Module 2: Structures of the Cloud

- infrastructure as a service (IaaS),
- platform as a service (PaaS), and
- software as a service (SaaS)

geographical layout of the Amazon Web Services (AWS) Cloud infrastructure, which includes Regions, Availability Zones, and edge locations.

IaaS:

- These services contain the basic building blocks of the cloud.
- They provide access to computers
  - physical and
  - Virtual
- to network features and storage space.
- Think of IaaS like renting a kitchen. You can use all the different appliances (mixers, blenders, sinks), and you can rent a kitchen with better appliances if you need them.
- Examples:
  - Amazon Elastic Compute Cloud (Amazon EC2),
  - Rackspace,
  - Google Compute Engine

PaaS:

- These services are the tools needed to manage the underlying hardware and launch applications.
- They include programming environments, application testing platforms, and application launchers.
- Think of PaaS as going to a restaurant. You are not managing the appliances in the kitchen, but you can ask the waiter or chef to make things however you want.
- Examples:
  - AWS Elastic Beanstalk,
  - Microsoft Azure,
  - Google App Engine

SaaS:

- These services are the actual apps and software provided over the internet.
- You are not responsible for managing or installing the software; you just access and use it.
- Think of SaaS as eating at an all-you-can-eat buffet. You have access to whatever food is being served. You don’t control what is made or how, but you can use as much as you want.
- Examples:
  - Dropbox,
  - Slack,
  - Spotify,
  - YouTube,
  - Microsoft Office 365,
  - Gmail

Assignment Questions

1. How does your computer get information from the internet?
2. When you open a website, where does the website come from?
3. Who provides the data?
4. Use what you have learned about computer science and cloud computing in your answer.

1. What is a program or an app that you use that runs entirely in the cloud, meaning you don’t have to store anything on your computer or device?
2. What do you use the program to do?
3. How do you think the program is provided to you at little or no cost?

- More and more programs and apps are being moved from being stored locally on individual computers to being in the cloud. For example, many people now use internet-based word processing instead of software such as Microsoft Word, and Spotify instead of CDs and MP3 players.
  - What is another program or service that you think will move into the cloud
  - Why do you think technology is moving in the direction of cloud computing?
  - Give reasoning for your ideas based on what you have learned previously about cloud computing.

Visualizing the AWS Global Infrastructure

- **Objectives**
  - Explain the purpose of a Region, Availability Zone, and edge location.
  - Identify connections among Regions, Availability Zones, and edge locations

Overview

- **Region:**
  - Areas where data is stored.
  - Data storage in a Region closest to you is one of the reasons it can be accessed at lightning speed.
- **Availability Zone:**
  - A data center that houses many servers.
  - Each Region has multiple, isolated locations known as Availability Zones.
  - Each Availability Zone is isolated, but the Availability Zones in a Region are connected through low-latency links. An Availability Zone is represented by a Region code followed by a letter identifier, for example, us-east-1a.
- **Edge location:**
  - A site where data can be stored for lower latency.
  - Often, edge locations will be close to high-population areas that will generate high-traffic volumes.

Types of Cloud Services

- **Objectives**
  - Recognize the types of cloud computing.
  - Compare the types of cloud computing.
- **Overview**
  - learn about the three different types of cloud services.
  - the benefits of using these cloud services over traditional models.

Factors to consider:

- AWS cost
- Availability of services
- Speed or latency
- Resiliency of AWS components
- Data rights
- Audience

AWS Console

Module purpose

- learn how to access and navigate to some of the most common Amazon Web Services (AWS) services in the console

Terminology

- Amazon S3 (Simple Storage Service)
  - A service provided by AWS that stores data for users in the cloud
  - https://www.youtube.com/watch?v=_I14_sXHO8U

- Questions:
  - Write the working principle of Amazon S3. Explain how it works.
  - Write the benefits of Amazon S3.
  - For what purpose Amazon S3 can be used?

- Amazon EC2 (Amazon Elastic Compute Cloud)
  - A web service that provide secure, resizable compute capacity in the cloud.
  - Think of it as renting a computer in the cloud.
  - https://www.youtube.com/watch?v=TsRBftzZsQo
- Questions:
  - Which type of cloud services is Amazon EC2? (IaaS/PaaS/SaaS)
  - Write the working principle of Amazon EC2. Explain how it works.

- Amazon EBS (Amazon Elastic Block Store)
  - Storage for specific EC2 instances.
  - Think of it as the storage drive for your EC2 instance.
  - https://www.youtube.com/watch?v=77qLAl-lRpo
- Questions:
  - For what purpose Amazon EBS is useful?

