AWS CCP Training 2020 (YT) Notes

ORIGINAL SOURCE - Credit Andrew Brown

What is Cloud Computing

- Cloud Computing - the practice of using a network of remote servers hosted on the internet to store, manage, and process data, rather than on a local server or personal computer
    - Traditional Approach (On-premise)
        - You own the servers
        - You hire the IT people
        - You pay or rent the real-estate
        - You take all of the risk
    - Cloud Providers
        - Someone else owns the servers
        - Someone else hires the IT people
        - Someone else pays or rents the real-estate
        - You are responsible for configured cloud services and code, and someone else takes care of the rest

- 6 Advantages of Cloud Computing
    - Trade capital expense for variable expense
        - No upfront cost
            - Instead of paying for data centers and servers
        - Pay on-demand
            - Pay only when you consume computing resources
    - Benefit from massive economies of scale
        - Usage from hundreds of thousands of customers aggregated in the cloud
        - You are **sharing the cost** with other customers to save money
    - Stop Guessing Capacity
        - Eliminate guesswork about infrastructure capacity needs
        - Instead of paying for idle or under-utilized servers, scale up and down to meet requirements
    - Increase Speed and Agility
        - Launch resources within a few clicks in minutes instead of days or weeks on site
    - Stop spending money on running and maintaining data centers
        - Focus on your own customers, rather than racking, stacking, and powering servers
    - Go global in minutes
        - Deploy your app in **multiple regions around the world** immediately
        - Provide lower latency and a better experience for your customers at minimal cost

Types of Cloud Computing

- SaaS - a complete product that is run and managed by the service provider (Salesforce, Gmail, Office 365)
  - You don't have to worry about how to the service is maintained, it just works and remains available
- PaaS (Platform as a Service) - Removes the need to manage the underlying infrastructure and allows you to focus on deployment and managing your applications
  - Don't worry about provisioning, configuring, or understanding the hardware or OS
  - Heroku, AWS Elastic Beanstalk, Engines for Google
- IaaS (Infrastructure as a Service) - the basic building blocks for cloud IT. Provides access to networking features, computers, and data storage space
  - Don't worry about IT staff, data centers, or hardware

Cloud Computing Deployment Models

- Cloud - fully utilizing cloud computing
  - Squarespace, Basecamp, Dropbox
  - Good for startups, SaaS offerings, new projects and companies
- Hybrid - using both Cloud and On-Premise
  - Good for banks, Fintech, Large Professional Service providers, Legacy on-premise (sensitive data)
- On-Premise - deploying resources on-premises, using virtualization and resource management tools, sometimes called "private cloud"
  - Good for public sector (government), sensitive data (hospitals), large enterprises with heavy regulation (insurance companies)

AWS Global Infrastructure

- 69 Availability Zones (with way more Edge locations than AZs)
  - AZs are one or more discrete data centers
- 22 Geographic Regions
  - Regions are a physical location in the world with multiple AZs
- Serves over a million active customers in more than 190 countries
- AWS is expanding global infrastructure to help customers achieve lower latency and higher **throughput**
- **Edge Location** is a datacenter owned by a trusted AWS partner

Regions

- A **geographically distinct** location with multiple AZs (data centers)
  - Every region is **physically isolated** from and independent of every other region in terms of location, power, and water supply

- Each region has **at least 2** AZs
- New services almost always become available in the US-EAST first
- Not all services are available in all regions
- US-EAST-1 is the region where you see all of the billing information
- Most companies have to operate in at least 3 AZs
    - Amazon is working on this

AZs

- An AZ is a datacenter owned and operated by AWS
- Each region has at least 2 AZs
- AZs are represented by a Region Code, followed by a letter identifier
    - Ex. us-east-1a
- Multi-AZ Distributing spreads your instances across multiple AZs, and allows failover configuration for handling requests when one instance goes down
- **There is less than 10ms latency between AZs**

Edge Locations (EL)

- Used for getting or uploading data fast to AWS
- EL is a datacenter owned by a trusted partner of AWS and has a **direct connection** to the AWS network
- These locations serve requests for **CloudFront** and **Route53**
    - Requests going to either of these services will be routed to the nearest EL automatically
- **S3 Transfer Acceleratio**n traffic and **API Gateway** endpoint traffic also use the AWS Edge Network
- ELs allow for low latency, no matter where the end user is geographically located

GovCloud Regions (GCR)

- AWS GovCloud Regions allow customers to host sensitive Controlled Unclassified Information and other types of regulated workloads
- GCRs are only operated by employees who are US citizens on US soil
- GCRs are **only** accessible to US entities and root account holders who pass a screening process
- Customers can architect secure cloud solutions that comply with
    - FedRAMP High baseline
    - DOJ Criminal Justice Information Systems (CJIS) Security Policy
    - US International Traffic in Arms Regulation (ITAR)
    - Export Administration Regulations (EAR)
    - Department of Defense Cloud Computing Security Requirements Guide

PowerUsers

- Provides full access to AWS services and resources, but does not allow the user to manage other Users and groups

When Creating a New Instance

- Add permissions through IAM Management Console
    - AmazonEC2RoleforSSM
    - Simple Systems Manager (SSM)
- You can STOP an instance to save money (not the same as terminating)

Sessions Manager

- Under SSM in AWS
- Advantage: it logs every time someone creates a session

Amazon Machine Image (AMI)

- Snapshot or copy of the entire server
- In EC2 > Instances, do Actions > Image > Create Image
- Once we have an AMI, we can launch another copy of this server/instance

CloudFront

- Used as a CDN (content distribution network)
- Can share static files across the globe by copying them to multiple edge locations across the world and will be accessible from those ELs
- Traffic will hit the domain name, and then it will route the traffic to the nearest EL

Relational Database Service (RDS)

- Amazon Aurora is one of the most-expensive options
- Has 3 templates
    - Production
    - Dev/Test
    - Free tier
- If you do not specify the initial database name, the db is not created
- Turn backup retention period to 0 days
- Turn off performance insights

Lambda

- Create a function in the preferred language
- With Lambda, you don't have to worry about servers, you just have to run your code
- Has integration with third-party Amazon partners

EC2 Pricing Model

- On-Demand
- Spot
- Reserved
- Dedicated

On-Demand Pricing (LEAST COMMITMENT)

- When you launch an EC2 instance, it is by default using On-Demand
- On-Demand has **no upfront payment and no long-term contract**
- You are charged by the **hour** or by the **minute** (varies based on EC2 Instance Types)
- On-Demand is for applications where the workload is short-term, spikey, or unpredictable
    - When you have a new app for development or you want to run an experiment

(RI) Reserved Instances (BEST LONG-TERM)

- Best long term savings
- Reserved Instances can be shared between multiple accounts within an organization
    - Unused Reserved instances can be sold in the **Reserved Instance Marketplace**
- Designed for applications that have a steady-state, predictable usage, or require reserved capacity
- Reduced pricing is based on **Term x Class Offering x Payment Option**
- **Terms**
    - You commit to a 1 or 3 year contract
        - The longer the contract, the more savings
- **Payment Options (greater upfront, greater savings)**
    - All upfront
    - Partial upfront
    - No upfront
        - Good way to save money
- **Class Offerings**
    - Standard - up to 75% reduced pricing compared to on-demand
        - Cannot change RI Attributes (ex. cannot change the number of instances)
    - Convertible - up to 54% reduced pricing compare to on-demand
        - Allows you to change RI Attributes if greater or equal in value
    - Scheduled - reserve instances for specific time periods, e.g. once a week for a few hours
        - Savings vary

Spot Instances (BIGGEST SAVINGS)

- Designed for applications that have flexible start and end times or applications that are only feasible at very low compute costs
- **AWS Batch is an easy way to use Spot Pricing**
- AWS has unused compute capacity that they want to maximize the utility of for their idle servers
    - Similar to when a hotel offers discounts to fill vacant rooms
- Spot instances provide a **discount of 90%** as compared to On-Demand Pricing
- Spot Instances can be terminated if the computing capacity is needed by on-demand customers

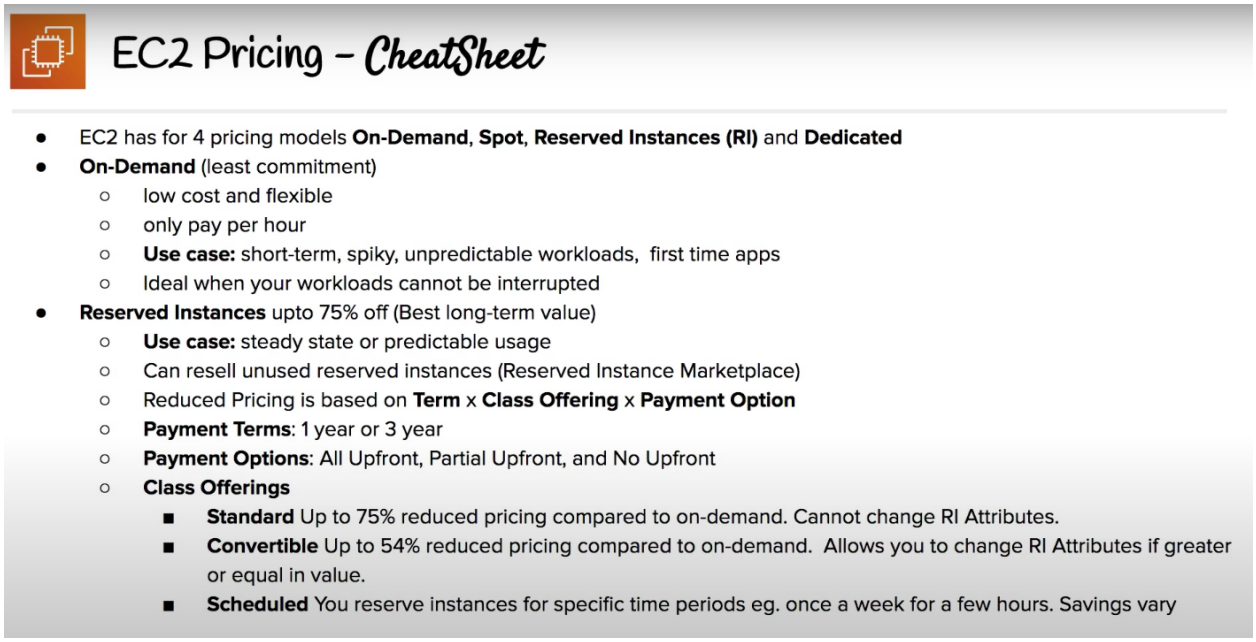
- **Termination Conditions**
    - Instances can be terminated by AWS **at anytime**
    - If your instance is terminated by AWS, **you don't get charged for a partial hour of usage**
    - If **you terminate,** you will still be charged for any hours in which it ran

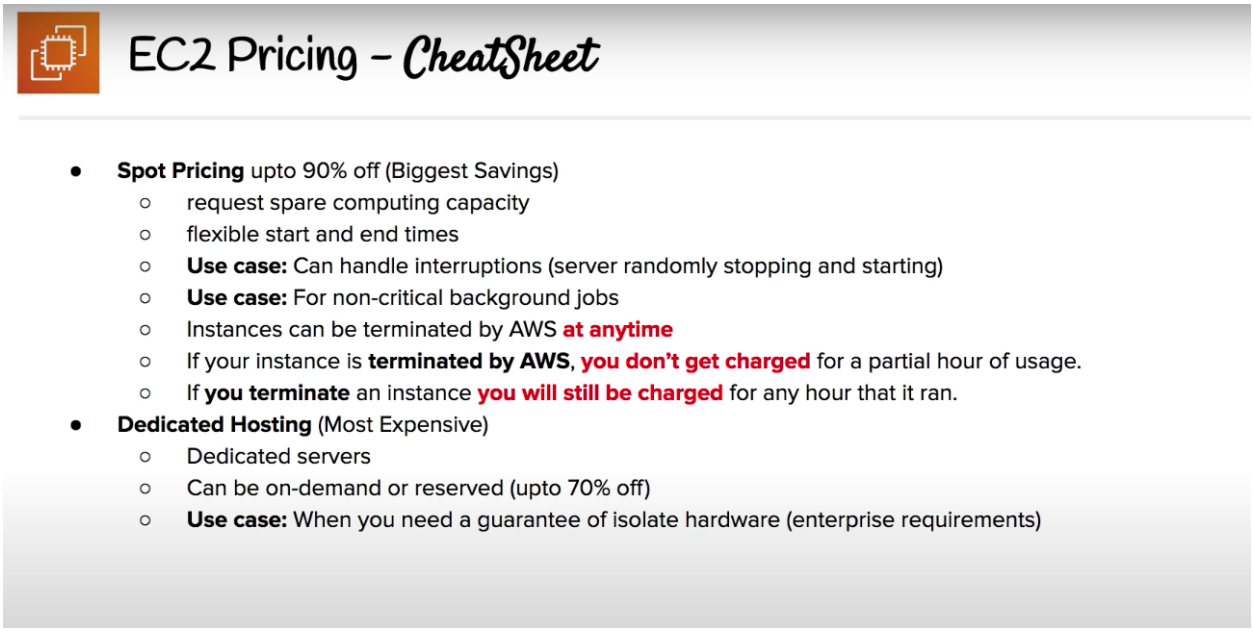
Dedicated Host Instances (MOST EXPENSIVE)

- Designed to meet regulatory requirements when you have strict server-bound licensing that won't support multi-tenancy or cloud deployments
- Offered in both **On-Demand** and **Reserved (70% off On-Demand Pricing)**
- Enterprises and large orgs may have security concerns or obligations about sharing the same hardware with other AWS customers

Multi-Tenant vs Single Tenant

- Multi Tenant
    - When multiple customers are running workloads on the same hardware. **Virtual Isolation** is what separates customers
- Single Tenant
    - When a single customer has dedicated hardware. **Physical Location** is what separates customers





