AWS Cloud Practioner Essentials

Module 1: Introduction to Amazon web services

Cloud Computing

- On demand delivery of IT resources with pay as you go pricing
- Undifferentiated heavy lifting of IT
    - AWS makes standard processes for you
- Take upfront expense
- Stop spending money to run data centers
- Benefit from economies of scale
- Stop guessing capacity
- Increase speed and agility
- Go global in minutes

Module 2: Compute in the Cloud

Introduction

- Flexible, Cost effective, Quick
- Launch, connect and use virtual servers
- Pay for what you use
- No Hardware research, waiting time, maintenance etc. needed
- Multitenancy through hypervisor
- Control OS, Software, Network

Amazon EC2 instance types

- General purpose instances
    - Balance of compute, memory, network
    - For eg. application servers, gaming servers, backend servers for enterprise applications, small and medium databases
- Compute optimized instances
    - For compute intensive tasks
    - web, application and gaming servers
- Memory optimized instances
    - Memory intensive tasks
    - Utilizes in memory processing
- Accelerated computing instances
    - Utilize hardware accelerators/ coprocessors
    - Eg. Floating point number calculations, graphics processing, data pattern matching, streaming
- Storage optimizes instances
    - High performance for locally stored data
    - Eg. Data warehouse, distributed file systems

Amazon EC2 pricing

- On demand
    - Pay for use
    - No communication with AWS required
- Amazon EC2 Saving Plans
    - Low prices for commitment for consistent usage (1 or 3 years)
- Reserved Instances
    - Low pricing for on demand service with commitment (1 or 3 years)
- Spot Instances
    - Request spare computing capacity for low pricing
    - AWS can reclaim instance at any time (2 min warning)
- Dedicated Hosts
    - Non shared hosts (mostly because of compliance)

Scaling Amazon EC2

- Scalability
    - Automatically respond to changing demand by scaling out or in
    - Plan for failure, make instances scalable and easy to duplicate
    - Decoupling system for better use of scaling

- Amazon EC2 Auto Scaling
    - Adds instances based on demand
    - Decommissions instances when no longer needed
    - Minimum, maximum and desired capacity can be set

Directing traffic with Elastic Load Balancing

- Automatically distributes incoming app traffic across resources/instances
- Single point of contact for all traffic
- Works together with Amazon EC2 Auto Scale
- Regional construct (runs on region level) → highly available
- ELB itself is scaled automatically
- Can also used to direct frontend/backend traffic

Messaging and queuing

- Microservice vs Monolithic architecture
    - Microservices
- Message queue between Services to store messages in queue, too keep them even if a
- service fails
- Amazon Simple Queue Service (Amazon SQS)
    - Send, store and receive messages between software components at any volume
    - Where messages are placed until they are processed
- Amazon Simple Notification Service (Amazon SNS)
    - Publish/subscribe service
    - Amazon SNS topic: channel for messages to be delivered
    - Send messages to services and notifications to end users

Additional compute services

- Serverless computing
    - Code runs on servers without need to provision or manage servers
    - You cannot see or access underlying infrastructure (is done for you)
    - AWS Lambda
        - Allows to upload code in lambda function
        - Code is automatically run in environment and executed by a trigger
        - For quick processing tasks (less than 15 min), event/service-oriented applications
- Container Orchestration Tools
    - Uses Docker Containers in Clusters for Virtualization
    - Host traditional applications with full OS access
    - Amazon Elastic Container Service (ECS)
        - Help to run containers at scale
    - Amazon Elastic Kubernetes Service (EKS)
        - Help to run containers at scale with k8s
    - Running on top of:
        - EC2 instances or
        - AWS Fargate (Serverless compute platform for ECS or EKS)

Module 3: Global Infrastructure and Reliability

AWS global infrastructure

- Building Data Centers in Regions close to Business Traffic
- Regions are connected by a High-Speed Fiber Network
- Regions are isolated from each other until requested export
- Customer can choose its Region
- Regions follow their locations government standards (compliance)
- Factors to choose a Region
    1. Compliance (because laws)
    2. Proximity (because latency)
    3. Feature availability (some Regions don't offer every Service)
    4. Pricing (some Locations are more costly)
- At least two Availability Zones in each Region
- Availability Zones (AZ) = one or more Datacenters, locally close, grouped together
- Best practice: run across at least two AZ in a region

Edge locations

- site that Amazon CloudFront uses to store cached copies of your content
    - closer to your customers for faster delivery
    - Amazon CloudFront is a Content Delivery Networks (CDN) that uses Edge Locations
- Edge Locations run DNS (Amazon Route 53)
- AWS Outposts
    - Fully operational mini Region in your own data center

