# AWS Certified Solutions Architect Associate (SAA-C03)

# About this course

An AWS solutions architect develops, implements and maintains digital infrastructure and business applications within the AWS cloud platform.

They collaborate with business leaders to learn more about a company's objectives and design effective cloud-based solutions and strategies to fulfill these objectives.

# What to study?

# Domains

- **Domain 1:** Design Secure Architecture
- **Domain 2:** Design Resilient Architecture
- **Domain 3:** Design High-Performing Architecture
- **Domain 4:** Design Cost-Optimized Architecture

# Basics of AWS Cloud

# AWS Cloud Practitioner

- Introduction to AWS
- AWS Core Services
- Security and Identity
- Database Services
- Management Tools
- Deployment and Elasticity
- Monitoring and Analytics
- Billing and Pricing
- AWS Architectural Best Practices

# Introduction to AWS

- ✓ Overview of Cloud Computing
- ✓ Introduction to AWS
- ✓ AWS Global Infrastructure
- ✓ AWS Management Console

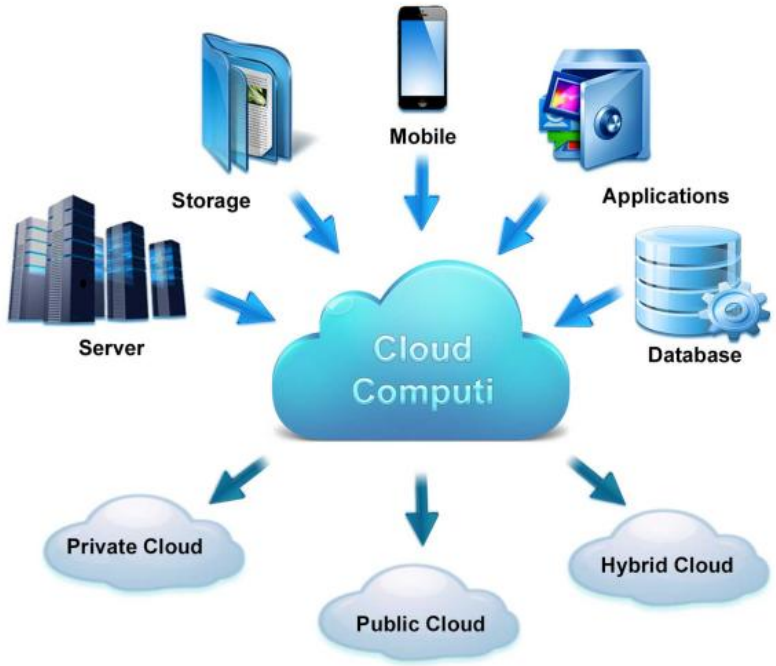
# Overview of Cloud Computing

- Cloud computing refers to the delivery of computing services over the internet ("the cloud") to provide on-demand access to resources and services like servers, storage, databases, networking, software, and more, without the need for direct management by the user.


- Cloud computing can be called a technology through which things like software, processing, and data storage are outsourced.

# Cloud Computing

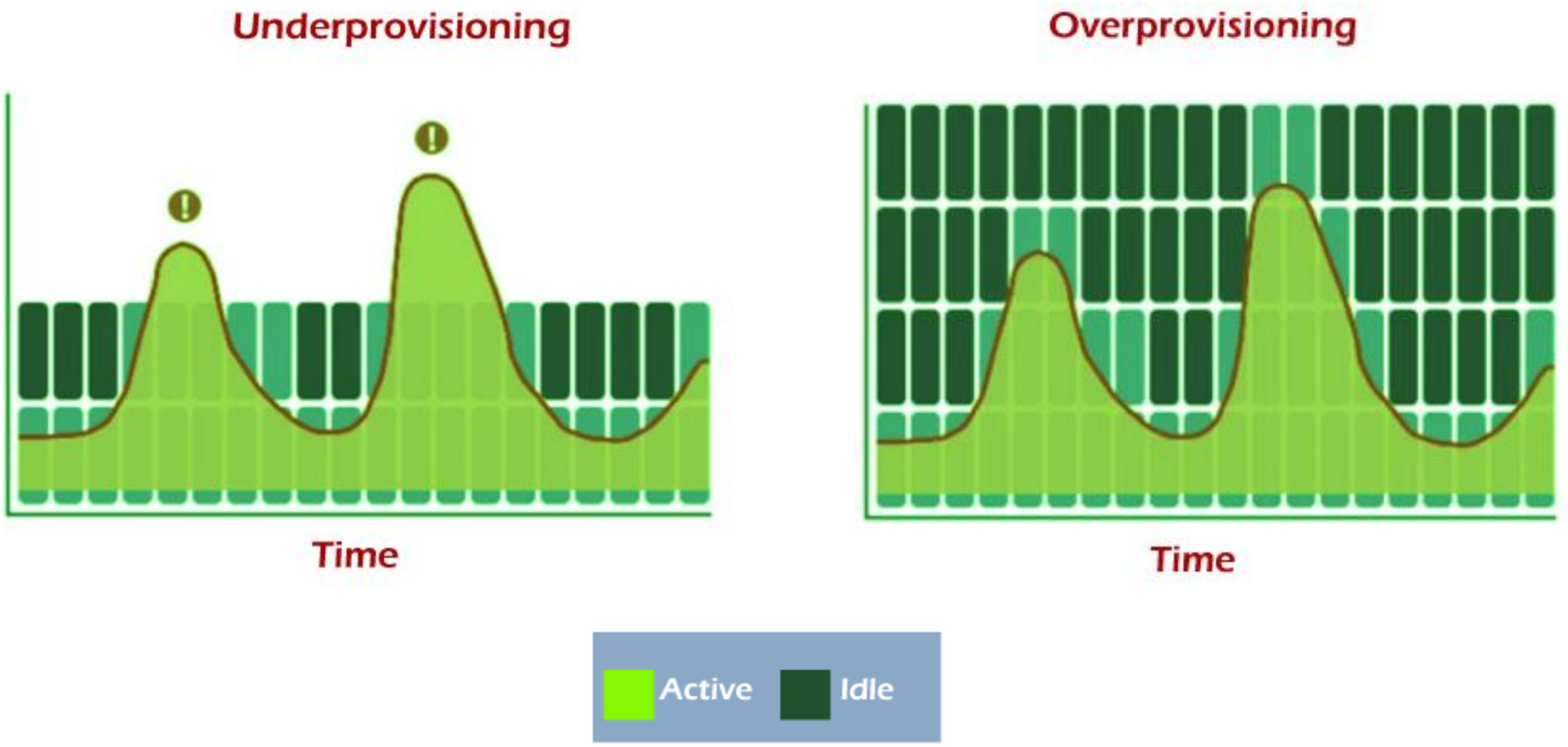
- ✓ Central data center for providing services.
- ✓ On-demand, scalable, unlimited computation & storage.
- ✓ It's basically a data center.
- ✓ 4 characteristics of a Cloud:
  - ✓ Everything is a Service (backup, firewall, network…)
  - ✓ Elasticity in nature
  - ✓ HA – 99.99% SLA
  - ✓ Unlimited computation power.
- ✓ Any Data Center that provides above 4 chars is a cloud.



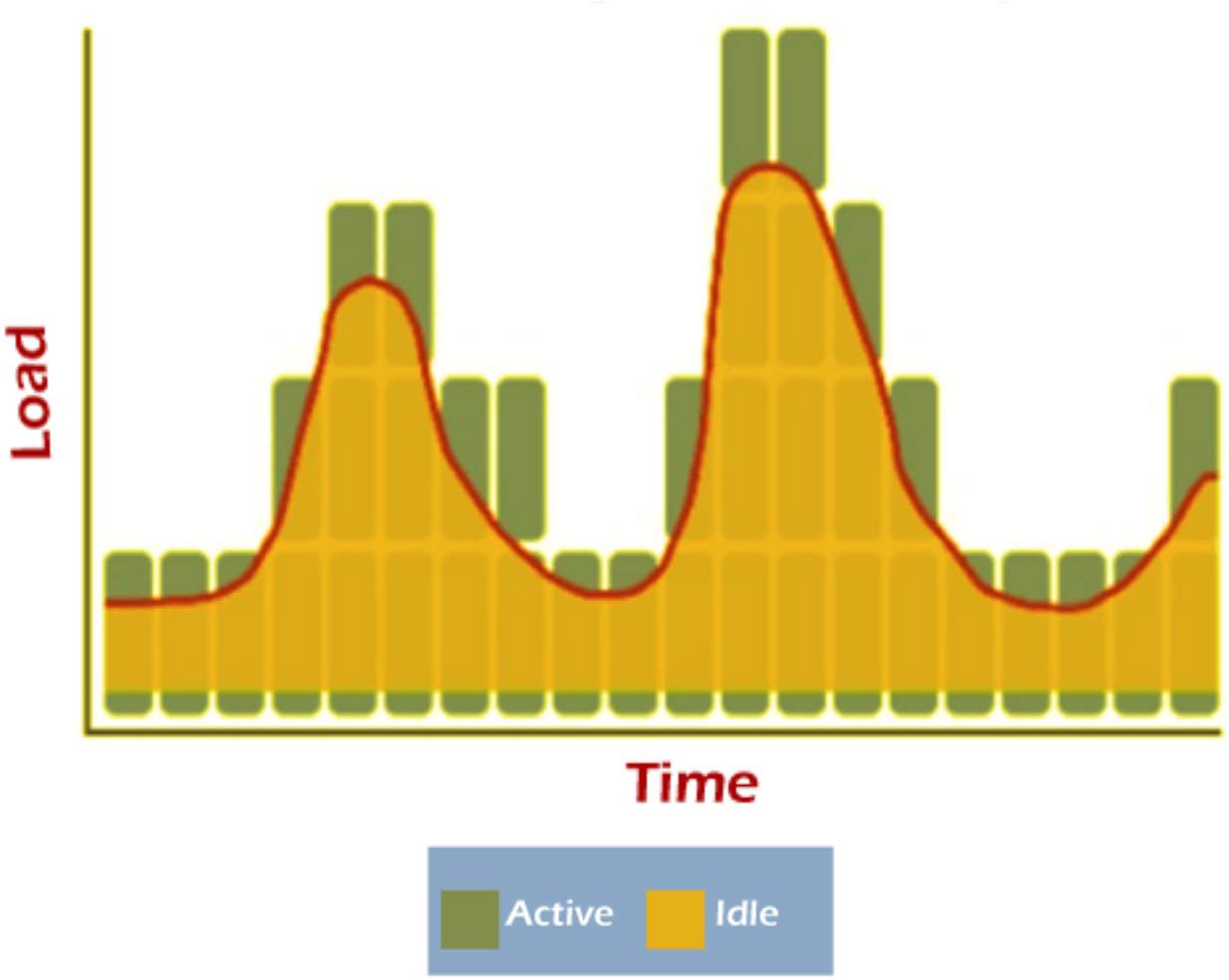
# Everything is a Service

- ✓ Software as a Service (SaaS)
- ✓ Platform as a Service (PaaS)
- ✓ Disaster Recovery as a Service (DRaaS)
- ✓ Infrastructure as a service (IaaS)
- ✓ Communication as a Service (CaaS)
- ✓ Network as a Service (NaaS)
- ✓ Database as a Service (DBaaS)
- ✓ Desktop as a Service (DaaS) etc.