Billing and Pricing - Free Services

- The following services are free, but **can provision AWS services that DO cost money**
    - The resources they setup will cost you
- Examples (in bold are ones to focus on)
    - **IAM**
    - **Amazon VPC**
    - **Auto Scaling**
    - **CloudFormation**
        - The service itself is free, but it can provision other services
    - **Elastic Beanstalk**
    - Opsworks
    - Amplify
    - AppSync
    - CodeStar
    - Organizations and Consolidated Billing
    - AWS Cost Explorer

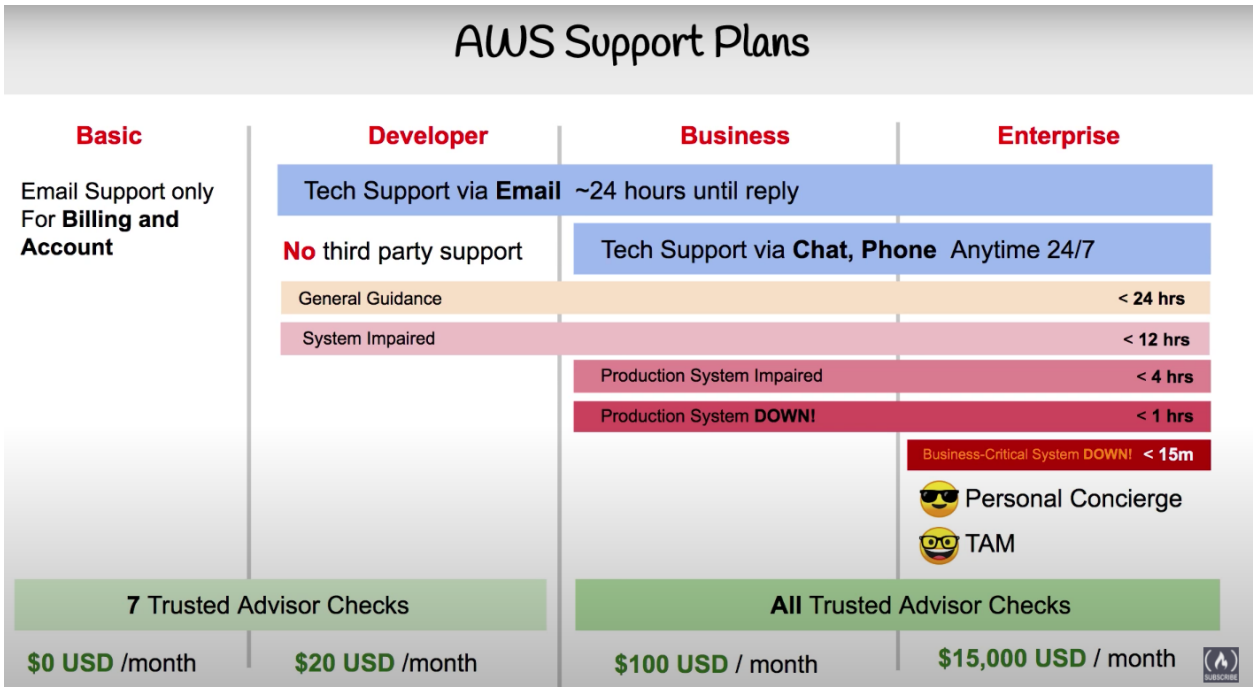
Billing and Pricing - AWS Support Plans

- Four Support Plans
    - Basic (default)
        - Email support only for billing and account management
        - NO third-party support (Express, Django, Node, etc.)
    - Developer
        - $20/month
    - Business
        - $100/month

    - Enterprise
        - $15,000/month
        - Personal Concierge
        - Personal Technical Account Manager (TAM)
        - Respond in less than 15 mins for critical issues
- **Advisor Checks

For Exam

- Know difference in pricing for different tiers
- Know response times
- Know when people are assigned to your account (only in enterprise)
- Know when third-party support is available in each tier (business and enterprise)



Billing and Pricing - AWS Marketplace

- AWS Marketplace is a curated digital catalog with thousands of software listings from independent software vendors
- Easy to find, buy, test, and deploy software that already runs on AWS
- The product can be **free,** or have an **associated charge**
    - The charge is added to the AWS bill, and, once you pay, AWS Marketplace pays the provider
- The sales channel for ISVs (independent software vendors) and Consulting Partners **allows you to sell your solutions** to other AWS customers
- Products can be offered as
    - AMIs

- AWS CloudFormation templates
- SaaS offerings
- Web ACL
- AWS WAF rules

Billing and Pricing - AWS Trusted Advisor

- Advises you on security, **saving money,** performance, service limits, and fault tolerance
- Think of it like an automated checklist of best practices on AWS
- Free Tier gets 7 Trusted Advisor Checks
- Business/Enterpress - All Trusted Advisor Checks

Cost Optimization Advisor Checks

- Idle Load Balancers
  - Will give you feedback on when Load Balancers are not being used (no instances)
- Unassociated Elastic IP Addresses
  - If you have an instance with a static IP, you can reserve an IP through AWS (which costs money)
  - If it is not attached to an EC2 instance, it costs money (because AWS wants to release the IP to be used by other customers potentially

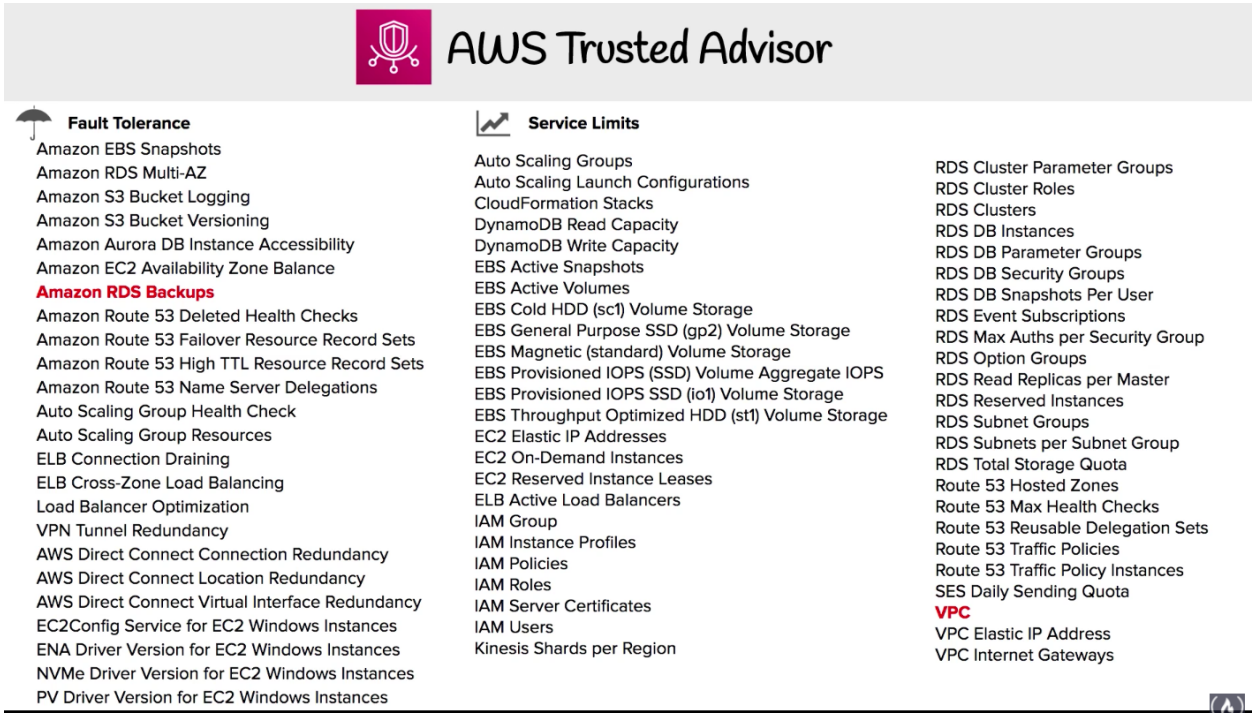
Performance

- High Utilization EC2 Instances

- Advises on upgrading to bigger instances if CPU usage is high to get better performance

Security

- MFA on Root Account
- IAM Access Key Rotation
  - Advises to rotate access keys to keep the instances secure



Fault Tolerance

- Amazon RDS Backups
  - Recommends that you have backups in place or turned on in case db goes down

Service Limits

- If you go beyond the capacity of a service, you will have to ask for a Service Limit Increase
  - Ex. SES Daily Sending Quota for emails
    - If you send more than 5,000 allotted emails per day, you will have to increase the Service Limit

Billing and Pricing - Consolidated Billing

- Allows for **one bill** for all of your accounts
  - AWS treats all accounts in an organization as if they were one account
  - Happens by default for the master account

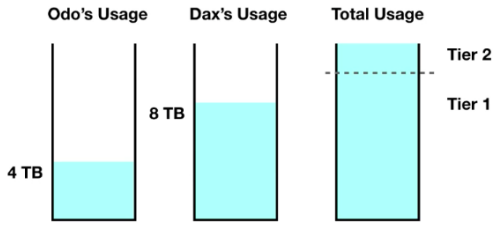
    - You can designate the **Master account** in charge of paying for all member accounts under it
- Offered at no additional cost
- Use **Cost Explorer** to visualize usage for consolidated billing
- *Note: if you have a member account that leaves the organization, the Cost Explorer data will no longer be available

Consolidated Billing Volume Discounts

- The more you use, the more you save
- Consolidated Billing lets you take advantage of Volume Discounts

Consolidated Billing – Volume Discounts

AWS has **Volume Discounts** for many services
The more you use, the more you save.
Consolidated Billing lets you take advantage of Volume Discounts



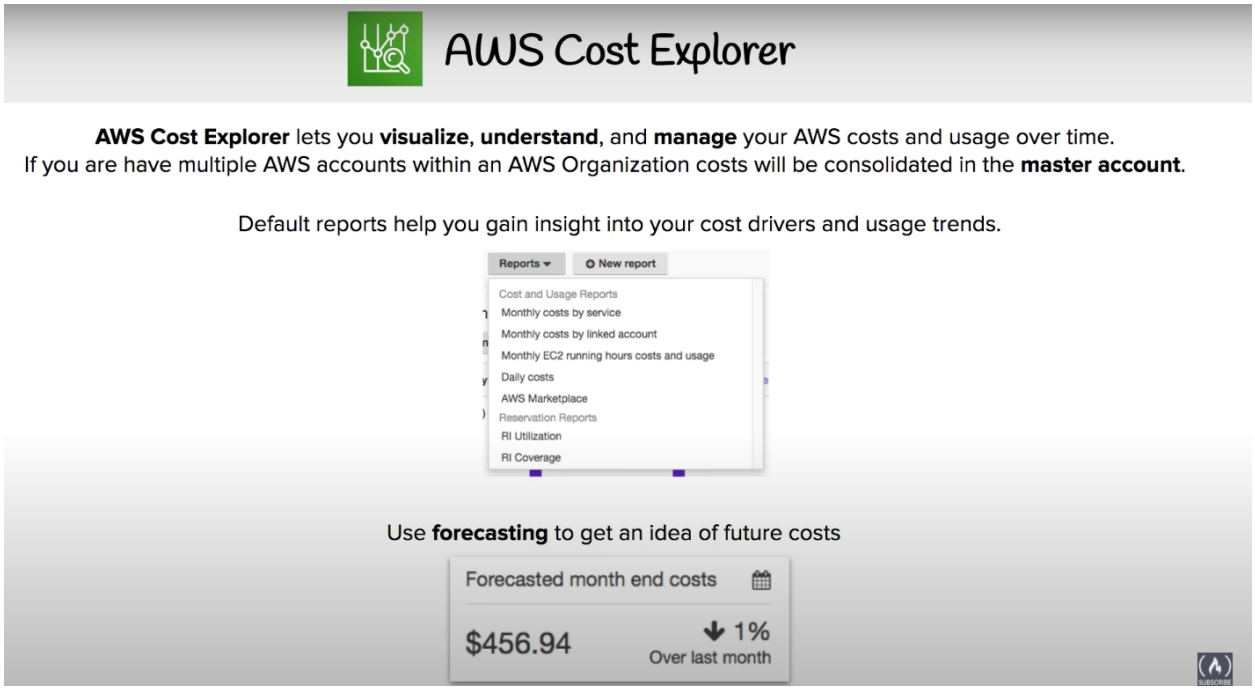
Data Transfer	
First 10 TB	$0.17 per GB
Next 40 TB	$0.13 per GB

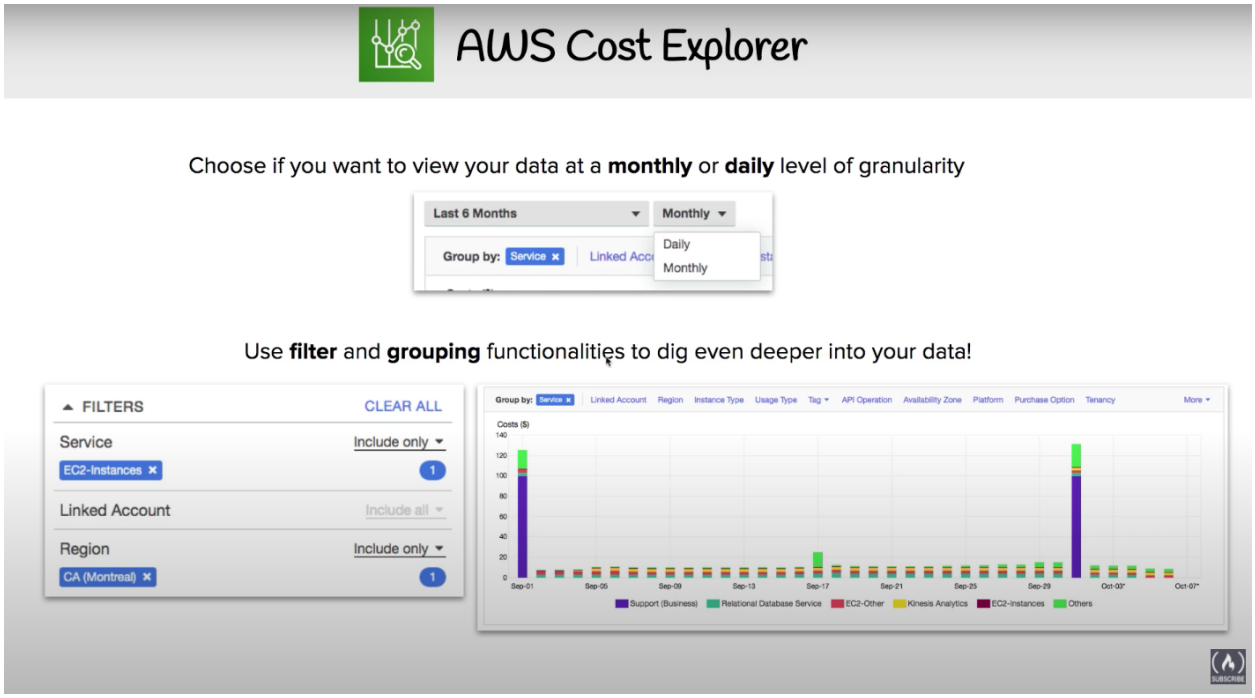
Odo	(4*1024)*0.17	= $696.32
Dax	(8*1024)*0.17	= $1392.64
Unconsolidated	696.32+1392.64	= **$2088.96**
Consolidated	((10*1024)*0.17)+((2*1024)*0.13)	= **$2007.04**

