Module 1

1. Client/Server Model
2. You only pay for what you use
3. Cloud Computing
    a. On-demand deliver of IT resources over the internet with pay-as-you-go pricing

Module 2

1. Amazon Elastic Compute Cloud (Amazon EC2)
    a. Highly Flexible
    b. Cost Effective
    c. Quick
    d. Amazon EC2 Instance is a VM on a physical host
        i. You are responsible for patching of OS
        ii. Setting up the scaling of those instances
        iii. Ensuring that you've architected your solutions to be hosted in a highly available manner
    e. Multitenancy
        i. Sharing underlying hardware between virtual machines
    f. Amazon EC2 Configurations
        i. Windows
        ii. Linux
        iii. Internal Business Application
        iv. Web App
        v. Databases
        vi. Third-party Software
    g. Vertically scaling an instance
        i. Adding more system resources
    h. Horizontally scaling an instance
        i. Creating more load balanced Amazon EC2 instances to share the workload
    i. You control the networking aspect of Amazon EC2
    j. Computer as a service (CaaS)
2. Amazon EC2 instance families
    a. General Purpose
        i. Balanced resources
        ii. Web servers
        iii. Code repositories
    b. Computer optimized
        i. Compute intensive tasks
        ii. Gaming servers
        iii. High performance computing (HPC)
        iv. Scientific modeling
    c. Memory optimized
        i. Memory intensive tasks
    d. Accelerated computing
        i. Floating point number calculations
        ii. Graphics processing
        iii. Data pattern matching
        iv. Utilize hardware accelerators

    e. Storage optimized
        i. High performance for locally stored data
3. Amazon EC2 purchase options
    a. On-Demand
        i. Only pay for the time your instance is running
        ii. Per Hour or Per Second depending on instance type and OS
        iii. Usually for startups or testing
        iv. Allows for baselining costs
    b. Savings Plan
        i. Low prices on EC2 usage in exchange for a commitment to a consistent amount of usage for 1 or 3 years
        ii. Up to 72% savings over on demand
        iii. Regardless of EC2 instance type, OS, or Region
        iv. Applies to AWS Faregate & AWS Lambda usage
    c. Reserved Instances
        i. Predictable usage
        ii. Offer up to 75% discount over on demand
        iii. Three payment options
            1. All upfront
            2. Partial upfront
            3. No upfront
    d. Spot Instances
        i. Request spare AWS compute capacity
        ii. AWS can reclaim instance with 2 minutes warning
        iii. Good for batch jobs that can be interrupted
        iv. Up to 90% off on demand
    e. Dedicated Hosts
        i. Physical Hosts dedicated to your EC2 use
        ii. Usually for meeting certain compliance requirements
4. Scaling Amazon EC2
    a. Deploy additional instances of the same EC2 configuration to share the workload
    b. No single point of failure
    c. You can scale up or out
        i. Up (vertically) is adding additional resources to an EC2 instance
        ii. Out (horizontally) is adding additional EC2 instances
    d. Amazon EC2 Auto Scaling
        i. Adds instances based on demand and then decommissions instances when they are no longer needed.
        ii. You always have the correct number of instances
5. Elastic Load Balancing
    a. Regional Construct
    b. Automatically HA
    c. Auto scaled EC2 instances tell the ELB they are online and the ELB routes traffic to them
    d. Once Load decreases
        i. ELB stops sending traffic and waits for existing traffic to drain out
        ii. ELB lets EC2 know it can terminate extra instances
    e. Can sit between the front end and back end of a dev tier
        i. Decoupled architecture
6. Messaging & Queuing

a. Tightly coupled architecture
    i. Single component fails or changes, it causes issues for other components
b. Loosely coupled architecture
    i. Single Failure won't cause a cascading failure
    ii. Buffer between systems
c. Amazon SQS
    i. Send messages
    ii. Store messages
    iii. Receive messages
    iv. Between software components
    v. At any volume
    vi. Data is called a payload
d. Amazon SNS
    i. Similar to SQS, but can send messages to end users
    ii. Publish Subscribe Model
    iii. SNS Topic
        1. Channel for messages to be delivered
    iv. One message to all subscribers
    v. Can be delivered to end users
        1. Mobile push
        2. SMS
        3. Email
e. Additional computer services
    i. Serverless computer options
        1. Cannot see or access the underlying infrastructure
        2. AWS Lambda
            a. Lambda function
            b. Waits for a trigger
            c. Code is run when triggered
            d. Run code (processes) in less than 15 minutes
        3. Amazon Elastic Container Service (Amazon ECS)
            a. Docker Container
            b. Manages your containers at scale for you
        4. Amazon Elastic Kubernetes Service (Amazon EKS)
            a. Docker Container
            b. Similar to EKS with different tools
        5. ECS & EKS can run on EC2
            a. If you want access to the underlying infrastructure
        6. AWS Fargate
            a. Can run ECS & EKS serverless
                i. Where you don't need access to the underlying infrastructure

