KodeKloud

Bringing it all together

Summary of Cloud Computing

What Is Cloud Computing? - Summary

- Cloud Computing is the on-demand delivery of IT resources, particularly compute power, application hosting, database application, networking, and more
- Three models of deployment: Cloud, On-Premises, and Hybrid
- Works on a Client-Server model
- Provides almost instant pay-as-you-go access to compute resources/ app hosting

What Is AWS?

What Is AWS? - Summary

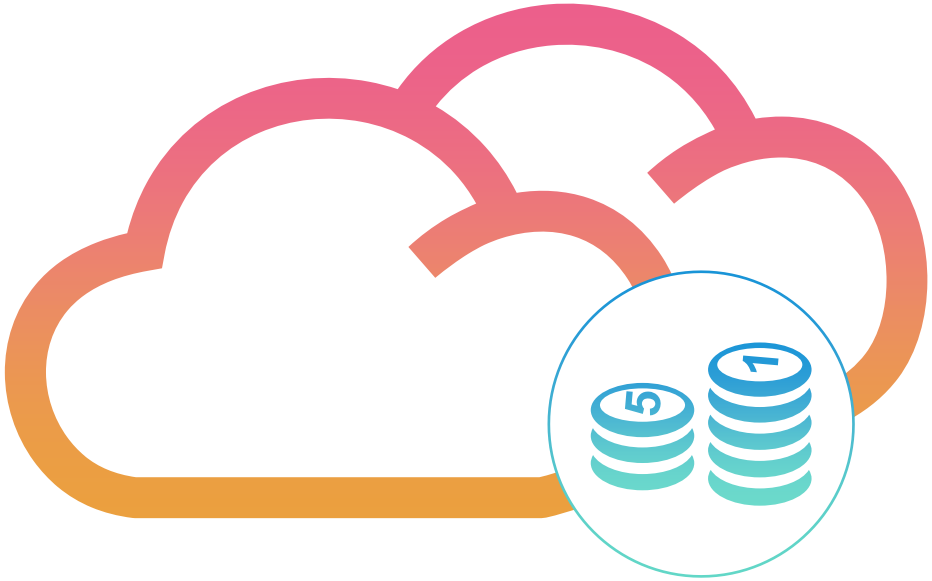
- Amazon Web Services or AWS was the first large-scale cloud provider
- AWS was launched in 2006, with S3 as the first service
- Since then, AWS has grown to 300+ services
- Signing up is free; all services usually are pay-to-use
- AWS has one of the largest communities, market positioning, and growth in the industry

Benefits of Cloud

Benefits of Cloud - Summary

- Trade upfront expense for variable expense
- Stop focusing on data centers
- Stop guessing capacity
- Benefit from economies of scale
- Increase your speed and agility
- Go global in minutes

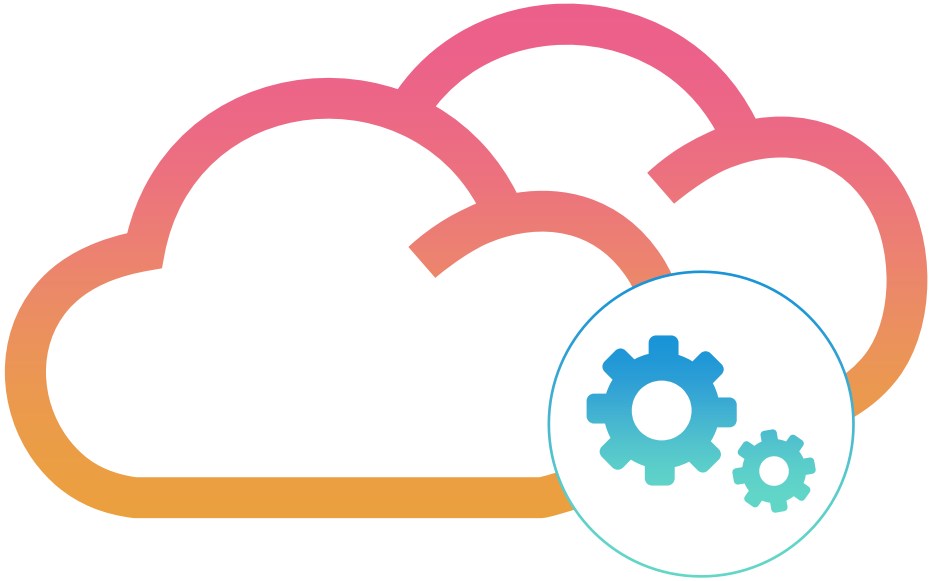
Cloud Economics



Cloud Economics - Summary

- Free Tier means that certain services are always free, and some are free for 12 months after new account creation
- On-Demand is full pricing and pay-as-you-go, but no contract and very flexible
- Reservations are contracts that you enter with Amazon for 1-3 years
- Volume Discounts are pay less per unit as you use more
- Price Drops are random price cuts that AWS does every few years on its services