# Elasticity in nature



# Elasticity in nature

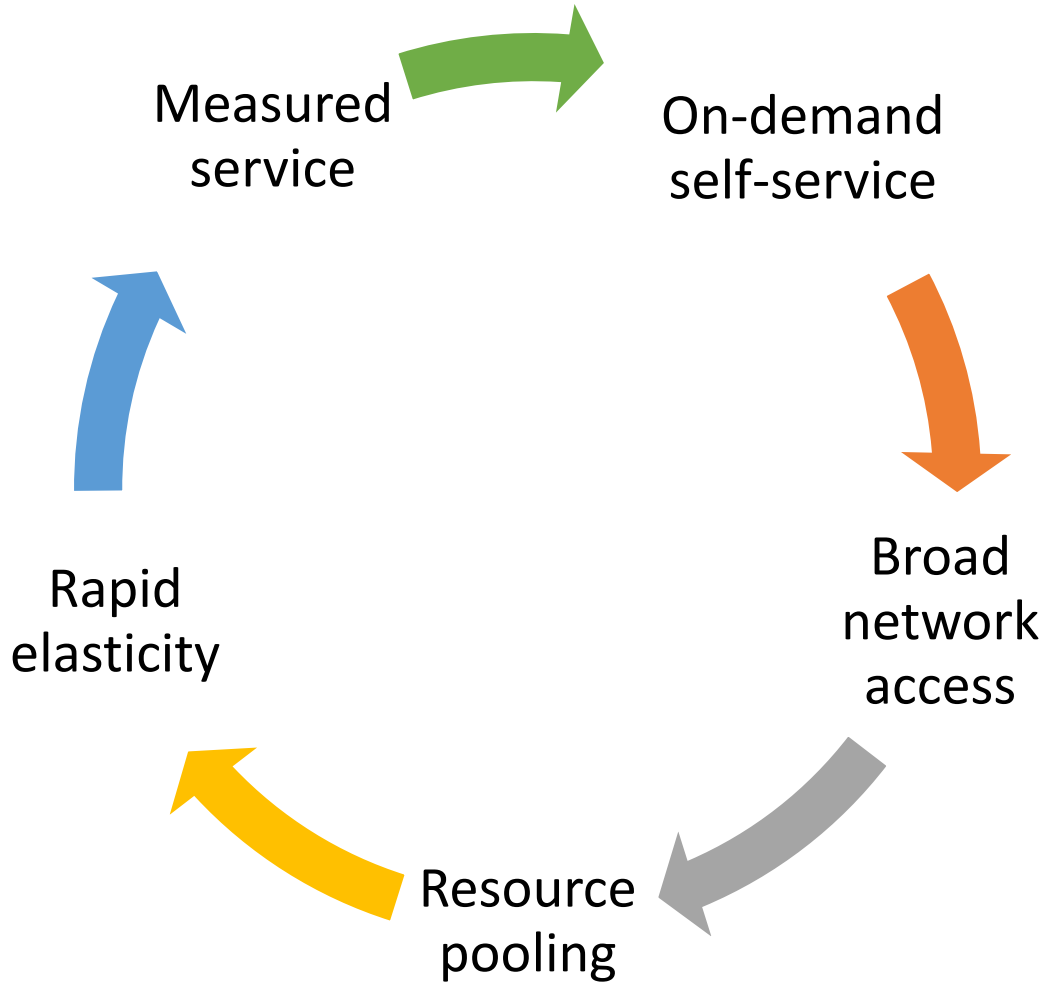


# High Availability (HA)

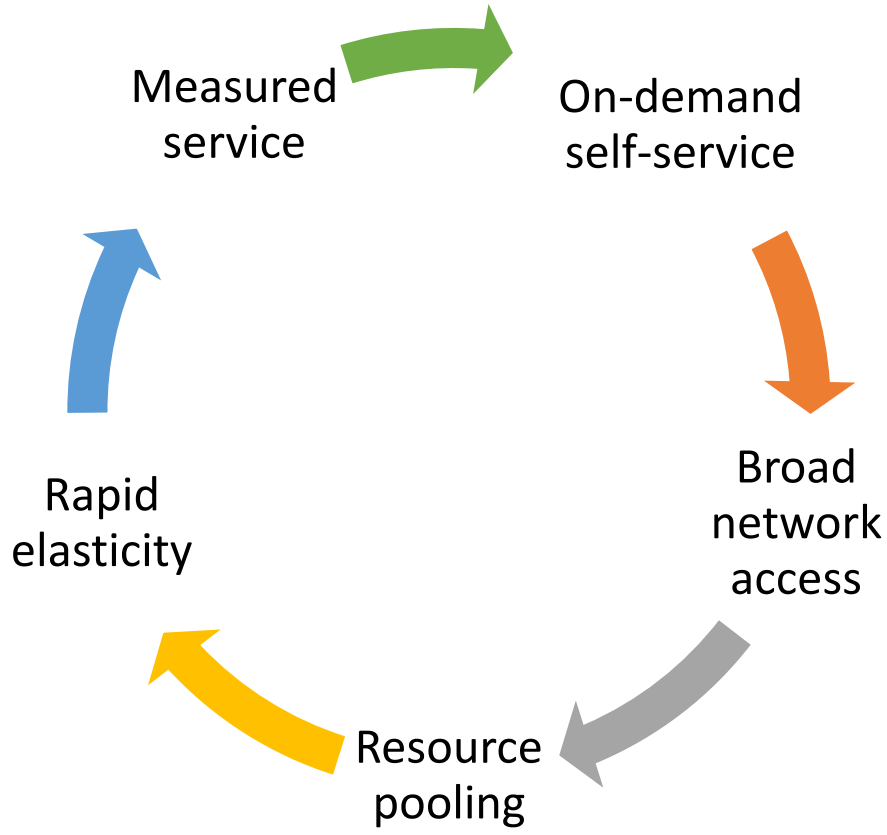
| Availability % | Downtime per year[note 1] | Downtime per month | Downtime per week | Downtime per day |
|---|---|---|---|---|
| 55.5555555% ("nine fives") | 162.33 days | 13.53 days | 74.92 hours | 10.67 hours |
| **90% ("one nine")** | **36.53 days** | **73.05 hours** | **16.80 hours** | **2.40 hours** |
| 95% ("one and a half nines") | 18.26 days | 36.53 hours | 8.40 hours | 1.20 hours |
| 97% | 10.96 days | 21.92 hours | 5.04 hours | 43.20 minutes |
| 98% | 7.31 days | 14.61 hours | 3.36 hours | 28.80 minutes |
| **99% ("two nines")** | **3.65 days** | **7.31 hours** | **1.68 hours** | **14.40 minutes** |
| 99.5% ("two and a half nines") | 1.83 days | 3.65 hours | 50.40 minutes | 7.20 minutes |
| 99.8% | 17.53 hours | 87.66 minutes | 20.16 minutes | 2.88 minutes |
| **99.9% ("three nines")** | **8.77 hours** | **43.83 minutes** | **10.08 minutes** | **1.44 minutes** |
| 99.95% ("three and a half nines") | 4.38 hours | 21.92 minutes | 5.04 minutes | 43.20 seconds |
| **99.99% ("four nines")** | **52.60 minutes** | **4.38 minutes** | **1.01 minutes** | **8.64 seconds** |
| 99.995% ("four and a half nines") | 26.30 minutes | 2.19 minutes | 30.24 seconds | 4.32 seconds |
| **99.999% ("five nines")** | **5.26 minutes** | **26.30 seconds** | **6.05 seconds** | **864.00 milliseconds** |
| **99.9999% ("six nines")** | **31.56 seconds** | **2.63 seconds** | **604.80 milliseconds** | **86.40 milliseconds** |
| **99.99999% ("seven nines")** | **3.16 seconds** | **262.98 milliseconds** | **60.48 milliseconds** | **8.64 milliseconds** |
| **99.999999% ("eight nines")** | **315.58 milliseconds** | **26.30 milliseconds** | **6.05 milliseconds** | **864.00 microseconds** |
| **99.9999999% ("nine nines")** | **31.56 milliseconds** | **2.63 milliseconds** | **604.80 microseconds** | **86.40 microseconds** |

# AWS Global Infrastructure

# Characteristics of Cloud Computing



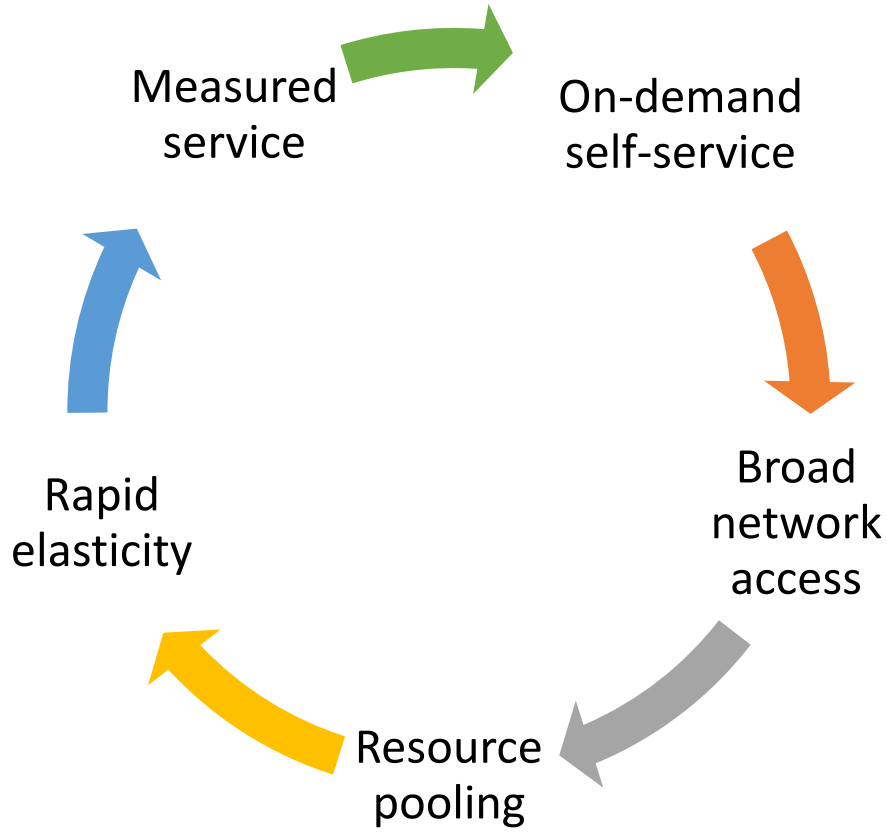
# Characteristics of Cloud Computing




**On-demand Self-Service:**

Users can provision and manage computing resources as needed without human intervention from the service provider.