Module 3

1. AWS Global Infrastructure
2. Regions are Geographically Isolated Areas
3. Regions Contain Availability Zones
    a. Physically Separated Buildings
    b. HA & DR
    c. Best Practices is to deploy across 2 or more Availability Zones

4. Edge Locations run Amazon CloudFront
5. Regional Data Sovereignty
    a. Subject to the local laws of the country
6. Each region has a different price sheet
7. Amazon Bracket
    a. Quantum Computing
8. 4 Key Factors
    a. Compliance
    b. Proximity (to customers)
    c. Feature Availability
    d. Pricing
        i. Each Region has its own price sheet
9. Edge Locations
    a. CDN - Content Delivery Networks
        i. Amazon CloudFront
    b. Cached Copies of Data
    c. Edge locations are separate from Regions
    d. DNS
        i. Amazon Route 53
    e. AWS Outposts
        i. WS Outposts is a fully managed service that offers the same AWS infrastructure, AWS services, APIs, and tools to virtually any datacenter, co-location space, or on-premises facility for a truly consistent hybrid experience.
        ii. AWS Outposts is ideal for workloads that require low latency access to on-premises systems, local data processing, data residency, and migration of applications with local system interdependencies.
        iii. https://aws.amazon.com/outposts/
10. How to Provision AWS Resources
    a. Everything in AWS is an API Call
        i. Application Programming Interface
    b. AWS Management Console
        i. Browser Based
            1. Visual
            2. Test Environments
            3. View Billing
            4. View Monitoring
            5. Work with Non-Technical Resources
    c. AWS Command Line Interface
        i. Scriptable
        ii. Repeatable
        iii. Less Susceptible to Human Error
        iv. Automation
    d. AWS Software Development Kits (SDKs)
        i. Interact with AWS Resources through various Programming Languages
    e. Various Other Tools
        i. AWS Cloud Formation
            1. Infrastructure as Code Tool
            2. JSON or yaml Text Documents
                a. Cloud Formation Templates
            3. Declare what you want to build, not how to build it

4. Supports Storage, Database, Analytics, Machine Learning
5. Can run the same Cloud Formation Template across multiple accounts or Regions

ii. AWS Elastic Beanstalk
1. Provision EC2 Environments
2. Build & Save Environment Configurations
    a. Adjust Capacity
    b. Load Balancing
    c. Automatic Scaling
    d. Application Health Monitoring

Module 4

1. Amazon Virtual Private Cloud (VPC)
    a. Private Network in AWS
    b. Provision a logically isolated section of the AWS cloud
    c. Launch Resources in a virtual network that you define
    d. Can be Public or Private facing
        i. Internet Access vs No Internet Access
    e. Subnets
        i. Ranges of IP addresses in your VPC
    f. Internet Gateway (IGW) at Border of VPC
        i. Accepts Public Traffic
    g. Virtual Private Gateway
        i. Rejects Public Traffic
        ii. Encrypted
        iii. VPN
    h. AWS Direct Connect
        i. Dedicated Fiber Connection to AWS
        ii. Dedicated Circuit
        iii. Side Step Bandwidth issues
        iv. Meet Regulatory Requirements
    i. One VPC may have multiple types of Gateways attached
        i. All Residing in the same VPC in different subnets
2. Subnets & Network Access Control Lists
    a. Network ACL
        i. Hardened Fortress
        ii. Internet Gateway (IGW)
        iii. The only technical reason to use subnets in a VPC is to control access to the gateways.
        iv. Every pack that enters a subnet is checked against the Network Access Control List (Network ACL)
            1. Check permissions to leave or enter the subnet
            2. Passport Control Officers
                a. If you're on the approve list or on the no approved list
        v. Only evaluates a packet if it crosses a subnet boundary
        vi. Stateless
            1. Remembers nothing
            2. Checks every single packet that crosses it's border
    b. Instance level Access Groups
        i. Security Groups