Cloud Native Design Principles



Cloud Native Design Principles - Summary

- Design for failure
- Decouple components
- Implement elasticity
- Think parallel

Summary on Security and Compliance

AWS Shared Responsibility Model

AWS Shared Responsibility Model - Summary

- The shared responsibility model delineates the customer's responsibilities and AWS's responsibilities
- Unmanaged services need to be secured by users
- Managed services offload some of the security responsibility onto AWS

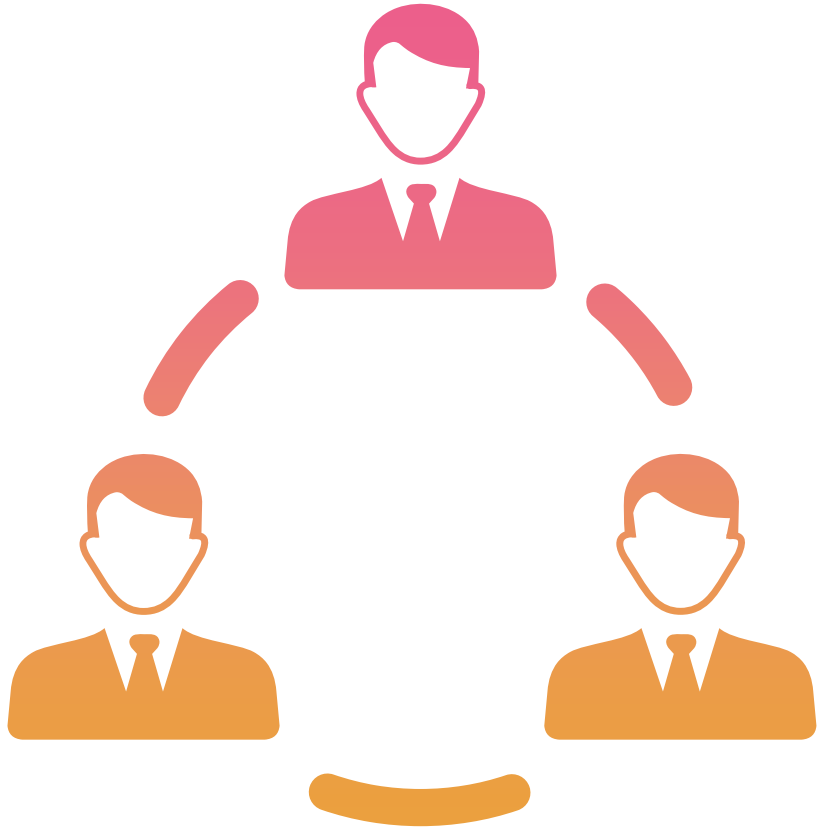
AWS Shared Responsibility Model - Summary

- Compliance and regulatory frameworks are sets of guidelines and best practices that organizations must follow
- AWS compliance reports can be accessed on-demand from AWS Artifact
- The AWS Compliance Center is a central location to research cloud-related regulatory requirements and how they impact your industry.
- Audit manager continuously collects data to prepare for audits and ensures that you are achieving compliance with regulatory standards
- AWS config monitors the configuration state of Aws resources over time

AWS Shared Responsibility Model

On-Premises	IaaS	PaaS	SaaS
Application	Application	Application	Application
Data	Data	Data	Data
Runtime	Runtime	Runtime	Runtime
Middleware	Middleware	Middleware	Middleware
OS	OS	OS	OS
Virtualization	Virtualization	Virtualization	Virtualization
Servers	Servers	Servers	Servers
Storage	Storage	Storage	Storage
Network	Network	Network	Network

Identity Access Management (IAM) Users, Groups, Roles



Identity Access Management Users, Groups, Roles - Summary

- Root user has unlimited access and no restrictions
- IAM is responsible for managing access to AWS resources
- An IAM user represents a person or application that needs access to AWS or a subset of services
- Policies are documents that either grant or deny access to specific AWS services/resources

