government, education and nonprofit organizations.



Startups

From the spark of an idea, to your first customer, to IPO and beyond, let Amazon Web Services help you build and grow your startup.

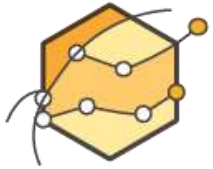
Advantages and Benefits of AWS Cloud Computing

Trade capital expense for variable expense.

Increase speed and agility.

Benefit from massive economies of scale.

Stop spending money on running and maintaining data centers.



Stop guessing capacity.

Go global in minutes.

AWS Positioned as a Leader in the Gartner Magic Quadrant for Cloud Infrastructure as a Service, Worldwide*

AWS is positioned highest in execution and furthest in vision within the Leaders Quadrant

Figure 1. Magic Quadrant for Cloud Infrastructure as a Service, Worldwide

Source: Gartner (August 2016)

*Gartner, Magic Quadrant for Cloud Infrastructure as a Service, Worldwide, Leong, Lydia, Petri, Gregor, Gill, Bob, Dorosh, Mike, August 32016

This graphic was published by Gartner, Inc. as part of a larger research document and should be evaluated in the context of the entire document. The Gartner document is available upon request from AWS :

http://www.gartner.com/doc/reprints?id=1-2G2O5FC&ct=150519&st=sb

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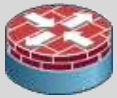
AWS Core Infrastructure and Services

Traditional Infrastructure

Amazon Web Services

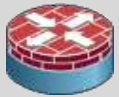

Firewalls


ACLs


Administrators

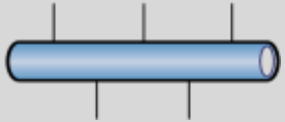
Security


Security Groups


Network ACLs


AWS IAM


Router


Network Pipeline


Switch

Networking


ELB


VPC


On-Premises Servers

Servers


AMI


Amazon EC2 Instances


DAS


SAN


NAS


RDBMS

Storage and Database


Amazon EBS


Amazon EFS


Amazon S3


Amazon RDS

AWS Cloud Computing

Applications

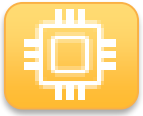
Virtual Desktops

Collaboration and Sharing

Platform Services

Databases	Analytics	App Services	Deployment and Management	Mobile Services
Relational	Cluster Computing	Queuing	Containers	Identity
NoSQL	Real-time	Orchestration	Dev/ops Tools	Sync
Caching	Data Warehouse	App Streaming	Resource Templates	Mobile Analytics
	Data Workflows	Transcoding	Usage Tracking	Notifications
		Email	Monitoring and Logs	
		Search		

Foundation Services



Compute
(Virtual, Auto-scaling and Load Balancing)

Networking

Storage
(Object, Block and Archive)