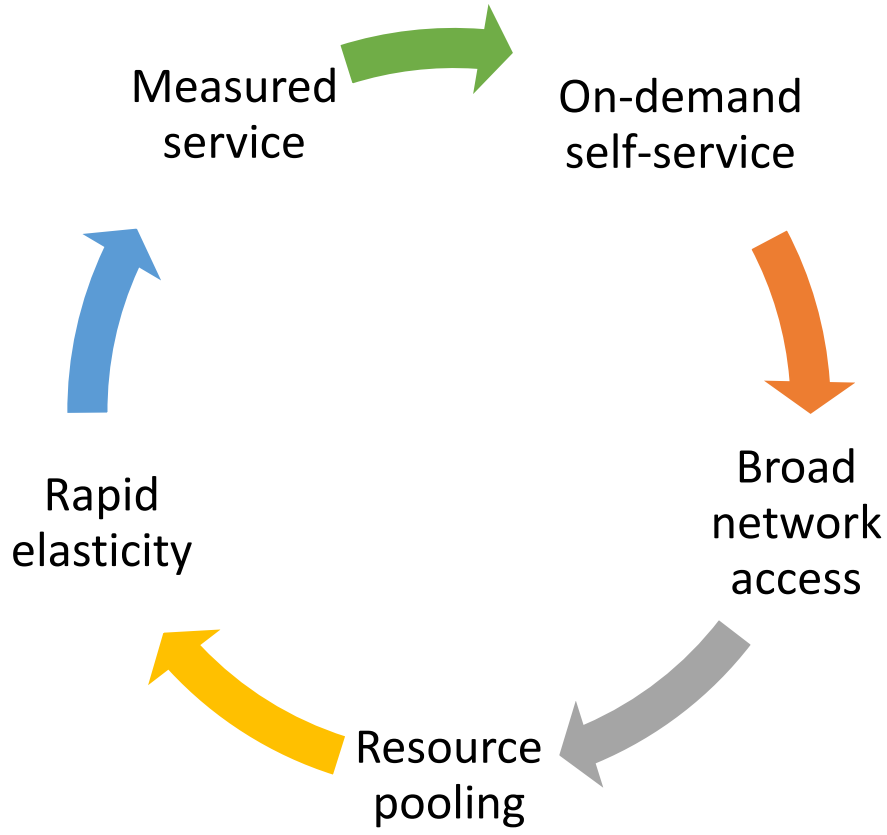
# Characteristics of Cloud Computing




**Broad network access:**

Services are available over the network and accessible through standard mechanisms, promoting ubiquitous access from a variety of devices.

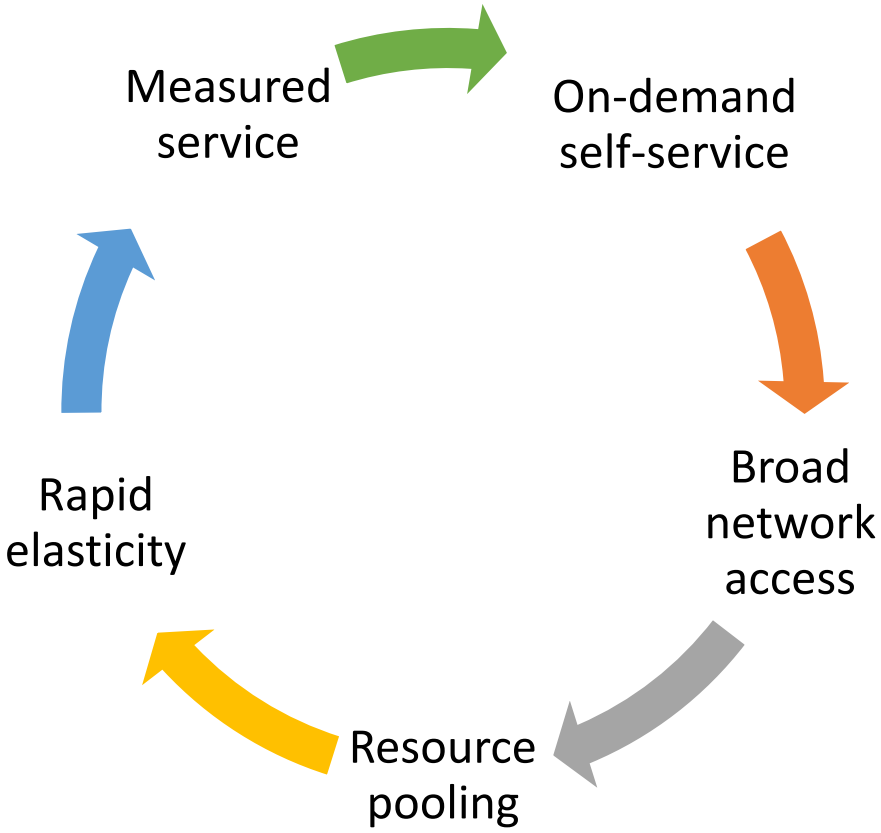
# Characteristics of Cloud Computing




**Resource pooling:**

Computing resources are pooled to serve multiple users, with different physical and virtual resources dynamically assigned and reassigned according to demand.

# Characteristics of Cloud Computing

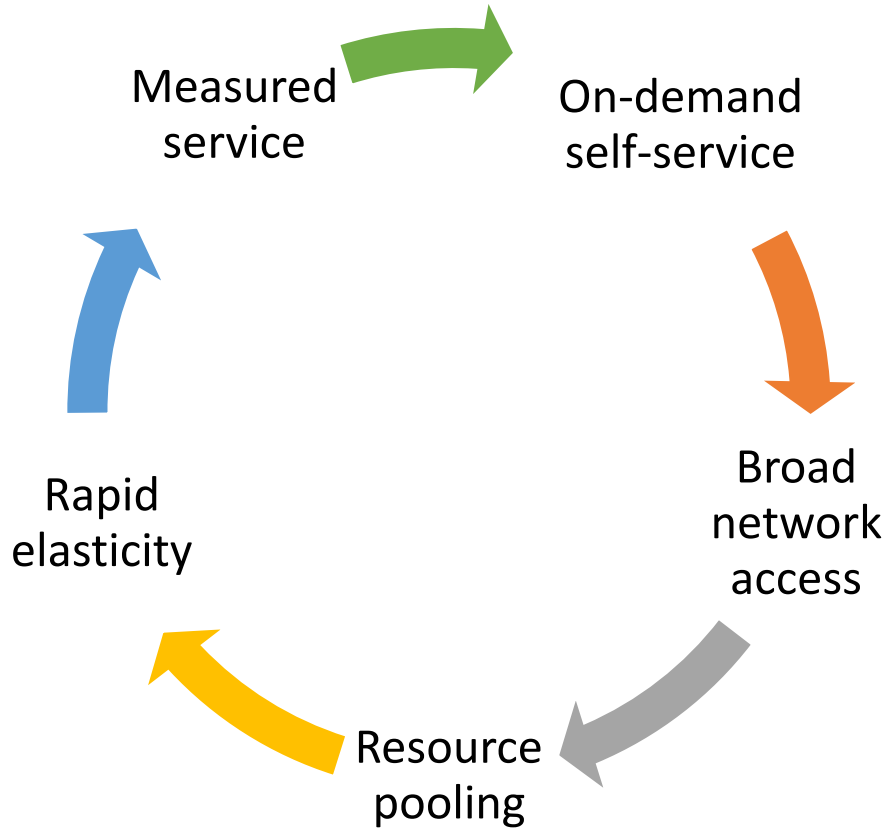



**Rapid elasticity:**

Computing resources can be rapidly and elastically provisioned and released to scale out or in according to demand.

Users can scale resources up or down quickly.

# Characteristics of Cloud Computing



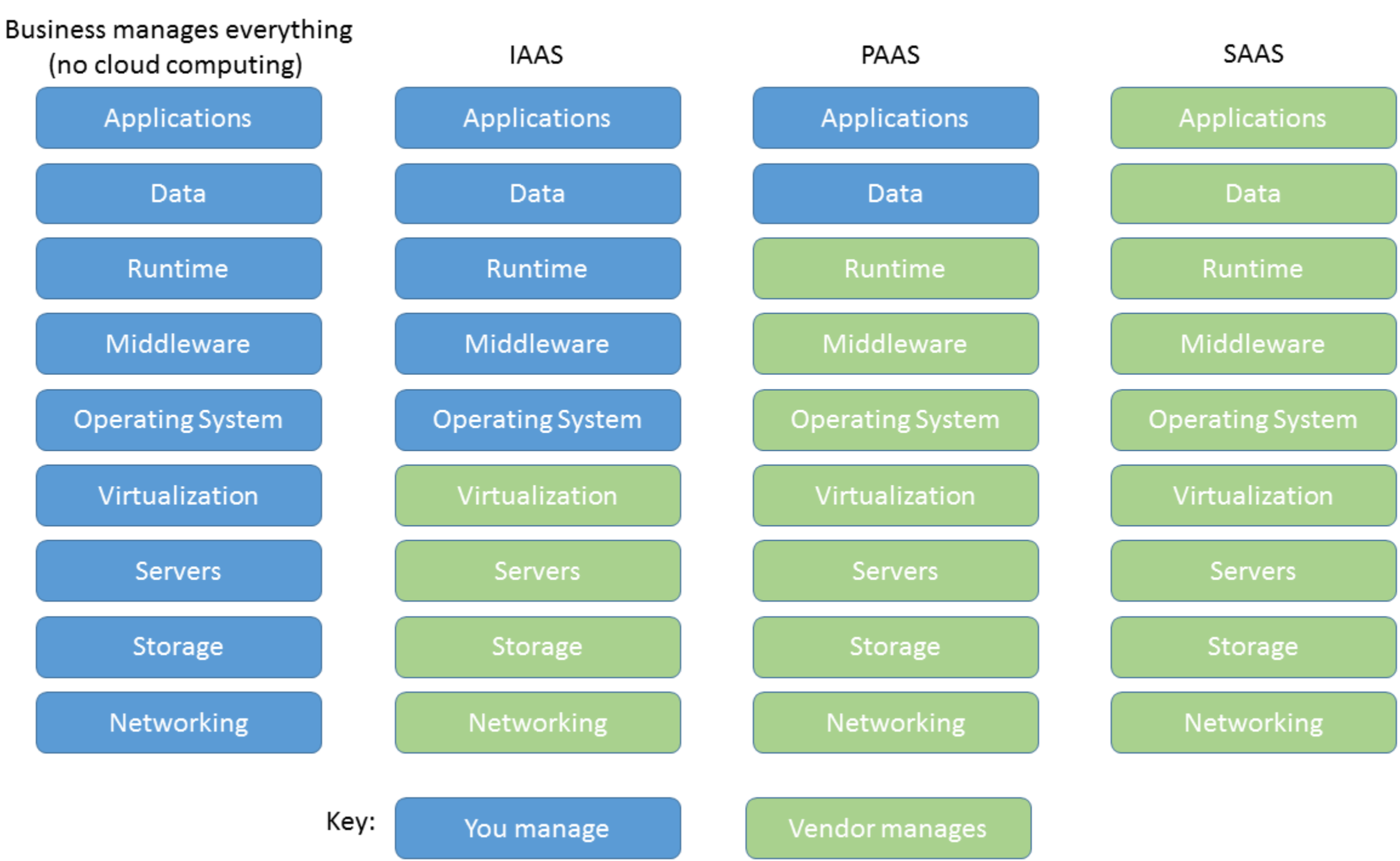

**Measured service:**

Cloud systems automatically control and optimize resource use by leveraging metering capabilities, allowing resource usage to be monitored, controlled, and reported, providing transparency for both the provider and consumer.