1. Door Man at your Building
2. Checks the list on the way in, but not on the way out
3. All traffic is allowed out
4. Stateful
    a. Memory of who to let in or out

ii. Every EC2 instance gets a security group that by default blocks all traffic
iii. Modify security group to accept a specific type of traffic

c. Send a packet from instance A to instance B in a different subnet (same VPC)
    i. Packet hits the security group of instance A
        1. Allowed out by default
    ii. Packet hits the boundary of Passport Control on instance A (network ACL)
        1. Every ingress & Egress are checked with the correct list
        2. Stateless
    iii. Packet hits the boundary of Passport Control on instance B (network ACL)
        1. Every ingress & Egress are checked with the correct list
        2. Stateless
    iv. Packets hits the security group of instance B
    v. Packet hits security group of instance B
        1. Allowed out by default
    vi. Packet hits the boundary of Passport Control on instance B (network ACL)
        1. Every ingress & Egress are checked with the correct list
        2. Stateless
    vii. Packet hits the boundary of Passport Control on instance A (network ACL)
        1. Every ingress & Egress are checked with the correct list
        2. Stateless
    viii. Packet hits the security group of instance A
        1. Security group remembers the packet and doesn't have to check again
            a. Stateful

d. Global Networking
    i. Route 53 (DNS)
        1. Latency-based routing
        2. Geolocation DNS
            a. Based on where the customer is located
        3. Geoproximity routing
        4. Weighted round robin
        5. Can Purchase Domains

e. Amazon Cloudfront
    i. Serving cached content as close to the customer as possible
    ii. Content Deliver Network (CDN)
        1. A network that delivers edge content to users based on their geographic location
    iii. Who should be allowed to communicate with each other?

Module 5

1. Storage & Databases
    a. Instance Stores & Elastic Block Store (Amazon EBS)
    b. Block level Storage
        i. Blocks of data on disk
        ii. Only updates the data that changes
    c. Instance Store Volumes

        i. Local EC2 Storage
        ii. Physically attached to hypervisor your EC2 is running on
        iii. Data is deleted if you stop your EC2 instance
        iv. Do not write important data to local EC2 storage
    d. Elastic Block Store (Amazon EBS)
        i. Virtual hard drives
        ii. Attached to EC2 instance
        iii. Persistent
        iv. Incremental Backups of Data
            1. Snapshots
            2. Day 1: All data Backed Up
            3. Day 2: Only data that has changed since the most recent snapshot is backed up
2. Amazon Simple Storage Service (Amazon S3)
    a. Store & retrieve an unlimited amount of data at any scale
    b. Stores data as objects
        i. File on your hard drive
    c. Store objects in buckets
        i. Folder on your hard drive
    d. Max Object Size is 5 TB
    e. Version Objects
        i. Retain previous versions
    f. Create multiple buckets
        i. Add permissions to buckets
    g. Amazon S3 Standard
        i. Eleven 9's
        ii. Data can survive 2 concurrent loss of data in 2 storage facilities
        iii. Data is stored in at least 3 storage facilities
        iv. Static Website Hosting
    h. Amazon S3 Standard-Infrequent Access (S3 Standard-IA)
        i. Less frequently access
        ii. Requires Rapid Access
        iii. Store Backups
        iv. Any object that requires long term storage
    i. Amazon S3 Glacier
        i. Archive Data
        ii. Non Rapid Access
        iii. Move data to it or create Vaults
        iv. S3 Glacier Vault Lock Policy
            1. Compliance requirements around retaining data
            2. Write Once/Read Many (WORM)
            3. Once locked, the policy can never be changed
        v. Upload directly to Glacier or use Lifecycle Policies
        vi. 3 Options for retrieval that range from minutes to hours
    j. Lifecycle policies
        i. Move data between tiers automatically
        ii. Keep data in S3 Standard for 90 days
        iii. Keep data in S3 Standard-IA for 30 days
        iv. Move data to Glacier after 120 days
    k. Other Storage Tiers

i. S3 Infrequent Access 1 Zone
ii. S3 Glacier deep archive

l. Comparing Amazon EBS (Elastic Block Storage) & Amazon S3 (Simple Storage Service)
    i. EBS
        1. Up to 16 TiB
        2. Survive termination of their EC2 instance
        3. Solid State by Default
        4. HDD Options
        5. Many micro changes
        6. Stores Data in Single Availability zone
        7. Volumes attached to EC2 instances
        8. Availability Zone level resource
        9. Need to be in the same Availability Zone to attach to EC2 instances
        10. Volumes do not automatically scale
    ii. S3
        1. Unlimited Storage
        2. Object Sizes up to 5TB
        3. Write Once/Read Many
        4. Occasional Changes
        5. 99.999999999% Durable for 1 year
        6. Web Enabled
        7. Regionally distributed
        8. Offers cost savings
        9. Serverless