1 TB = 1024 GB

AWS Cost Explorer

- Cost Explorer lets you visualize, understand, and manage your AWS costs and usage over time
- If you have multiple AWS accounts within an AWS Organization, costs will be consolidated in the **master account**
- Default Reports give insight into cost drivers and usage trends
- Use **forecasting** to get an idea of future costs
- You can view data at a **monthly** or **daily level of granularity**
- Use **filter** and **grouping** functionalities to dig even deeper into your data

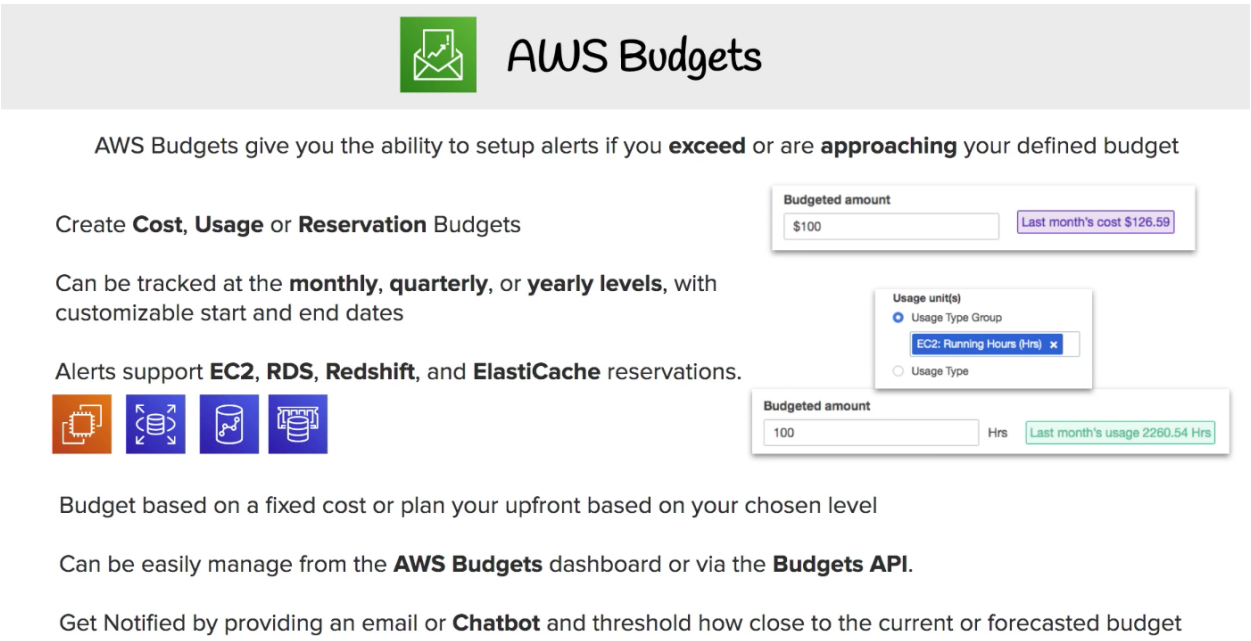




Billing and Pricing - AWS Budgets (Service)

- Plan your service usage, service costs, and Instance reservations
    - Billing alarms on steroids
- First two budgets are FREE
- Each additional budget costs $0.60/month
- Limit of 20,000 budgets

- Create budgets for
    - Cost - dollar amount
    - Usage - e.g. EC2 running hours
    - Reservation - for Reserved Instances
- Tracked **monthly, quarterly, or yearly**, with customizable start and end dates
- Alerts support EC2, RDS, Redshift, and ElastiCache reservations
- Can be managed via the Dashboard or Budgets API
- Get notified of by providing an email or Chatbot, and check how close to the threshold of the current or forecasted budget you are
- Based on fixed cost OR plan on upfront based on your chosen level (tier)



Billing and Pricing - TCO Calculator

- Total Cost of Ownership - allows you to estimate how much you would save when moving from on-premise to AWS
- Provides a detailed set of reports that can be used in **executive presentations**
- Built on underlying calculation models that generate fair assessments of value that you can achieve given the data provided
- Helps to reduce the need to invest in large capital expenditures (datacenters, hard disks, IT staff)
- ONLY FOR APPROXIMATION - not exact
- Three Steps
    - 1. Describe your environment
    - 2. View 3 Year Summary of Cost Comparisons

    - 3. Download a detailed report

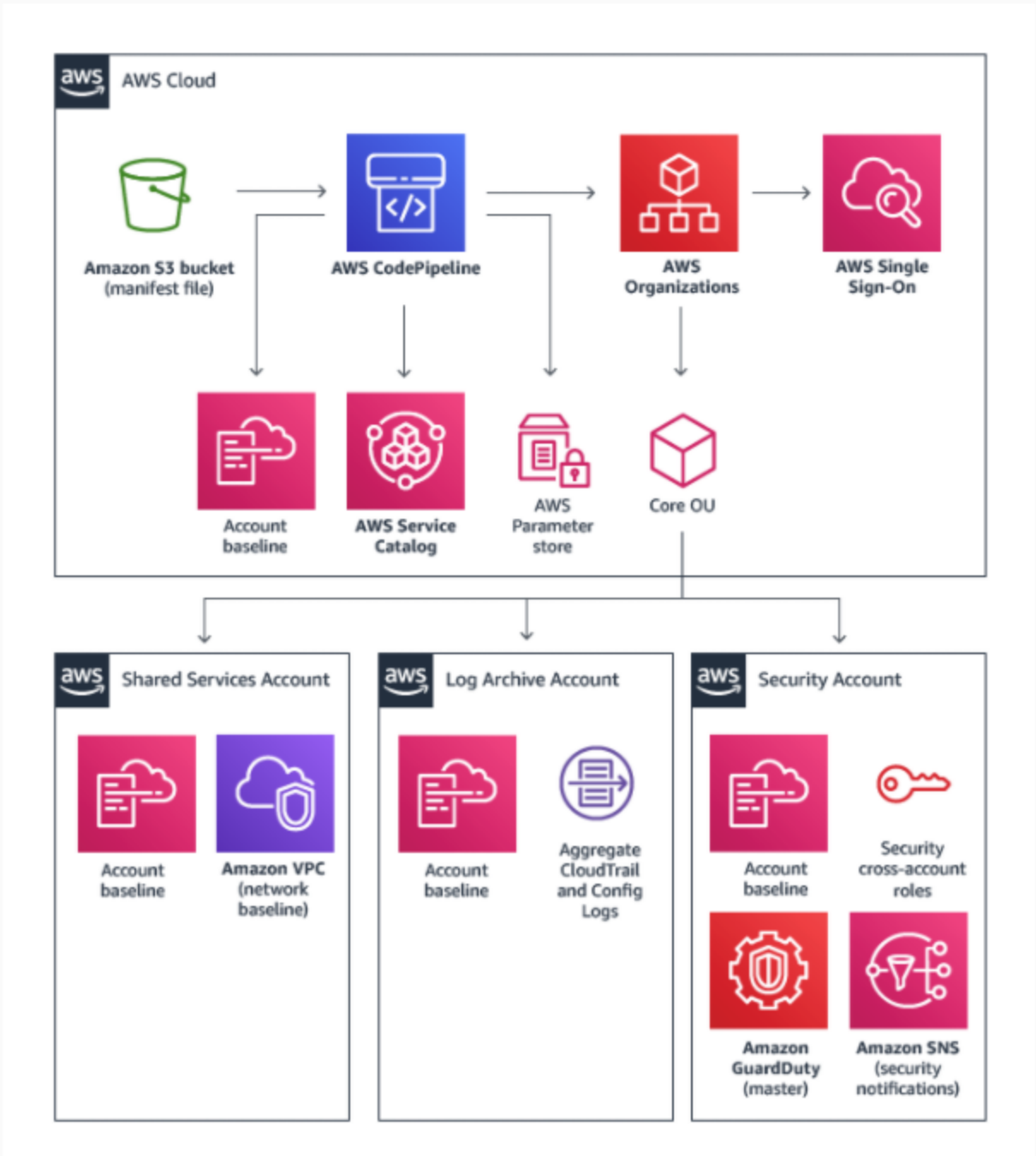
Billing and Pricing AWS Landing Zone - Diagrams

- Helps **enterprises** quickly set up a secure, AWS multi-account
- Provides a **baseline environment** to get started with a **multi-account architecture**
- **AWS Account Vending Machine (AVM)**
    - Automatically provisions and configures new accounts via a Service Catalog Template
    - Uses Single Sign On (SSO) for managing and accessing accounts
        - Single sign-on (SSO) is an authentication scheme that allows a user to log in with a single ID and password to any of several related, yet independent, software systems.
- The environment is customizable to allow customers to implement their own account baselines through a Landing Zone configuration and update pipeline

Notes

- When setting up an AWS Organization account, always have an isolated Log In Account and an isolated Security Account
    - Better for auditing purposes
    - This is done by AWS Landing Zone

The AWS Landing Zone solution includes four accounts, and add-on products that can be deployed using the AWS Service Catalog such as the Centralized Logging solution and AWS Managed AD and Directory Connector for AWS SSO.



Billing and Pricing - Resource Groups and Tagging

- **Tags** - words or phrases that act as metadata for organizing AWS resources
- **Resource Groups** - collections of resources that share one or more **TAGS**

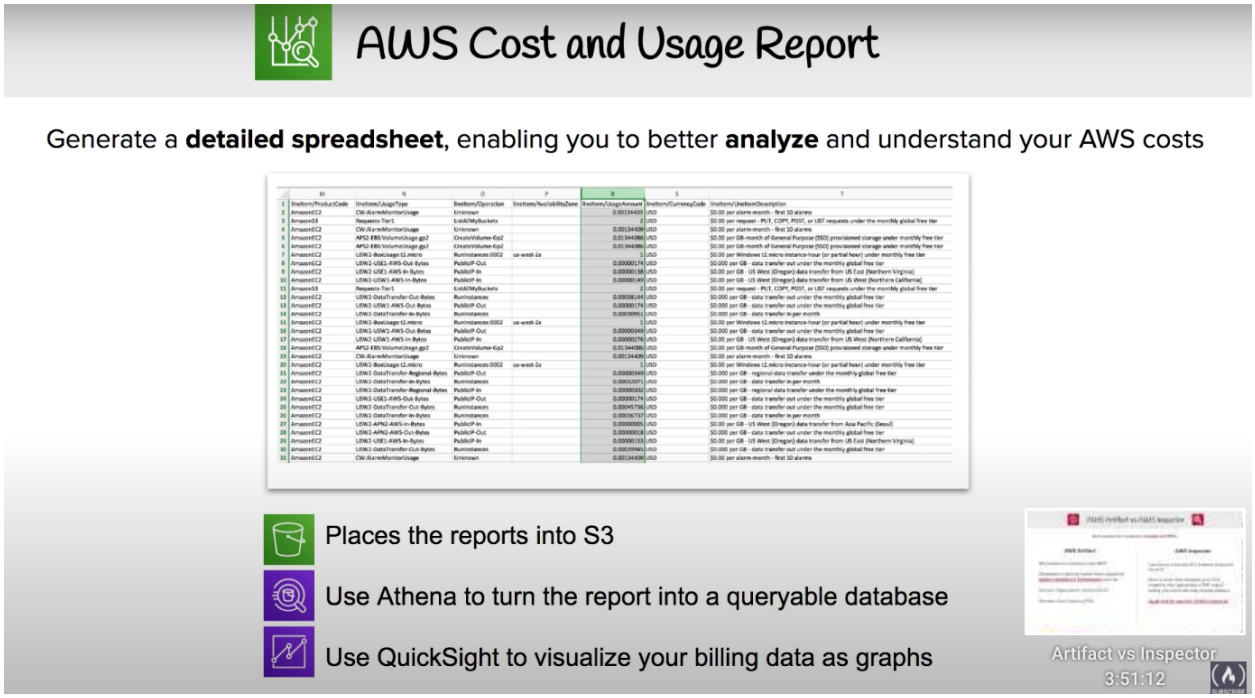
- Helps to organize and consolidate information based on your project and resources that you use
- Resource Groups can display details about a group of resources based on:
    - Metrics
    - Alarms
    - Configuration Settings
- At any time, you can modify the settings of your resource groups to change which resources appear
- Ex. If you have a database, a server, and an S3 Bucket, you would give them the same tag and put them in the same Resource Group