# Cloud Service Models

- ✓ **Infrastructure as a Service (IaaS)**
  - ✓ Provides virtualized computing resources over the internet, allowing users to rent virtual machines, storage, and networking.
- ✓ **Platform as a Service (PaaS)**
  - ✓ Offers a platform allowing customers to develop, run, and manage applications without dealing with the underlying infrastructure complexities.
- ✓ **Software as a Service (SaaS)**
  - ✓ Delivers software applications over the internet on a subscription basis, eliminating the need for users to install, maintain, and upgrade software locally.

# Pizza as a Service


Business manages everything
(no cloud computing)
Applications
Data
Runtime
Middleware
Operating System
Virtualization
Servers
Storage
Networking
IAAS
Applications
Data
Runtime
Middleware
Operating System
Virtualization
Servers
Storage
Networking
PAAS
Applications
Data
Runtime
Middleware
Operating System
Virtualization
Servers
Storage
Networking
SAAS
Applications
Data
Runtime
Middleware
Operating System
Virtualization
Servers
Storage
Networking
Key:
You manage
Vendor manages

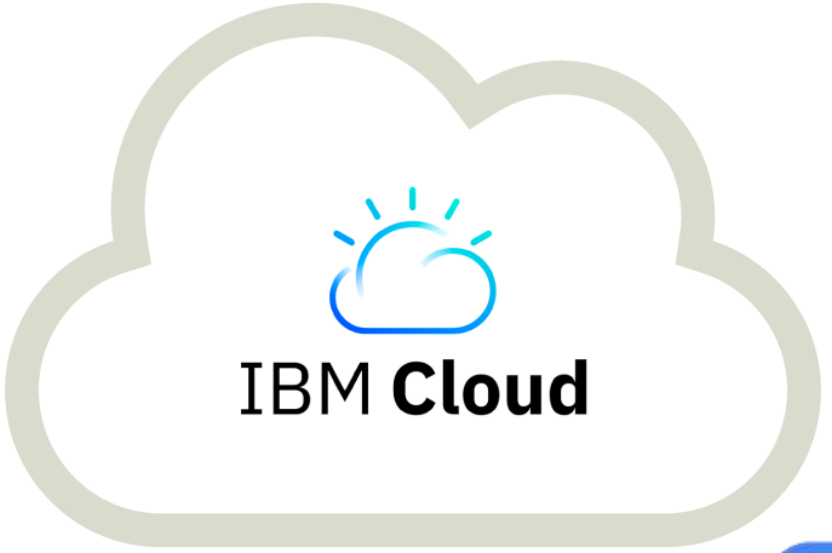
# Cloud Deployment Models

- ✓ **Public Cloud**
  - ✓ Services are provided over the public internet and available to anyone who wants to purchase them.
- ✓ **Private Cloud**
  - ✓ Services are maintained on a private network, often within an organization's data center, offering more control, security, and customization.
- ✓ **Hybrid Cloud**
  - ✓ Combines public and private cloud resources, allowing data and applications to be shared between them while offering greater flexibility and deployment options.
- ✓ **Multi-cloud**
  - ✓ Involves using multiple cloud computing services from different providers, providing redundancy, diversity, and the ability to optimize for specific workloads.

# Benefits of Cloud Computing

- ✓ **Cost Savings**
  - ✓ Pay-per-use pricing models and economies of scale can result in lower costs compared to traditional on-premises infrastructure.
- ✓ **Scalability**
  - ✓ Easily scale resources up or down based on demand, allowing organizations to handle fluctuating workloads more efficiently.
- ✓ **Flexibility and Agility**
  - ✓ Rapid provisioning and deployment of resources enable faster development and innovation cycles.
- ✓ **Reliability and Availability**
  - ✓ Cloud providers typically offer high levels of uptime and redundancy, ensuring services remain accessible even in the face of failures.
- ✓ **Security**
  - ✓ Cloud providers invest heavily in security measures, often offering more robust security than many organizations can afford to implement on-premises.

# Cloud Vendors

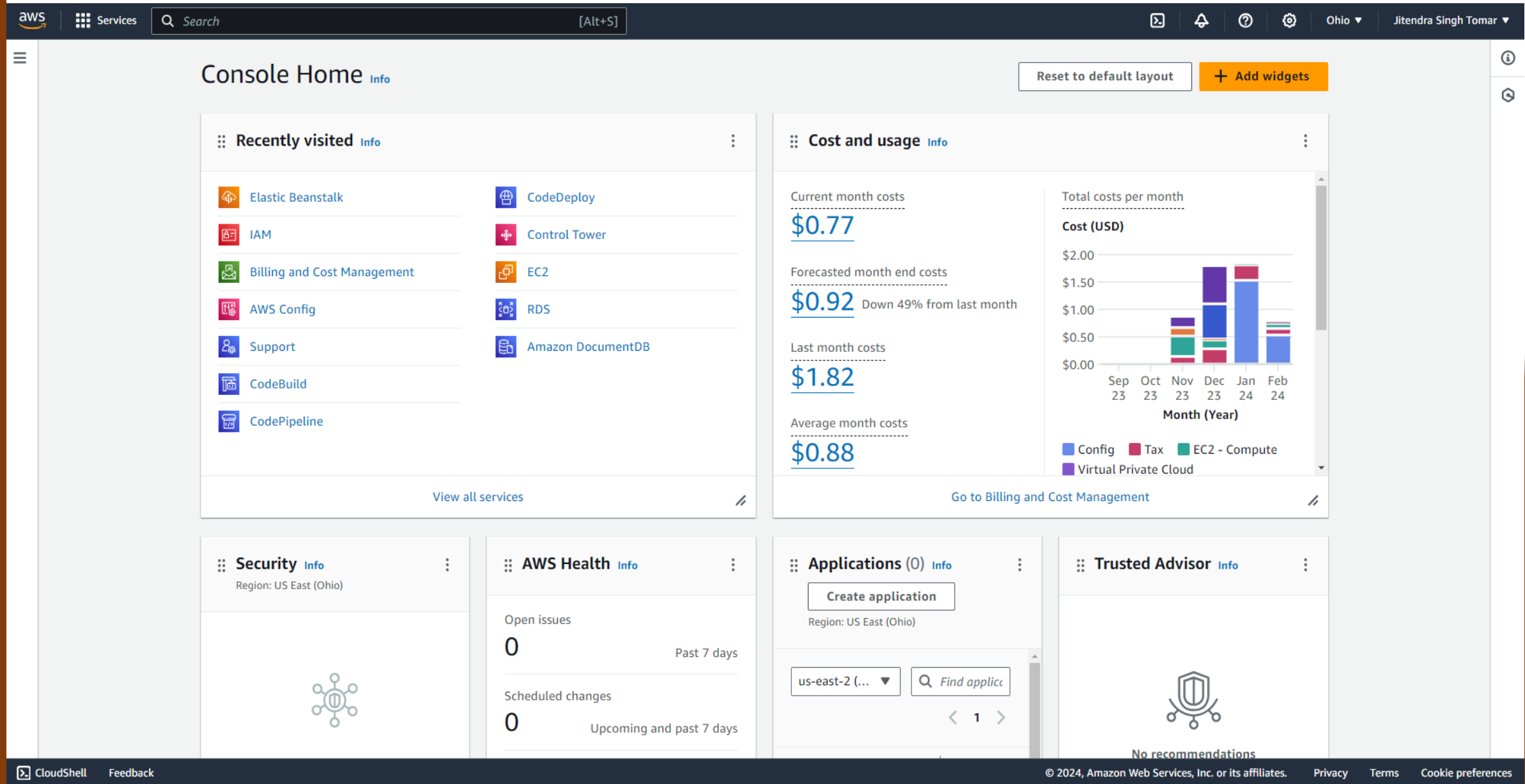






Google Cloud Platform

# AWS Management Console



# AWS Core Services

- ✓ Compute Services
- ✓ Amazon EC2 (Elastic Compute Cloud)
- ✓ Amazon EC2 Auto Scaling
- ✓ Amazon Elastic Container Service (ECS)
- ✓ Storage Services
- ✓ Amazon S3 (Simple Storage Service)
- ✓ Amazon EBS (Elastic Block Store)
- ✓ Amazon Glacier
- ✓ Networking Services
- ✓ Amazon VPC (Virtual Private Cloud)
- ✓ Amazon Route 53
- ✓ AWS Direct Connect

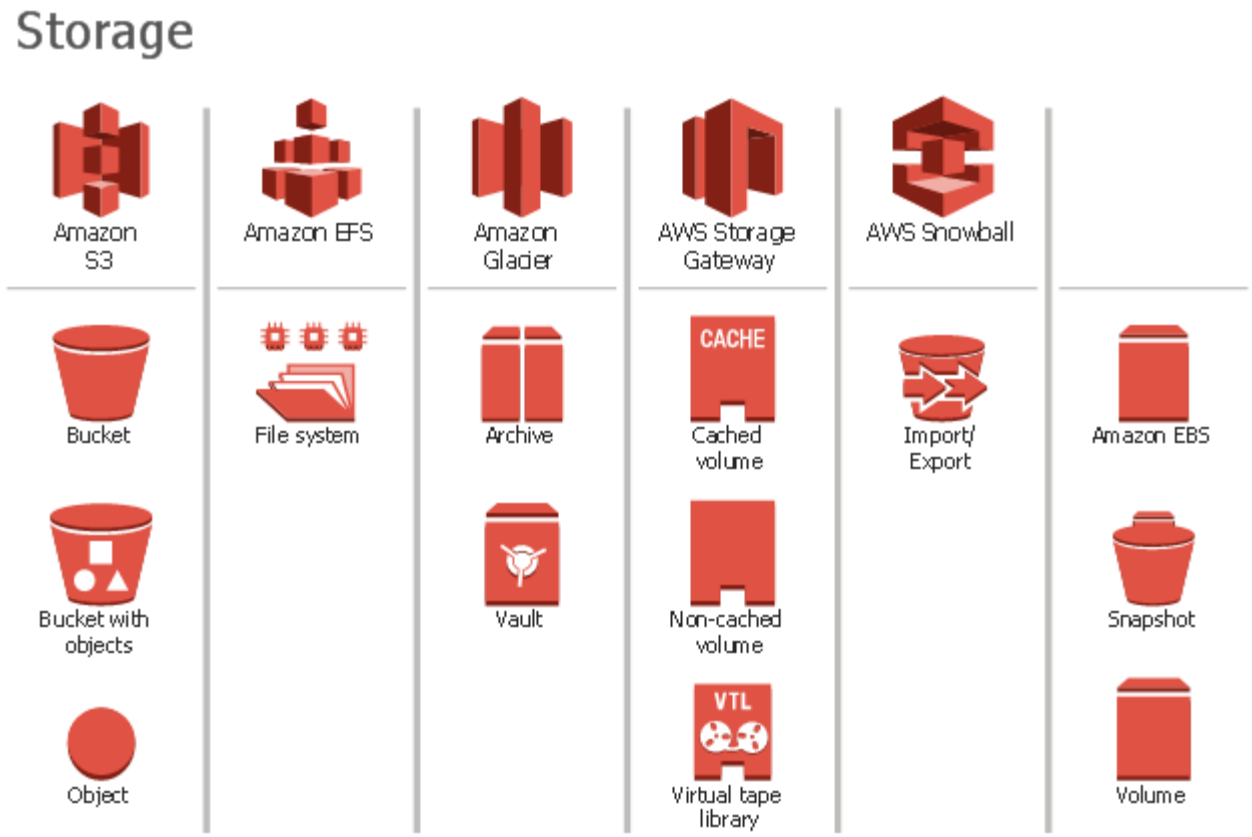
# AWS Compute Services

| Instance | Containers | Serverless |
| --- | --- | --- |
| Amazon Elastic Compute Cloud<br><br>Amazon EC2 Auto Scaling | Amazon Elastic Container Service<br><br>Amazon Elastic Kubernetes Service | AWS Lambda |

