CIS Active Learning

Comparing different AWS services with others

Our team

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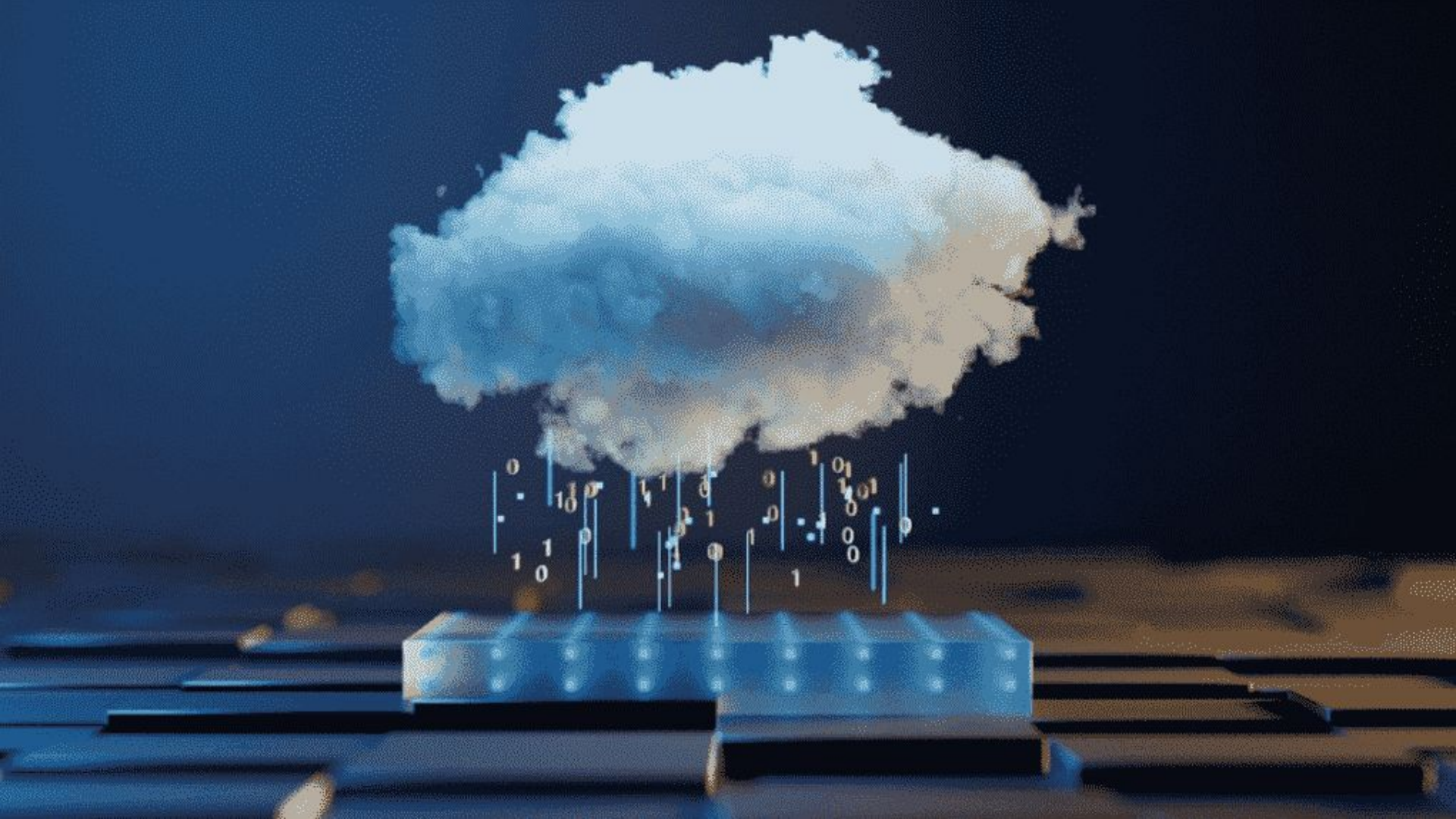
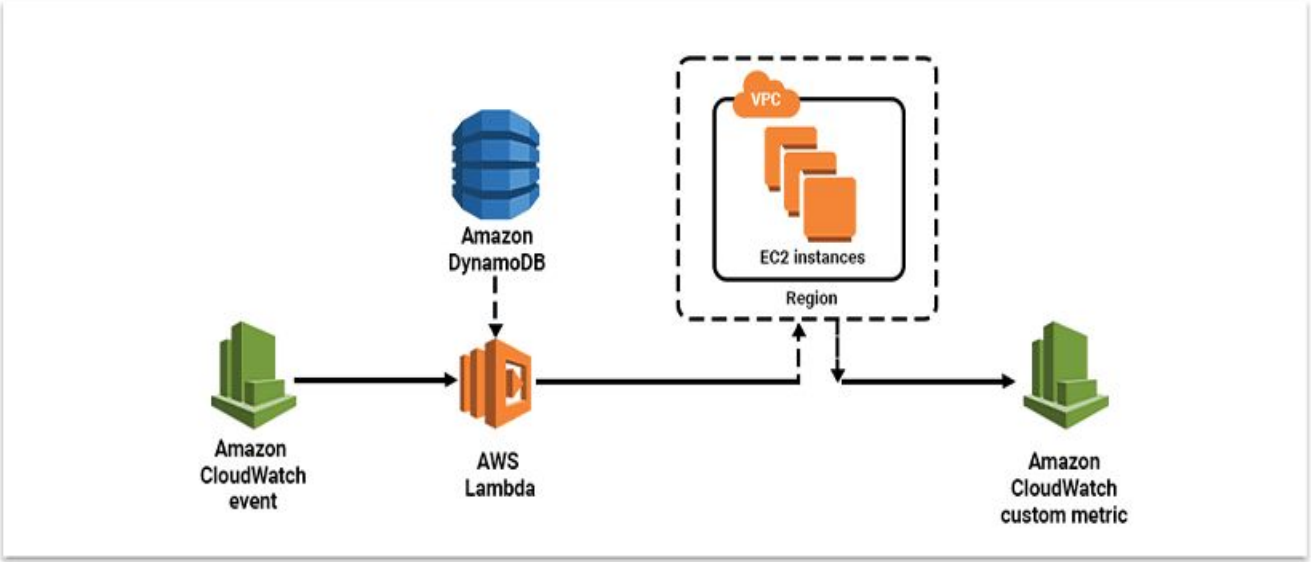


Amazon EC2(Elastic Compute Cloud)



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Amazon EC2 (Elastic Compute Cloud):

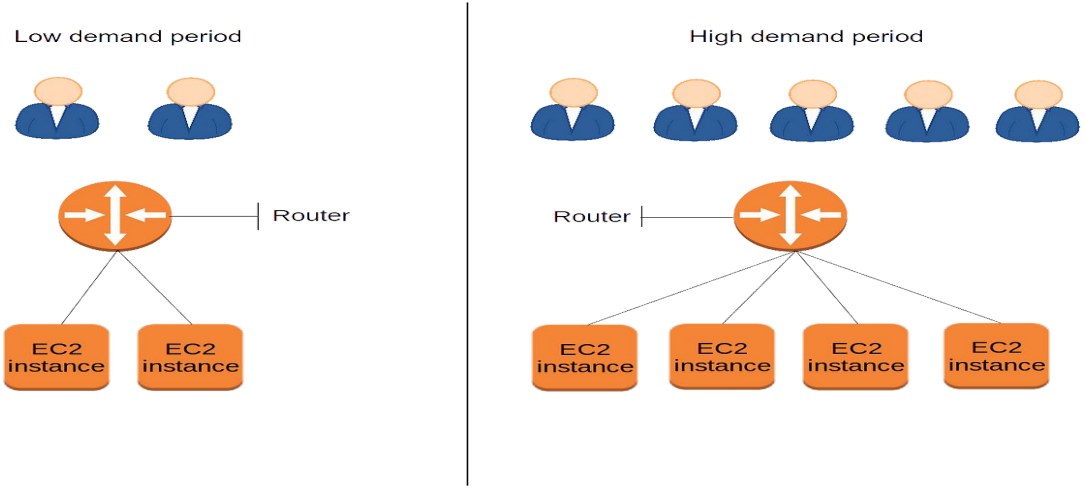
Instance Types and Pricing Models:

- Amazon EC2 provides various instance types categorized based on CPU, memory, storage, and networking capabilities, catering to different workload requirements such as general-purpose, memory-optimized, compute-optimized, storage-optimized, etc.