3. Amazon Elastic File System (Amazon EFS)
    a. Managed File System
    b. Shared File System
    c. Multiple instances can access the data in EFS at the same time
    d. Linux File System
    e. Regional resource
    f. Automatically scales
4. Amazon Relational Database Service (Amazon RDS)
    a. Features
        i. Automated Patching
        ii. Backups
        iii. Redundancy
        iv. Failover
        v. Disaster Recovery
    b. Relational database management system (RDBMS)
    c. Amazon Aurora
        i. Enterprise-class relational database. It is compatible with MySQL and PostgreSQL relational databases. It is up to five times faster than standard MySQL databases and up to three times faster than standard PostgreSQL databases.
        ii. MySQL
        iii. PostgreSQL
        iv. 1/10 the cost of commercial databases
        v. Data replication
            1. 6 copies at any time
        vi. Deploy up to 15 read replicas of database

vii. Continuous Backups to Amazon S3
    1. Point-in-time recovery

d. AWS supported databases
    i. MySQL
    ii. PostgreSQL
    iii. Oracle
    iv. Microsoft SQL Server

e. Lift-and-shift migration of DB
    i. Control over the database and the hardware it runs on

f. Amazon DynamoDB
    i. Serverless Database
    ii. You create tables
        1. Tables contain Items
            a. Items have Attributes
    iii. Millisecond response time
    iv. Stores data redundantly across availability zones
    v. Mirrors data across multiple drives
    vi. Does not use SQL for queries
        1. Can't run complex sql queries
    vii. Non-Rigid Schema
    viii. Simple Schema
    ix. Non-Relational Databases (No SQL)
    x. Purpose Built
    xi. Fully Managed
    xii. Highly Scalable
    xiii. Primeday 2019
        1. 7.11 Trillion calls to DynamoDB API
            a. 48 Hours
        2. Peaking at 45.4 million request per second

g. Amazon RDS vs Amazon DynamoDB
    i. Amazon RDS
        1. Automatic High Availability
        2. Recovery provided
        3. Customer Ownership of Data
        4. Customer Ownership of Schema
        5. Customer Control of Network
        6. Been Around Forever
        7. Complex Analysis of Data
            a. Built for Complex Data Analytics
    ii. Amazon DynamoDB
        1. Key-Value Pair
        2. Massive Throughput Capabilities
        3. PB Size Potential
        4. Granular API Access
        5. Non Complex Data
            a. Lookup Tables
        6. Employee Lookup
            a. Single Table

h. Amazon Redshift

i. Data Warehousing for Big Data Analytics
    1. Good for looking back at historical data
ii. Data Warehousing as a Service
iii. Multiple PB Sizes
iv. 10 times higher performance than traditional DB's
v. Can get started with a single API call

i. AWS DB Migration Service
    i. Amazon DMS
    ii. Source DB remains fully operational during migration
        1. Minimizing downtime
    iii. Source and Target DB's don't have to be the same type
    iv. Homogenous Databases
        1. MySQL -> Amazon RDS for MySQL
        2. MS SQL -> Amazon RDS for SQL Server
        3. Oracle -> Amazon RDS for Oracle
        4. Schema Structures, Data Types, Database Code are compatible
        5. Source DB
            a. On-Prem
            b. Amazon EC2
            c. Amazon RDS
        6. Target DB
            a. Amazon EC2
            b. Amazon RDS
        7. Create migration task with connections to source and target
            a. Amazon Database Migration Service (DMS)
    v. Heterogeneous Databases
        1. Source & Target are different DB Types
        2. 2-Step process
        3. Schema Structures, Data Types, & Database Code are different
        4. Requires AWS Schema Conversion tool as intermediary
            a. Converts Schema Structure & Database Code to Match Target
        5. Use Amazon DMS to migrate the data
    vi. Amazon DMS can be used to
        1. Development & Test Database Migrations
            a. Test against Prod without affecting Prod
        2. Database Consolidation
            a. Consolidate multiple DB's into one DB
        3. Continuous Database Replication
            a. Continuous Replication for Disaster Recovery
            b. Geographic Separation