Infrastructure

Regions

Availability Zones

Edge Locations

AWS Foundation Services

Compute


Amazon EC2


Amazon EC2 Container Registry


Amazon EC2 Container Service


Amazon Lightsail


Amazon VPC


AWS Batch


AWS Elastic Beanstalk


AWS Lambda


Elastic Load Balancing

Network


Amazon CloudFront


Amazon Route 53


Amazon VPC


AWS Direct Connect


Elastic Load Balancing

Storage


Amazon EFS


Amazon Glacier


Amazon S3


AWS Snowball


AWS Storage Gateway

Security & Identity


Amazon Inspector


AWS Artifact


AWS Certificate Manager

AWS CloudHSM


AWS Directory Service


IAM


AWS KMS


AWS Organizations


AWS Shield


AWS WAF

Applications


Amazon WorkDocs


Amazon WorkMail


Amazon AppStream


Amazon WorkSpaces

AWS Platform Services

AWS Global Infrastructure

Regions

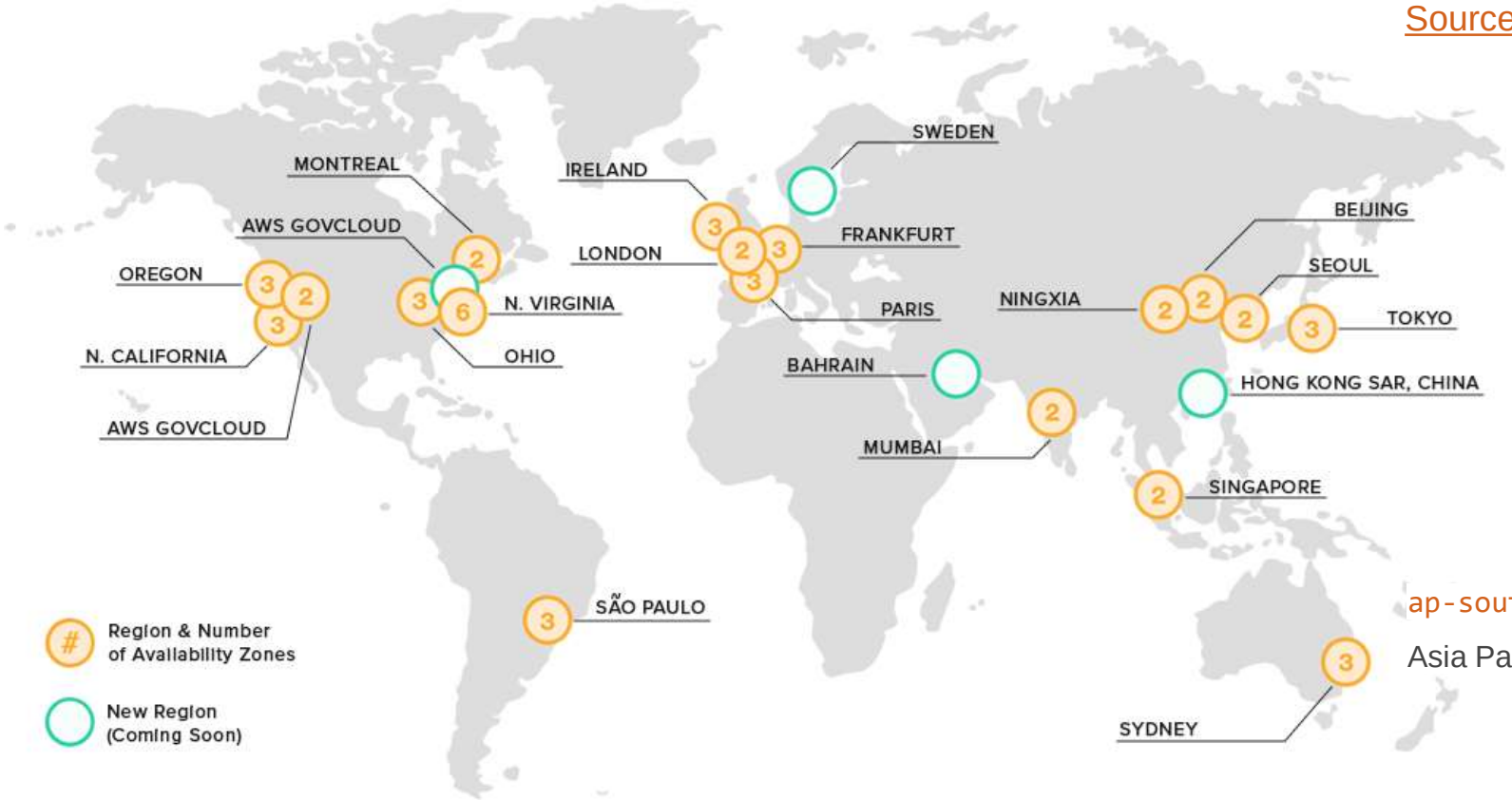
- Geographic locations
- Consist of **at least two** Availability Zones

Availability Zones

- Clusters of data centers
- **Isolated from failures** in other Availability Zones