Identity Access Management Users, Groups, Roles - Summary

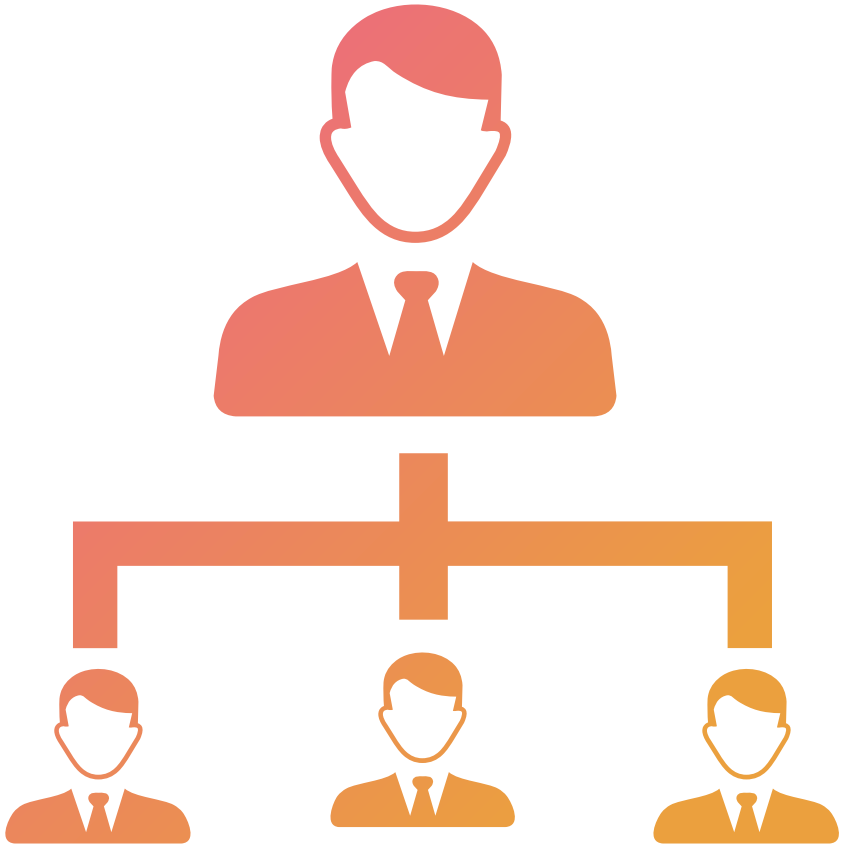
- Groups are a collection of IAM users
- Roles allow a user to get temporary access to a service or resource
- Least-privilege permissions – Grant users or entities the minimum level of access required to perform their specific tasks, reducing the risk of unauthorized actions or potential security breaches