Billing and Pricing - AWS Quick Starts

- **Prebuilt templates** by AWS and AWS Partners that help to **deploy popular stacks** on AWS
    - Reduces hundreds of manual procedures into a few steps
- Composed of 3 Parts
    - A reference architecture for the deployment
    - AWS **CloudFormation** templates that automate and configure the deployment
    - A deployment guide that explains the architecture and implementation in detail
- Most Quick Starts reference deployments enable you to spin up a fully functional architecture in less than an hour

Billing and Pricing - Cost and Usage Report

- Generates a detailed spreadsheet that enables you to better analyze and understand your AWS costs
- Places report into S3 Bucket
- Use **Athena** to turn the report into a queryable database
- Use **QuickSight** to visualize your billing data as graphs



Technology Overview - AWS Organizations and Accounts

- Organizations allow you to centrally manage billing, control access, compliance, security, and share resources across your AWS accounts
- Root Account User is a single, sign-in identity that has complete access to all AWS services and resources in an account.
    - Each account has a root user
- Organization Units are a group of AWS accounts within an organization which can also container other organizational units - creating a hierarchy
- Service Control Policies give central control over the allowed permissions for all accounts in your organization, helping to ensure your accounts stay within your organization's guidelines

Tech Overview - AWS Networking

- Region - the geographical region of your network
- AZ - the data center of your AWS resources
- VPC (Virtual Private Cloud) - a logically isolated section of the AWS Cloud where you can launch AWS resources
- Internet Gateway - enable access to the internet
- Route Tables - determine where network traffic from your subnets is directed
- NACLs (Network Access Control List) - act as firewalls at the subnet level
- Security Groups - act as firewalls at the instance level
- Subnets - a logical partition of an IP network into multiple, smaller network segments
    - Public vs Private Subnets

- Public - accessible to the internet (Ex. EC2 Instance)
- Private - secure, not accessible to the internet (Ex. RDS DB)

AWS Networking

Region the geographical location of your network

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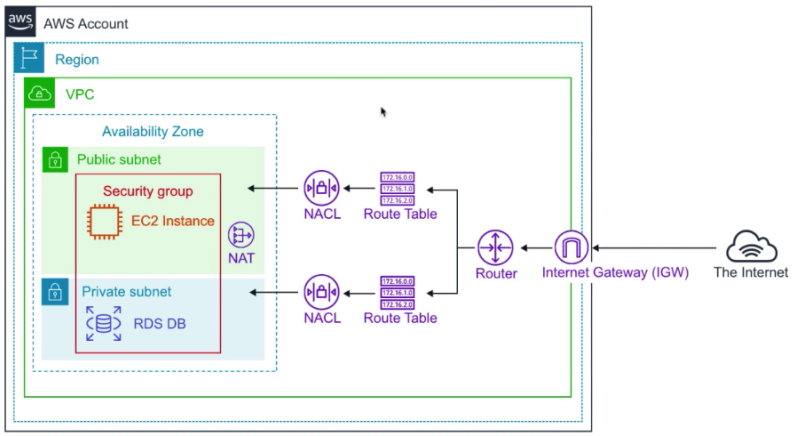

Tech Overview - DB Services

Database Services

DynamoDB - NoSQL **key/value** database

cassandra

DocumentDB - NoSQL **Document** database that is MongoDB compatible

mongoDB

RDS - **Relational** Database Service that supports multiple engines

ENGINES: MySQL, Postgres, Maria DB, Oracle, Microsoft SQL Server, Aurora

MySQL

Aurora MySQL (5x faster) and PSQL (3x faster) database **fully managed**

Aurora Serverless - only runs when you need it, like AWS Lambda

Neptune - Managed **Graph** Database

Redshift - **Columnar** database, **petabyte** warehouse 1000 TB = 1 PB!!!!!

ElastiCache - **Redis** or, **Memcached** database

redis

**Probably just know DynamoDB, RDS, Aurora, Redshift

- When you run Aurora is highly available and durable, and when you have a cluster, it will run 6 copies of the DB across 3 AZs (more expensive than RDS)
- Aurora Serverless - much less expensive than Aurora (need be basis)
    - Good for development or infrequently used apps
- Neptune - Managed **Graph** DB
- Redshift - Columnar DB, petabyte warehouse (1000 TB = 1PB)
    - Instead of reading via rows, it reads via columns
    - Good for working with large amounts of data for reports, analytics
    - Handles PBs of data!!!
- ElastiCache - Redis or Memcached database
    - For caching
- Caching
    - Caching is an area of a computer's memory devoted to temporarily storing recently used information. The content, which includes HTML pages, images, files and Web objects, is stored on the local hard drive in order to make it faster for the user to access it, which helps improve the efficiency of the computer and its overall performance.

Provisioning Services

- Provisioning - the allocation or creation of resources and services to a customer
- Elastic Beanstalk - service for deploying and scaling web apps and services developed with Java, .NET, PHP, Node, Python, Ruby, Go, Docker
    - Similar to Heroku, Netlify
- OpsWorks - configuration management service that provides managed instances of **Chef** and **Puppet**
    - Chef and Puppet programmatically set up a server
        - Chef uses Ruby to define *recipes* to set up servers, dependencies, pull code
    - OpsWorks has **layers for infrastructure**
        - DB layer, network layer, application layer
- CloudFormation - infrastructure as code, JSON or YAML
    - Create a JSON or YAML file that defines all AWS Resources and how you want to configure them, and this will set up everything that you want in one go
    - CloudFormation is the most complex option/most flexible option (more powerful than Opsworks)
- AWS QuickStart - pre-made packages that can launch and configure your AWS compute, network, storage, and other services required to deploy a workload on AWS
- AWS Marketplace - a digital catalogue of **thousands** of software listings from independent software vendors to find, buy, test, and deploy software

Provisioning

What is provisioning?
The allocation or creation of resources and services to a customer


Elastic Beanstalk - service for deploying and scaling web applications and services developed with Java, .NET, PHP, Node.js, Python, Ruby, Go, and Docker


OpsWorks - configuration management service that provides managed instances of **Chef** and **Puppet**.


CloudFormation - infrastructure as code, **JSON** or **YAML**


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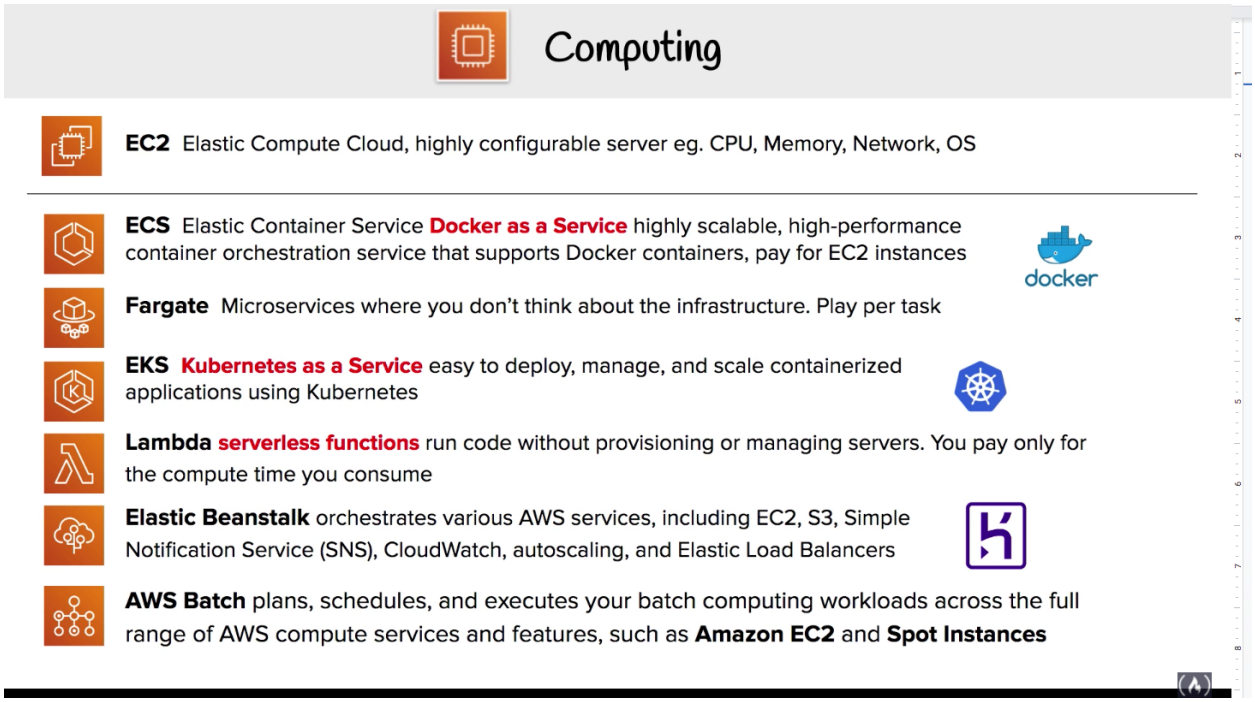
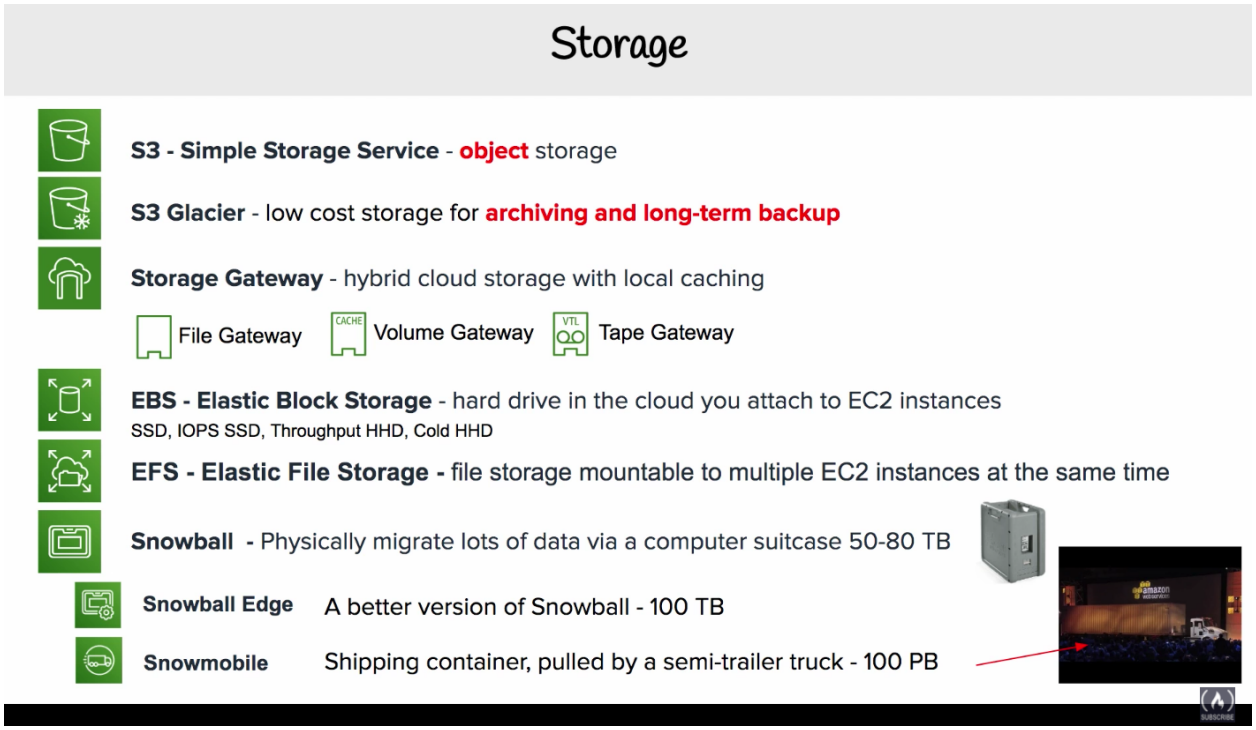
Computing Services

- EC2 (Elastic Compute Cloud) - highly configurable server in terms of CPU, Memory, Network, OS
    - **Every service under the hood is running on EC2 instances**
- ECS (Elastic Container Service) - **Docker as a Service** - highly scalable, high-performance container orchestration service that supports Docker containers, pay for EC2 instances
- Fargate - Microservices with which you don't have to think about infrastructure
    - Pay per task (runtime and CPU utilized when running)
    - You don’t choose EC2 instances, just define containers within a task or service, and AWS will run it
- EKS - Kubernetes as a Service - easy to deploy, manage, and scale containerized applications using Kubernetes
    - Kubernetes is a standard in the industry
- Lambda serverless functions run code without provisioning or managing servers
    - Pay for compute time that you consume (how long it runs)
- Elastic Beanstalk - orchestrates various AWS services, including EC2, S3, Simple Notification Service (SNS), CloudWatch, autoscaling, and Elastic Load Balancers (ELBs)
- AWS Batch - plans, schedules, and executes batch computing workloads across the full range of AWS compute services and features, such as Amazon EC2 and Spot Instances
    - Saves a lot of money $$$



Storage Services



- Storage Gateway - hybrid cloud storage with local caching
    - An extension of on-premise storage in the cloud
- EBS (Elastic Block Storage) - hard drive in the cloud you attach to EC2 instances

    - Different choices include SSD, IOPS SSD, Throughput HHD, Cold HHD
- Snowball - physically migrate lots of data via a computer suitcase 50-80 TB
    -
- Snowball Edge - a better version of Snowball (100TB)
- Snowmobile - shipping container, pulled by a semi-trailer truck (100PB)
    - Actually in a truck!!!!