AWS Global Infrastructure

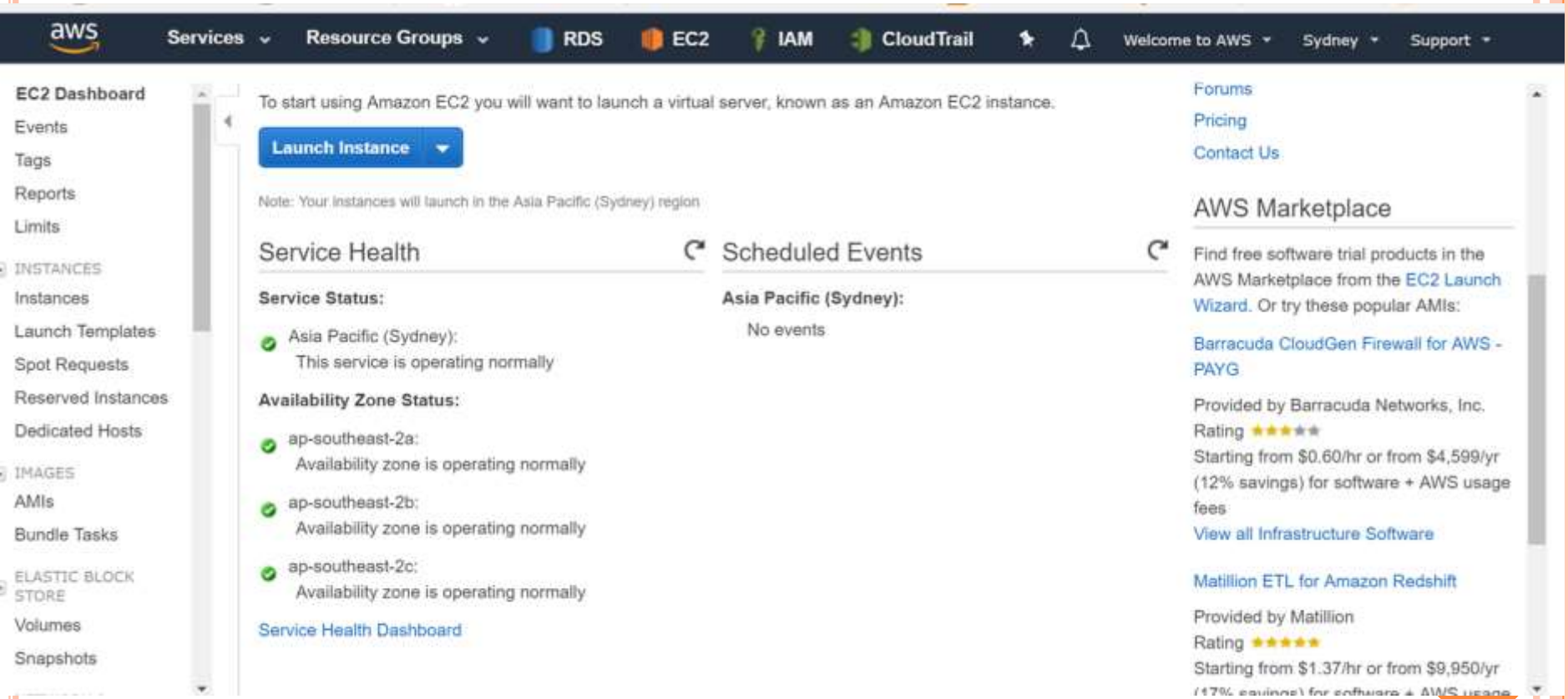
55 Azs
18 Regions
Source



ap-southeast-2

Asia Pacific (Sydney)

AWS Management Console

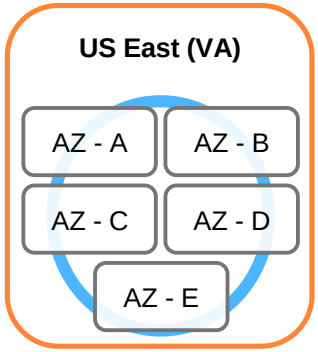


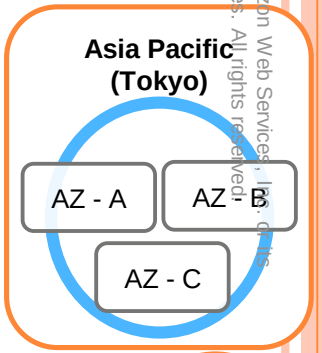
AWS Global Infrastructure

At least 2 Availability Zones per region.

Examples:

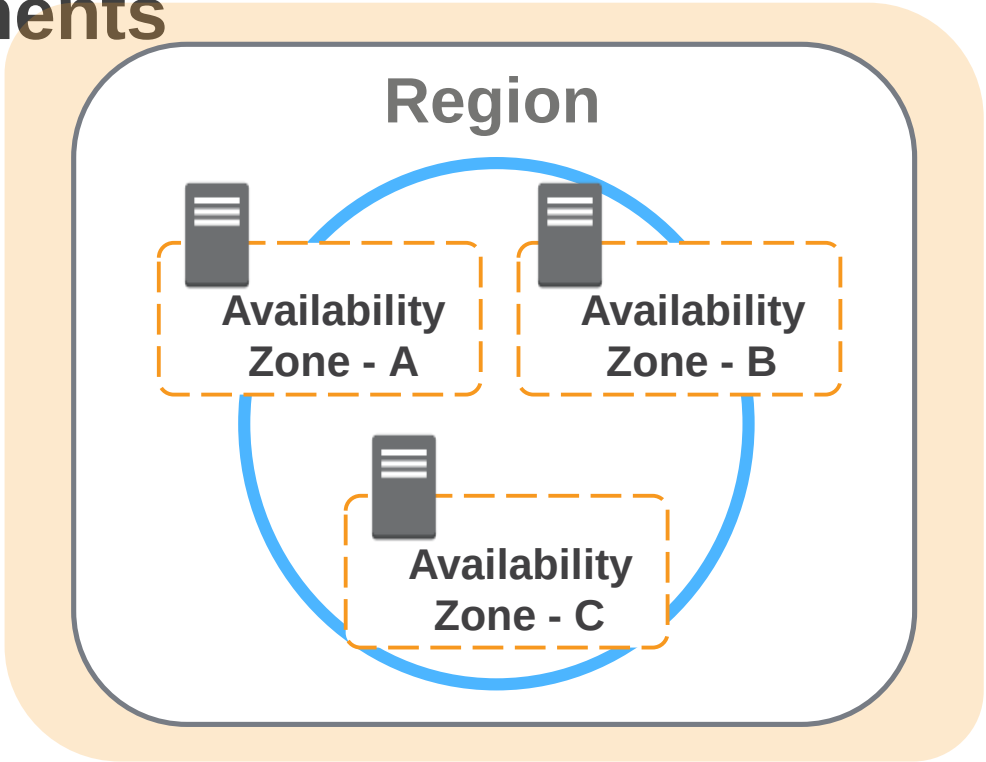
- US East (N. Virginia)
  - us-east-1a
  - us-east-1b
  - us-east-1c
  - us-east-1d
  - us-east-1e





Note: Conceptual drawing only. The number of Availability Zones (AZ) may vary.