5. Choosing the Right Database
    a. No one size fits all
    b. Amazon DocnmentDB
        i. CMS System
        ii. MongoDB Compatibility
    c. Amazon Neptune
        i. Graph Database
        ii. Engineered for Social Networking
        iii. Fraud Detection

    d. Amazon Quantum Ledger Database (Amazon QLDB)
        i. Immutable Ledger
        ii. No Entry can be Removed
    e. Amazon Managed Blockchain
    f. Amazon ElastiCache
        i. Improve Read times of Common Requests
        ii. From milliseconds to microseconds
        iii. Memcached & Redis Flavors
    g. Amazon DynamoDB Accelerator (DAX)
        i. Native Caching Layer
        ii. Improves read times for non-relational Database
6. Summary
    a. Elastic Block Store
        i. Amazon EBS
        ii. Attached to EC2
        iii. Not Local Storage to EC2
        iv. Persistent between EC2 instances
    b. Amazon Simple Storage Service
        i. Amazon S3
        ii. Buckets
    c. Relational Database Options
        i. Amazon RDS
    d. Non-Relational Database Options
        i. DynamoDB
    e. Amazon Elastic File System
        i. Amazon EFS
    f. Amazon RedShift
        i. Data Warehouse
    g. AWS Database Migration Service
        i. AWS DMS
    h. Amazon DocumentDB
    i. Amazon Neptune
    j. Amazon QLDB
        i. Amazon Quantum Ledger Database
    k. Amazon Managed Blockchain
    l. Amazon Elasticache
    m. Amazon DynamoDB Accelerator
        i. DAX

Module 6

1. AWS Shared Responsibility Model

   a. AWS
      i. Responsible for Security “of” the cloud
      ii. Infrastructure of the cloud
   b. Customer
      i. Responsible for security “in” the cloud
      ii. Customer Workloads
   c. Who is responsible for security
      i. Both Parties
      ii. The House Builder built a house with 4 walls and a door
      iii. Homeowner has to close and lock the doors
      iv. OS is the dividing line between AWS & the Customer in EC2
2. User Permissions & Access (IAM)
   a. AWS Root user
      i. Keys to the Kingdom
      ii. Enable MFA as soon as you log in with Root Account
   b. AWS Identity & Access Management (AWS IAM)
      i. Tool to manage access
      ii. Create IAM Users
         1. By default, has no permissions
            a. Cannot log into AWS Account by default
            b. All actions are denied by default
      iii. Least Privilege
         1. Only grant the access necessary
      iv. Assign IAM policy to IAM User
         1. Way to grant access
         2. IAM Policy – JSON Document
            a. Defines API Calls a user can or cannot make
            b.

```
{
  "Version": "2012-10-17",
  "Statement": {
    "Effect": "Allow",
    "Action": "s3:ListBucket",
    "Resource": "arn:aws:s3:::coffee_shop_reports"
  }
}
```

i. Effect = Allow or Deny
ii. Action = Any AWS API Call
iii. Resource the API Call is for
iv. User can only view Coffee Shop Reports

c. IAM Groups
    i. Attach Policy to Group
    ii. Root User
        1. God
    iii. Users
        1. Can be members of Groups
    iv. Groups
        1. Have Policies applied to them
    v. Policies
        1. Can be applied to users or groups
        2. Allow or deny a specific action in AWS
    vi. Role
        1. Temporary in nature
        2. Set amount of time
        3. Associated permissions
        4. Allow or Deny
        5. Assume for Temporary amounts of time
        6. Similar to user with no username and password
        7. Identity to gain temporary permissions
        8. Grant access to
            a. AWS Resources
            b. Users
            c. External Identities
            d. Applications
            e. Other AWS Services
            f. Abandons all previous permissions when it assumes that role
        9. Federate users into AWS
            a. Using corporate account using Role Based Access
            b. Single Sign On (SSO)
    vii. Enable MFA for users

3. AWS Organizations
    a. Separation of Duties
    b. Central location to manage multiple AWS Accounts
        i. Hierarchical Fashion
    c. Centralized Management
    d. Consolidated Billing
    e. Hierarchical groupings of Accounts
        i. Organizational Units
        ii. Business Units
    f. AWS Service & API Actions Access Control
        i. Service Control Policies (SCP)
        ii. Specify maximum permissions for member accounts
4. Compliance
    a. Uses 3rd party Auditors
    b. Region you operate out of can help you meet compliance requirements

c. AWS will not replicate data that needs to stay in a “home” country
d. You own your data in AWS
e. Build your compliance on top of AWS or Use Built in AWS Features in many services
f. AWS Artifact
    i. Compliance Documents done by 3rd parties
g. AWS Compliance Center
    i. Compliance Info all in one place
    ii. Displays compliance enabling services
    iii. AWS Risk & Security White Paper