Policy

Terminal

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "SecondStatement",
      "Effect": "Allow",
      "Action": "ec2:*",
      "Resource": "*"
    },
    {
      "Sid": "ThirdStatement",
      "Effect": "Allow",
      "Action": [
        "s3:List*",
        "s3:Get*"
      ],
      "Resource": [
        "arn:AWS:s3:::bucket1",
        "arn:AWS:s3:::bucket1/*"
      ]
    }
  ]
}
```


AWS Organizations



AWS Organizations - Summary

- Organizations help manage multiple AWS accounts
- Organizational units (OUs) allow you to group accounts with similar business or security requirements
- Service Control Policies (SCPs) restrict what an account can do
- SCPs can be applied to individual accounts or OUs

Security Resources

Security Resources - Prevention - Summary

- WAF prevents applications from common attacks like SQL injection and XSS attack
- Shield prevents apps and services from DDoS attacks
- Network Firewalls monitor traffic entering and leaving VPCs

Security Resources – Detection - Summary

- GuardDuty monitors and detects suspicious activity and potential threats in your AWS environment
- Detective helps analyze and investigate security-related events by collecting and visualizing data
- CloudTrail logs and monitors all user and API activity within an AWS account
- AWS Config tracks and audits the configuration of AWS resources over time
- Security Hub automates security checks and brings alerts to a central location. Also performs validation on AWS best practices
- Security Lake collects logs from a variety of locations and transforms them into a query-efficient format
- AWS Macie scans S3 buckets for sensitive data and notifies users of findings

Security Resources – Management - Summary

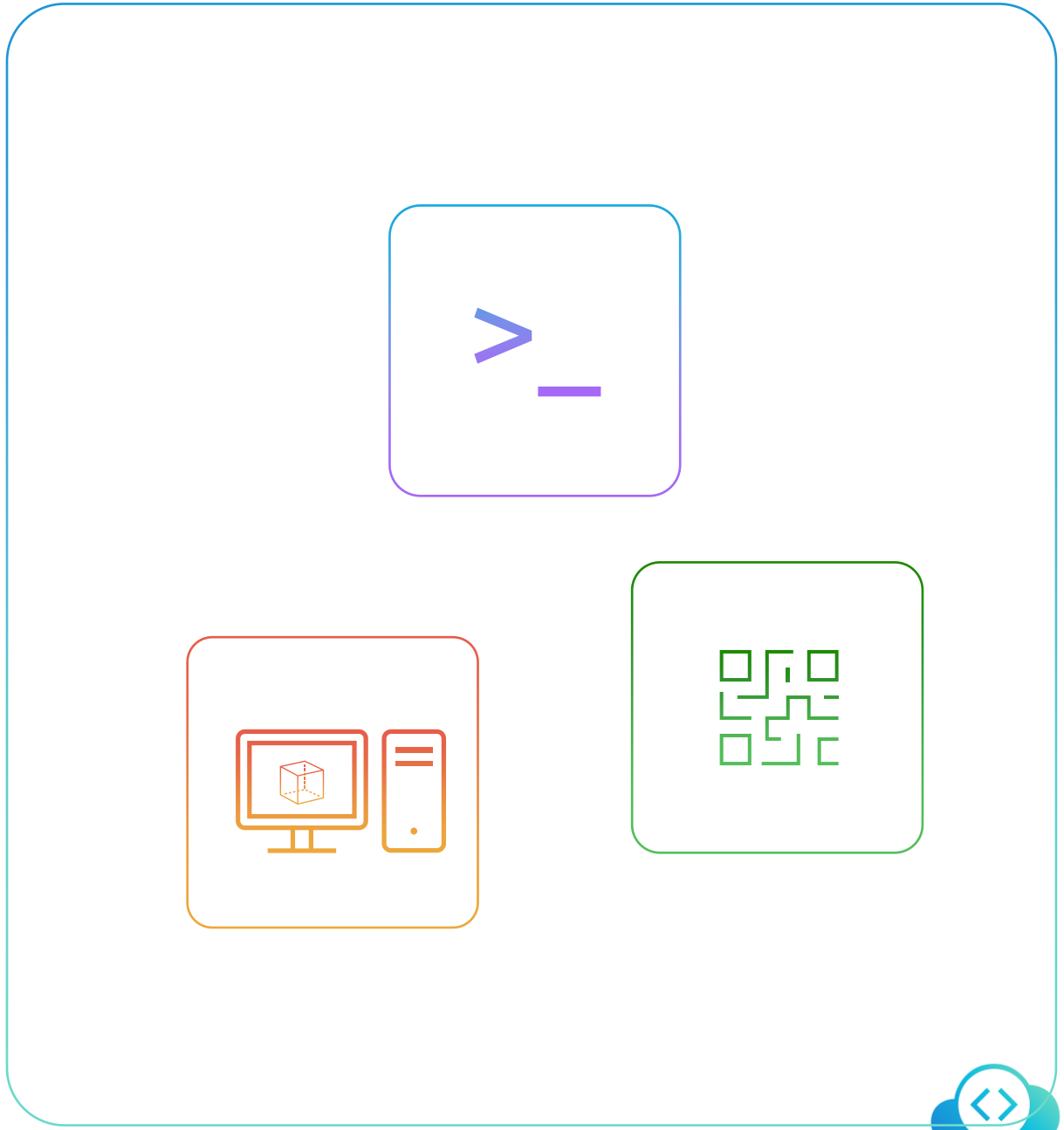
- Firewall Manager helps manage security configurations across multiple AWS accounts
- Resource Access Manager helps you securely share resources across accounts, organizations, and organizational units
- Cognito provides authentication (with social logins), authorization, and user management for web and mobile applications
- IAM enables you to manage user identities and their access to AWS resources
- Identity Center provides a central location for managing user authentication across multiple AWS accounts
- Secrets Manager allows you to securely store and manage sensitive information like passwords and credentials

Security Resources – Management - Summary

- AWS Certificate Manager (ACM) provisions, manages, and deploys SSL/TLS certificates for AWS resources
- Private Certificate Authority manages your own private certificate authority within AWS
- Key Management Service (KMS) creates and manages encryption keys used to encrypt data
- Hardware Security Module (HSM) – AWS provides a dedicated hardware to store and operate cryptographic keys

Summary on Technology

Deployment Methods



Deployment Methods - Summary

- [x] Console
- [x] CLI
- [x] SDK

Global infrastructure

Global Infrastructure - Summary

- Regions are locations to which certain services can be deployed