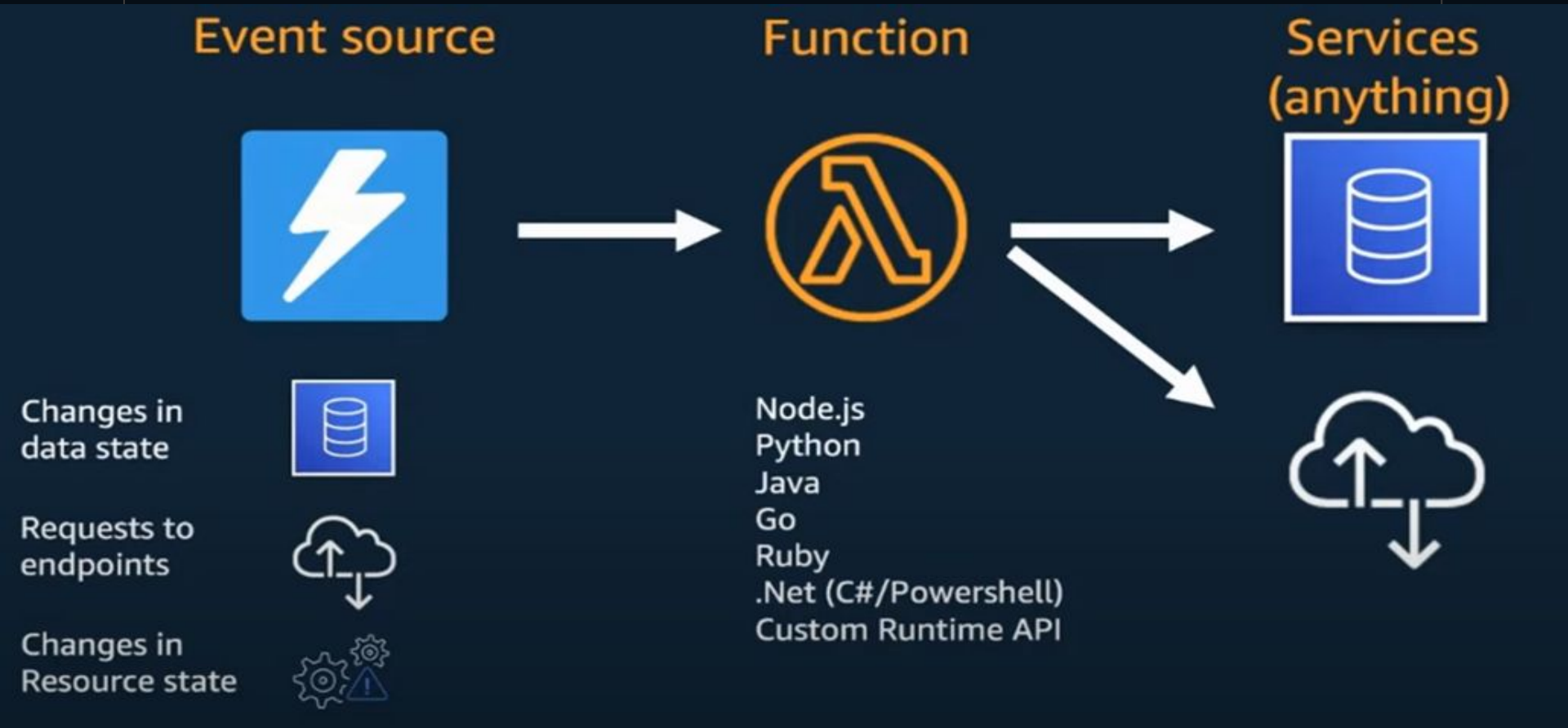
- Pricing models include On-Demand Instances (pay-as-you-go), Reserved Instances (long-term commitment for discounted pricing), Spot Instances (bid for unused capacity at lower rates), and Dedicated Hosts (physical servers dedicated to your use).

Scalability and Elasticity Features:

- EC2 offers Auto Scaling, allowing you to automatically adjust the number of instances based on demand, ensuring optimal performance and cost-efficiency.
- Elastic Load Balancing distributes incoming traffic across multiple EC2 instances, enhancing fault tolerance and scalability.



AWS Lambda


Event source
Function
Services (anything)
Changes in data state
Requests to endpoints
Changes in Resource state
Node.js
Python
Java
Go
Ruby
.Net (C#/Powershell)
Custom Runtime API

Serverless Computing Paradigm:

- AWS Lambda enables serverless computing, where you can run code without provisioning or managing servers. It automatically scales based on the incoming workload.
- You pay only for the compute time consumed by your code in response to events, making it cost-effective for event-driven applications.

Event-Driven Architecture and Use Cases:

- Lambda is designed for event-driven architectures, responding to events from various sources like HTTP requests (API Gateway), file uploads (S3), database updates (DynamoDB), message queues (SQS), etc.
    - Use cases include real-time data processing, IoT applications, automation workflows, and microservices architectures.