High Availability Using Multi-AZ Deployments



AWS Global Infrastructure – Edge Locations

- 105 edge locations and 11 regional cache locations*
- Local points of presence that support AWS services like:


Amazon Route 53

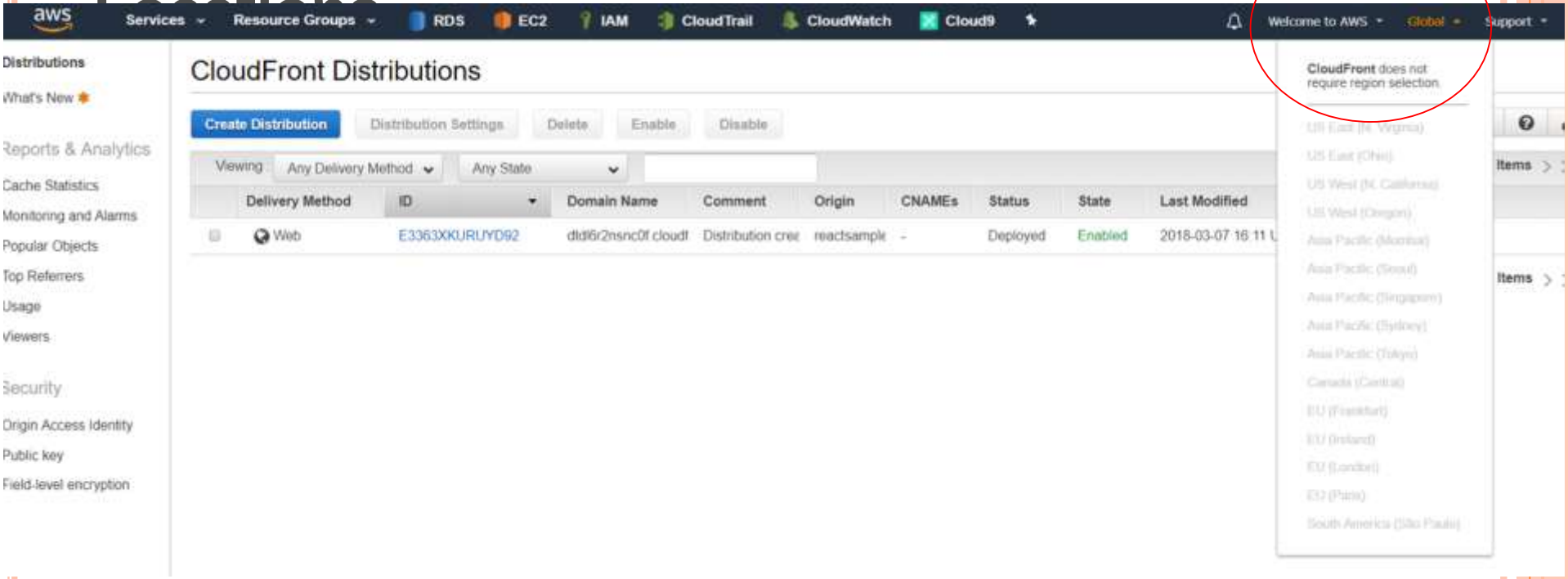

Amazon CloudFront


AWS WAF

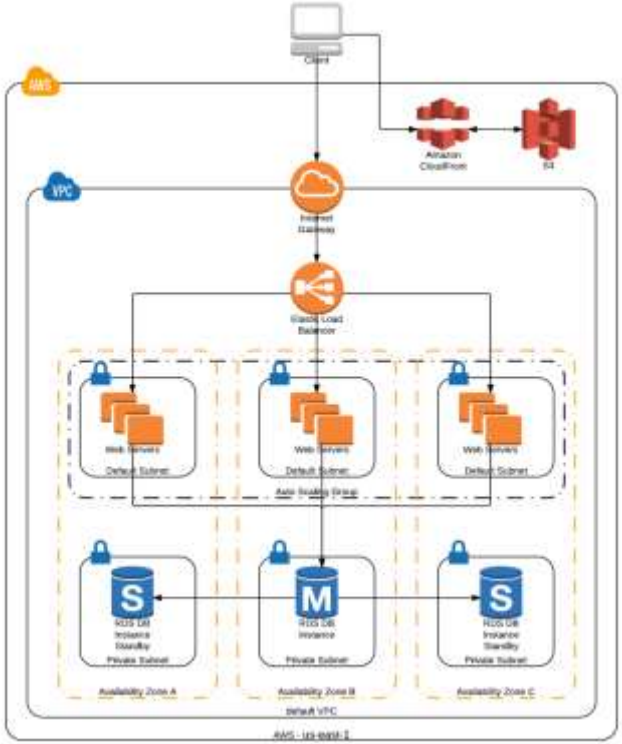

AWS Shield

*as of May 2018
source

AWS Global Infrastructure – Edge Locations



An Example---------Putting Pieces



Deploying CloudFront, Route 53, and AWS WAF enables the built-in DDoS protections for your dynamic web applications. Source