- Not all services are available in all Regions
- Availability Zones (AZ) are isolated and independent datacenters inside Regions
- Edge locations are smaller Points of Presence where services are run closer to customers
- Local Zones are extensions of AWS regions located near users in select metropolitan areas

Networking

Networking - Summary

- VPC isolates computing resources from other computing resources available in the cloud
- VPCs are isolated to a region
- VPC CIDR block defines the ip addresses a VPC can use
- Subnets are a range of ip addresses within a VPC
- Subnets reside within a single Availability Zone

Networking - Summary

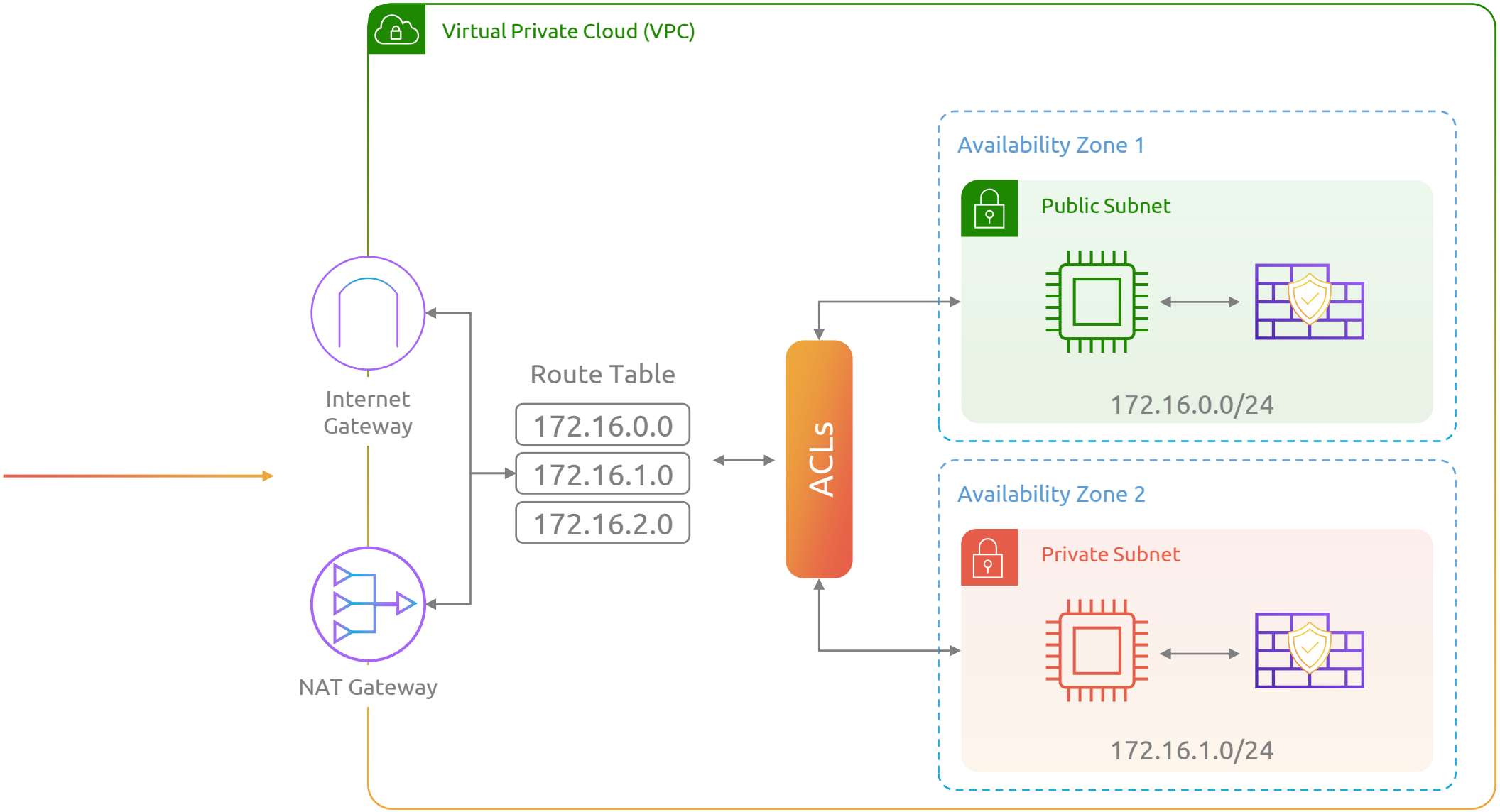
- Subnets can be made public/private using Internet Gateways & Nat Gateways
- Internet Gateways allow subnets to communicate with internet & vice versa
- NAT Gateways allow subnets to talk to the internet but connections must be initiated from within the VPC
- Virtual Private Gateway enable secure access to private resources over the internet
- Direct Connect(DX) is a direct connection into an aws regions that provide low latency + high speeds

Default VPC - Summary

- Every region has a Default VPC with default subnets, Security Groups, and NACLs
- The CIDR block for the Default is 172.31.0.0/16
- The Default VPC and its subnets have outbound access to the Internet by default.
- One default subnet in each Availability Zone
- The Security Groups allow outbound and the NACLs are open in both inbound and outbound directions.

Firewalls - Summary

- Stateless firewalls require traffic to be explicitly permitted inbound & outbound
- Stateful firewalls are intelligent firewalls that track requests and allow response
- Network ACLs filter traffic entering & leaving a subnet
- Network ACLs are stateless firewalls
- Security Groups act as firewalls for individual resources such as EC2, NICs, and other network objects
- Security Groups are stateful firewalls



Storage

Block Storage - Summary

- A collection of blocks can be presented to the OS as a volume
- EBS Volumes can be mounted & booted
- EBS Volumes are within an Availability Zone
- Instance Stores are removed when EC2 instances are stopped/started

File Storage - Summary

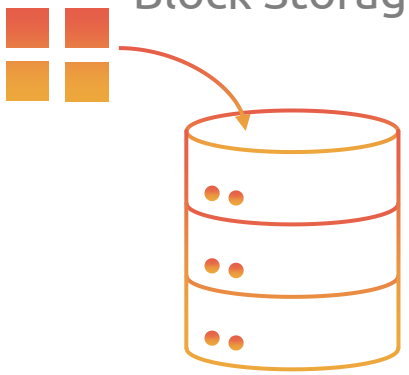
- File Storage services like EFS store data in a hierarchical structure of files and folders
- It is accessible over the network
- EFS can be mounted as a file system inside an OS
- It cannot be used as a boot volume(can’t install OS)

Object Storage - Summary

- Objects are just files
- Flat file structure (no folders); but they look like folders
- Great for storing media files, logs, audit reports or basically any file you want.
- API storage so it cannot be and should not be mounted or boot.
- Storage classes impact accessibility, resiliency, and cost

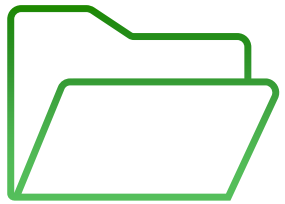
Types of Storage

Block Storage



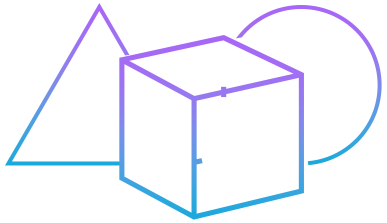
Amazon Elastic Block Store
(Amazon EBS)

File Storage



Amazon Elastic File System