How to provision AWS resources

- Everything in AWS is an API call
- Interacting with AWS Services
    - AWS Management Console
        - Web-based GUI
        - See Test environments, AWS billing, monitoring, work with non-technical resources
    - AWS Command Line Interface (CLI)
        - Control multiple AWS services directly with command line
        - Make API calls using terminal on your machine
        - Allows automation with scripts/programs
    - AWS Software Development Kits (SDKs)
        - Interact with AWS resources through various programming languages
    - AWS Elastic Beanstalk
        - Service to provision EC2 based environments
        - Helps to focus on application not infrastructure
        - Provide code and config to Beanstalk → Builds environment for you
    - AWS CloudFormation
        - Automatically build infrastructure by code (YAML or JSON)
        - CloudFormation Template is built in parallel for you

Module 4 Networking

Introduction

- Amazon Virtual Private Cloud (Amazon VPC)

Connectivity to AWS

- Amazon Virtual Private Cloud (Amazon VPC)
    - Private Network in AWS
    - Split into Subnets
    - Public:
        - Internet Gateway to allow outside connectivity
    - Private:
        - Private Gateway to allow selected outside connectivity through VPN
    - AWS Direct Connect
        - dedicated private connection between your network and your AWS VPC

Subnets and network access control lists

- Network hardening
- Subnets to control access to the gateways
    - Network traffic checked by Network access control list (Network ACL)
    - Only if packets crossing subnet boundaries
    - Stateless (doesn't remember previous packages)
    - Ingress and Egress is checked
- Security Groups for security on instance level
    - Checks incoming network traffic
    - Stateful (allowing all returning traffic)

Global networking

- Amazon Route 53
    - Domain Name System (DNS) Service
    - Connects user requests to infrastructure running in AWS
    - Policies:
        - Latency-based routing
        - Geolocation DNS
        - Geoproximity
        - Weighted round robin
- Amazon Cloud Front
    - See Module3 Edge Locations

Module 5: Storage and Databases

Instance stores and Amazon Elastic Block Storage (Amazon EBS)

- Block Level Storage
  - Databases, Enterprise Software, File Systems
  - Instance Store Volumes
    - physically attached to EC2 host
    - Temporary (Data will be lost by host change/restarting instance)
  - Amazon Elastic Block Store (Amazon EBS)
    - EBS volumes attached to instances and not to host
    - AZ level resource
    - Persistent volume
    - Allows Snapshots(incremental backup)

Amazon Simple Storage (Amazon S3)

- Store and retrieve unlimited amount of data
- Provides object-level storage in buckets
- Max upload to 5TB
- Offers object versioning
- Buckets can have different permissions
- S3 Standard
  - For frequently accessed data
  - Stores in minimum of 3 AZs
- S3 Static website hosting
  - Bucket is hosted as static website
- S3 Standard-Infrequent-Access (S3 Standard-IA)
  - For infrequently accessed data
  - Similar to S3 standard but lower storage price and higher retrieval price
  - S3 Zone-infrequent Access (S3 One Zone-IA) → single AZ
- S3 Glacier
  - Low-cost storage designed for data archiving
  - Able to retrieve objects within a few minutes to hours
  - S3 Glacier Deep Archive (lower cost, longer retrieval time)
- S3 Lifecycle management
  - Move data automatically between storage tiers
  - Done with policies

EBS vs S3

EBS	S3
Up to 16 TiB	Unlimited storage (Upload up to 5 TB)
Persistent volume	
SSD by default (HDD option)	
Block storage	Object Storage
	99.99999999% durability (Backup etc.)
	Write once/read many
	Web enabled
	Serverless
	Offers cost savings

Amazon Elastic Filesystem (Amazon EFS)

- Shared managed Linux Filesystem
  - Multiple instances can access the data at the same time
- EFS scales automatically
- Regional resource (EBS is AZ-level)

Amazon Relational Database (RDS)

- SQL database management system to store and query data
- Amazon Aurora, PostgreSQL, MySQL, MSSQL, Oracle, …
- Lift-and-shift migration possible
- Amazon RDS
  - Automated patching
  - Backups
  - Redundancy
  - Failover
  - Disaster Recovery
- Amazon Aurora
  - MySQL or PostgreSQL
  - 1/10 commercial DB costs
  - Data replication
  - Up to 15 read replicas
  - Continuous S3 backup
  - Point in time recovery

Amazon Dynamo DB

- Serverless
- Dynamo automatically scales storage
- Redundant storage
- Millisecond response time
- NoSQL database
  - Simple flexible schemas
  - Items can be added and removed at any time
  - Not every item has to have every attribute
  - Query's based on subsets of attributes (keys)
    - Not spanning multiple tables
  - Quicker response times and easy scalable