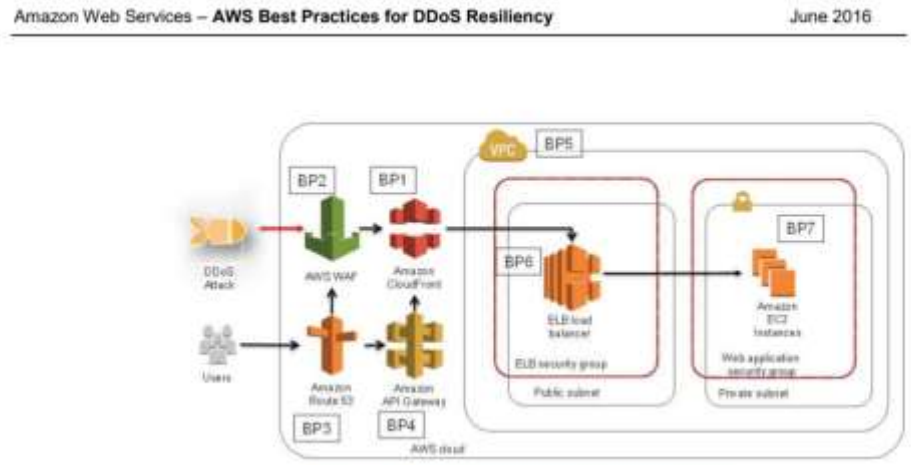


Figure 5: DDoS-resilient reference architecture

Securely Store and Analyze Terabytes of Data

Mount Sinai uses AWS to securely store and analyze 100 TB of data…

> By using AWS, we met strict HIPAA standards for confidentiality… and we can store source files securely and cost-effectively.
>
> **Dr. John A. Martignetti**
> Icahn School of Medicine at Mount Sinai

Icahn School of Medicine at Mount Sinai

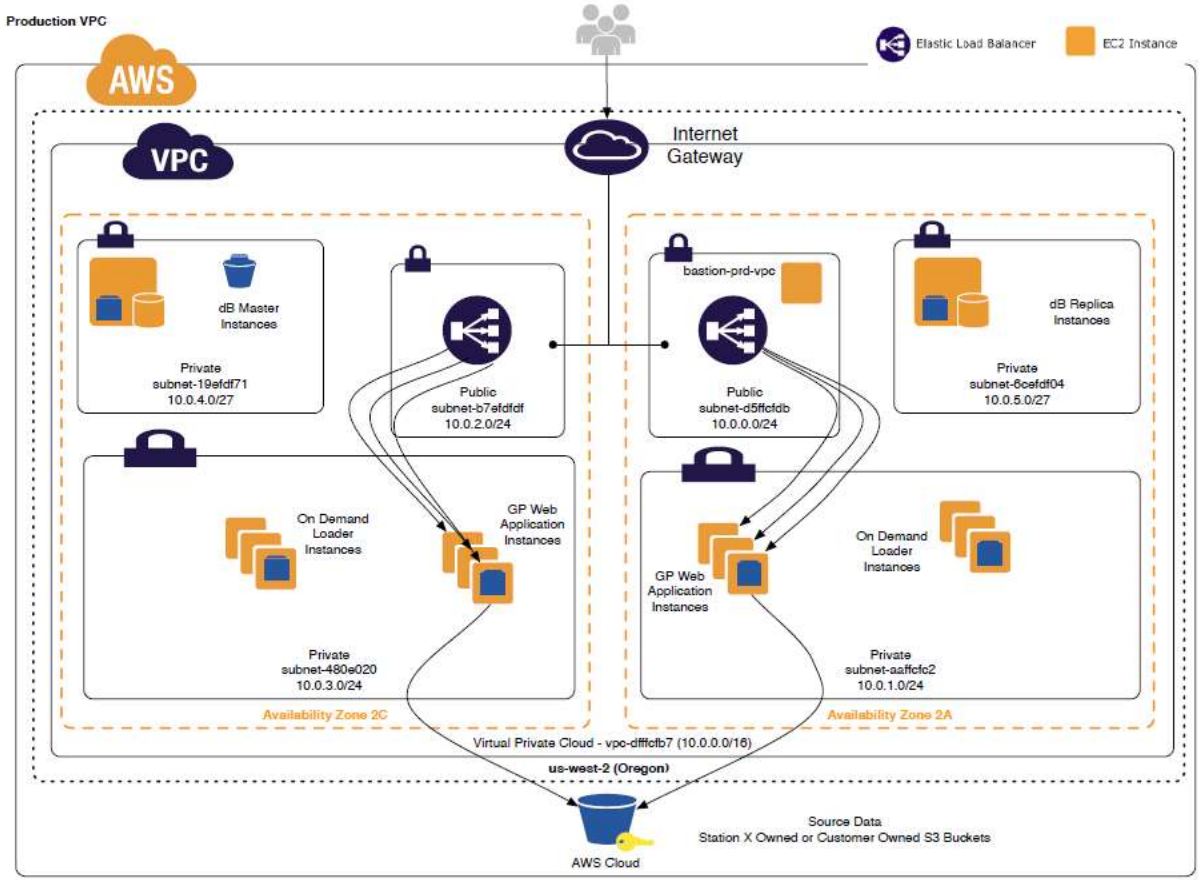
Internationally recognized leader in medical and scientific training, biomedical research, and patient care.