(Amazon EFS)

Object Storage



Amazon Simple Storage
Service (Amazon S3)

Compute

Elastic Compute Cloud (EC2) - Summary

- EC2 allows you to provision a server in AWS within minutes
- AMIs are templates for deploying EC2 instances
- AWS has a variety of instance types to support all your computing needs(Memory, Compute, Storage optimized)
- AWS supports a wide variety of Operating Systems from RHEL, SUSE, Ubuntu, Amazon Linux and Windows
- AWS also offers a variety of processors from ARM to AMD to Intel.
- AWS marketplace has thousands of AMIs that offer a variety of prebuilt services(NGINX, Palo Alto Firewall, MongoDB)

Elastic Compute Cloud (EC2) - Summary

- OnDemand Pricing – Pay for what you use, only billed when instance is running
- Spot Pricing – discounted rates when Amazon has spare capacity
- Workloads on Spot Pricing need to tolerate interruptions
- Reserved Pricing – Discounted rates when reserved for long periods of time(1-3 years)
- Dedicated Host – Reserves an entire host(physical server) for you.
- Dedicated instance – Only your instances run on a server, but that server can change if instances are stopped/started

Lambda - Summary

- AWS Lambda is a compute service that lets you run code without having to provision or manage servers
- AWS manages the server maintenance, scaling, capacity provisioning, and logging
- Use cases include file processing, mobile and web backend
- Autoscales to handle spike in traffic
- Pay per invocation, only pay for what you use

Containers – Summary

- Containers are a tool that allows you to package an application and all of the necessary files, libraries, and dependencies the application needs to run
- Container orchestrators deploy, manage, and scale containerized applications
- ECS is simple managed container orchestrator provided by AWS
- Kubernetes is an open source container orchestrator
- EKS is a managed Kubernetes service – where AWS manages the control plane for you

Database

Self-Hosted Database Service

- Self-Managed is an option if you need management and control
- RDS and Redshift are the primary SQL database systems
- RDS has five engines is supports: Oracle, MySQL, MariaDB, MS SQL, and PostgreSQL
- DynamoDB, DocumentDB, and others are NoSQL services that are fully managed.
- Make sure you look at the last slide for use cases for each service.

SQL Database Services

- RDS is the RDBMS SQL database service in AWS
- Aurora is a sub-service of RDS that supports PostgreSQL and MySQL cloud-natively
- Aurora Serverless v2 is an Aurora variation, but without any VM management + Autoscaling
- All of the RDS services feature encryption, replication, some type of scaling, and more
- RedShift is unlike the others in that is it for reporting (OLAP)
- Redshift has a serverless version and can handle Petabytes of data.

NoSQL Database Services

- Most of the AWS NoSQL collection is based on Open Source Products
- DynamoDB is the primary NoSQL service and has a ton of features
- Remember that AWS has several NoSQL options that fit different use cases like Search, Security, and more