Read More: https://docs.aws.amazon.com/whitepapers/latest/aws-overview/compute-services.html

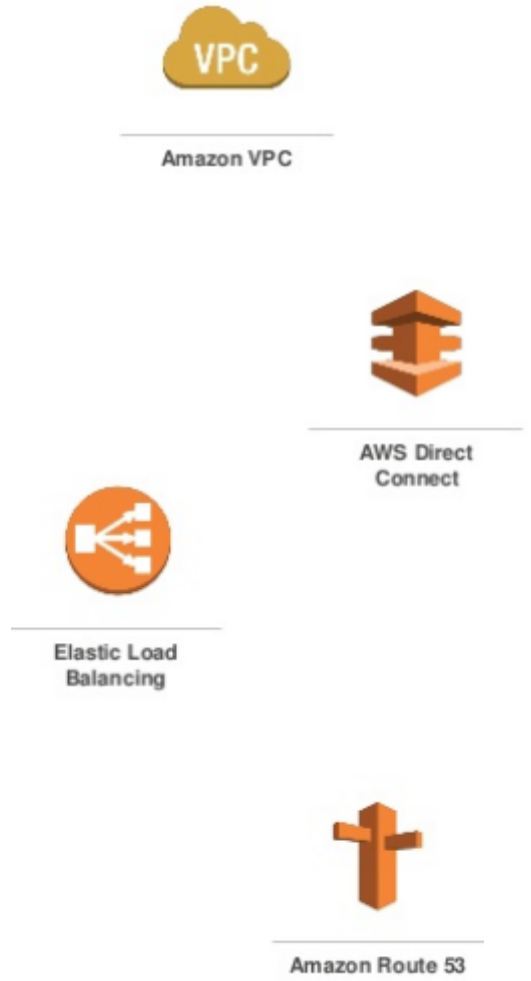
# AWS Storage Services

- ✓ AWS Backup
- ✓ Amazon Elastic Block Store
- ✓ AWS Elastic Disaster Recovery
- ✓ Amazon Elastic File System
- ✓ Amazon File Cache
- ✓ Amazon FSx for Lustre
- ✓ Amazon FSx for NetApp ONTAP
- ✓ Amazon FSx for OpenZFS
- ✓ Amazon FSx for Windows File Server
- ✓ Amazon Simple Storage Service
- ✓ AWS Storage Gateway



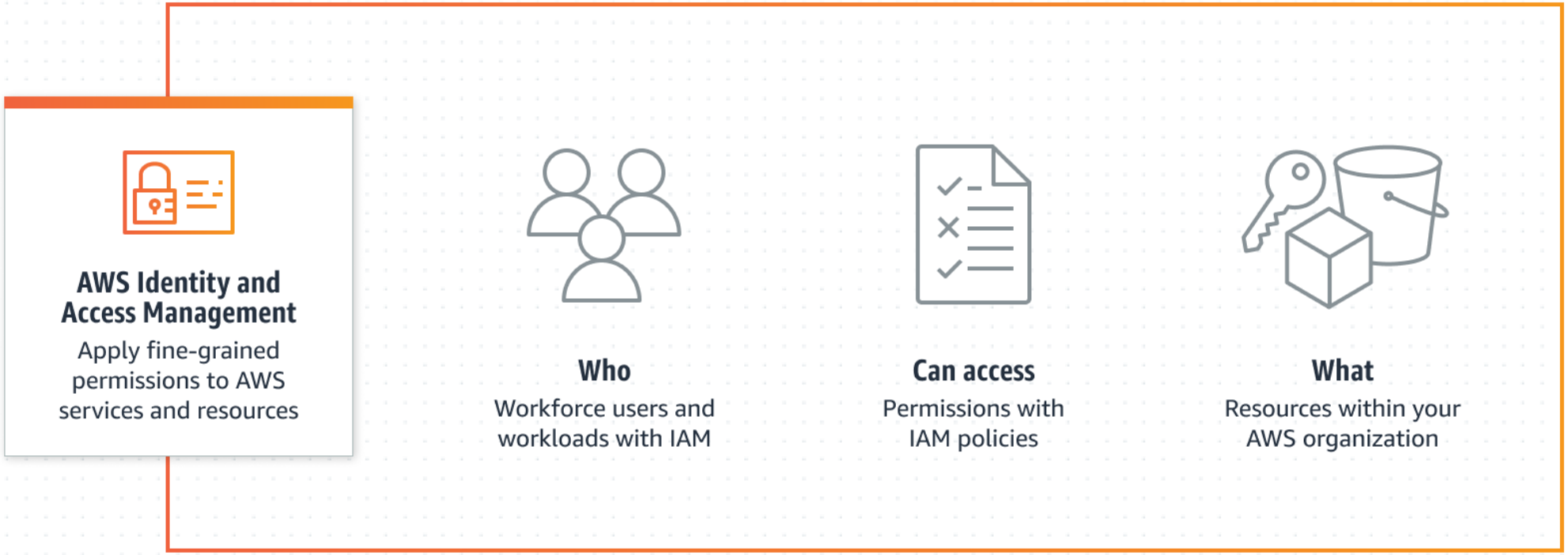
# AWS Networking Services

- ✓ Amazon API Gateway
- ✓ Amazon CloudFront
- ✓ Amazon Route 53
- ✓ AWS Verified Access
- ✓ Amazon VPC
- ✓ Amazon VPC Lattice
- ✓ AWS App Mesh
- ✓ AWS Cloud Map
- ✓ AWS Direct Connect
- ✓ AWS Global Accelerator
- ✓ AWS PrivateLink
- ✓ AWS Private 5G
- ✓ AWS Transit Gateway
- ✓ AWS VPN
- ✓ Elastic Load Balancing
- ✓ Integrated Private Wireless on AWS

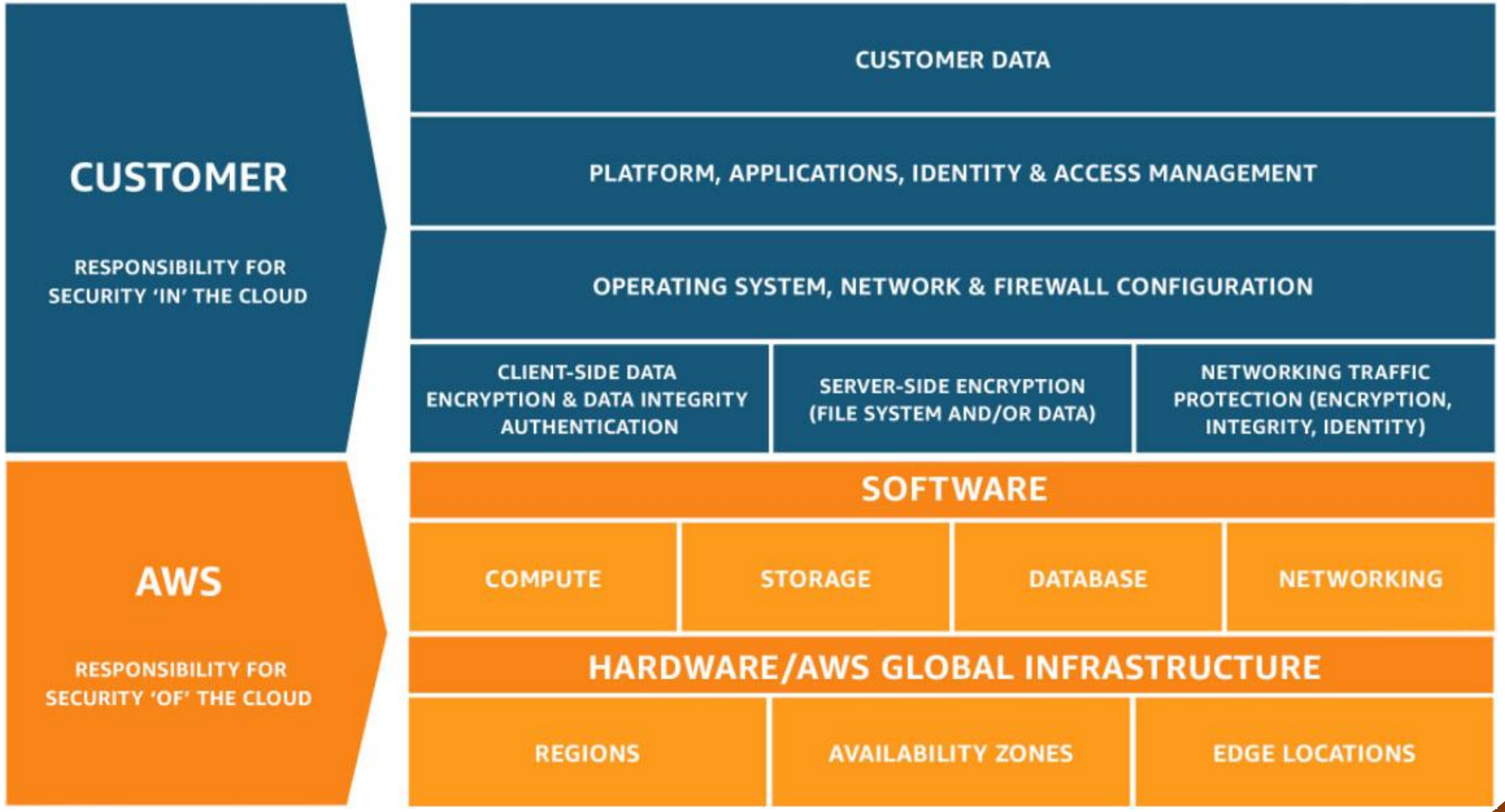


# Security and Identity

- ✓ AWS Shared Responsibility Model
- ✓ AWS Organizations
- ✓ AWS Identity and Access Management (IAM)
- ✓ AWS Key Management Service (KMS)