- Needed to search and analyze terabytes of genomics data to investigate the causes of aggressive forms of cancer: breast and ovarian.
- Using AWS gives researchers the ability to mine data from cancer patients all over the world.
- Analyzes more than 100 TB of data each time new information comes in.
- Can store source files securely and cost-effectively with durability and accessibility.

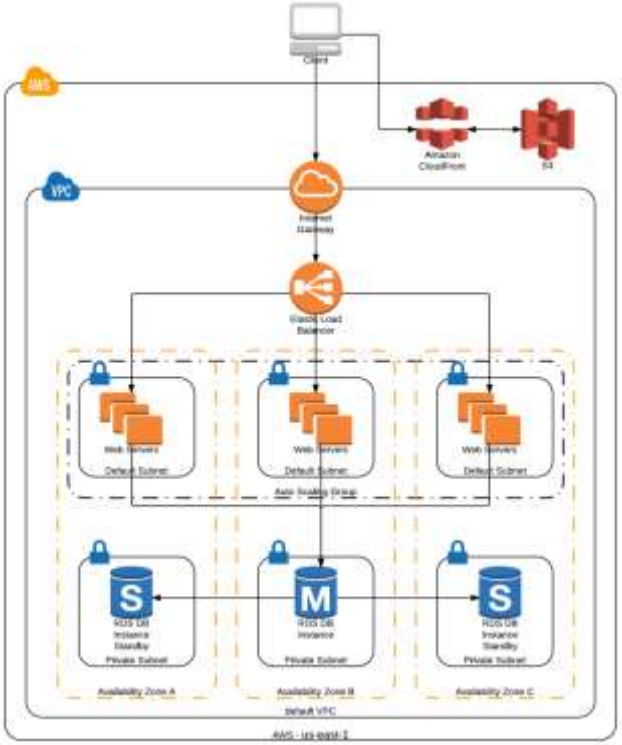
Mount Sinai leveraged Station X's GenePool platform, which is built on the AWS Cloud, to complete this project.

“By using AWS, we can store source files securely and cost-effectively with significant durability and accessibility. We wouldn’t be able to conduct our research without it,” Martignetti says. “But by using AWS and GenePool, we hope to discover mutations that prove to be the missing links for why some women are at increased risk for developing these cancers.”

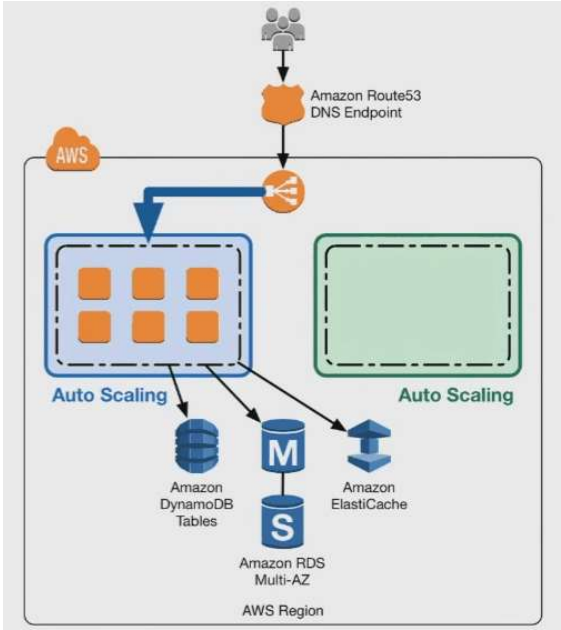
“By using AWS, we’re well positioned for the challenge.”



Significant spike in traffic in the weeks leading up to Father's Day and Christmas