Amazon RDS vs Dynamo DB

Amazon RDS	Dynamo DB
Automatic HA and recovery	
Customer ownership of data	PB size potential
Customer ownership of schema	Massive throughput capabilities
Customer control of network	Granular API access
SQL	Key value (NoSQL)
For complex relations between tables	For everything else

Amazon Redshift

- Data warehouse service
    - For big data analysis
    - For already stored data and not data that is still changing
    - Massively scalable
    - Up to 10 times higher performance than traditional DBs

AWS Database Migration Service

- Enables you to migrate relational databases, nonrelational databases and other types of data store
- Source DB remains fully operational
- Downtime is minimized
- Source and target DB don't have to be the same type (Heterogeneos migration)
    - AWS schema conversion tool converts for you
- Development and test database migration (test against production data without changing it)
- Database consolidation (multiple databases into one)
- Continuous database replication

Additional database services

- Amazon DocumentDB
    - Content management system
- Amazon Neptune
    - Graph database
    - For highly connected data
- Amazon Quantum Ledger Database
    - Immutable ledger system
- Amazon Managed Blockchain
    - Distributed ledger system
- Amazon ElastiCache
    - Adding caching layers for faster query's
- Amazon DynamoDB Accelerator
    - Adding caching layers for faster query's for NoSQL

Module 6: Security

Shared responsibility model

- AWS environment not seen as collection of parts
    - AWS responsible for some of these parts, customer for others
- AWS responsibilities:
    - Physical layer
    - Network
    - Hypervisor
- Customer responsibilities:
    - Operating System
    - Applications
    - Data

User permissions and access

- Root user given by default
- Multi factor authorization should be set up as soon as possible
- AWS Identity and Access Management (IAM)
    - Manage access to AWS resources and services
    - Least privileged is used by default (all permissions denied by creation)
    - Users, groups, roles
    - Policies (done with JSON)
    - Multi-factor auth.

AWS Organizations

- Centrally consolidate and manage multiple AWS accounts
    - Centralized Management of Accounts
    - Consolidated billing
    - Hierarchical groupings of accounts
    - AWS service and API actions access control
    - Permissions with service control policies
- Organizational units (OU)
    - Group of accounts under an organization

Compliance

- AWS already using lots of compliance regulations
- AWS Artifact
    - Provides on-demand access to AWS security and compliance reports and select online agreements
    - AWS Artifact Agreements
        - review, accept, and manage agreements for an individual account and for all your accounts in AWS Organizations
    - AWS Artifact Reports
        - provide compliance reports from third-party auditors
- Customer Compliance Center
    - Learning and help center for Compliance stuff

Denial-of-service attacks

- Deliberate attempt to make a website or application unavailable to users
- Distributed denial-of-service attacks (DDoS)
    - multiple sources are used to start an attack
- AWS Shield
    - Protects applications against DDoS attacks.
    - AWS Shield Standard
        - Automatically protects all AWS customers at no cost
        - Protects from most common DDoS attacks
        - uses a variety of analysis techniques to detect malicious traffic in real time and automatically mitigates it
    - AWS Shield Advanced
        - Paid service
        - provides detailed attack diagnostics and the ability to detect and mitigate sophisticated DDoS attacks
        - also integrates with other services such as Amazon CloudFront, Amazon Route 53, and Elastic Load Balancing
        - with Web Application Firewall (WAF)

Additional security services

- AWS Key Management Service (AWS KMS)
    - enables you to perform encryption operations through the use of cryptographic keys
    - encryption at rest and in transit
- AWS WAF
    - web application firewall that lets you monitor network requests that come into your web applications
- Amazon Inspector
    - Amazon Inspector helps to improve the security and compliance of applications by running automated security assessments
- Amazon GuardDuty
    - provides intelligent threat detection for your AWS infrastructure and resources

Module 7: Monitoring and Analytics

Amazon CloudWatch

- Enables you to monitor and manage various metrics and configure alarm actions
- Metrics are tied to resources
- Alarms can be set to custom metrics
- CloudWatch offers also a dashboard
    - Access all your metrics from central location
- Reduce MTTR and improve TCO

AWS CloudTrail

- Records API calls for your account
- View a complete history of user activity and API calls for your applications and resources
- CloudTrail Insights: Automatically detect unusual API calls

AWS Trusted Advisor

- Web service that inspects your AWS environment and provides real-time recommendations in accordance with AWS best practices
- Five categories:
    - Cost optimization
    - Performance
    - Security
    - Fault tolerance
    - Service limits
- Some checks are free others are depending on support plan
- Offers a dashboard with all categories and displays recommendations