Google CE

vs

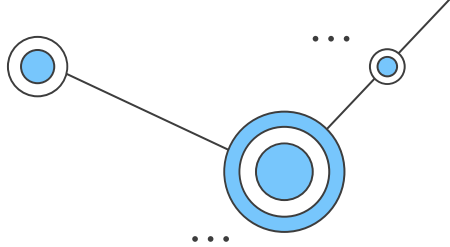
Amazon EC2

vs

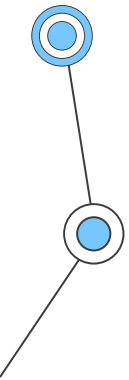
Azure VM

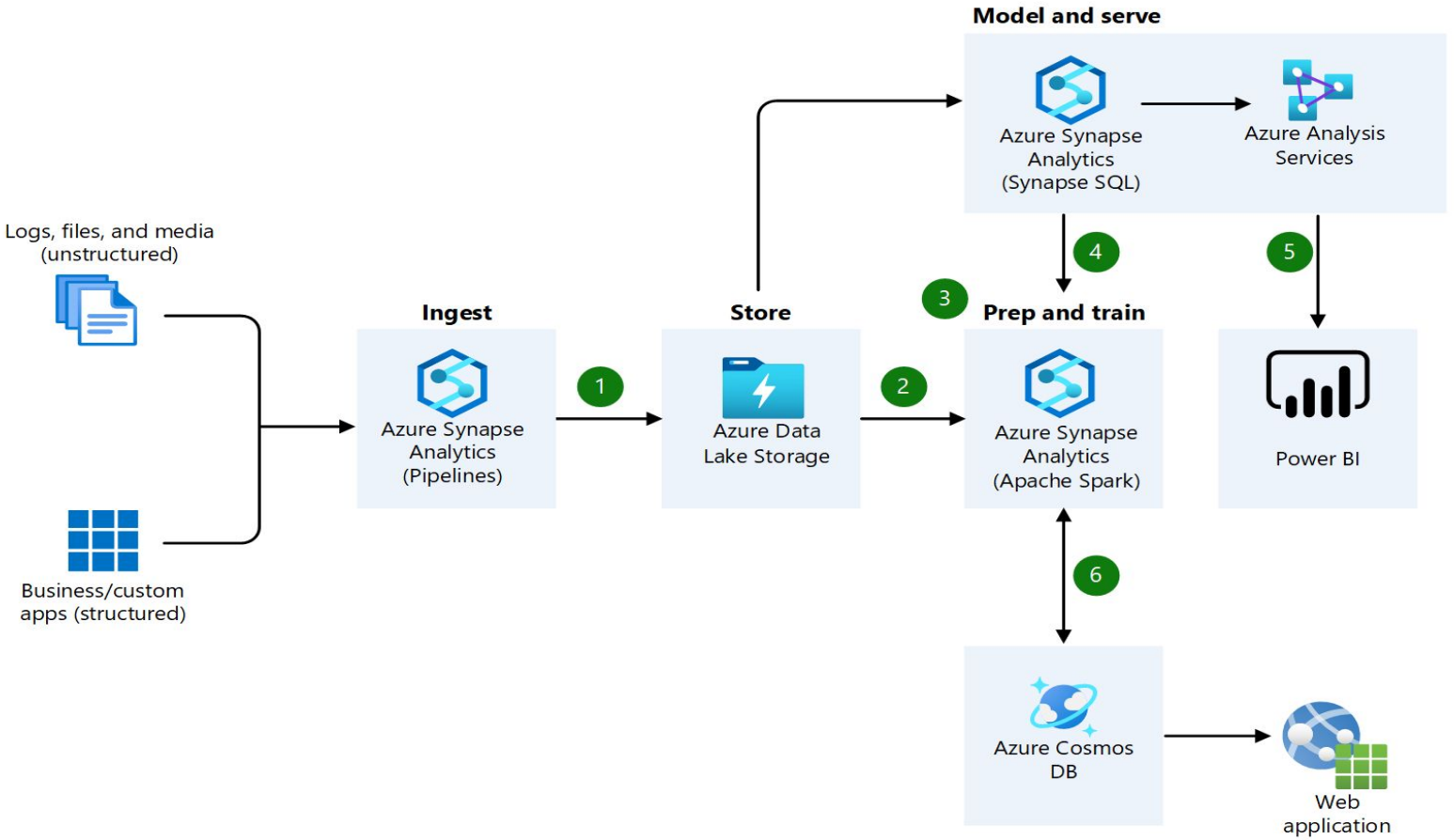
Microsoft Azure

Azure Virtual Machines
(equivalent to Amazon EC2):

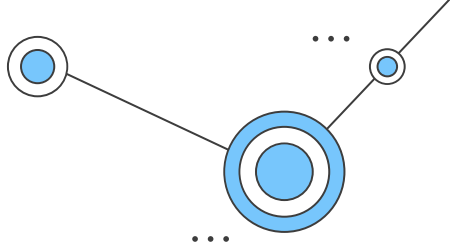


- Azure VMs offer a range of instance types similar to EC2, with options for general-purpose, memory-optimized, compute-optimized, etc.
- Pricing models include Pay-As-You-Go, Reserved Instances, and Spot-like pricing with Azure Spot Virtual Machines.



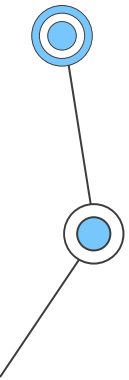


Microsoft Azure



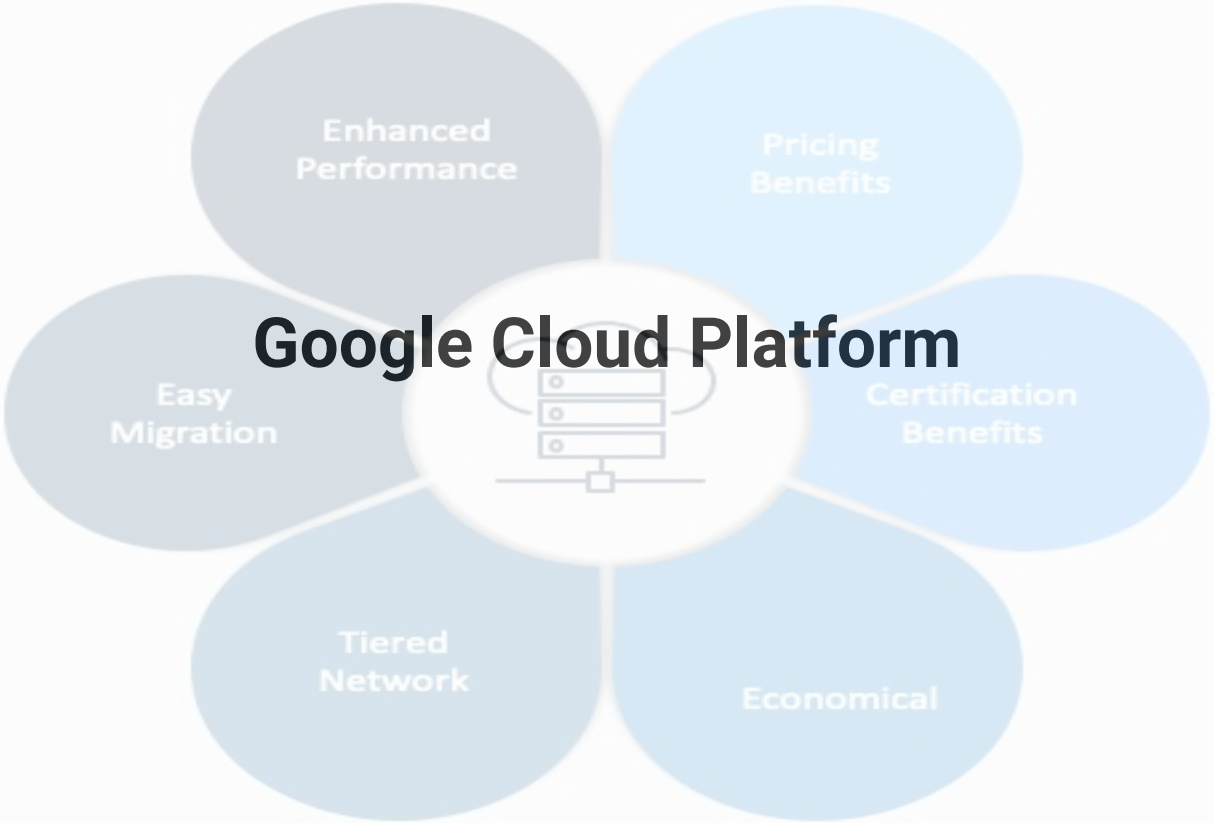
Azure Functions (equivalent to AWS Lambda):

- Azure Functions provide serverless compute, allowing you to run code in response to events without managing infrastructure.
- It supports multiple programming languages and integrates seamlessly with Azure services like Azure Storage, Event Grid, and Cosmos DB.

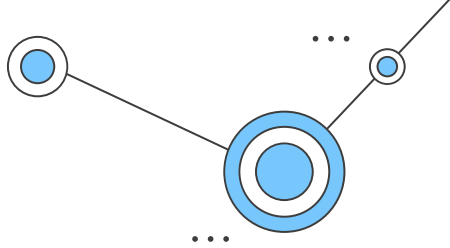


CLOUD PLATFORM

Benefits of Google Cloud Platform

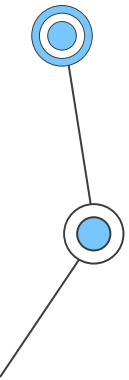


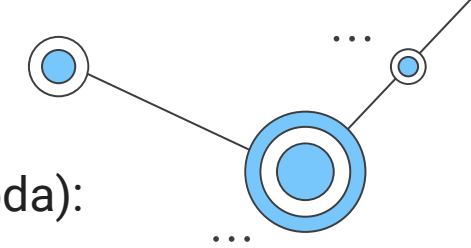
Google Cloud Platform



Google Compute Engine (equivalent to Amazon EC2):

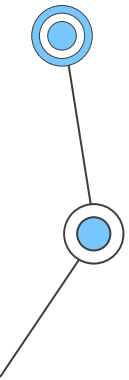
GCE offers virtual machines similar to EC2, with customizable instance types, automatic scaling, and pricing options including On-Demand and Preemptible VMs (similar to Spot Instances).





Google Cloud Functions (equivalent to AWS Lambda):

- Google Cloud Functions enable serverless execution of code in response to events from Google Cloud services or HTTP requests.
- It supports multiple programming languages and integrates with other GCP services like Cloud Storage, Pub/Sub, and Firestore



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Amazon S3

Amazon S3 (Simple Storage Service) is a cloud-based storage service provided by Amazon Web Services (AWS) that allows you to store and retrieve data over the internet. It offers scalability, durability, and high availability for storing various types of data, including files, documents, images, videos, and backups.

Storage Classes and Durability Options

Standard

Suitable for frequently accessed data with high durability and availability

Standard-Infrequent Access (Standard-IA)

Lower-cost option for less frequently accessed data with immediate access when needed

One Zone-Infrequent Access (One Zone-IA)

Similar to Standard-IA but stores data in a single availability zone, reducing costs further.

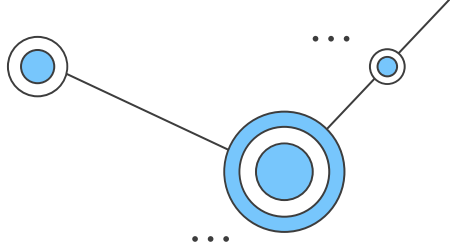
Intelligent-Tiering

Automatically moves objects between Standard and Standard-IA based on access patterns, optimizing costs.