Business Centric Services

- Amazon Connect
    - Accept inbound calls and dial outbound
    - Record calls and store them in S3 (run analysis through Amazon Comprehend)
    - Set up workflows
- WorkSpaces
    - Virtual, remote desktop
    - Spin up Windows 10 server from AWS
- WorkDocs
    - Sharepoint competitor
- Chime
    - Ex. Slack + Skype
- Workmail
    - Gmail for AWS
- Pinpoint
    - Email marketing
    - Create campaigns
    - Do A/B testing
- SES Simple Email Service
    - Cloud-based email for developers
    - For when you are building an app and want to send out emails FROM that application
    - Supports HTML emails
    - SNS can also send emails, but only plain text
- QuickSight
    - Connect data from S3, Aurora, RDS
        - Creates graph from this data

Business Centric Services

Amazon Connect - **Call Center** - Cloud-based call center service you can setup in just a few clicks - based on the same proven system used by the Amazon customer service teams.

WorkSpaces - **Virtual Remote Desktop** - Secure managed service for provisioning either Windows or Linux desktops in just a few minutes which quickly scales up to thousands of desktops

WorkDocs - A content creation and collaboration service - easily create, edit, and share content saved centrally in AWS. **(the AWS version of Sharepoint)**

Chime - AWS Platform for **online meetings, video conferencing**, and business calling which elastically scales to meet your capacity needs

WorkMail - Managed **business email**, contacts, and calendar service with support for existing desktop and mobile email client applications. (IMAP)

Pinpoint - Marketing campaign management system you can **use for sending targeted email,** SMS, push notifications, and voice messages

SES - Simple Email Service - A cloud-based email sending service designed for marketers and application developers to **send marketing, notification, and emails**

QuickSight - A Business Intelligence (BI) service. Connect multiple datasource and quickly visualize data in the form of graphs with little to no programming knowledge.

Enterprise Integration

- Going Hybrid! (On-premise + Cloud)
- Direct Connect
    - Low latency, dedicated connection
- VPN
- Storage Gateway
    - Ex. extends on-prem hard drives onto AWS
- Active Directory

Enterprise Integration

Going Hybrid!

Direct Connect dedicated Gigabit network connection from your premises to AWS
Imagine having a direct fibre optic cable running straight to AWS

VPN establish a **secure** connection to your AWS network

Site-to-Site VPN - Connecting your on-premise to your AWS network
Client VPN - Connecting a Client (a laptop) to your AWS network

Storage Gateway A hybrid storage service that enables your on-premises applications to use AWS cloud storage. You can use this for backup and archiving, disaster recovery, cloud data processing, storage tiering, and migration.

Active Directory The AWS Directory Service for Microsoft Active Directory also known as AWS Managed Microsoft AD - enables your directory-aware workloads and AWS resources to use managed Active Directory in the AWS Cloud.

Logging Services

- CloudTrail
    - Determines who we should blame for something on AWS (which employee)
    - Detect developer misconfiguration ^
    - Detect malicious actors
    - Automate response (everytime something is created, create a notification)
- CloudWatch
    - CloudWatch Logs****

Logging Services

CloudTrail - logs all **API calls** (SDK, CLI) between **AWS services** (who can we blame)

Who created this bucket?
Who spun up that expensive EC2 instance?
Who launched this SageMaker Notebook?

- Detect developer misconfiguration
- Detect malicious actors
- Automate responses

CloudWatch - is a collection of multiple services

CloudWatch **Logs**	Performance data about AWS Services eg. CPU Utilization, Memory, Network In Application Logs eg. Rails, Nginx Lambda logs
CloudWatch **Metrics**	Represents a time-ordered set of data points. A variable to monitor
CloudWatch **Events**	trigger an event based on a condition eg. ever hour take snapshot of server
CloudWatch **Alarms**	triggers notifications based on metrics
CloudWatch **Dashboard**	create visualizations based on metrics

Quick Guide

Know your Initialisms

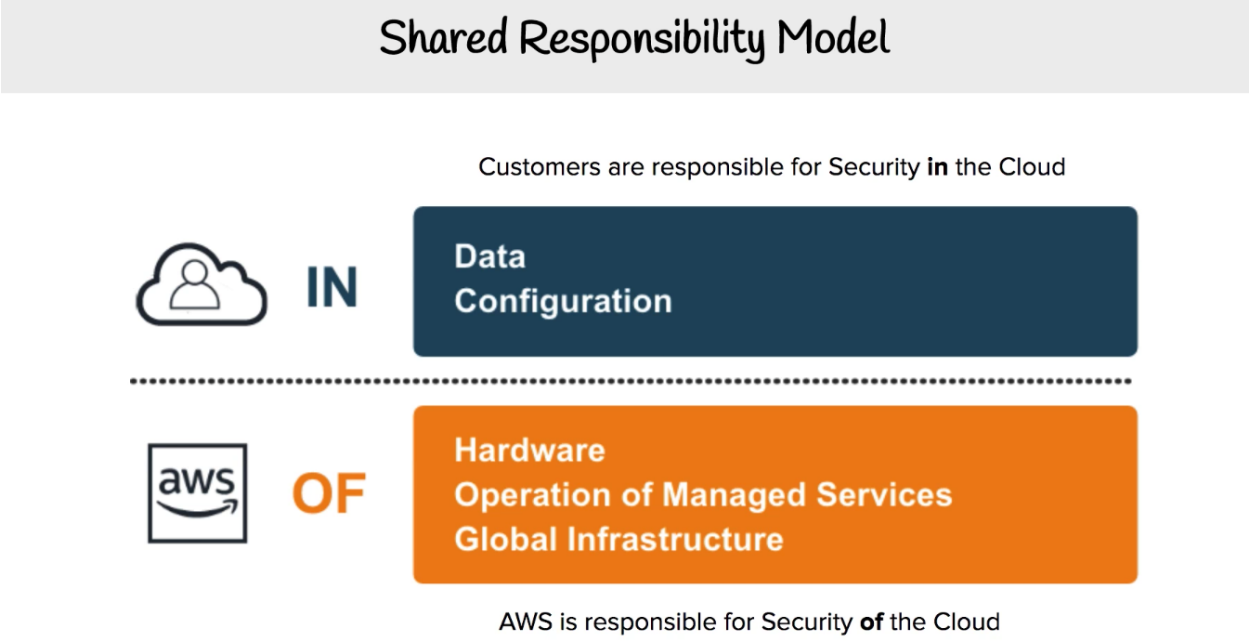
IAM Identity and Access Management
S3 Simple Storage Service
SWF Simple Workflow Service
SNS Simple Notification Service
SQS Simple Queue Service
SES Simple Email Service
SSM Simple Systems Manager
RDS Relational Database Service
VPC Virtual Private Cloud
VPN Virtual Private Network
CFN CloudFormation
WAF Web Application Firewall
MQ Amazon ActiveMQ
ASG Auto Scaling Groups
TAM Technical Account Manager

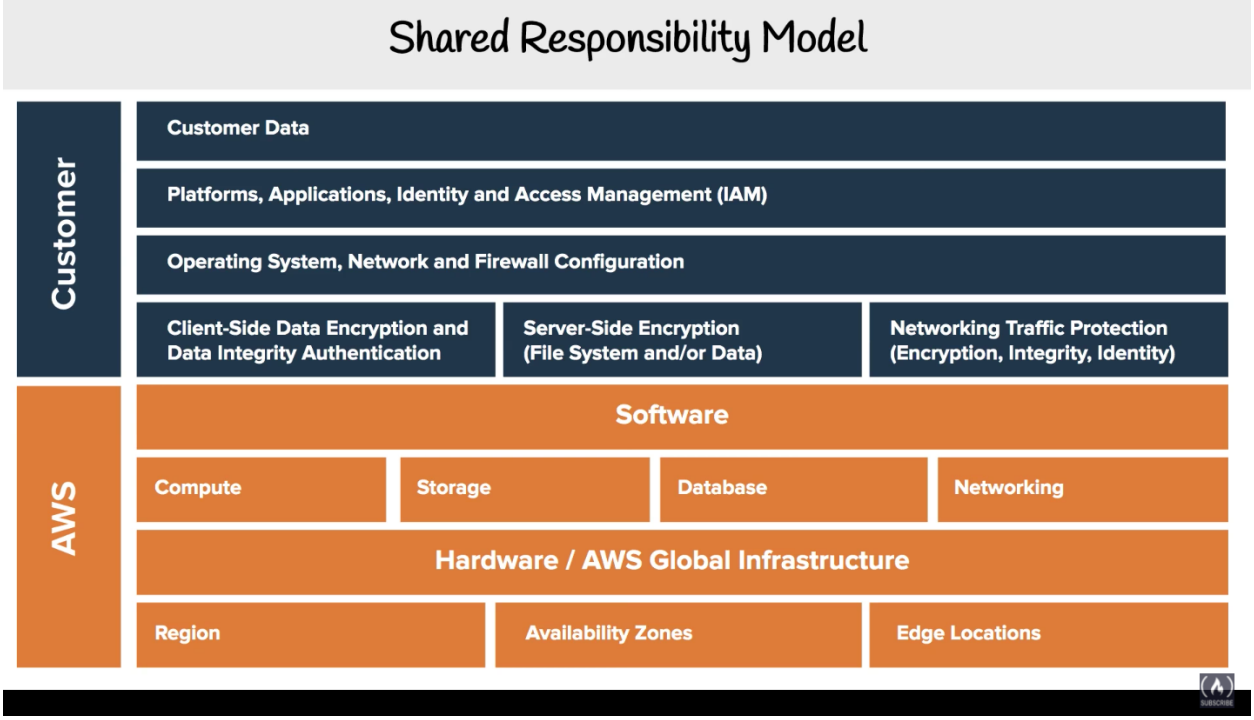
ELB Elastic Load Balancer
ALB Application Load Balancer
NLB Network Load Balancer
EC2 Elastic Cloud Compute
ECS Elastic Container Service
ECR Elastic Container Repository
EBS Elastic Block Storage
EFS Elastic File Storage
EMR Elastic MapReduce
EB Elastic Beanstalk
ES Elasticsearch
EKS Elastic **Kubernetes** Service
MKS Managed **Kafka** Service
IoT Internet of Things
RI Reserved Instances

Shared Responsibility Model

- Customers are responsible for security IN the cloud
    - Any data that you put into AWS
    - If you do not secure it, that is your fault

    - If you do not monitor sensitive data, that is your fault
- AWS is responsible for Security of the CLOUD
- Just know the first model**



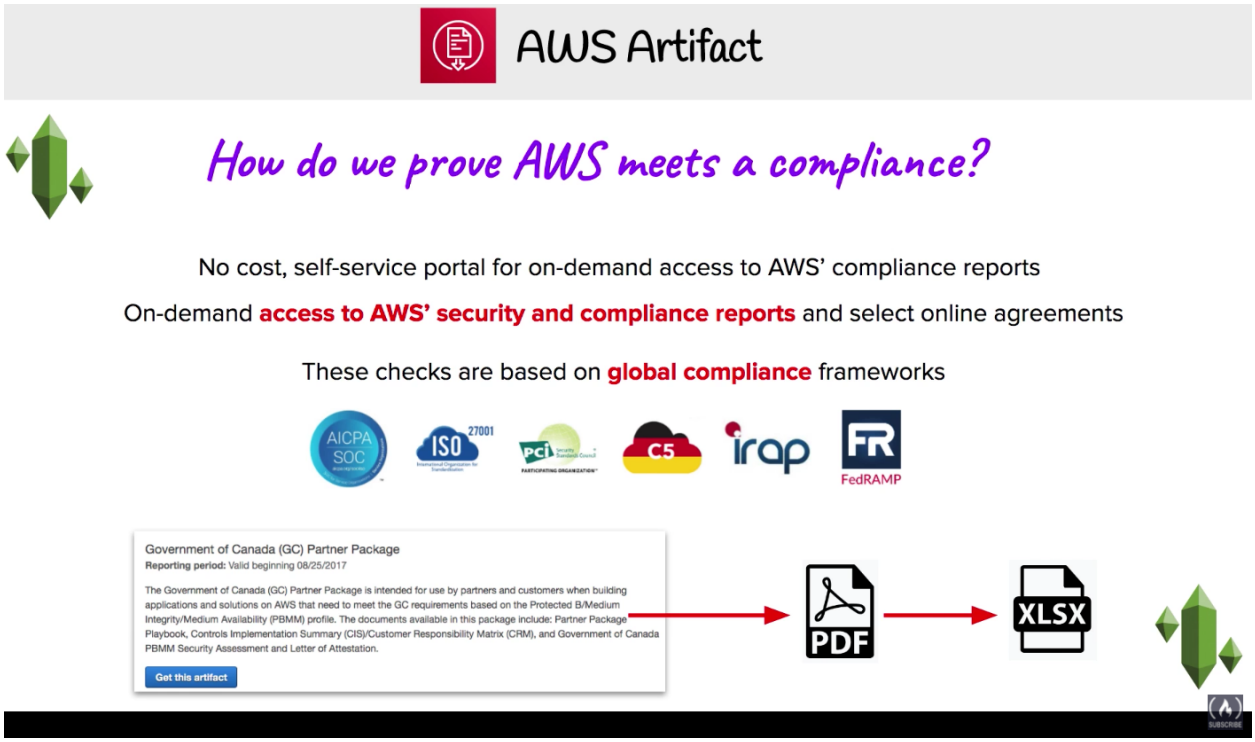


AWS Compliance Programs

- Set of internal policies and procedures of a company to comply with laws, rules, and regulations, or to uphold business reputation
- Ex.
    - HIPAA
        - Safeguards medical information
    - PCI DSS
        - When you want to sell things online and handle credit card information

AWS Artifact

- How do we prove AWS meets a compliance?
- Go into AWS Artifiact, choose package or Artifact, it will generate a PDF, and within this PDF you will click a link to get the files that you want



Amazon Inspector

- How do we prove an EC2 Instance is **hardened?**
- Hardening - the act of eliminating as many security risks as possible
- Runs a **Security Benchmark** against specific EC2 instances
    - You can run a variety of these
- CIS - Center of Internet Security - a benchmark that runs over 699 checks
- Network Assessment - checking whether ports are open and whether they're reachable to the internet
- Host - checks the applications and OS

Amazon Inspector

How do we prove an EC2 Instance is harden?

Hardening
The act of eliminating as many **security** risks as possible.