# AWS Shared Responsibility Model

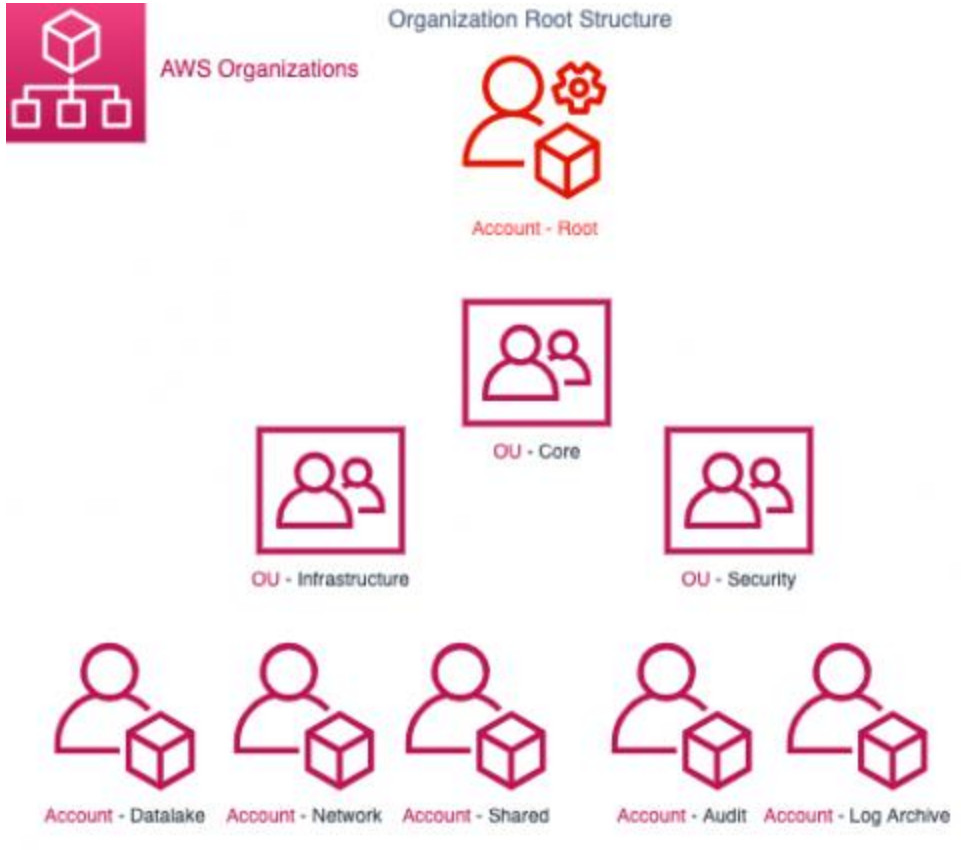


# AWS Identity and Access Management (IAM)

- ✓ AWS Identity and Access Management (IAM) is a web service that helps you securely control access to AWS resources.
- ✓ With IAM, you can centrally manage permissions that control which AWS resources users can access.
- ✓ You use IAM to control who is authenticated (signed in) and authorized (has permissions) to use resources.
- ✓ When you create an AWS account, you begin with one sign-in identity that has complete access to all AWS services and resources in the account → ROOT USER.
- ✓ This identity is called the AWS account root user and is accessed by signing in with the email address and password that you used to create the account.

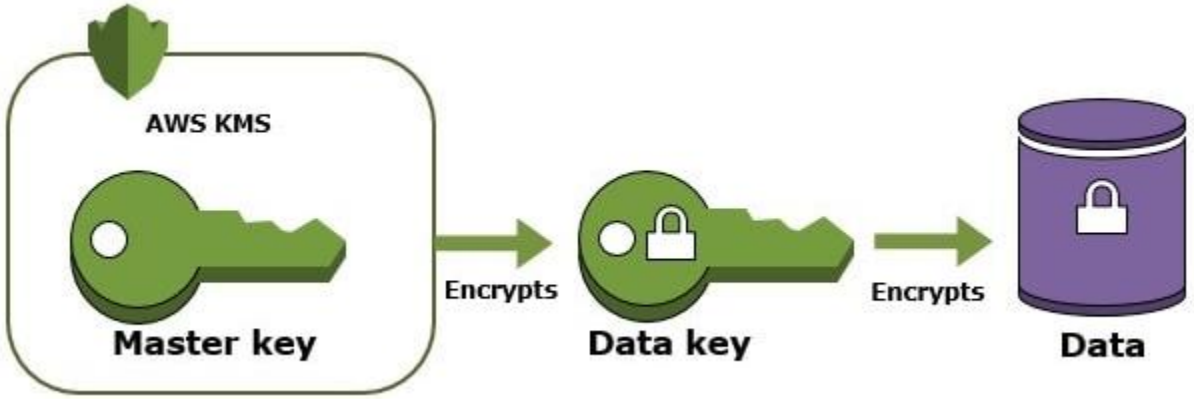
# AWS Organizations

- ✓ AWS Organizations is an account management service that enables you to consolidate multiple AWS accounts into an organization that you create and centrally manage.
- ✓ AWS Organizations includes account management and consolidated billing capabilities that enable you to better meet the budgetary, security, and compliance needs of your business.
- ✓ As an administrator of an organization, you can create accounts in your organization and invite existing accounts to join the organization.



# AWS Key Management Service (KMS)

- ✓ AWS Key Management Service (AWS KMS) is a managed service that makes it easy for you to create and control the cryptographic keys that are used to protect your data.
- ✓ AWS KMS uses hardware security modules (HSM) to protect and validate your AWS KMS keys under the FIPS 140-2 Cryptographic Module Validation Program.
- ✓ AWS KMS integrates with most other AWS services that encrypt your data.
- ✓ AWS KMS also integrates with AWS CloudTrail to log use of your KMS keys for auditing, regulatory, and compliance needs.



# Database Services

RDS

DynamoDB

DocumentDB

Neptune

ElasticCache

RedShift

TimeStream

Quantum Ledger Database

Key Spaces

Amazon Aurora

# Amazon RDS (Relational Database Service)

- ✓ It's a is a fully managed relational database service provided by AWS.
- ✓ It supports multiple database engines including MySQL, PostgreSQL, MariaDB, Oracle, SQL Server, and Amazon Aurora.
- ✓ Amazon RDS automates routine administrative tasks such as hardware provisioning, database setup, patching, and backups, allowing developers to focus on their applications.
- ✓ It offers high availability through automated backups, multi-AZ deployments, and automatic failover, minimizing downtime and data loss.
- ✓ Amazon RDS provides security features such as encryption at rest and in transit, network isolation using Amazon VPC, and IAM database authentication.
- ✓ Users can monitor and manage their databases using Amazon CloudWatch metrics, AWS Management Console, and command-line tools.

# Amazon DynamoDB

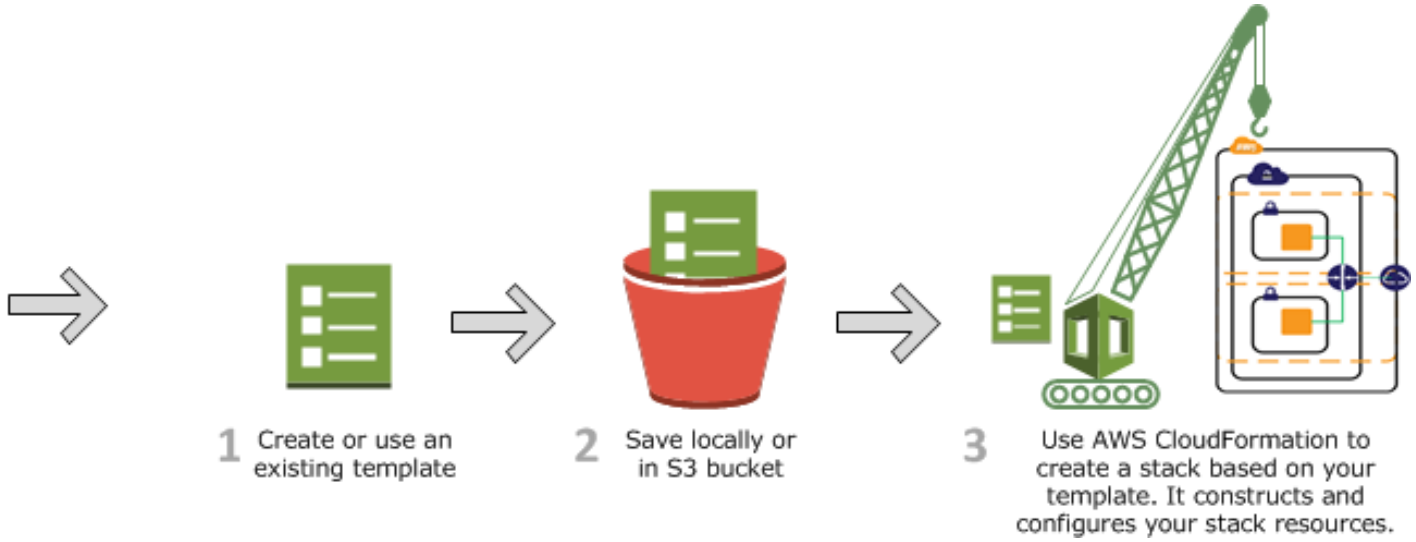
- ✓ Amazon DynamoDB is a fully managed NoSQL database service provided by Amazon Web Services (AWS).
- ✓ It offers seamless scalability, allowing users to easily scale their databases up or down based on demand without downtime or performance degradation.
- ✓ DynamoDB provides high availability and fault tolerance with built-in replication and automatic multi-AZ deployments.
- ✓ It offers flexible data models, supporting both key-value and document data structures, enabling developers to choose the best fit for their applications.
- ✓ DynamoDB provides low-latency performance, with single-digit millisecond response times even at scale, making it suitable for real-time applications.
- ✓ DynamoDB offers flexible pricing models including on-demand, provisioned capacity, and DynamoDB Accelerator (DAX), allowing users to optimize costs based on their workload patterns.