- DynamoDB, DocumentDB, and others are NoSQL services that are fully managed.
- Review the use cases slide to ensure you know the general use of each service.

Another way to think about the database

My Applications

What Kind of data does my application need?

Structured Relational Transactions

Amazon (RDS)

Amazon Aurora

Structured Relational Reporting

Amazon Redshift

Unstructured Fast Data Blobs

Amazon DynamoDB

Semi-structured Fast Data

Amazon Keyspaces (for Apache Cassandra)

Semi-structured Fast Timestamped data

Amazon Timestream

Caching

Amazon ElastiCache

Amazon MemoryDB for Redis

Search

Amazon OpenSearch Service

Relationships of the Data

Amazon Neptune

Collections of Documents

Amazon DocumentDB (with MongoDB compatibility)

Very Secure Transactions

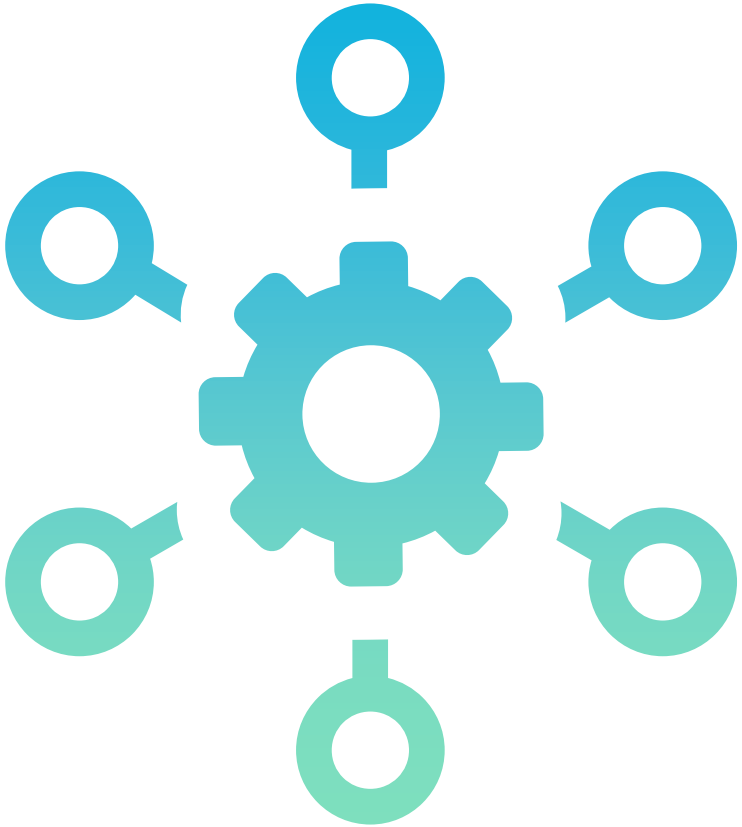
Amazon Quantum Ledger Database (Amazon QLDB)

Application Integration

Application Integration

- Simple Notification Service is to duplicating multiple messages to many different sources like email, text, other applications, etc.
- Simple Queue system is built to receive messages and hold them for processing
- Elastic Load Balancing distributes network connections over a pool of applications
- Autoscaling handles add and removing capacity whether servers or read/write units
- A variety of other services will be covered in the practice exams.

Management Services



Management – Summary

- Many Management Services used to manage AWS services
- CloudFormation and OpsWorks are used to create AWS service objects, while Systems Manager is configuration
- Organizations and Control Tower are all about multi-account management and setup
- AWS Config and AWS CloudTrail are configuration tracking and API tracking
- There are other Management services, but these are the main ones.

Migration Services

Migration Services – Summary

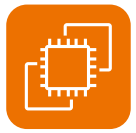
- Migration starts with a good plan; remember the Cloud Adoption Framework
- Migration Hub allows you to centralize your migration tools and plans on AWS
- Data transfer happens with the Snowcone, Snowball (edge), or SnowMobile
- AWS supports FTPS, SFTP, FTP, and AS2 for transfer as well
- Application discovery is used for scanning inventory of migratable servers/apps
- Application/Database/Data Center all have Migration services available on AWS
- Mainframe Modernization is a service/framework for engineering Mainframe migration

Summary on Billing

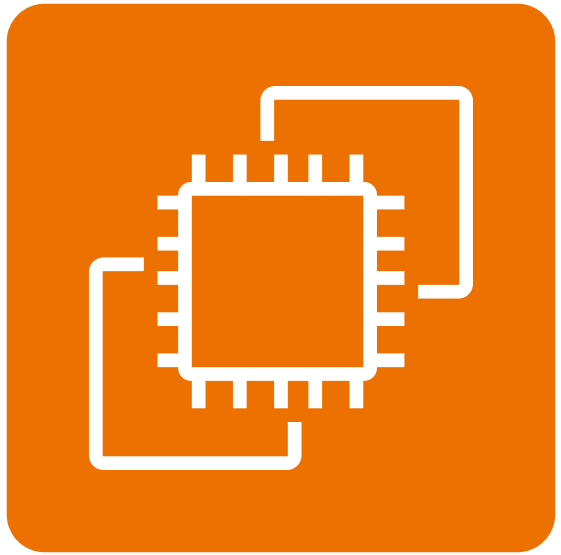
General Billing

General Billing - Summary

- Most services charge based on usage and capacity (always over time)
- Compute, Storage, and Requests/Network are the common dimensions
- Understand billing to optimize you spend
- Scale up and down as needed
- Use the appropriate billing model for your workload
- Use the Free tier when you can if learning



EC2 Billing



EC2 Billing - Summary

- With EC2, you only pay when the machine is running
- Compute, Storage, Requests/Network are the common dimensions even with EC2