Glacier and Glacier Deep Archive

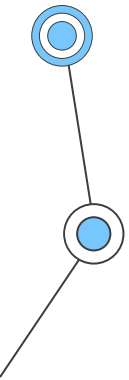
Designed for long-term archival with varying retrieval times and lower costs.

Durability

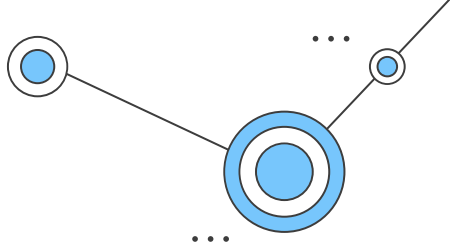


- Durability options ensure data integrity and resilience against failures:

  Amazon S3 provides 99.999999999% (11 9's) durability for objects stored, utilizing data replication across multiple devices and facilities within a region.

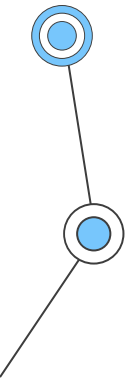


Object Versioning



Object Versioning:

- Amazon S3 supports object versioning, allowing you to preserve, retrieve, and restore every version of every object stored in a bucket.
- Versioning prevents accidental deletion or overwrite, providing a way to recover from unintended changes or data loss.



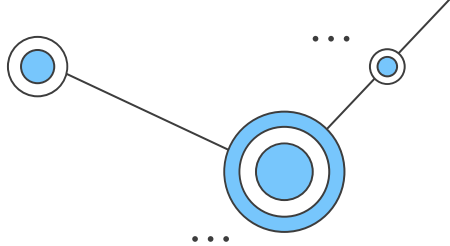
Amazon EBS

Amazon Elastic Block Store (EBS) is a scalable block storage service offered by Amazon Web Services (AWS) that provides persistent storage volumes for use with Amazon EC2 instances. It serves as a foundational component in the AWS cloud infrastructure, allowing users to create and manage storage volumes that can be attached to EC2 instances as virtual hard drives.

Block Storage for EC2 Instances:

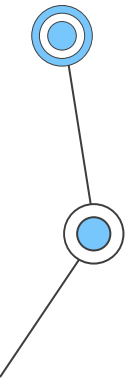
- Amazon EBS provides persistent block-level storage volumes for use with Amazon EC2 instances.
- EBS volumes are highly available and reliable, offering consistent low-latency performance for applications requiring persistent storage.
- You can attach and detach EBS volumes from EC2 instances, making it flexible for storage management and data persistence.

Snapshots and Data Backup Strategies:



Snapshots: Amazon EBS allows you to create snapshots, which are point-in-time backups of your EBS volumes. Snapshots capture the entire volume's data, including all blocks, regardless of whether they contain data or are empty.

- Snapshots are incremental, meaning only the changed blocks since the last snapshot are saved, reducing storage costs and backup time.
- Snapshots are stored in Amazon S3, providing durability and availability.



Data Backup Strategies:

- **Regular Snapshots:** Schedule regular snapshots to capture incremental changes and ensure data integrity. This helps in recovering data in case of accidental deletion or corruption.
- **Data Lifecycle Management**: Define lifecycle policies to manage snapshots efficiently, including retention periods, deletion rules, and storage optimization.
- **Encryption:** Use encryption options such as AWS Key Management Service (KMS) to encrypt snapshots for enhanced data security and compliance.
- **Cross-Region Replication:** Replicate snapshots across AWS regions for disaster recovery and data redundancy, ensuring business continuity in case of regional outages.


Industry-leading performance, scalability, availability, and durability
Wide range of cost-effective storage classes
Easily manage data and access controls
Amazon S3
Unmatched security, compliance, and audit capabilities
Query-in-place services for analytics
Most supported cloud storage service

Azure Blob Storage (equivalent to Amazon S3)

- Azure Blob Storage is a scalable object storage service in Microsoft Azure designed to store and manage unstructured data such as documents, images, videos, backups, and logs.
- It provides different storage tiers including hot, cool, and archive, offering cost-effective options based on data access frequency and retention requirements.
- Azure Blob Storage supports features like versioning, lifecycle management, encryption at rest and in transit, access control, and integration with Azure services and third-party tools.

Azure Managed Disks (equivalent to Amazon EBS)

- Azure Managed Disks offer persistent block storage for virtual machines in Azure, similar to Amazon EBS in AWS.
- Managed Disks abstract the complexity of managing storage accounts and provide simplified disk management with features such as disk snapshots, encryption, resizing, and high availability options.
- Users can choose from different disk types including Standard HDD, Standard SSD, and Premium SSD based on performance and cost requirements, ensuring optimal storage solutions for Azure virtual machines

Google Cloud Storage (equivalent to Amazon S3):

- Google Cloud Storage is a scalable and durable object storage service in Google Cloud Platform, offering similar functionalities to Amazon S3.
- It provides storage classes such as Standard, Nearline, Coldline, and Archive, allowing users to optimize storage costs based on data access patterns and retention policies.
- Google Cloud Storage supports features like versioning, lifecycle management, access controls, encryption at rest and in transit, and seamless integration with other GCP services and third-party tools

Google Persistent Disks (equivalent to Amazon EBS):

- Google Persistent Disks provide persistent block storage for virtual machines in Google Cloud Platform, comparable to Amazon EBS in AWS.
- Persistent Disks offer options for Standard HDD, Standard SSD, and Persistent SSD disks with features like snapshots, encryption, resizing, and high availability configurations.
- Users can attach Persistent Disks to virtual machines and scale storage capacity and performance as needed, ensuring reliable and scalable storage solutions for GCP workloads

AWS

Block Storage

- Elastic Block Store (EBS)

Object Storage

- Simple Storage Service (S3)

File Storage

- Elastic File System (EFS)
- FSx

Azure

Block Storage

- Disk Storage (Managed Disks)

Object Storage

- Blob Storage

File Storage

- Azure Files
- NetApp Files

GCP

Block Storage

- Persistent Disk
- Local SSD

Object Storage

- Cloud Storage

File Storage

- Filestore

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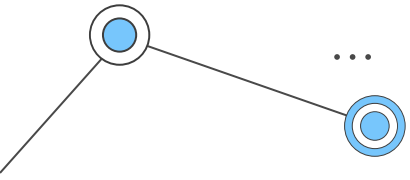
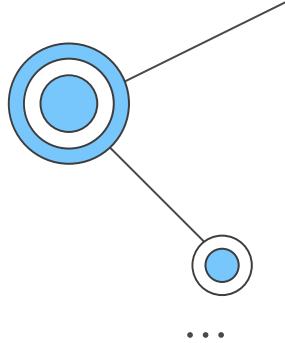
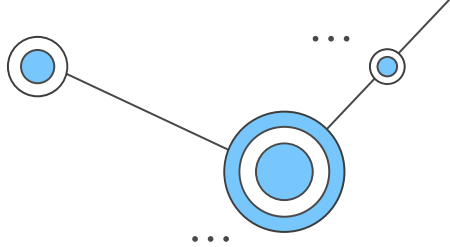
SOURAB KARAD

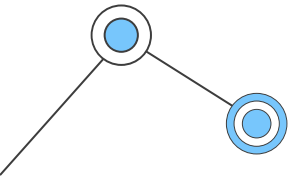




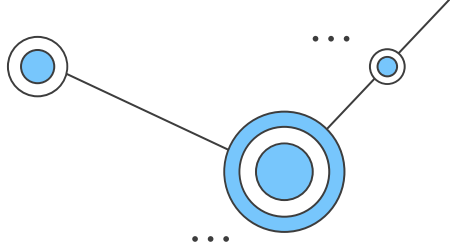
Amazon RDS



Amazon RDS (Relational Database Service) is a fully managed database service provided by Amazon Web Services (AWS) that makes it easy to set up, operate, and scale relational databases in the cloud. It supports popular database engines such as MySQL, PostgreSQL, Oracle, SQL Server, and MariaDB, allowing you to choose the engine that best fits your application's requirements.