# Amazon Redshift

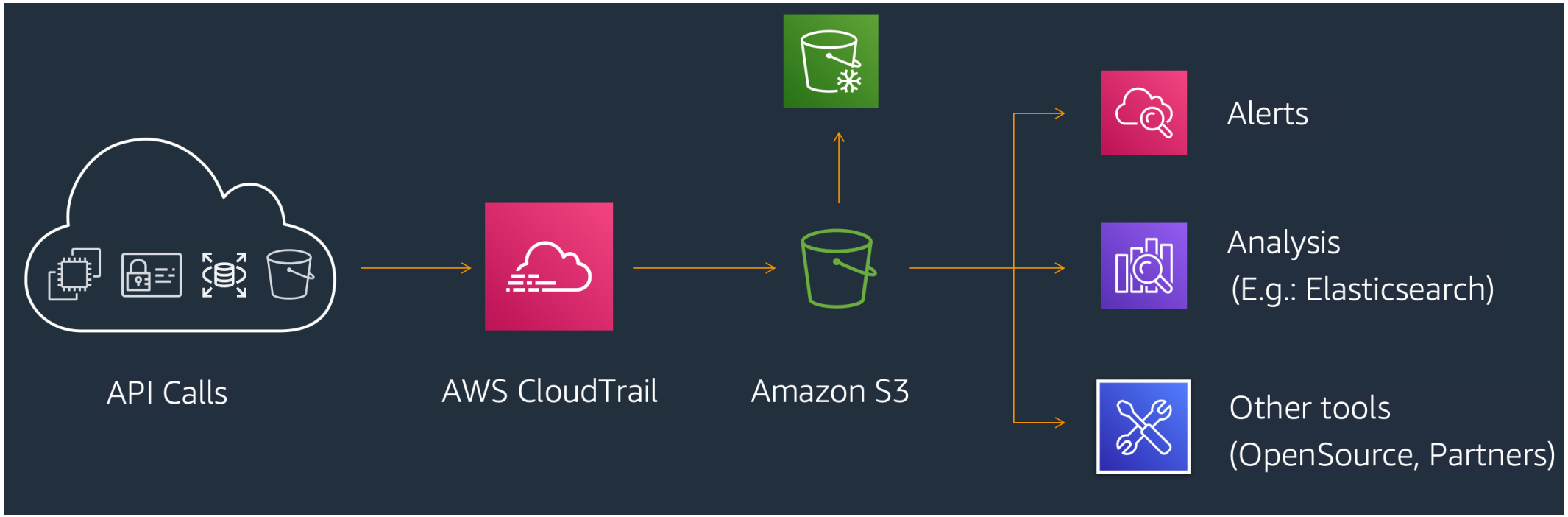
- ✓ Amazon Redshift is a fully managed data warehousing service provided by Amazon Web Services (AWS), designed to analyze large datasets using SQL queries.
- ✓ It offers fast query performance by utilizing columnar storage, massively parallel processing (MPP), and advanced optimization techniques.
- ✓ Redshift is highly scalable, allowing users to easily scale their data warehouse up or down by adding or removing nodes as needed.
- ✓ It supports petabyte-scale data warehouses, making it suitable for businesses with large volumes of data.
- ✓ It supports data ingestion from various sources including Amazon S3, Amazon DynamoDB, Amazon EMR, and streaming data sources such as Amazon Kinesis, enabling users to consolidate and analyze data from multiple sources in one place.

# AWS Management Tools - AWS CloudFormation

```
{
    "AWSTemplateFormatVersion": "2010-09-09",
    "Description": "A simple EC2 instance",
    "Resources": {
        "MyEC2Instance": {
            "Type": "AWS::EC2::Instance",
            "Properties": {
                "ImageId": "ami-0ff8a91507f77f867",
                "InstanceType": "t2.micro"
            }
        }
    }
}
```

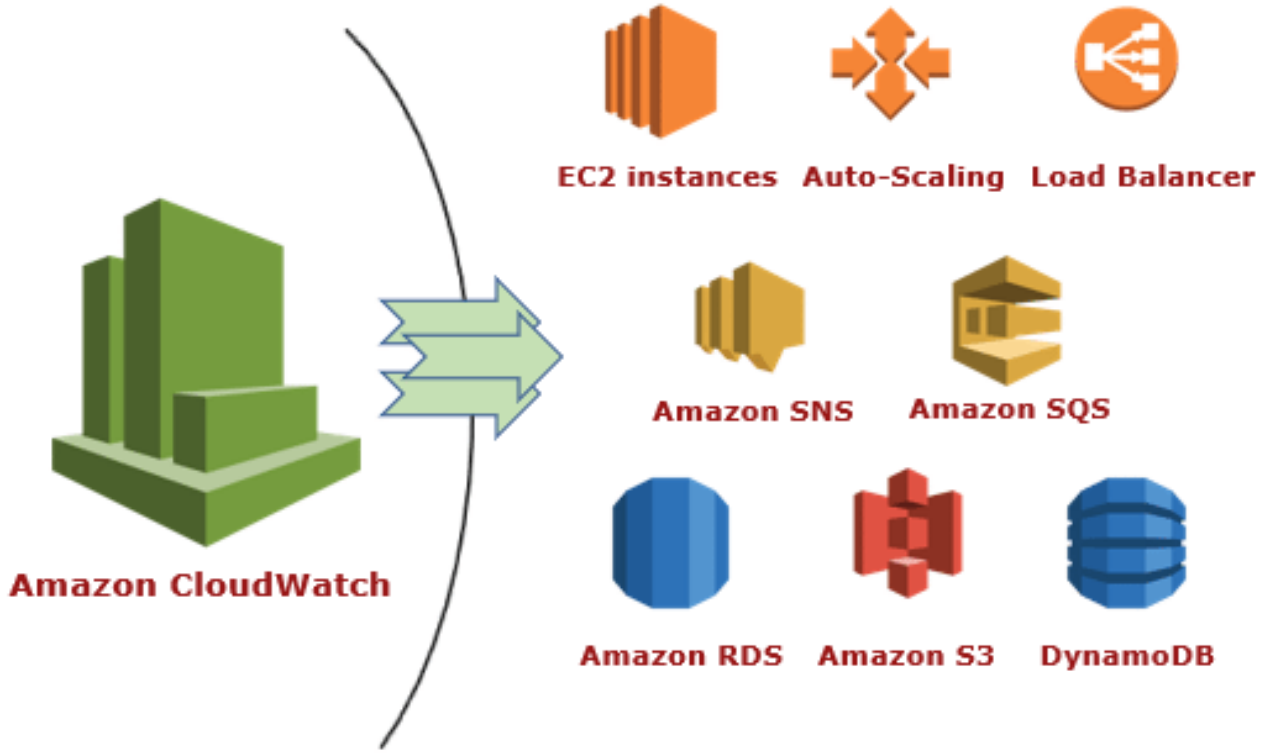


# AWS Management Tools - AWS CloudTrail



# AWS Management Tools - Amazon CloudWatch

CloudWatch enables you to monitor your complete stack (applications, infrastructure, network, and services) and use alarms, logs, and events data to take automated actions and reduce mean time to resolution (MTTR).



# AWS Management Tools - AWS Config

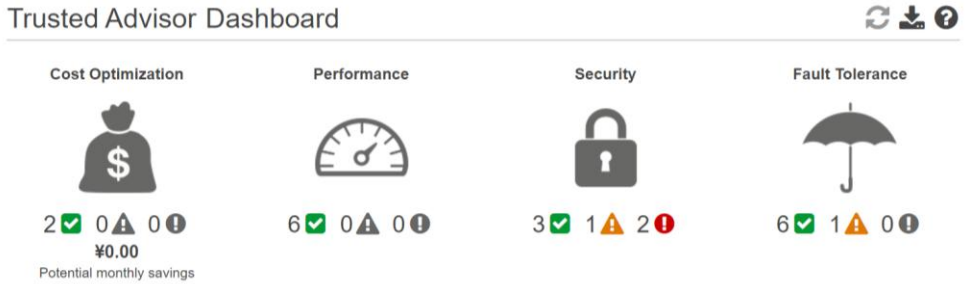
- ✓ AWS Config is a service provided by Amazon Web Services (AWS) that enables continuous monitoring and assessment of AWS resource configurations.
- ✓ It automatically evaluates the configuration of AWS resources against desired configurations specified by users, helping to ensure compliance with security policies, industry regulations, and best practices.
- ✓ AWS Config provides a detailed inventory of AWS resources, including configuration history and relationships between resources, facilitating resource tracking and management.
- ✓ It offers configuration snapshots, which capture the state of AWS resources at specific points in time, enabling users to audit and troubleshoot configuration changes.
- ✓ AWS Config supports customizable rules that allow users to define their own compliance checks and automated remediation actions, helping to maintain a secure and compliant AWS environment.
- ✓ AWS Config offers insights into resource relationships and dependencies, helping users understand the impact of configuration changes and improve resource management.

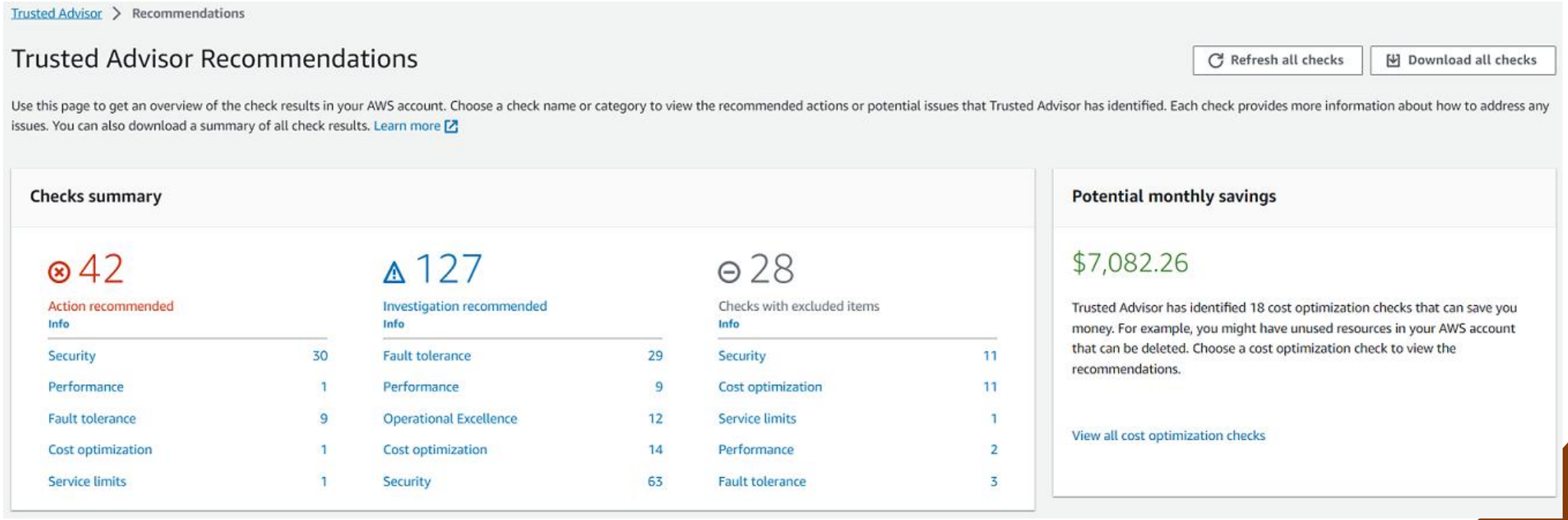
# AWS Monitoring and Analytics - Amazon CloudWatch

- ✓ Amazon CloudWatch is a monitoring and observability service provided by Amazon Web Services (AWS) for tracking and managing the performance of AWS resources and applications.
- ✓ It collects and aggregates metrics, logs, and events from various AWS services, providing a unified view of the operational health and performance of your AWS environment.
- ✓ CloudWatch offers customizable dashboards that allow users to visualize metrics, logs, and alarms in real-time, enabling effective monitoring and troubleshooting.
- ✓ It provides automated monitoring and alerting capabilities through CloudWatch Alarms, which can be configured to trigger notifications or automated actions based on predefined thresholds or anomaly detection.
- ✓ CloudWatch Logs enables users to centralize and analyze log data from applications and services running on AWS.
- ✓ It supports detailed monitoring of AWS resources with high-resolution metrics, providing insights into resource utilization, performance trends, and operational patterns.
- ✓ CloudWatch Events allows users to respond to changes in AWS resources and system events by triggering automated actions using AWS Lambda functions or other targets.