5. Denial-of-Service Attacks
    a. Distributed Denial-of-Service (DDos)
        i. UDP Flood
            1. Spoofs the return address of system to flood target with data
            2. Brute Force Attack
            3. Security Groups
                a. Only allows proper request traffic
                b. Operates at the AWS Network Level
                c. You’d have to overwhelm the entire AWS Region to succeed
        ii. HTTP Level Attacks
            1. Looks like legit traffic
            2. Performs complex queries of your products
        iii. Slowloris Attack
            1. Attacker pretends to have a slow connection and take up resources
            2. Elastic Load Balancer
                a. Handles HTTP Traffic Request First
                b. Waits for entire message
                c. You’d have to overwhelm the entire AWS Region to succeed
    b. AWS Shield with AWS Web Application Firewall (WAF)
        i. Web Application Firewall to filter incoming traffic
        ii. Machine Learning
        iii. Recognize new threats as they evolve
        iv. Proactively help defend against an ever-growing list of destructive vectors
    c. Already defended against most attacks
    d. AWS Shield Standard
        i. Automatically protects all AWS Customers at no cost
    e. AWS Shield Advanced
        i. Paid service that provides detail3ed attack Diagnostics
        ii. Ability to detect & mitigate traffic in real time
        iii. Automatically Mitigates
6. AWS Key Management Service (AWS KMS)
    a. Encryption
        i. Only authorized parties can access it
    b. Encryption at Rest
        i. Data Idle (being stored)
        ii. At Rest Encryption is enabled on all DynamoDB Tables
    c. Encryption in Transit
        i. Data traveling between 2 points
7. Amazon Inspector
    a. Automated Security Assessment against your infrastructure

    b. Deviations of security best practices
    c. 3 Pieces
        i. Network Configuration Reachability Piece
        ii. Amazon Agent
            1. Installed on EC2 Instance
        iii. Security Assessment Service
            1. Brings everything together
8. Amazon GuardDuty
    a. Analyzes streams of meta data from your account & Network Activity
    b. Integrated Threat Intelligence
        i. Known Malicious IP Addresses
    c. Anomaly Detection
    d. Machine Learning
    e. Runs Independently from other AWS Services

Module 7

1. Amazon CloudWatch
    a. Web service that enables you to monitor & manage various Metrics
    b. Configure alarm actions based on data from those metrics
    c. Integrated with SNS & can send SMS
    d. Custom Alarms for all different types of AWS resources
    e. Dashboard feature to aggregate all those metrics
    f. Access to all your metrics from a central location
        i. Cloud & On Prem
    g. Gain visibility into your applications, infrastructure, & services
    h. Reduce MTTR & improve TCO
        i. Mean Time To Resolution
        ii. Total Cost of Ownership
    i. Drive insights to optimize applications and operational resources
        i. Aggerate metrics from a fleet of EC2 instances
2. AWS CloudTrail
    a. Trust but verify
    b. API Auditing Tool
    c. Every request gets logged in CloudTrail engine
    d. Vault Lock can show absolute provenance of all these critical security audit logs
3. AWS Trusted Advisor
    a. Evaluate Resources vs 5 Pillars based on AWS Best Practices
        i. Cost Optimization
        ii. Performance
        iii. Security
        iv. Fault Tolerance
        v. Service Limits
    b. Examples of checks
        i. Lack of MFA for Root user
        ii. Underutilized EC2 Instances
        iii. EBS Volumes not backed up in awhile
    c. Some are free, and some depend on your support plan

Module 8

1. AWS Free Tier
    a. Always Free
        i. Does Not Expire
    b. 12 months free
        i. From date you created your AWS account
    c. Trials
        i. Short Term Free Trial
    d. AWS Lambda
        i. Free for 1 million free invocations per month
        ii. Up to 3.2 million seconds of computer time per month
    e. AWS S3
        i. Free for 12 months for up to 5 gb of standard storage
    f. AWS Lightsail
        i. 1 month trial of up to 750 hours of usage
    g. AWS Free Tier Services
        i. Amazon SageMaker
        ii. Amazon Comprehend Medical
        iii. Amazon DynamoDB
        iv. Amazon SNS
        v. Amazon Cognito
2. Pricing Concepts
    a. Pay for what you use
    b. Pay less when you reserve
    c. Pay less with volume-based discounts when you use more
    d. AWS Pricing Calculator
        i. Can save estimate
3. Billing Dashboard
4. Consolidated Billing
    a. Part of AWS Organizations
    b. Usage is rolled up to the Organization level
        i. Useful because of bulk pricing
    c. Reserved instances of EC2 can be shared across AWS Accounts
5. AWS Budgets
    a. Set alert when you've used a % of your budgeted amount
6. AWS Cost Explorer
    a. Displays Spending
    b. Has 12 months worth of data
    c. Grouping costs
        i. Can group by Tag
            1. User defined key value pair
            2. Tag resources by project name
    d. Can save custom reports
7. AWS Support Plans
    a. Basic (All customers receive this)
        i. 27/7 Customer Service
        ii. Documentation
        iii. Whitepapers
        iv. Support Forums
        v. AWS Trusted Advisor