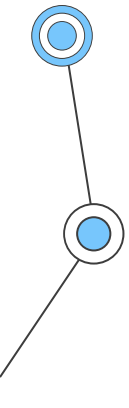


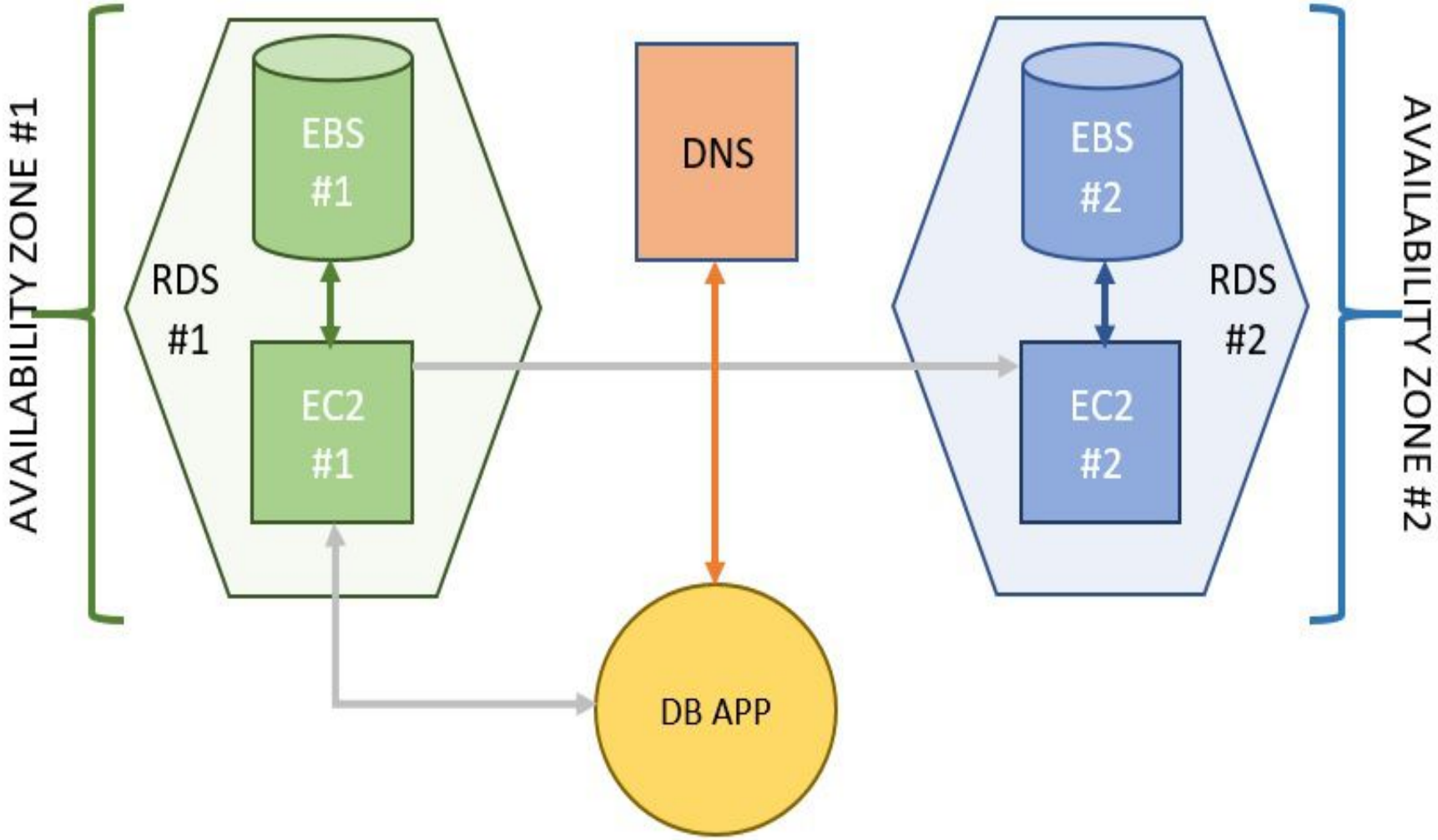
Amazon RDS (Relational Database Service):



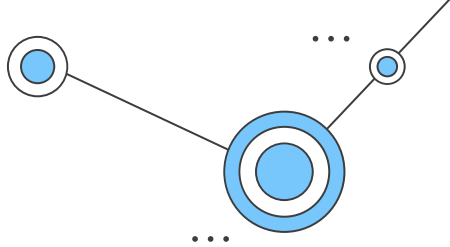
Managed Database Instances (MySQL, PostgreSQL, etc.):
Amazon RDS is a managed database service that simplifies the setup, operation, and scaling of relational databases in the cloud. It supports various database engines such as MySQL, PostgreSQL, Oracle, SQL Server, and MariaDB.

- With Amazon RDS, you can easily deploy and manage database instances without worrying about infrastructure management tasks such as hardware provisioning, patching, backups, and database scaling.
- RDS provides automated monitoring, performance optimization, and security features to ensure reliable and secure database operations.

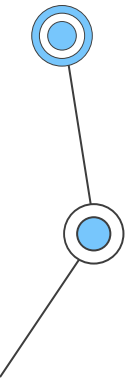


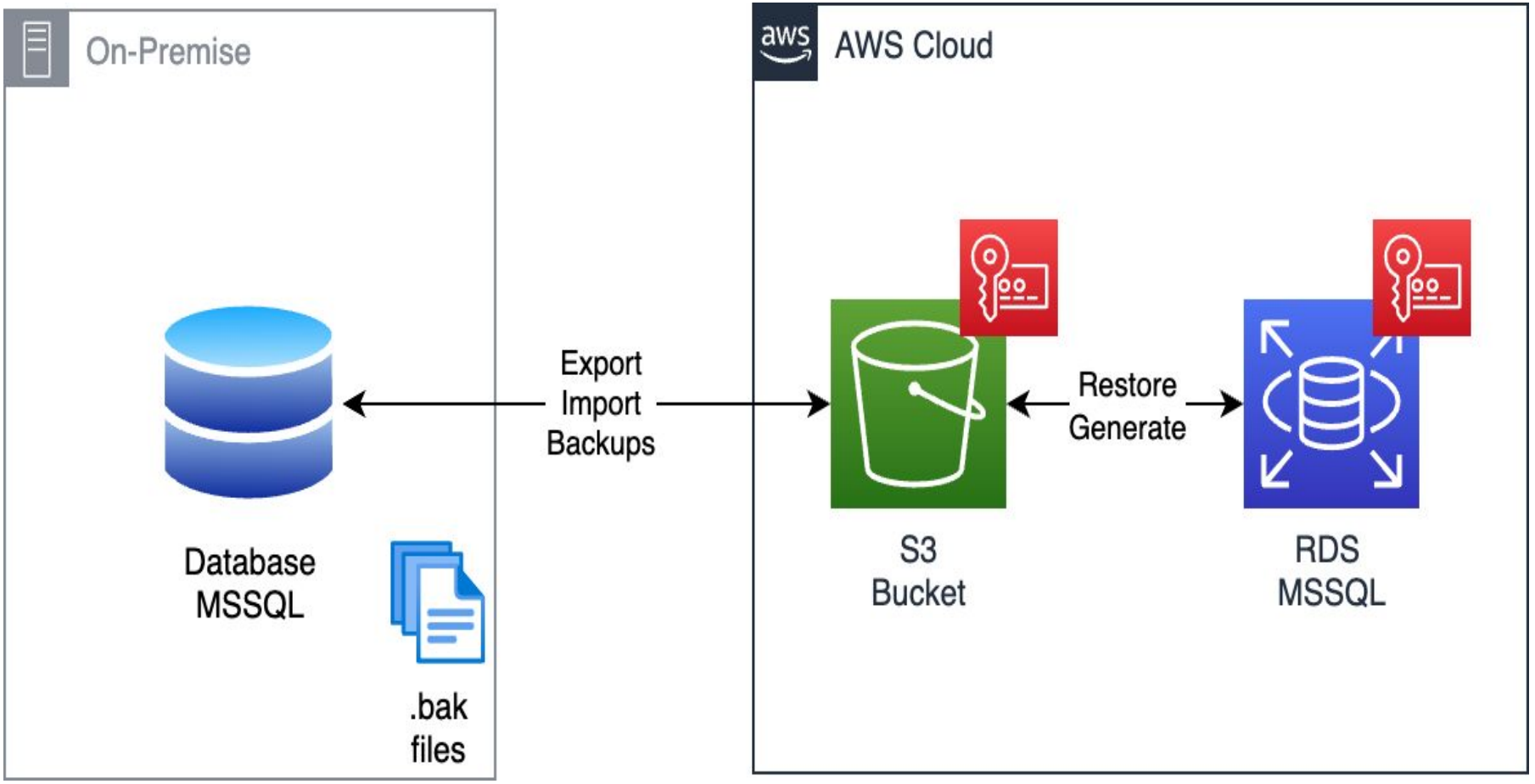

AVAILABILITY ZONE #1
EBS #1
RDS #1
EC2 #1
DNS
EBS #2
RDS #2
EC2 #2
AVAILABILITY ZONE #2
DB APP

Automated Backups and Multi-AZ Deployments:



- Amazon RDS offers automated backups, allowing you to schedule regular backups of your database instances. These backups can be retained for a specified period, and you can restore databases to any point in time within the retention period.
- Multi-AZ deployments in RDS provide high availability and fault tolerance by replicating your database instance to a standby instance in a different Availability Zone (AZ). In case of a primary instance failure, RDS automatically fails over to the standby instance, minimizing downtime




On-Premise
AWS Cloud
Export
Import
Backups
Restore
Generate
Database
MSSQL
.bak
files
S3
Bucket
RDS
MSSQL

Amazon DynamoDB

Amazon DynamoDB is a fully managed NoSQL database service provided by Amazon Web Services (AWS). It is designed for applications that require seamless scalability, low latency, and high performance when working with large volumes of structured data. DynamoDB is known for its reliability, performance, and ease of use in building modern, data-driven applications.

NoSQL Database for High-Throughput Applications:

Amazon DynamoDB is a fully managed NoSQL database service designed for applications that require high throughput, low latency, and seamless scalability.

- It offers fast and predictable performance at any scale, making it suitable for use cases such as gaming, e-commerce, real-time analytics, and IoT applications.
- DynamoDB supports both key-value and document data models, providing flexibility for various data access patterns and query requirements.

Scalability and Performance Considerations:

- DynamoDB automatically scales your database tables based on traffic patterns and workload demands. It can handle millions of requests per second with consistent low-latency responses.
- Performance considerations in DynamoDB include optimizing table design, partition keys, secondary indexes, and provisioned throughput capacity to ensure efficient data access and query execution.
- DynamoDB also offers features like encryption at rest and in transit, global tables for multi-region deployments, and on-demand backup and restore capabilities for data protection and disaster recovery.

Azure SQL Database (equivalent to Amazon RDS):

Azure SQL Database is a fully managed relational database service in Microsoft Azure that is equivalent to Amazon RDS (Relational Database Service). It offers scalable and highly available SQL databases in the cloud without the need to manage underlying infrastructure.

- Azure SQL Database supports multiple database engines, including SQL Server and PostgreSQL, providing compatibility and flexibility for different application requirements.
- Key features of Azure SQL Database include automated backups, high availability, performance monitoring, built-in security features, and options for elastic scaling to handle varying workloads.

Azure Cosmos DB (equivalent to Amazon DynamoDB)

Azure Cosmos DB is a globally distributed NoSQL database service in Microsoft Azure that is equivalent to Amazon DynamoDB. It is designed for building highly responsive and scalable applications with low-latency access to data.

- Cosmos DB supports multiple data models, including document, key-value, graph, and column-family, allowing developers to choose the most suitable model for their application needs.
- Key features of Azure Cosmos DB include automatic scaling, multi-region replication, tunable consistency levels, comprehensive SLAs for throughput and latency, and support for popular APIs such as SQL, MongoDB, Cassandra, Gremlin, and Table API.

Cloud SQL (equivalent to Amazon RDS):

Cloud SQL is a managed relational database service in Google Cloud Platform that is equivalent to Amazon RDS (Relational Database Service). It supports popular database engines such as MySQL, PostgreSQL, and SQL Server, providing fully managed database instances with automatic backups, high availability, and scalability.

- Cloud SQL offers features like automated patching, monitoring, encryption at rest and in transit, point-in-time recovery, read replicas, and integration with other GCP services for seamless application development and deployment.

Cloud Bigtable (equivalent to Amazon DynamoDB)

Cloud Bigtable is a fully managed NoSQL database service in Google Cloud Platform that is equivalent to Amazon DynamoDB. It is designed for handling massive amounts of structured data with low-latency and high-throughput requirements.

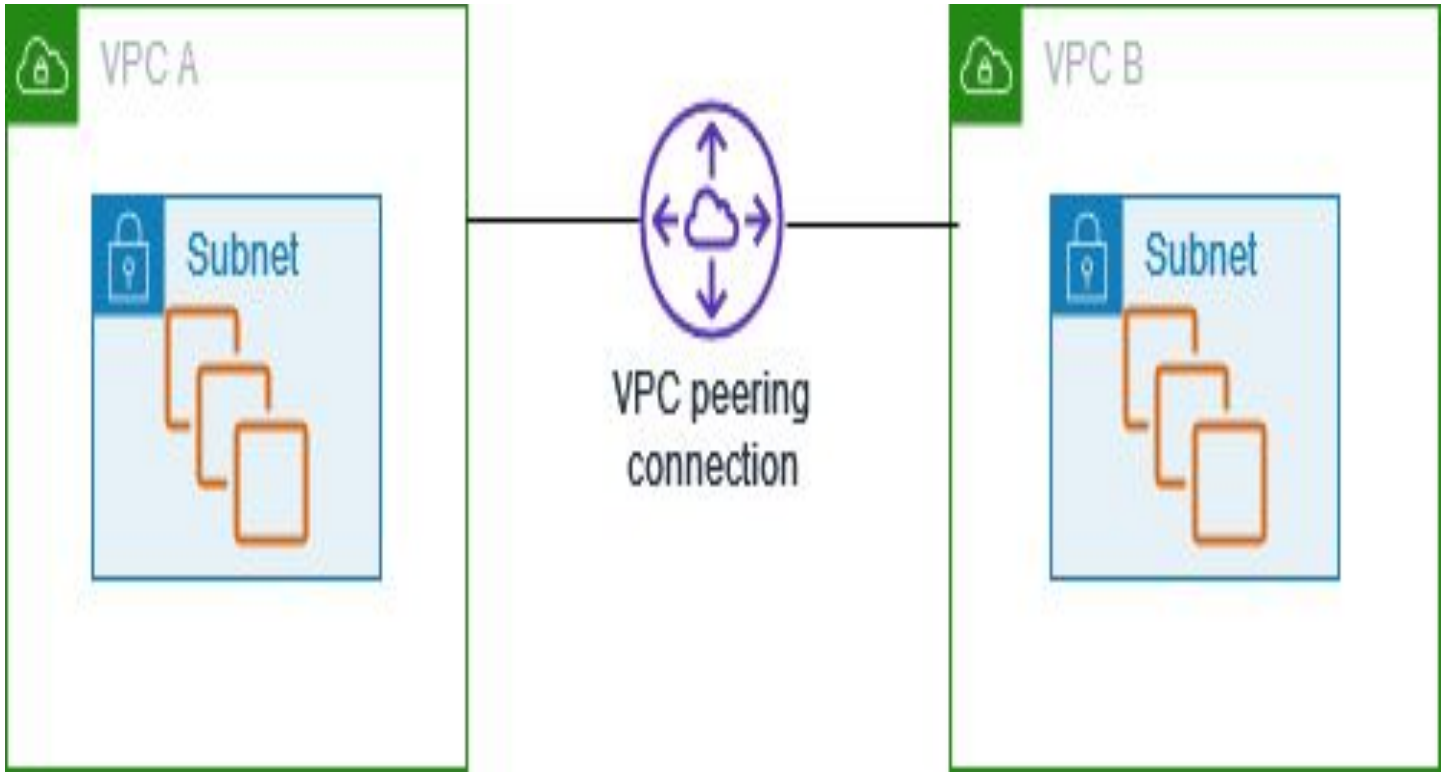
- Cloud Bigtable is well-suited for use cases such as time-series data, IoT data processing, analytics, and machine learning, offering scalability, automatic sharding, replication, and integration with popular big data tools like Hadoop, Spark, and Dataflow.
- Key features of Cloud Bigtable include automatic scaling, high availability, consistent low-latency reads and writes, data compression, row-level access controls, and compatibility with the HBase API.