# AWS Trusted Advisor

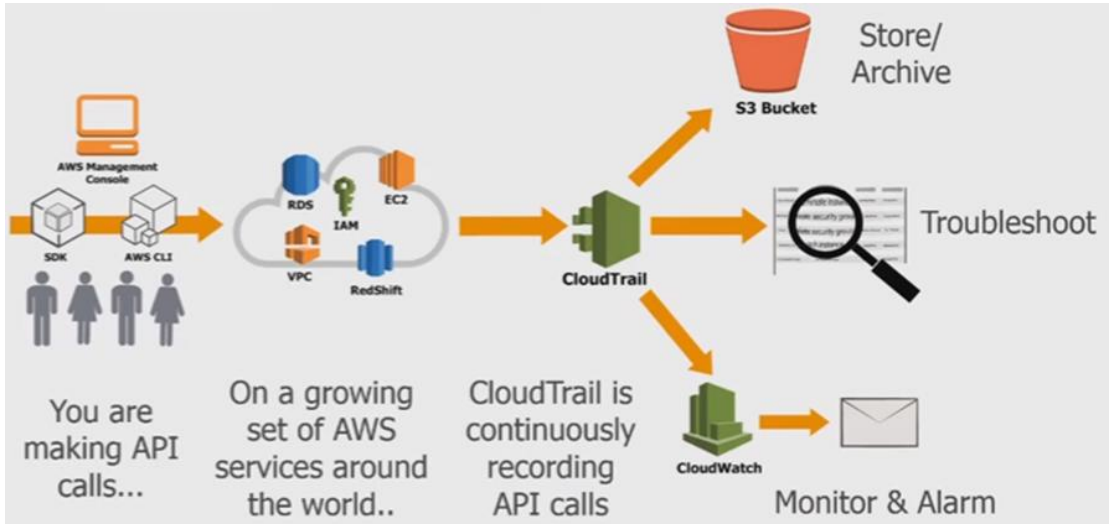
- ✓ AWS Trusted Advisor is a service that continuously analyzes your AWS accounts and provides recommendations to help you to follow AWS best practices and AWS Well-Architected guidelines.



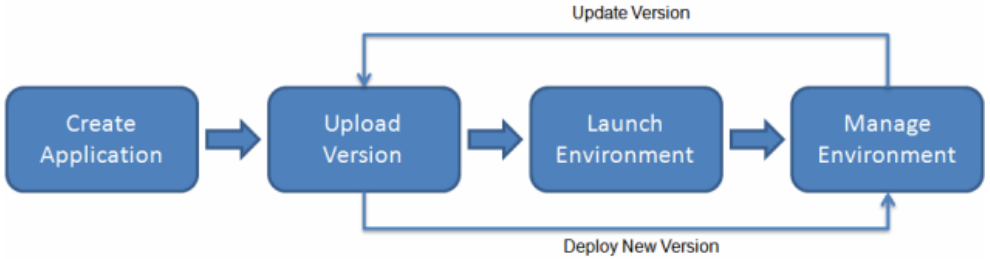
# AWS CloudTrail

- ✓ AWS CloudTrail is an AWS service that helps you enable operational and risk auditing, governance, and compliance of your AWS account.
- ✓ Actions taken by a user, role, or an AWS service are recorded as events in CloudTrail.
- ✓ Events include actions taken in the AWS Management Console, AWS Command Line Interface, and AWS SDKs and APIs.
- ✓ CloudTrail is active in your AWS account when you create it and doesn't require any manual setup.
- ✓ When activity occurs in your AWS account, that activity is recorded in a CloudTrail event.



# Deployment and Elasticity - AWS Elastic Beanstalk

- ✓ AWS Elastic Beanstalk is a Platform as a Service (PaaS) offering from AWS that simplifies the deployment, management, and scaling of web applications and services.
- ✓ It supports a variety of programming languages and frameworks including Java, .NET, Node.js, Python, Ruby, PHP, Go, and Docker.




- ✓ Elastic Beanstalk automatically handles the deployment and provisioning of underlying infrastructure components such as EC2 instances, load balancers, auto-scaling groups, and networking resources.
- ✓ It integrates seamlessly with other AWS services such as Amazon RDS, Amazon S3, Amazon SQS, and Amazon DynamoDB, enabling developers to leverage additional AWS capabilities in their applications.
- ✓ It supports automatic scaling based on customizable triggers such as CPU utilization, request rates, or custom metrics, allowing applications to automatically scale up or down to accommodate changing traffic patterns.

# Deployment and Elasticity - AWS Lambda


- ✓ AWS Lambda is a serverless compute service provided by Amazon Web Services (AWS) that allows developers to run code without provisioning or managing servers.
- ✓ It supports a variety of programming languages including Node.js, Python, Java, Go, .NET, and Ruby, providing flexibility for developers to choose the language they are most comfortable with.
- ✓ Lambda functions are event-driven, meaning they can be triggered by events such as changes to data in Amazon S3, updates to DynamoDB tables, API Gateway requests, or messages from Amazon SQS or SNS.
- ✓ Developers can write Lambda functions to perform tasks such as data processing, real-time file processing, backend API services, and more, without worrying about server management or scalability.
- ✓ Lambda automatically scales to handle incoming requests and executes functions in response to events, ensuring high availability and scalability without the need for manual intervention.
- ✓ It offers built-in integrations with other AWS services, allowing developers to easily connect Lambda functions to services like S3, DynamoDB, API Gateway, SNS, SQS, and more.

# Deployment and Elasticity - AWS Lambda

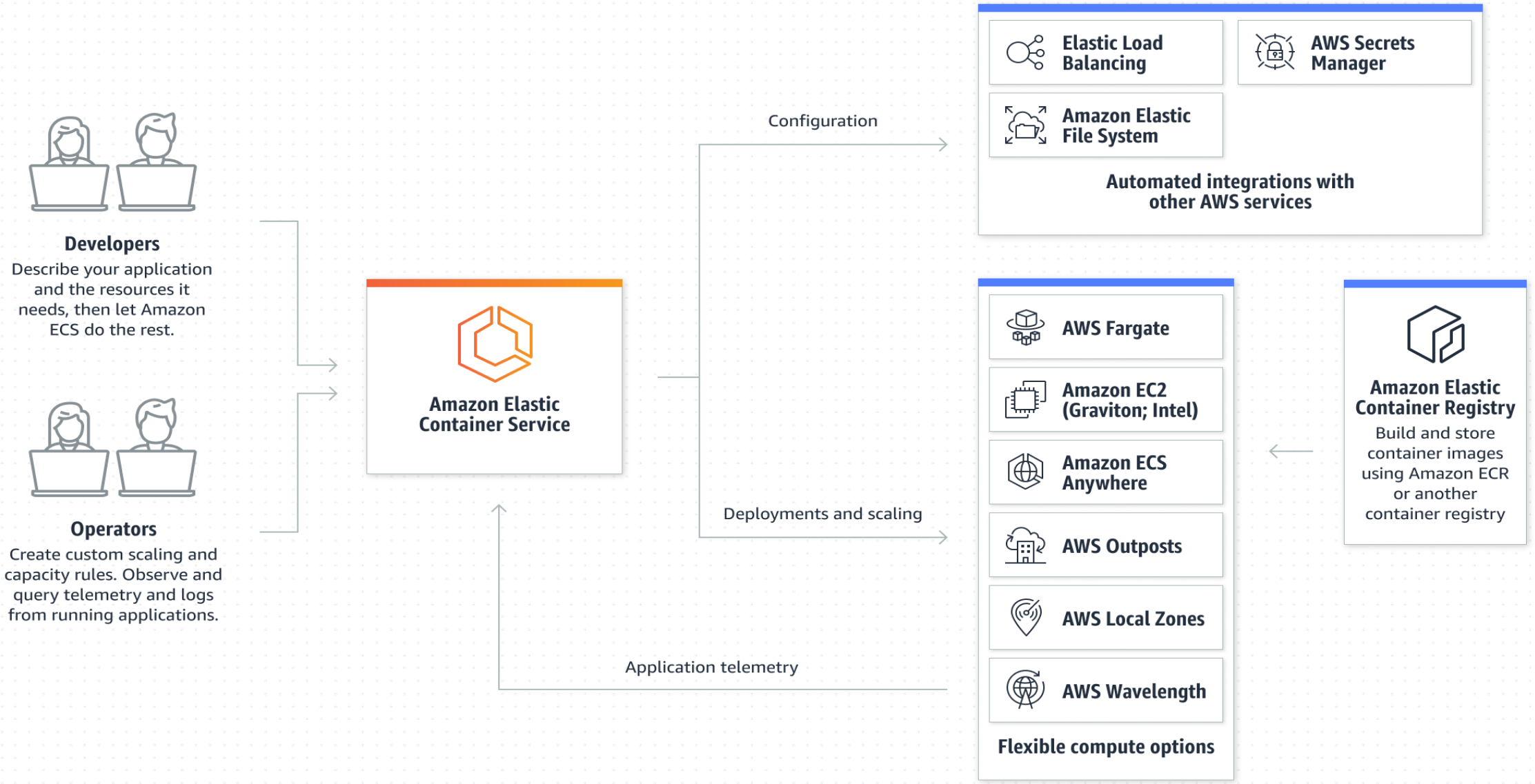
AWS Lambda

# Deployment and Elasticity - Amazon ECS

- ✓ Amazon ECS (Elastic Container Service) is a fully managed container orchestration service provided by Amazon Web Services (AWS), supporting Docker containers.
- ✓ It allows users to easily run, manage, and scale containerized applications on a cluster of EC2 instances or AWS Fargate, without needing to manage the underlying infrastructure.
- ✓ Amazon ECS supports deploying applications in two modes:
  - ➢ EC2 launch type, where users manage the EC2 instances running the containers, and
  - ➢ Fargate launch type, where AWS manages the infrastructure for running containers.

- ✓ ECS integrates seamlessly with other AWS services such as Elastic Load Balancing (ELB), Amazon VPC, AWS IAM, AWS CloudFormation, Amazon ECR, and AWS CloudWatch, providing a comprehensive container orchestration solution.
- ✓ It offers flexible scheduling options, allowing users to define placement constraints and strategies to control how tasks are distributed across the cluster and where they run.

# Deployment and Elasticity - Amazon ECS



# AWS Pricing Models

- ✓ Pay-as-you-go
- ✓ Reserved Instances (RIs)
- ✓ Spot Instances
- ✓ Savings Plans
- ✓ Reserved Capacity
- ✓ Free Tier
- ✓ Pay-as-you-go with Commitments
- ✓ Data Transfer Pricing
- ✓ Data Transfer Acceleration
- ✓ Content Delivery Network (CDN)

# AWS Pricing Models - Offerings

**Free Trials**

**12 months free**

**Always free**


That's all Folks!