vi. AWS Personal health Dashboard
    1. Personalized View

b. Developer
    i. Basic Support
    ii. Email Access to Customer Support
        1. 24 hour response time for questions
        2. 12 hour response time for impaired systems
    iii. Great for non production workloads

c. Business
    i. Previous Tiers
    ii. AWS Trusted Advisor provides full set of best practice checks
    iii. Direct phone access to cloud support engineers
        1. 4 hour SLA if your production system is impaired
        2. 1 hour SLA if your production system is down
    iv. Infrastructure event management
        1. Help plan for massive events like brand new launches
            a. For a fee

d. Enterprise
    i. Previous Tiers
    ii. 15 minute SLA for business critical workloads
    iii. Dedicated Technical Account Manager (TAM)
    iv. TAM's are concierge support team that comes with enterprise
        1. Proactively monitor your environment
        2. Assisting with optimization
        3. Infrastructure event management
        4. Well-Architected reviews
            a. Work with customers to review architecture using the Well-Architected framework
            b. Checked against
                i. Operational Excellence
                ii. Security
                iii. Reliability
                iv. Performance Efficiency
                v. Cost Optimization
        5. Operational reviews

e. Pricing Structures for Plans

8. AWS Marketplace
    a. Digital Catalog
        i. Find, deploy & manage 3rd party software
        ii. Range of payment options
        iii. Rapidly & Securely deploy solutions
        iv. Reduce Total Cost of Ownership (TCO)
    b. One Click Deployment
    c. Pay-as-you go options from vendors
    d. Enterprise focused features
        i. Custom terms & pricing
        ii. Private marketplace
            1. To meet legal or security standards
        iii. Integration into your procurement systems

iv. Cost management tools

Module 9

1. AWS Cloud Adoption Framework (AWS CAF)
    a. 6 Perspectives based types of people you will need
        i. Business
            1. Focused on Business Capabilities
            2. Finance Analyst
        ii. People
            1. Focused on Business Capabilities
            2. HR
        iii. Governance
            1. Focused on Business Capabilities
        iv. Platform
            1. Focused on Business Technologies
            2. Cloud Architect
        v. Security
            1. Focused on Business Technologies
        vi. Operations
            1. Focused on Business Technologies
        vii. Used to identify gaps in skills and processes
            1. Recorded as inputs
                a. Used to create AWS Cloud Adoption Framework Action Plan
                    i. Guide's change management
2. 6 R's of Migration
    a. Every Application/Application Group will fall into one of these for migration
        i. Rehosting
            1. Lift & Shift
            2. Not making changes
            3. Save up to 30% by rehosting
            4. Easier to optimize applications after
        ii. Replatforming
            1. Lift, Tinker, & Shift
            2. Not 1 to 1
            3. No Code Changes
            4. On Prem MySQL -> RDS MySQL or Aurora
            5. High initial cost
        iii. Refactoring/re-architecting
            1. Write new code
            2. Business need to add features or performance
            3. Highest initial cost
        iv. Repurchasing
            1. Abandon legacy software vendors
            2. End licensing with out of date DB vendor in favor of cloud native DB offerings
        v. Retaining
            1. Need to run for another X amount of time
            2. Nearing EOL
        vi. Retiring
            1. No longer needed