AWS Inspector runs a **security benchmark** against specific EC2 instances.
You can run a variety of security benchmarks.

Can perform both **Network** and **Host** Assessments

1. Install the AWS agent on your EC2 instances.
2. Run an assessment for your assessment target.
3. Review your findings and remediate security issues.

One very popular benchmark you can run is by CIS which has **699 checks!**

CIS Center for Internet Security®

AWS WAF (Web Application Firewalls)

- WAF has to be attached to either **CLOUDFRONT or APPLICATION LOAD BALANCER (ALB)**

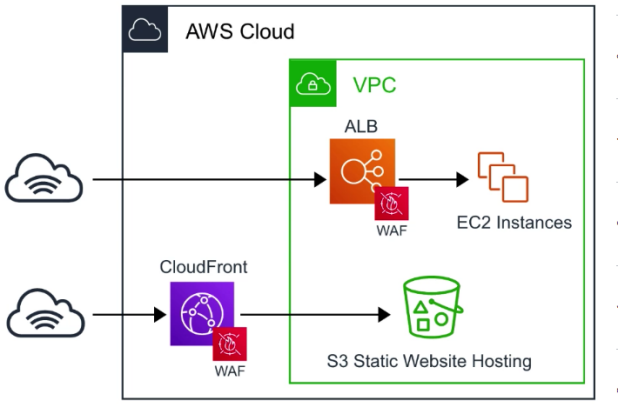
AWS WAF

AWS **Web Application Firewall** protect your web applications from common web exploits
Write your own **rules** to ALLOW or DENY traffic based on the contents of an HTTP requests
Use a **ruleset** from a trusted AWS Security Partner in the AWS WAF Rules Marketplace
WAF can be attached to either **CloudFront** or an **Application Load Balancer**

Protect web applications from attacks covered in the **OWASP Top 10** most dangerous attacks:

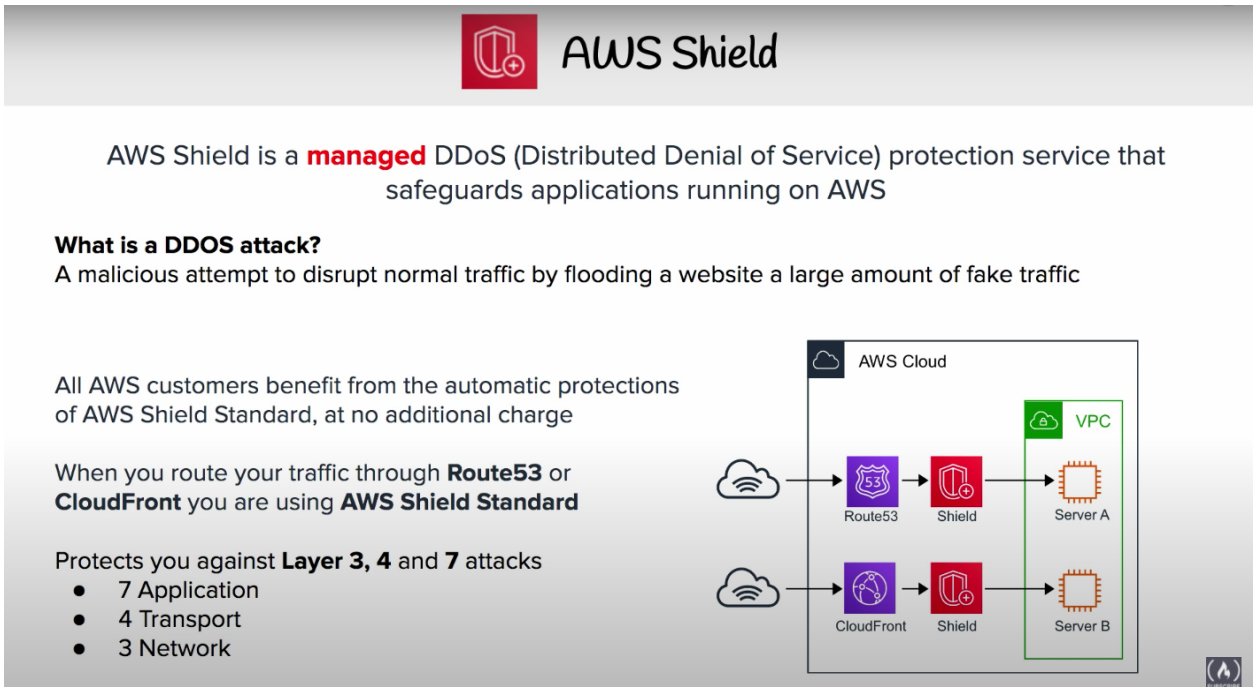
1. Injection
2. Broken Authentication
3. Sensitive data exposure
4. XML External Entities (XXE)
5. Broken Access control
6. Security misconfigurations
7. Cross Site Scripting (XSS)
8. Insecure Deserialization
9. Using Components with known vulnerabilities
10. Insufficient logging and monitoring

OWASP Open Web Application Security Project



AWS Shield

- DDOS Attack - a malicious attempt to disrupt normal traffic by flooding a website with a large amount of fake traffic
- DDOS = Distributed Denial of Service
- AWS Shield is a managed DDOS protection service that safeguards applications on AWS
- You should always be routing your traffic through Route53 or CloudFront (Automatically come with AWS Shield Standard)
- Protects against Layer 3,4, and 7 attacks
    - 7 = Application
    - 4 = transport
    - 3 = network



AWS Shield Plans

- Shield Standard - Free
    - Protects again most common DDOS attacks
- Shield Advanced - $3000/year
    - Additional protection against larger and more sophisticated attacks
    - Available for:
        - Route53
        - CloudFront
        - ELB
        - AWS Global Accelerator
        - Elastic IP (Amazon Elastic Compute Cloud and Network Load Balancer)

AWS Shield

Shield Standard

Free

For **protection against most common DDoS attacks**, and access to tools and best practices to build a DDoS resilient architecture.

Automatically available on all AWS services.

Shield Advanced

3000 USD / Year

For **additional protection against larger and more sophisticated attacks**, visibility into attacks, and 24x7 access to DDoS experts for complex cases.

Available on:

- Amazon Route 53
- Amazon CloudFront
- Elastic Load Balancing
- AWS Global Accelerator
- Elastic IP (Amazon Elastic Compute Cloud and Network Load Balancer)

Security - Penetration Testing

- PenTesting - authorized simulated cyberattack on a computer system, performed to evaluate the security of a system
- You CAN do this on AWS for some services

Penetration Testing

What is PenTesting?
An authorized simulated cyberattack on a computer system, performed to evaluate the security of the system.

Can you perform PenTesting on AWS? Yes!

Permitted Services

1. EC2 instances, NAT Gateways, and ELB
2. RDS
3. CloudFront
4. Aurora
5. API Gateways
6. AWS Lambda and Lambda@Edge functions
7. Lightsail resources
8. Elastic Beanstalk environments

Prohibited Activities

- DNS zone walking via Amazon Route 53 Hosted Zones
- Denial of Service (DoS), Distributed Denial of Service (DDoS), Simulated DoS, Simulated DDoS
- Port flooding
- Protocol flooding
- Request flooding (login request flooding, API request flooding)

For **Other Simulated Events** you will need to submit a request to AWS. A reply could take up to 7 days.

AWS Security - Guard Duty

- IDS = Intrusion Detection System
- IPS = Intrusion Protection System
- How do you detect whether someone is attempting to gain access to your AWS account or resources
- Guard Duty is a threat detection service that uses machine learning to analyze:
    - CloudTrail logs
    - VPC Flow logs
    - DNS logs

What is IDS/IPS?
Intrusion Detection System and Intrusion Protection System.
A device or software application that monitors a network or systems for malicious activity or policy violations.

How do we detect if someone is attempting to gain access to our AWS account or resources?

Guard Duty is a **threat detection service** that continuously monitors for malicious, suspicious activity and unauthorized behavior. It uses Machine Learning to analyze the following AWS logs:

- CloudTrail Logs
- VPC Flow Logs
- DNS logs

It will alert you of **Findings** which you can automate a incident response via CloudWatch Events or with 3rd Party Services

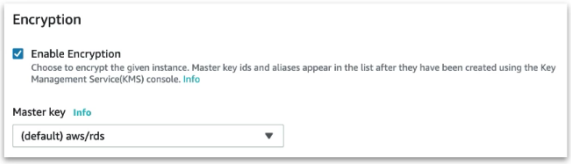
Key Management Service (KMS)

- Makes it easy to create and control encryption keys to encrypt your data
- KMS is a multi-tenant hardware security module (HSM)
    - An actual piece of hardware that is used by multiple AWS customers that are isolated using virtual software
- Many AWS services use KMS to encrypt data with a simple checkbox
- KMS uses Envelope Encryption
    - Envelope Encryption - when you encrypt your data, your data is protected, but you have to protect your **data/encryption key**. When you encrypt your data key with a **master key,** you have an additional layer of security
        - Like putting your key in an envelope so others can't see

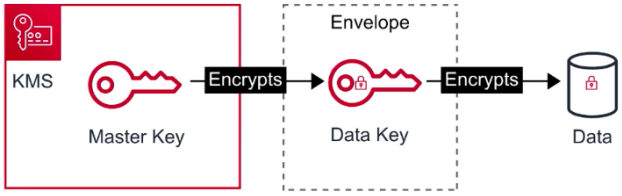
Key Management Service (KMS)

A managed service that makes it easy for you to create and control the encryption keys used to encrypt your data.

- KMS is a multi-tenant HSM (hardware security module)
- Many AWS services are integrated to use KMS to encrypt your data with a simple checkbox
- KMS uses Envelope Encryption.



Envelope Encryption
When you encrypt your data, your data is protected, but you have to protect your encryption key. When you encrypt your data key with a master key as an additional layer of security.



Amazon Macie

- Macie is a fully managed service that continuously monitors S3 data access activity for anomalies, and generates detailed alerts when it detects risk of unauthorized access or inadvertent data leaks
    - Uses Machine Learning to analyze your CloudTrail logs
    - When you put data in your S3 Data, like credit card numbers, Macie detects sensitive data and whether that data is exposed or can be compromised
        - Ex. if credit card numbers are stored as plain text, Macie will alert you that you should encrypt that data
- Will identify your most at-risk users
    - Ranked by badges
        - The nicer the badge, the worse the user is at best practices

Amazon Macie

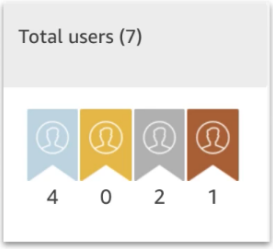
Macie is a fully managed service that continuously monitors **S3 data access** activity for anomalies, and generates detailed alerts when it detects risk of unauthorized access or inadvertent data leaks.

Macie works by uses Machine Learning to Analyze your CloudTrail logs

Macie has a variety of alerts

- Anonymized Access
- Config Compliance
- Credential Loss
- Data Compliance
- File Hosting
- Identity Enumeration
- Information Loss
- Location Anomaly
- Open Permissions
- Privilege Escalation
- Ransomware
- Service Disruption
- Suspicious Access

Macie's will identify your most at-risk users which could lead to a compromise



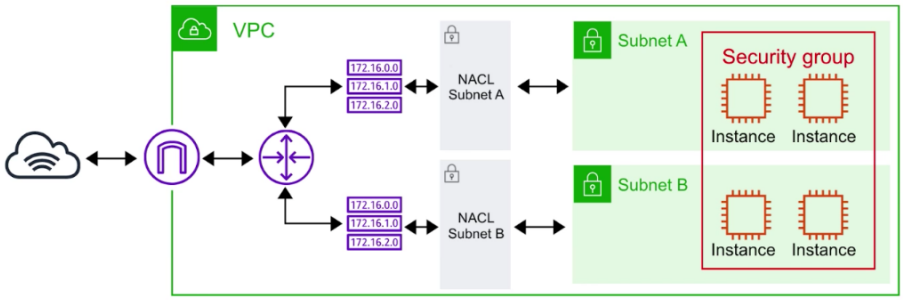
- Ransomware - locking you out of your data and asking for money
- Privilege Escalation - someone getting access to stuff they're not supposed to
- Identity Enumeration - trying to enumerate over data to figure out what they can steal
- Credential Loss

Security Groups vs. NACLs

- Security Groups are firewalls at the **instance level**
- NACLs are a firewall at the **subnet level**

Security Groups vs NACLs

Security Groups	NACLs Network Access Control Lists
Acts as a firewall at the **instance** level Implicitly denies all traffic. You create Allow rules.	Acts as a firewall at the **subnet** level You create Allow and Deny rules.
Eg. Allow an EC2 instance access on port 22 for SSH	Eg. Block a specific IP address known for abuse



AWS VPN

- Lets you establish a **secure and private tunnel** from your network or device to the AWS Global Network
- Site-to-Site VPN
    - Securely connect on-premises network or branch office site to VPC
    - Ex. connect an entire office or network
- AWS Client VPN
    - Securely connect users to AWS or on-premises networks
    - Connect individual employees

Security Groups vs NACLs

Security Groups

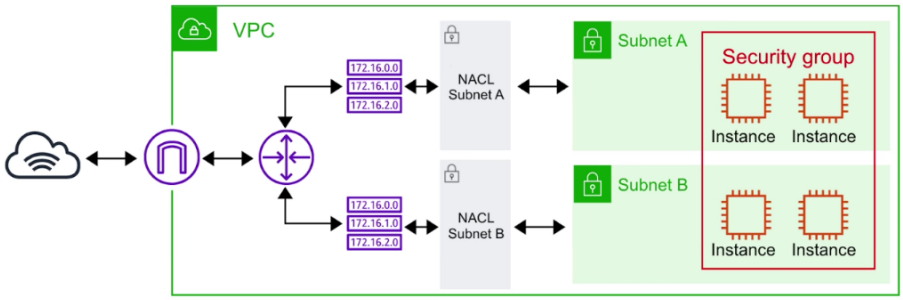
Acts as a firewall at the **instance** level
Implicitly denies all traffic. You create Allow rules.