Module 8: Pricing and Support

AWS Free Tier

- Always Free Services
    - offers do not expire and are available to all AWS customers
    - AWS Lambda 1 Million invocations per month
    - SageMaker
    - Comprehend Medical
    - Dynamo DB
    - SNS
    - Cognito
    - …
- 12 Months Free Services
    - S3 5GB
- Trials
    - Lightsail 1 month trial up to 750h usage

AWS pricing concepts

- Pay for what you use
- Pay less when you reserve
- Pay less with volume-based discounts
- AWS Pricing Calculator for calculations

Billing dashboard

- AWS Billing & Cost Management Dashboard
    - Compare your current month-to-date balance with the previous month, and get a forecast of the next month based on current usage
    - View month-to-date spend by service
    - View Free Tier usage by service
    - Access Cost Explorer and create budgets
    - Purchase and manage Savings Plans
    - Publish AWS Cost and Usage Reports

Consolidated billing

- AWS Organizations provides the option for consolidated billing
- Single bill for all AWS accounts in your organization
- Share bulk discount pricing

AWS Budgets

- Create budgets to plan your service usage, service costs, and instance reservations
- Alerts can be set when (forecast) exceeds usage

AWS Cost Explorer

- Enables you to visualize, understand, and manage your AWS costs and usage over time

AWS Support Plans

- Basic (Free)
    - 24/7 customer service
    - Documentation
    - Whitepapers
    - Support Forms
    - AWS Trusted Advisor
    - AWS Personal Health dashboard
- Developer
    - Basic
    - Email access to customer support
- Business
    - Developer
    - Full AWS Trusted Advisor set
    - Direct phone access to cloud engineers
    - Infrastructure event management
- Enterprise
    - Business
    - 15 min SLA
    - Technical Account Manager
        - Provides expertise across the full range of AWS services
        - Help you design solutions that efficiently use multiple services together through an integrated approach

AWS Marketplace

- Digital catalog that includes thousands of software listings from independent software vendors
- Filtered in Categories and with filter and search function

Cost Optimization (from pricing whitepaper)

- Choose the right pricing model
    - Use reserved instances or spot instances if possible for use case
- Match capacity with Demand
    - EC2: Cost explorer to find underutilized instances
    - RDS: Trusted Advisor Amazon RDS Idle DB instances check and Redshift cluster check
    - DynamoDB: Use Auto Scaling or On-demand option
- Implement processes to identify resource waste
    - EBS: Trusted Advisor Underutilized Amazon EBS Volumes check
    - S3: Use S3 Analytics and S3 Intelligent Tiering
    - Networking Resources: Trusted Advisor Idle Load Balancers check and cost explorer

Module 9: Migration and Innovation

AWS Cloud Adoption Framework (AWS CAF)

- organizes guidance into six areas of focus, called Perspectives
    - Business: ensures that IT aligns with business needs and that IT investments link to key business results
    - People: supports development of an organization-wide change management strategy for successful cloud adoption
    - Governance: focuses on the skills and processes to align IT strategy with business strategy
    - Platform: includes principles and patterns for implementing new solutions on the cloud, and migrating on-premises workloads to the cloud
    - Security: ensures that the organization meets security objectives for visibility, auditability, control, and agility
    - Operations: helps you to enable, run, use, operate, and recover IT workloads to the level agreed upon with your business stakeholders

Migration strategies

- Rehosting (lift-and-shift)
    - moving applications without changes
- Replatforming (lift, tinker, and shift)
    - Involves making a few cloud optimizations to realize a tangible benefit
    - Without changing core architecture
- Refactoring/re-architecting
    - Reimagining how an application is architected and developed by using cloud-native features
- Repurchasing
    - Moving from a traditional license to a software-as-a-service model
- Retaining
    - Keeping applications that are critical for the business in the source environment
- Retiring
    - Removing applications that are no longer needed

AWS Snow Family

- Collection of physical devices that help to physically transport up to exabytes of data into and out of AWS
- AWS Snowcone
    - Up to 8 TB with edge computing
- AWS Snowball
    - Snowball Edge Storage Optimized
        - 80 TB, 40 vCPUs, 80GiB memory
    - Snowball Edge Computing Optimized
        - 42TB, 52 vCPUs, 208 GiB memory
- AWS Snowmobile
    - Exabite-scale data transfer service up to 100 petabytes