        2. 10 – 20% of Application portfolios are no longer needed
    b. Each option is judged against
        i. Time
        ii. Cost
        iii. Priority
        iv. Criticality
3. AWS SNOW Family
    a. Collection of physical devices that help physically transport up to exabytes of data in & out of AWS
    b. AWS Snowcone
        i. Up to 8 tb of data
        ii. Contains edge computing
            1. Amazon EC2 Instances
            2. AWS IoT Greengrass
        iii. Migration Path
            1. Order Device
            2. Amazon ships device
            3. Attach device to network & copy data
            4. Ship device back
            5. Amazon copies data to S3 bucket that you own
        iv. Use Case
            1. Analytics data
            2. Video Libraries
            3. Image Collections
            4. Backups
            5. Even tape replacement data
    c. AWS Snowball
        i. Snowball Edge Compute Optimized
        ii. Snowball Edge Storage Optimized
            1. 80 tb capacity
        iii. Fit into server racks
        iv. Can be clustered
        v. Can run Amazon Lambda
        vi. Can run Amazon EC2 compatible AMI's
        vii. AWS IoT Greengrass
        viii. Usually shipped to remote locations
        ix. Use Case
            1. Capturing of streams from IoT devices
            2. Image Compression
            3. Video Transcoding
            4. Industrial signaling
    d. ASW Snowmobile
        i. 45 foot Shipping Container
            1. Data center in a box
        ii. Houses 100 petabytes
            1. 100,000 terabytes
        iii. Appears as a network attached storage device
        iv. Ideal for large migrations or data center shutdowns
        v. Weatherproof
        vi. Temperature Controlled

vii. Fire suppression
viii. GPS Tracking
ix. 24/7 video surveillance
x. Security while in transit

e. AWS SNOW devices are designed
i. Secure & Tamper-resistant
ii. 2560bit encryption keys owned and managed by you
iii. AWS Key Management Service can generate and manage keys

4. Innovation with AWS
a. VMWare Cloud on AWS
b. Machine Learning & AI
i. AWS has the Broadest & Deepest set of ML & AI services
ii. Pre-trained AI
1. Computer vision
2. Language recommendations
3. Forecasting
iii. Amazon SageMaker
1. Quickly build, train, & deploy machine learning models at scale
iv. Custom models with support for all popular open-source frameworks
1. Amazon SageMaker
2. Amazon Augmented AI
3. Amazon Augmented AI2
v. Ready-to-go AI Solutions
1. Amazon Lex
a. Heart of Alexa
b. Helps you build chat bots
2. Amazon Textract
a. Optical Character Recognition
b. Extracts text & data from documents
3. AWS DeepRacer
a. Allows developers to

Module 10

1. Each AWS service is a building block for your solution
a. String together services
b. Well Architected Framework
i. Operational Excellence
ii. Security
iii. Reliability
iv. Performance Efficiency
v. Cost Optimization
2. Well Architected Framework
a. Designed to enable architects, developers, and users of AWS to build secure, high-performing, resilient, and efficient infrastructure for their applications
b. Five Pillars (consistent approach to reviewing & designing architectures)
i. Operational Excellence
1. Running & monitoring systems to deliver business value, and with that, continually improving processes and procedures

2. Automating changes with deployment pipelines, or responding to events that are triggered

ii. Security
1. Checking integrity of data and, for example, protecting systems by using encryption

iii. Reliability
1. Recovery planning

iv. Performance Efficiency
1. Using IT and computing resources efficiently

v. Cost Optimization
1. Controlling where money is spent

c. AWS Well Architected Tool
i. Accessed via AWS Management Console
ii. Run against AWS Account
1. Generate report showing areas that should be addressed

iii. RAG Chart Design
1. Red
2. Amber
3. Green

d. Benefits of the AWS Cloud
i. AWS Services are building blocks
ii. AWS Terminology
iii. 6 Main Benefits of using the AWS Cloud
1. Trade upfront expense for variable expense
a. On-prem data center costs
i. Physical space
ii. Hardware
iii. Staff for racking & stacking
iv. Overhead for running the data center
v. Fixed cost of static data center

b. Save money with AWS
i. Turn off unused instances
ii. Delete old resources
iii. Optimize your applications
iv. Receive recommendations from AWS Trusted Advisor

2. Benefit from massive economies of scale
a. Lower variable cost than you could running a data center on your own

3. Stop guessing capacity
a. You have to own enough hardware to cover your capacity
i. Over or under estimating

b. Provision the resources you need now
c. Scale resources up or down
i. Scaling can take minutes, not weeks or months

4. Increased speed & agility
a. Spin up test environments
b. Run experiments
c. Delete resources
d. Stop incurring costs
e. Flexibility drives innovation

5. Stop sending money running & maintaining datacenters

    a. Unless you are a datacenter company, why run a datacenter
    b. Focus on what makes your business valuable
        i. What makes you better than your competitors
6. Go global in minutes
    a. Replicate architecture to another region
        i. Can be automated with AWS CloudFormation