Eg. Allow an EC2 instance access on port 22 for SSH

NACLs
Network Access Control Lists

Acts as a firewall at the **subnet** level
You create Allow and Deny rules.

Eg. Block a specific IP address known for abuse



Cloud Service Variation Study

- CloudFormation - infrastructure as code, sets up services via templating script via JSON and YML
- CloudTrail - who you can blame - logs all API calls between AWS Services
- CloudFront - Content Distribution Network (CDN) creates a cached copy of your website and copies to servers located near people trying to download the website
- CloudWatch - a collection of services
    - CloudWatch logs
        - Any custom log data, Memory Usage, Rails Logs, Nginx Logs
    - CloudWatch Metrics
        - Metrics based off of logs, i.e. Memory Usage
    - CloudWatch Events
        - Trigger an event based on a condition, i.e. every hour take a snapshot of the server
    - CloudWatch Alarms
        - Triggers notifications based on metrics
    - CloudWatch Dashboard
        - Create visualizations based on metrics
- CloudSearch
    - Search engine for when you have an ecommerce website and you want a search bar

Cloud* Services

Similar names, completely different services.

CloudFormation - infrastructure as code, set up services via templating script eg. yml,json

CloudTrail - logs all api calls between aws services (who can we blame)
eg. aws s3api create-bucket --bucket my-bucket-ash-test-123

CloudFront - Content Distribution Network, It create a cached copy of your website and copies to server located near people trying download website

CloudWatch - is a collection of multiple services
CloudWatch Logs - any custom log data, Memory Usage, Rails Logs, Nginx Logs
CloudWatch Metrics - metrics that are based off of logs eg. Memory Usage
CloudWatch Events - trigger an event based on a condition eg. ever hour take snapshot of server
CloudWatch Alarms - triggers notifications based on metrics
CloudWatch Dashboard - create visualizations based on metrics

CloudSearch - search engine, you have an ecommerce website and you want to add a search bar

Connect Service Variation Study

- Direct Connect - dedicated fiber optics connections from DataCenter to AWS
    - A large enterprise has their own datacenter and they need an insanely fast connection directly to AWS. If you need security, you can apply a VPN on top of Direct Connect
- Amazon Connect - Call Center Service
    - A call center in the cloud
    - Toll free number, accept inbound and outbound calls, setup automated phone payments
- Media Connect - New version of Elastic Transcoder, Converts Videos to different Video Types

*Connect Services

Direct Connect Dedicated Fiber Optics Connections from DataCenter to AWS

A large enterprise has their own datacenter and they need an insanely fast connection directly AWS. If you need to security you can apply a VPN connect on-top of Direct Connect

Amazon Connect Call Center Service

Get a toll free number, accept inbound and outbound calls, setup automated phone systems.

Media Connect New Version of Elastic Transcoder, Converts Videos to DIfferent Video Types

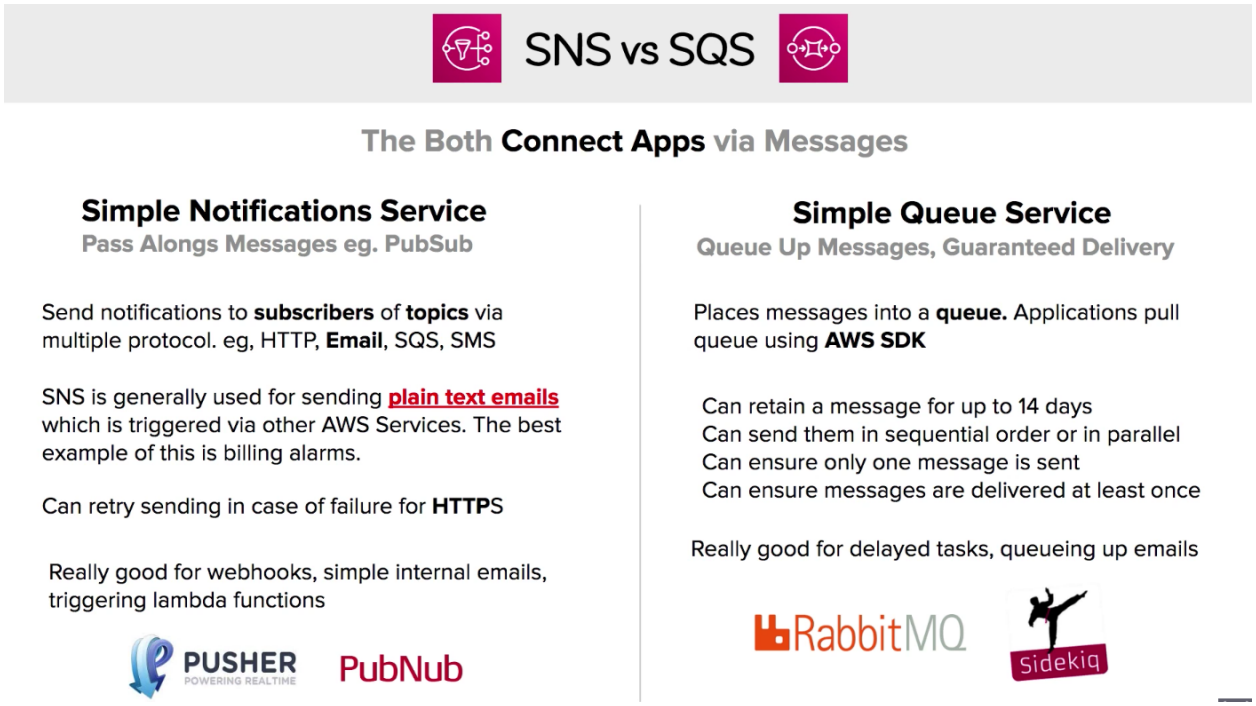
You have 1000 of videos you and you need to transcode them into different videos format, maybe you need to apply watermarks, or insert introduction video in front of every video

Elastic Transcoder vs. MediaConvert (Same price)

- **Both services transcode videos**
- Elastic Transcoder is the old way
    - Transcodes videos to streaming formats
- AWS Elemental MediaConvert (new way)
    - Transcodes videos to streaming formats
    - Overlays images
    - Insert video clips
    - Extracts captions data
    - Robust UI

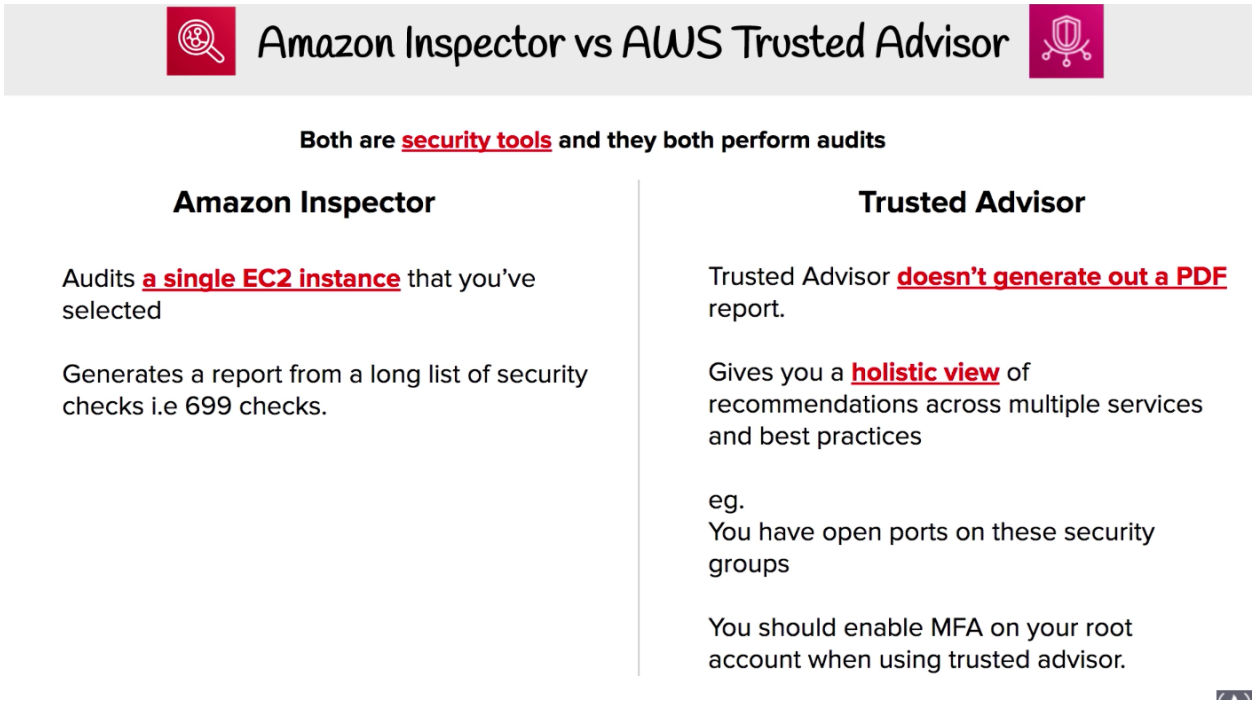
SNS vs SQS (They both connect apps via Messages)

- SNS - Simple Notification Service
    - Passes along messages using PubSub (Publisher - Subscriber)
    - Send notifications to subscribers on topics via HTTP, email, SQS, SMS
    - Used for **plain text emails (cannot do HTML emails)**, ex. Billing alarms
- SQS - Simple Queue Service
    - Queue up messages, guaranteed delivery
    - Places messages into a queue - applications pull queue using the AWS SDK (Software Development Kit)
    - Retains message up to 14 days
    - Sends messages in sequential order
    - Ensure only one message is sent
    - Ensure messages are delivered at least ONCE
    - Good for delayed tasks, i.e. queueing up emails

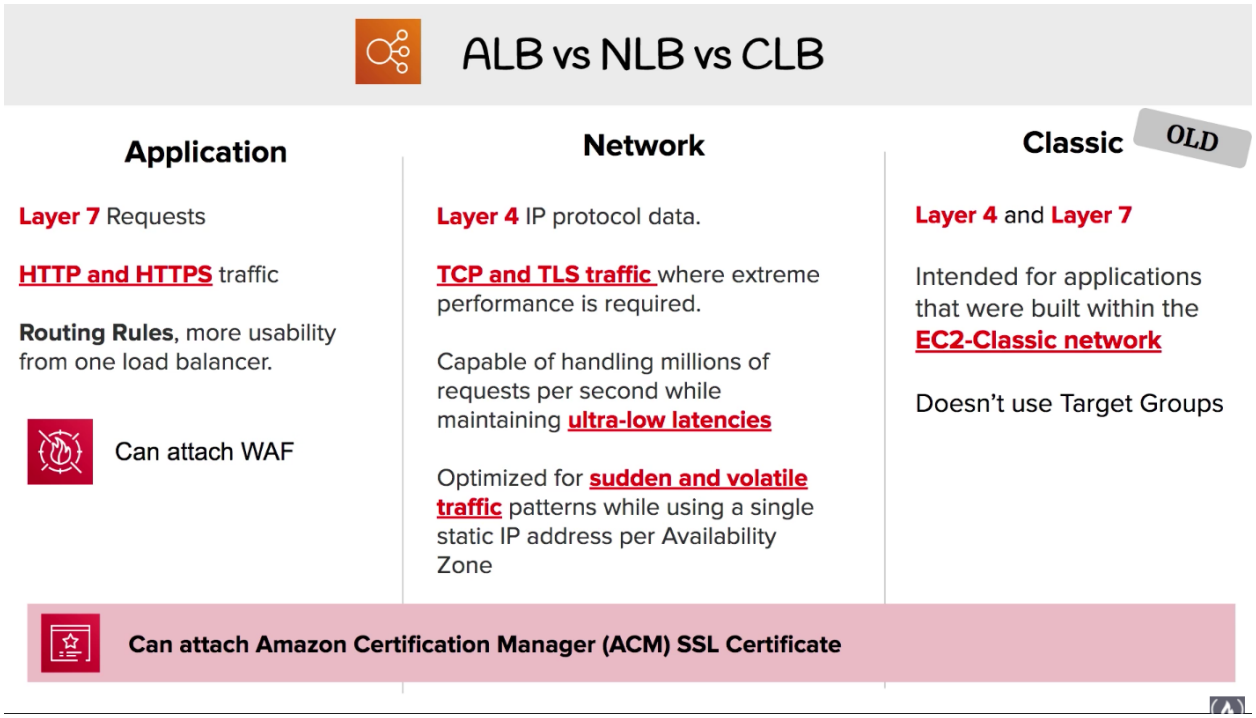


Inspector vs. Trusted Advisor (Both security tools to perform audits)