Capabilities	Azure Cosmos DB	AWS DynamoDB	Google Cloud Spanner
Global distribution	A single entity can span any number of Azure regions (30+).	No	No, currently single region. Multi-region support is coming later in 2017.
Horizontal scalability of both storage and throughput worldwide	Yes, across any number of Azure regions	No	No
Multi-homing APIs	Yes	No	No
Guaranteed low read/write latency worldwide	Yes, at 99th percentile worldwide	No	No
Consistency models	5 (*Strong, Eventual, Bounded Staleness, Session, Consistent-Prefix*)	2 (*Strong, Eventual*)	1 (*Strong*)
Multi-model + multi-API	Yes	Yes	No
Schema management	Schema agnostic; no management required	Index management required	Schema and index management required
Automatic indexing	Yes	No	No
Comprehensive SLAs	Yes (latency, consistency, throughput, high availability)	No	No (availability only)

PA-10
KRISHNARAJ

Amazon VPC

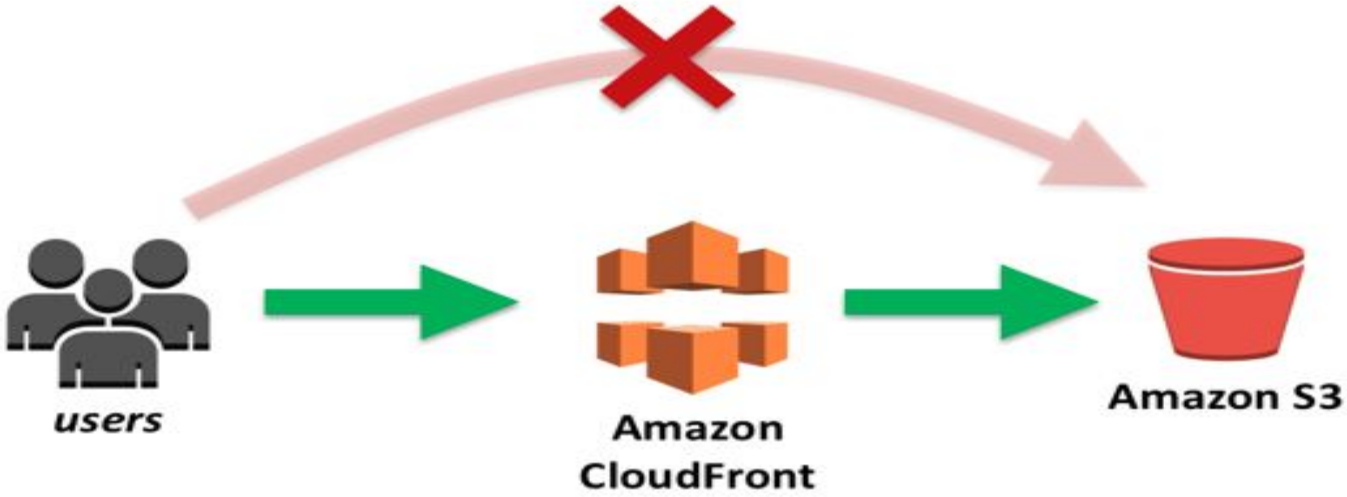
Amazon VPC is a service that lets you create a private, isolated section of the AWS cloud where you can launch resources such as EC2 instances, databases, and load balancers. It provides network isolation and security by allowing you to define your own virtual network environment within AWS.

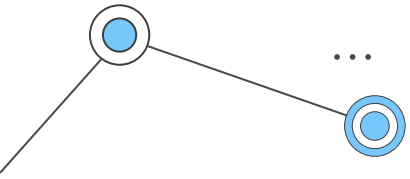

VPC A
Subnet
VPC peering
connection
VPC B
Subnet

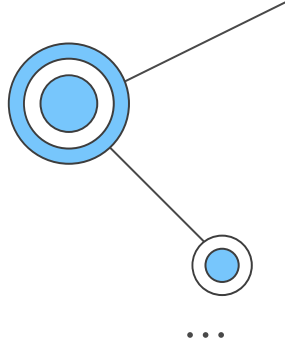
- **Network Isolation and Security:** With Amazon VPC, you can define your own IP address range, create subnets, and configure routing tables and network access control lists (ACLs) to control inbound and outbound traffic. This allows you to create a private network environment that is isolated from other networks and the internet, enhancing security for your resources.
- **Subnetting and Routing Configuration**: Amazon VPC supports subnetting, which involves dividing your IP address range into smaller subnets to organize and manage your resources effectively. You can configure routing tables to control traffic flow between subnets and to external networks, enabling communication between different parts of your VPC and connecting your VPC to the internet or on-premises networks using VPN or Direct Connect.

Amazon CloudFront:

Amazon CloudFront is a content delivery network (CDN) service provided by AWS that helps deliver your web content, videos, and APIs with low latency and high transfer speeds to users globally. It uses a network of edge locations located in different geographic locations to cache and distribute content closer to end users.

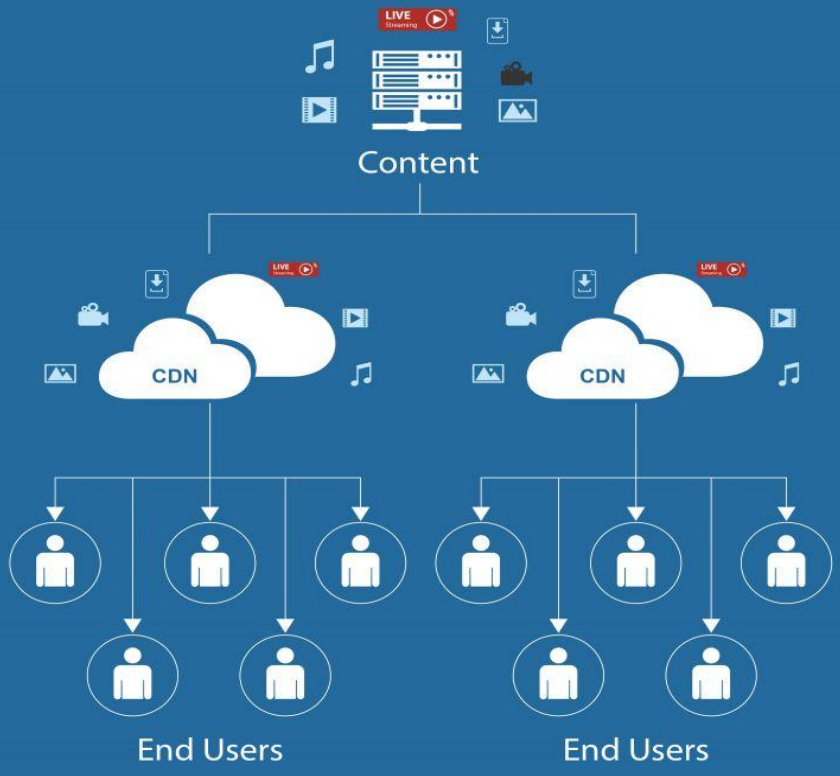

users
Amazon
CloudFront
Amazon S3



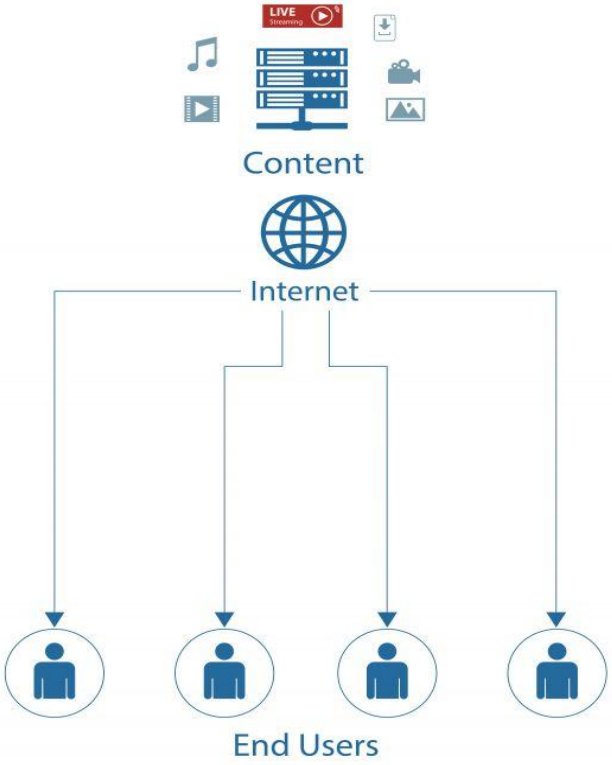


- **Content Delivery Network (CDN) for Low-Latency Content Delivery**: CloudFront accelerates content delivery by caching copies of your content at edge locations around the world. When a user requests content, CloudFront serves the content from the nearest edge location, reducing latency and improving performance.