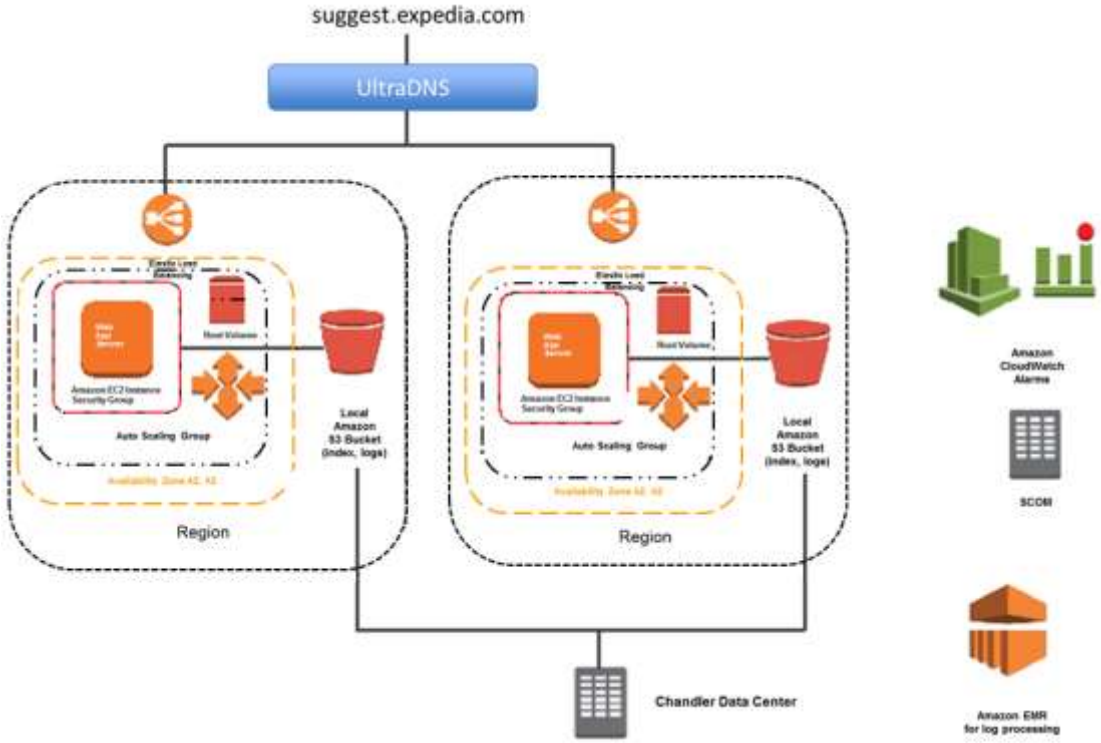


graphics heavy product catalogue

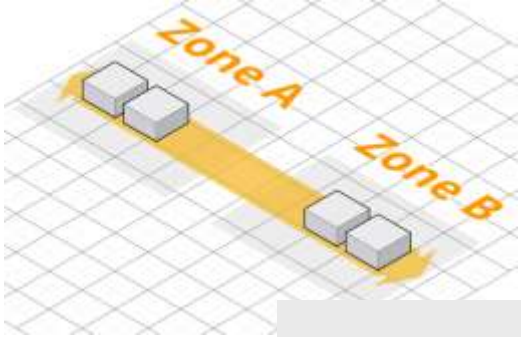


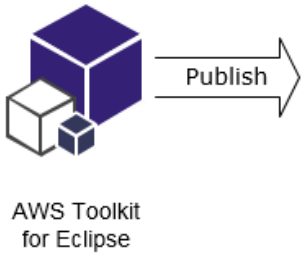
Expedia Story

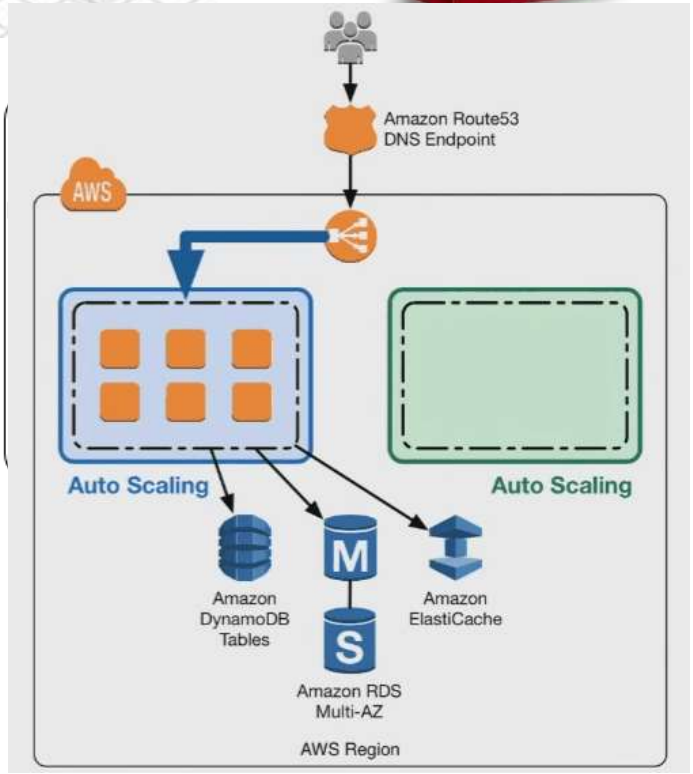
By deploying ESS on AWS, Expedia was able to improve service to customers in the Asia Pacific region as well as Europe. “Latency was our biggest issue,” says Chandramouli. “Using AWS, we decreased average network latency from 700 milliseconds to less than 50 milliseconds.”



AWS Management Console Demonstration







Storage

Development and Management Tools

Content Delivery

Analytics

Compute

Messaging

App Services

Database

Payments

Mobile

Networking

On-Demand Workforce

VPC

Knowledge Check

Q: What is the AWS term for physically distinct groups of **data centers** within a region?

Availability Zone

True or False: There are more **Regions** than **Edge locations**.