- Five models - On-demand, Reserved, Spot, Dedicated, and Savings Plans
- The Fifth Model - Dedicated to both instance and host
- Sizing is the biggest dimension
- Enabling Features or Service Integrations can increase costs

RDS Billing

RDS Billing - Summary

- Which RDS service are you running - Aurora, “main” RDS, or Aurora Serverless?
- What Database engine are you using?
- What Size of DB engine are you using - DB.t3.large, DB.t3.xlarge, or others?
- How big and how fast are the disks?
- Are you using On-demand RDS/ you get Reservations for your RDS instances?
- Did you enable other features like Multi-AZ (failover) or long back-up retention?

VPC Billing

VPC Billing - Summary

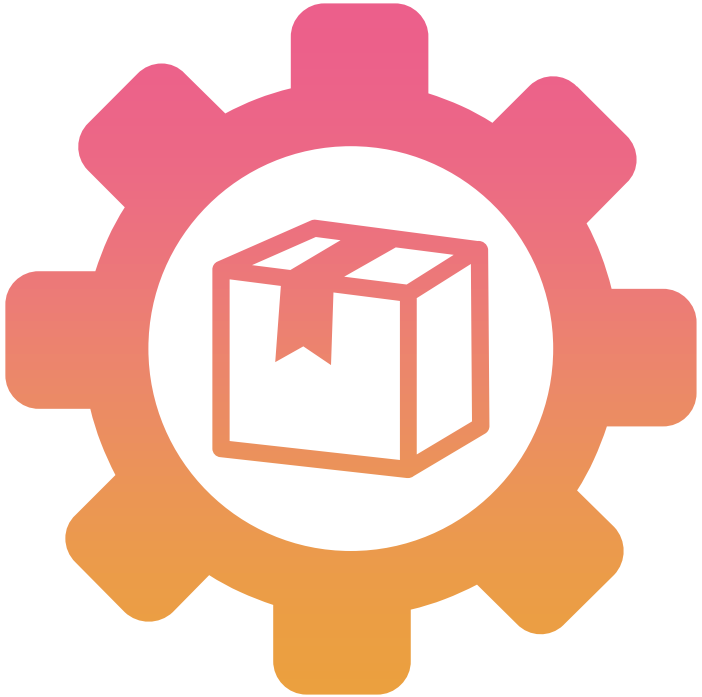
- VPC components are mostly free
- Data, particularly outbound data = Not free
- Same region, same AZ, with private IP = Free
- Different region or AZ or public IP = Paid
- Add-on components add extra cost, particularly when data is run through them
- AWS does not test on specific numbers but does only general comparisons

Lambda Billing

Lambda Billing - Summary

- Lambda pricing is based on size, duration, and frequency
- The more often you run it, the more you pay (frequency)
- The larger the memory and the longer it runs, the more you pay
- Lambda functions have a maximum memory limit up to 10 GB and/or execution time up to 15 minutes
- Additional features can be added but not required for Cloud Practitioner level
- AWS does not test on specific numbers and does only general comparisons. Did we say this already?

Billing - Other Services



Other Services and their Billing - Summary

- Not required to know the specifics of billing for every service
- EBS charges based on type, size, and storage duration of virtual hard drive
- S3 charges based on number of objects, number of requests, storage class, and outbound pull
- DynamoDB charges based on table type, number of data, and read/write capacity units
- CloudFront charges based on data pulled/actions against “cached” objects
- Kinesis charges like DDB/Macie charges based on data scanned (number of objects)

Billing Account Structure

Account Structures on Billing - Summary

- Solo AWS accounts have their own bills, details, and savings
- Two/More accounts can designate a payer account with Consolidated Billing
- Biller account ready if it is part of an AWS Organization
- Control Tower is a practiced way to deploy a multi-account “Meta” account
- All three Consolidated Billing options allow for billing by account

Tools for Billing

Tools for Billing - Summary

- Billing, Cost Explorer, and CUR are tools for Billing Analysis
- AWS Budgets is focused on soft and hard limits and notifications for billing
- The “bill” or billing dashboard is great for skimming
- Cost Explorer is more about visualization of billing data
- CUR is the most detailed in terms of usage report
- Modify AWS Budgets to “restrict” service launch and send notifications based on thresholds/alarms

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