- Amazon RDS (Amazon Relational Database Service)
  - This lets developers create an manage relational database in the cloud.
  - Think of a relational database as a set of data with 1 to 1 relationships.
  - Eg: A database of transactions in a department store would match every customer with their purchases.
  - Amazon RDS lets developers track large amount of this data and orgainse and search through it easily.
  - Relational databases are equipped with non procedural SQL that simplifies interactions with the database.
  - https://www.youtube.com/watch?v=eMzCI7S1P9M&feature=youtu.be

  Questions:
  - What are the features of Amazon RDS?

- Amazon DynamoDB
  - The AWS nonrelational database service.
  - Data is stored in key-value pairs.
  - https://www.youtube.com/watch?v=sI-zciHAh-4

  Question:
  - Difference between Amazon RDS and DynamoDB.

- AWS Lambda
  - Lambda lets you run code without provisioning or managing servers.
  - You pay only for the computing time you consume
  - There is no charge when your code is not running.
  - With Lambda you can run code for virtually any type of application or backend service all with zero administration
  - Upload code and lambda take care of everything required to run and scales that code with high availability.
  - You can setup code to automatically start from other AWS services or call it directly form any web or mobile app.

- Amazon VPC (Amazon Virtual Private Cloud)
  - A service that provides a virtual network that is dedicated to your AWS account to your AWS account.
  - It is logically isolated from other virtual networks in AWS Cloud.
  - All AWS services can be launched from VPC.
  - It is useful for protecting your data and managing who can access your network.
- AWS IAM (Identity and Access Management)
  - Involves the application of controls to users who need access to computing resources.

- AWS Cloud Trail
  - Monitors every action that is performed on your AWS account for security purposes
- Amazon CloudWatch
  - CloudWatch is a monitoring service to monitor your AWS resources and the applications that you run on AWS.
- Amazon Redshift
  - The AWS data-warehousing service can store massive amounts of data in a way that makes it fast to query for business intelligence purpose.

Amazon S3 and Amazon EBS are both forms of data storage. There are a few key differences:

1. Amazon EBS can only be used when attached to an EC2 instance, and Amazon S3 can be accessed on its own.
2. Amazon EBS cannot hold as much data as Amazon S3.
3. Amazon EBS can only be attached to one EC2 instance, whereas data in an S3 bucket can be accessed by multiple EC2 instances.
4. Amazon S3 experiences more delays than Amazon EBS when writing data.

Difference between Amazon RDS, Amazon Redshift, and DynamoDB

1. Amazon RDS is the classic relational database that uses SQL Server, Oracle Database, Amazon Aurora, or other similar database systems. Think of this as a gradebook where each student is a row, and they all have the same number of assignments (columns) that they are attached to. Businesses can use code to search for specific data based on the information in the rows and columns. Amazon RDS is useful for companies that store a moderate amount of data that is uniform in structure, meaning each unique ID, like student name, is attached to the same number of data points (grades).
2. Amazon Redshift is a relational database like Amazon RDS, but it is specifically made for huge amounts of data. It is a data-warehousing tool that is good for users working with big data.
3. DynamoDB is a nonrelational database, meaning that you can't use traditional systems like SQL Server or Aurora. Each item in the database is stored as a key-value pair or JavaScript Object Notation (JSON). This means that each row could have a different number of columns. The entries do not all have to be matched in the same way. This permits flexibility in processing that works well for blogging, gaming, and advertising.

Difference between CloudTrail and CloudWatch

- CloudTrail monitors all the actions that users have taken in a given AWS account. This means that any time someone uploads data, runs code, creates an EC2 instance, changes an S3 drive type, or any other action that can be done on AWS, CloudTrail will keep a log of it. This is very useful for security reasons so that administrators can know who is using their account and what they are doing. If anything goes wrong or if a security issue arises, CloudTrail will be the best evidence to figure out what happened.
- CloudWatch monitors what all the different services are doing and what resources they are using. If CloudTrail is the people monitor, CloudWatch is the service monitor. CloudWatch is great for making sure that your cloud services are running smoothly and not using more or fewer resources than you expect, which is important for budget tracking. CloudWatch is great for making sure all your different resources are running, which can get tricky if a large company is using hundreds of different machines and drives. Monitors and alarms can be set up through CloudWatch to automatically initiates an alert when a metric hits a specific limit.