Innovation with AWS

- VMWare Cloud on AWS possible
- Serverless applications
- Lots of Machine Learning and AI Services
    - Amazon SageMaker
    - Amazon Augmented AI
    - Amazon Lex (conversational AI like Alexa)
    - Amazon Textract (document tracking with AI)
    - AWS DeepRacer (reinforcement learning)
- IoT Services
    - AWS Ground Station (service offering a Satellite connection)

Module 10: The Cloud Journey

The AWS Well-Architected Framework

- Helps you understand how to design and operate reliable, secure, efficient, and cost-effective systems in the AWS Cloud
- 5 Pillars
    - Operational excellence (pipelines, etc.)
    - Security (checking data integrity, encryption, etc.)
    - Reliability (recovery planning, etc.)
    - Performance (using resources efficiently)
    - Cost (optimizing costs)
- Shows green, orange or red lights and gives recommendations

Benefits of the AWS Cloud

- Trade upfront expense for variable expense.
- Benefit from massive economies of scale.
- Stop guessing capacity.
- Increase speed and agility.
- Stop spending money running and maintaining data centers.
- Go global in minutes.

Module 11: AWS Certified Cloud Practitioner Basics

Exam details

- 65 questions in 90 min
- 70% required
- Multiple-Choice and Multiple-Response questions, no penalty of guessing
- Domain 1: Cloud Concepts (26%)
- Domain 2: Security and Compliance (25%)
- Domain 3: Technology (33%)
- Domain 4: Billing and Pricing (16%)
- Whitepapers:
    - https://d1.awsstatic.com/whitepapers/aws-overview.pdf
    - http://d1.awsstatic.com/whitepapers/aws_pricing_overview.pdf
    - https://aws.amazon.com/premiumsupport/plans/
- Sample Exam Questions: https://d1.awsstatic.com/training-and-certification/docs-cloud-practitioner/AWS-Certified-Cloud-Practitioner_Sample-Questions.pdf

Additional interesting Services

Amazon Kendra

- Enterprise search service powered by machine learning
- Enables devs to add search cababilities to applications

Amazon Macie

- Fully managed data security and data privacy service using machine learning
- Detects sensitive data

Amazon Kinesis

- Collect, process and analyze real-time streaming data as it arrives
- Amazon Kinesis Video Streams: securely stream media from connected devices to AWS for storage, ml, playback and other processing
- Amazon Kinesis Data Firehose
- Amazon Kinesis Data Analytics
- Amazon Kinesis Data Streams

AWS IoT Events

- Continuously monitor equipment and fleets of devices and trigger alerts

Amazon Athena

- Analyze data in S§ using standard SQL

Amazon EMR

- Managed Hadoop framework

Amazon CloudSearch

- Set up, manage and scale search solution for website or application

Amazon Elasticsearch Service

- Deploy, secure, operate and scale Elasticsearch to search

Amazon QuickSight

- Cloud powered business intelligence (BI) to deliver organization insights

Amazon Data Pipeline

- Process and move data between AWS compute and storage services

AWS Glue

- Fully managed extract, transform and load (ETL) service

AWS Lake Formation

- Set up a secure data lake
    - Centralized, curated and secured repository that stores all your data

Amazon Managed Streaming for Apache Kafka

- Fully managed service to build and run applications with Apache Kafka

AWS Step Functions

- Coordinate multiple AWS services into serverless workflows

Amazon MQ

- Managed message broker service for Apache ActiveMQ

Amazon SWF

- Build, Run and scale background jobs / task coordinator

Amazon Sumerian

- Create and run VR, AR and 3D applications quickly and easily

Alexa for Business

- Use Alexa for organization

Amazon WorkDocs

- Fully managed secure enterprise storage and sharing system

Amazon WorkMail

- Secure managed business email and calendar service

Amazon Chime

- Communication service for meetings

Amazon Lightsail

- Launch and mange a virtual private server

AWS Batch

- Easily run lots of batch computing jobs

AWS Serverless Application Repository

- Deploy code samples and applications

Amazon Connect

- Cloud based contact center service

Amazon SES

- Cloud-based email sending service

Amazon WorkSpaces

- Secure cloud desktop service

Amazon AppStream 2.0

- Fully managed application streaming service

AWS CodeCommit

- Source control service(git)

CodeBuild

- Build service

CodeDeploy

- Deployment service

CodePipeline

- CI service

AWS CodeStar

- Quickly develop, build and deploy applications (like gitlab)

Amazon Corretto

- Distribution of OpenJDK

AWS Cloud9

- Web based IDE

AWS X-Ray

- Analyze and Debug applications in production

Amazon GameLift

- Deploying, operating and scaling dedicated game servers

Amazon Lumberyard

- Cross-platform 3D game engine

Lots of IoT, ML and other services, they have extra certifications so I will not include them here