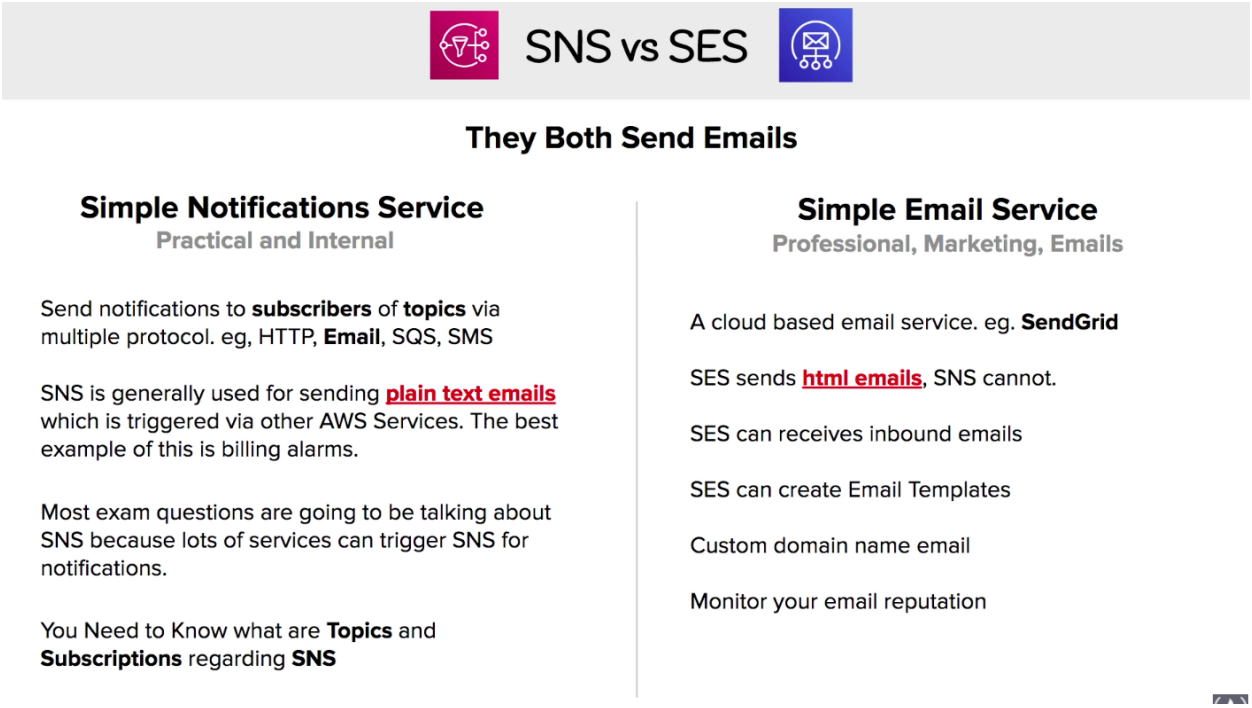
- Amazon Inspector (Only for EC2 instances
    - Audits a SINGLE EC2 instance that you have selected
    - Generates reports from a long list of checks… 699 checks
- Trusted Advisor (Multiple AWS services and security practices)
    - Doesn't generate a PDF report
    - Gives a holistic view of recommendations across **multiple services** and best practices
        - Ex. you have open ports on these security groups
        - Ex. you should enable MFA on your root account when using trusted advisor



ALB v. NLB v. CLB

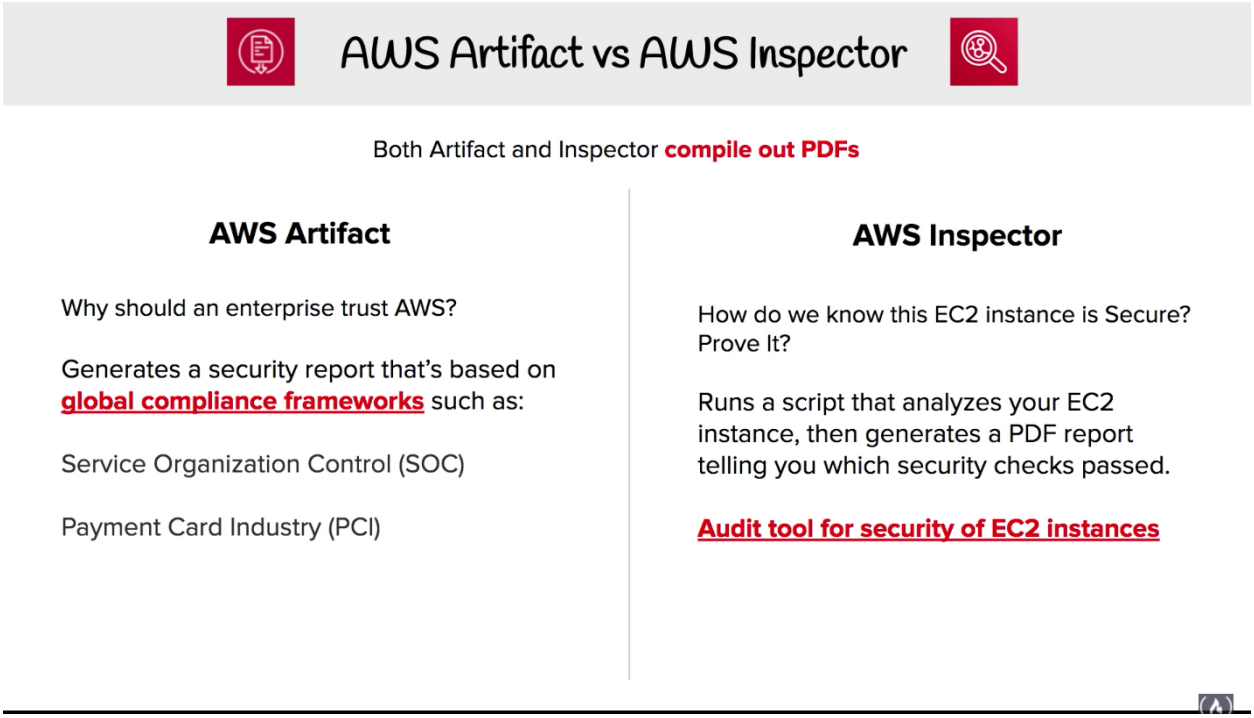


SNS vs. SES



TOPICS and SUBSCRIPTIONS REGARDING SNS!!!

Artifact v. Inspector



Last Minute Tips

- Global Accelerator can be used to reduce latency of websites to load faster for users around the world
    - Monitors health with the ability to route traffic to healthy regional endpoints
- VPC Flow Logs can capture information about IPD traffic or any traffic flowing into your VPC
- You can use Snowball or Data Migration Service (DMS) to move data from on-premise to AWS

Tricky Questions

- S3 Standard Storage Class has 99.999999999% Durability and 99.99% Availability
- What is the main benefit of on-demand EC2 instances?
    - You can create, start, stop, and terminate at any time
- If you are using an on-demand EC2 instance, how are you being charged for it?
    - You are charged per second, based on an hourly rate, and there are no termination fees
- What is benefit of choosing reserved instance over on-demand instance ?
    - Lower cost when compared to on-demand
- Which AWS service can help against DDOs protection ?
    - CloudFront
- Which AWS service can help caching objects ?
    - CloudFront
- You are building online cloud storage platform. Users will be uploading their files for backup to your applications. You are unsure about the capacity requirements. Which AWS service can help you here ?
    - S3
- What is the benefit of using RDS instead of hosting own database in EC2 instance ? Which of the following are benefits of AWS's Relational Database Service (RDS)?
    - Automated patches and backups
- Alice is a DevOps and he wants to ensure that all servers are working perfectly. One of the aspects is monitor the CPU usage. Application tends to slow down when CPU usage is greater then 60%. How can Alice track down when CPU usage goes above 60% for any of the EC2 instance ?
    - Use CloudWatch Alarms
- You have a very critical application which your organization simply can't afford to have it down. What is the architecture strategy you would use to prepare to be used for the application ?
    - Use Multi-region based architectures
- What is one of the advantages of the Amazon Relational Database Service (Amazon RDS)?

    - It simplifies relational database administration tasks
- A customer needs to run a MySQL database that easily scales. Which AWS service should they use?
    - Amazon Aurora
- Which of the following is a shared control between the customer and AWS?
    - AWS is responsible for creating awareness and providing training of their employees. Client is responsible to do the same for their employees.
    - Awareness and Training
- How many Availability Zones should compute resources be provisioned across to achieve high availability?
    - Minimum of 2
- Which AWS IAM feature allows developers to access AWS services through the AWS CLI?
    - Access Keys
- Which of the following is a fast and reliable NoSQL database service?
    - Amazon DynamoDB
- What approach to transcoding a large number of individual video files adheres to AWS architecture principles?
    - Using many instances in parallel
- Which of the following is an AWS managed Domain Name System (DNS) web service?
    - Amazon Route 53
- Which storage service can be used as a low-cost option for hosting static websites?
    - Amazon Simple Storage Service (S3)
- What is the AWS customer responsible for according to the AWS shared responsibility model?
    - Data encryption
- Which of the following AWS Cloud services can be used to run a customer-managed relational database?
    - Amazon EC2
- A company is looking for a scalable data warehouse solution. Which of the following AWS solutions would meet the company's needs?
    - Amazon Redshift (warehouse!)
- Which of the following are valid ways for a customer to interact with AWS services?
    - Command line interface
- What is the benefit of using AWS managed services, such as Amazon ElastiCache and Amazon Relational Database Service (Amazon RDS)?
    - They simplify patching and updating underlying OSs
- Which AWS service provides a simple and scalable shared file storage solution for use with Linux-based AWS and on-premises servers?
    - Amazon EFS (Elastic File System) ???

- Under the shared responsibility model, which of the following is a shared control between a customer and AWS?
    - Patch management
- Which AWS service allows companies to connect an Amazon VPC to an on-premises data center?
    - Amazon Direct Connect
- Which AWS service provides alerts when an AWS event may impact a company's AWS resources?
    - AWS Personal Health Dashboard
- Which task is AWS responsible for in the shared responsibility model for security and compliance?
    - Updating Amazon EC2 host firmware
- If a customer needs to audit the change management of AWS resources, which of the following AWS services should the customer use?
    - AWS Config
- What is Amazon CloudWatch?
    - A metrics repository with customizable notification thresholds and channels
- Which design principles for cloud architecture are recommended when re-architecting a large monolithic application?
    - Implement loose coupling
    - Designing loosely-coupled system is one of the very important design principles.
- Which AWS services are defined as global instead of regional?
    - Amazon CloudFront
        - Amazon CloudFront is a Content Distribution Network for global access to data
- Which AWS Cost Management tool allows you to view the most granular data about your AWS bill?
    - AWS Cost and Usage Report
- Which of the following services falls under the responsibility of the customer to maintain operating system configuration, security patching, and networking?
    - Amazon EC2
- Which service is best for storing common database query results, which helps to alleviate database access load?
    - ElastiCache
- How does data get into Glacier ?
    - S3 Lifecycle policy
        - In order to upload to Glacier, S3 LifeCycle policy should be used
- Which of the following AWS services ensures that only authorized and authenticated request are allowed?
    - AWS Identity and Access Management (IAM)

- Small Corp is planning to create a disaster recovery stratergy for their workloads in AWS. Which among these is a good DR stratergy for worst case scenerio?
    - AWS Regions
- Which among the following is true about Availability Zones?
    - Multiple zones across distinct locations in the same region connected by high speed networks
- The use of what AWS feature or service allows companies to track and categorize spending on a detailed level?
    - Cost Allocation tags
- What AWS team assists customers with accelerating cloud adoption through paid engagements in any of several specialty practice areas?
    - AWS Professional Services
- A customer would like to design and build a new workload on AWS Cloud but does not have the AWS-related software technical expertise in-house.
    - AWS Partner Network Consulting Partners
- Which AWS services can host a Microsoft SQL Server database?
    - Amazon RDS
- Which AWS services can host a Microsoft SQL Server database?
    - Amazon EC2
- Which of the following Amazon EC2 pricing models allow customers to use existing server-bound software licenses?
    - Dedicated Hosts
- Which services can be used across hybrid AWS Cloud architectures?
    - Amazon Route 53
    - **Virtual Private Gateways can also be used for hybrid architectures
- A company is considering using AWS for a self-hosted database that requires a nightly shutdown for maintenance and cost-saving purposes. Which service should the company use?
    - Amazon EC2 with Amazon Elastic Block Store (EBS)
- Which is a recommended pattern for designing a highly available architecture on AWS?
    - Ensure that the application is designed to accommodate failure of any single component
- Which AWS services are defined as global instead of regional?
    - Amazon Route 53
    - DNS (Domain Naming System)
- Which of the following features can be configured through the Amazon Virtual Private Cloud (Amazon VPC) Dashboard?
    - Subnets
- Where should users report that AWS resources are being used for malicious purposes?

    - AWS Abuse Team
- Which Amazon RDS feature can be used to achieve high availability?
    - Multiple AZs
- What helps a company provide a lower latency experience to its users globally?
    - Using EL (edge locations) to put content closer to all users
- Which activity is a customer responsibility in the AWS Cloud according to the AWS shared responsibility model?
    - Ensuring Amazon EBS volumes are backed up
- Which AWS service allows users to identify the changes made to a resource over time?
    - AWS Config
- A Cloud Practitioner needs a consistent and dedicated connection between AWS resources and an on-premises system. Which AWS service can fulfill this requirement?
    - Amazon Direct Connect
- Which security service automatically recognizes and classifies sensitive data or intellectual property on AWS?
    - Macie
- ****How can a company isolate the costs of production and non-production workloads on AWS? .
    - Use different accounts for production and non-production expenses
- A web application running on AWS has been spammed with malicious requests from a recurring set of IP addresses. Which AWS service can help secure the application and block the malicious traffic?
    - AWS WAF
- What is the advantage of deploying an application across multiple Availability Zones?
    - The application will have higher availability because it can withstand a service disruption in one AZ
- Which AWS service provides inbound and outbound network ACLs to harden external connectivity to Amazon EC2?
    - Amazon VPC
- Access keys in AWS Identity and Access Management (IAM) are used to:
    - Make programmatic calls to AWS from AWS APIs
- A customer runs an On-Demand Amazon Linux EC2 instance for 3 hours, 5 minutes, and 6 seconds. For how much time will the customer be billed?
    - 3 hours, 5 mins, 6 seconds
- A company wants to monitor the CPU usage of its Amazon EC2 resources. Which AWS service should the company use?
    - Amazon CloudWatch
- Which of the following is the responsibility of AWS?

    - Physically destroying storage media at the end of life
- Which of the following services is a MySQL-compatible database that automatically grows storage as needed?
    - Amazon Aurora
- What feature of Amazon RDS helps to create globally redundant databases?
    - Cross-region read replicas
- How is asset management on AWS easier than asset management in a physical data center?
    - Users can gather asset metadata reliability with a few API calls
- Which of the following can a customer use to enable single sign-on (SSO) to the AWS Console?
    - AWS Directory Service
- Which services are parts of the AWS serverless platform?
    - AWS Step Functions, Amazon DynamoDB, Amazon SNS