False (18 regions 105 edge locations)

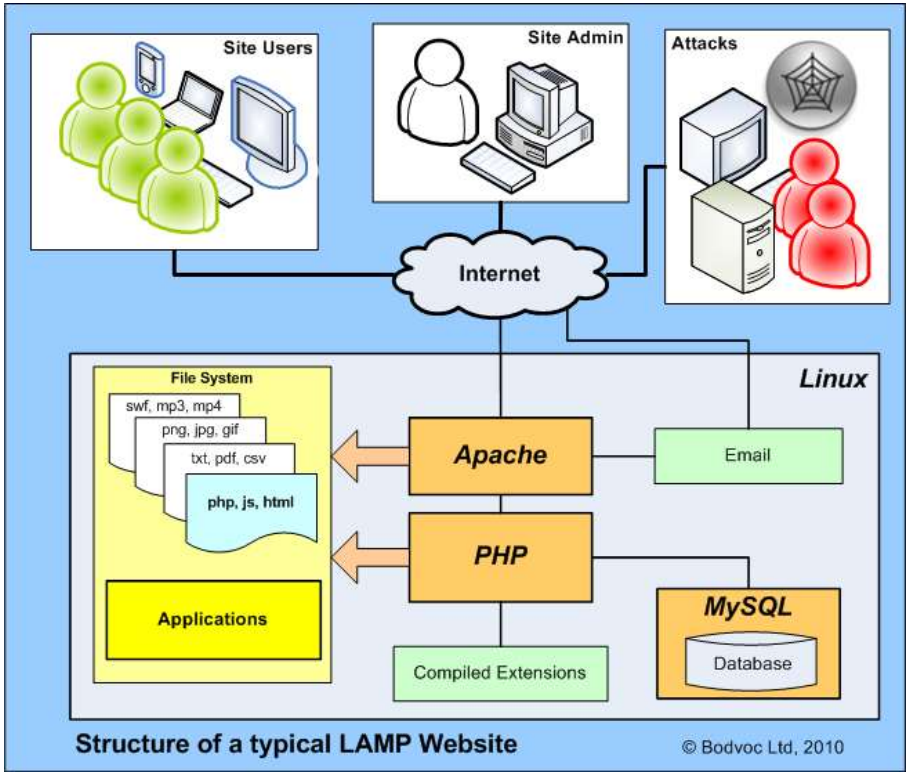
True or False: AWS owns and maintains the infrastructure required for application services. You provision and use them as needed.

True (API call--Automations, Secure, Scalable, Reliable ,Cost Effective)

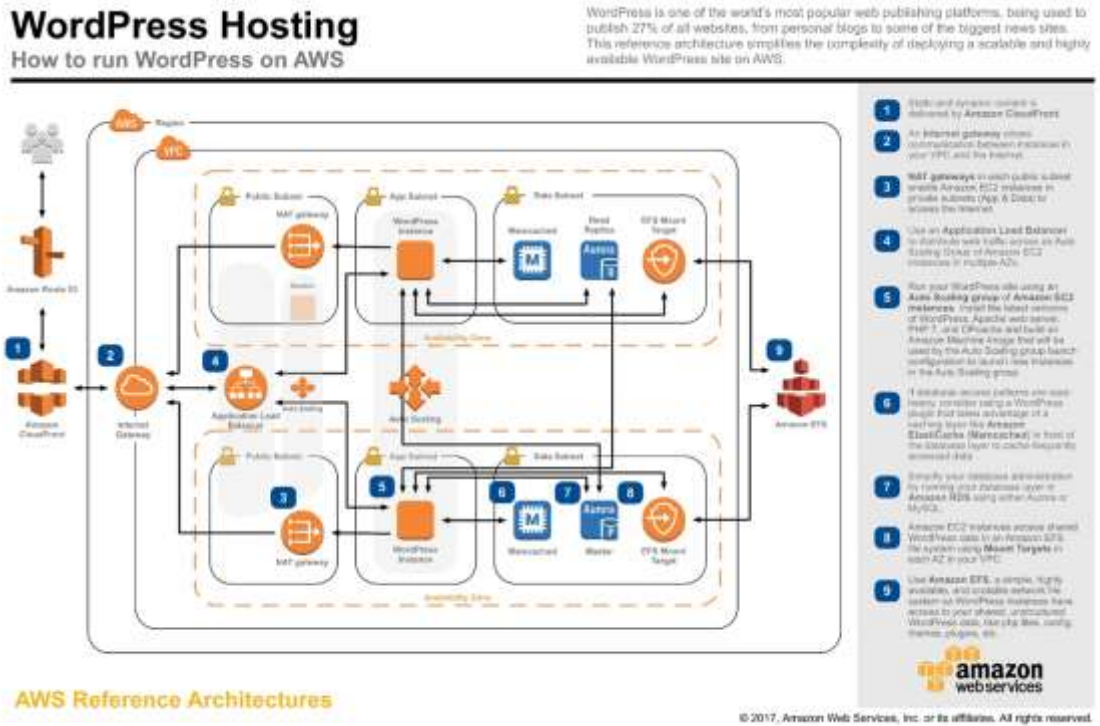
Q: How do **Availability Zones** in the same region differ?

Each Availability Zone is isolated, but the Availability Zones in a region are connected through low-latency links.

Sample Web Application



Cloud Application



Cloud Application