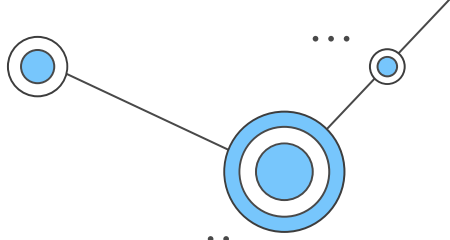
HOW CDN MAKES CONTENT DELIVERY FASTER



Most of the traffic is served by local CDN nodes

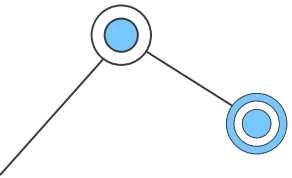


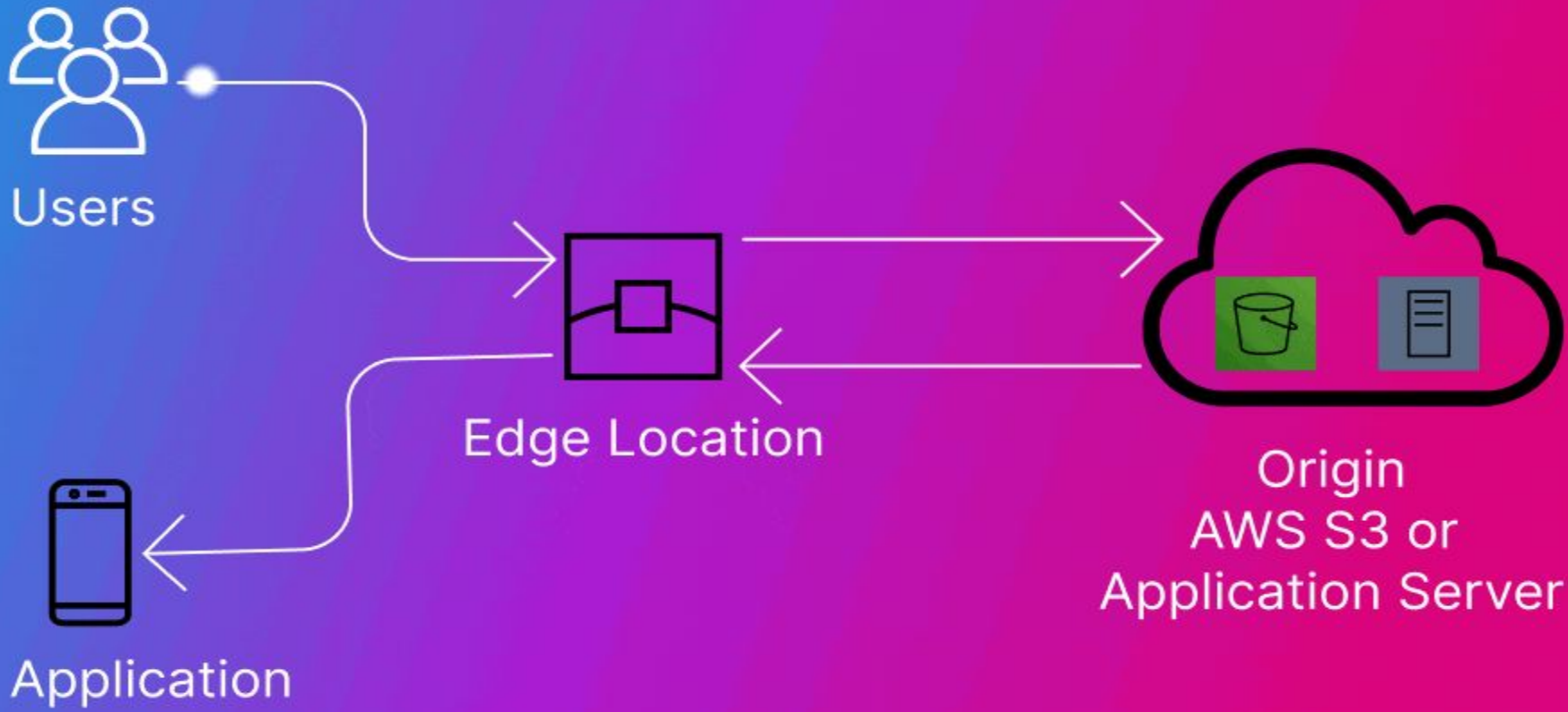
All of the traffic is served by the origin server



- **Caching and Distribution Strategies:** CloudFront supports caching strategies such as time-based caching, which caches content for a specified period, and invalidation, which allows you to remove outdated or stale content from edge caches. You can configure cache behaviors, origin settings, and distribution settings to optimize content delivery and control how CloudFront handles requests.

- **Edge Locations and Global Reach:** CloudFront has a global network of edge locations strategically located in major cities worldwide. This enables CloudFront to deliver content quickly to users regardless of their geographic location, improving user experience and reducing latency for accessing web applications, streaming media, or downloading files.




Users
Edge Location
Origin
AWS S3 or
Application Server
Application

Azure Virtual Network (equivalent to Amazon VPC)

Azure Virtual Network (VNet) is a service that provides network isolation and segmentation within the Microsoft Azure cloud environment, similar to Amazon VPC (Virtual Private Cloud) in AWS. It allows you to create a private virtual network with customizable IP address ranges, subnets, routing tables, and network security groups (NSGs).

- Key features of Azure Virtual Network include network isolation, connectivity options (like VPN and ExpressRoute for hybrid scenarios), subnetting, route tables, security controls, and integration with other Azure services.

Azure Content Delivery Network (CDN)
(equivalent to Amazon CloudFront):

Azure Content Delivery Network (CDN) is a global content delivery service in Microsoft Azure that caches and delivers web content, videos, and applications to users worldwide with low latency and high transfer speeds, similar to Amazon CloudFront in AWS.

- Azure CDN uses a network of edge servers located in different geographic regions to cache and serve content from the nearest edge location to end users, reducing latency and improving performance.
- Key features of Azure CDN include caching rules, dynamic site acceleration, HTTPS support, custom domain mapping, real-time analytics, and integration with Azure services like Blob Storage, Web Apps, and Media Services.

GCP : Virtual Private Cloud (VPC) (equivalent to Amazon VPC):

Google Cloud Virtual Private Cloud (VPC) is a networking service in Google Cloud Platform (GCP) that provides a private, isolated virtual network environment for deploying Google Cloud resources, similar to Amazon VPC (Virtual Private Cloud) in AWS.

- Google Cloud VPC allows you to define IP address ranges, create subnets, configure firewall rules, set up VPNs or Interconnect for secure connectivity, and manage routing tables and network policies.
- Key features of Google Cloud VPC include network isolation, subnetworks, firewall rules, routes, VPN options, Cloud Router for dynamic routing, Private Google Access, and integration with GCP services.

	AWS	Azure	GCP
Virtual network	Virtual Private Cloud (VPC)	Virtual Network (VNet)	Virtual Private Cloud (VPC)
Virtual network scope	Regional	Regional	Global
Network created by default	Yes	No	Yes (can be disabled)
Subnet scope	Zonal	Regional	Regional
Routing scope	Subnet	Subnet	VPC
Controlling inbound/outbound traffic	• Network Access Control Lists • Security Groups	• Network Security Groups • Application Security Groups	• Firewall
Private connections to services	VPC Endpoints	Service Endpoints	Private Google Access
Connections to other networks	• VPC Peering • AWS Site-to-Site VPN • AWS Direct Connect	• VNET Peering • VPN Gateway • Express Route	• VPC Network Peering • Cloud VPN • Cloud Interconnect
IPv6 support	Yes	Yes	No

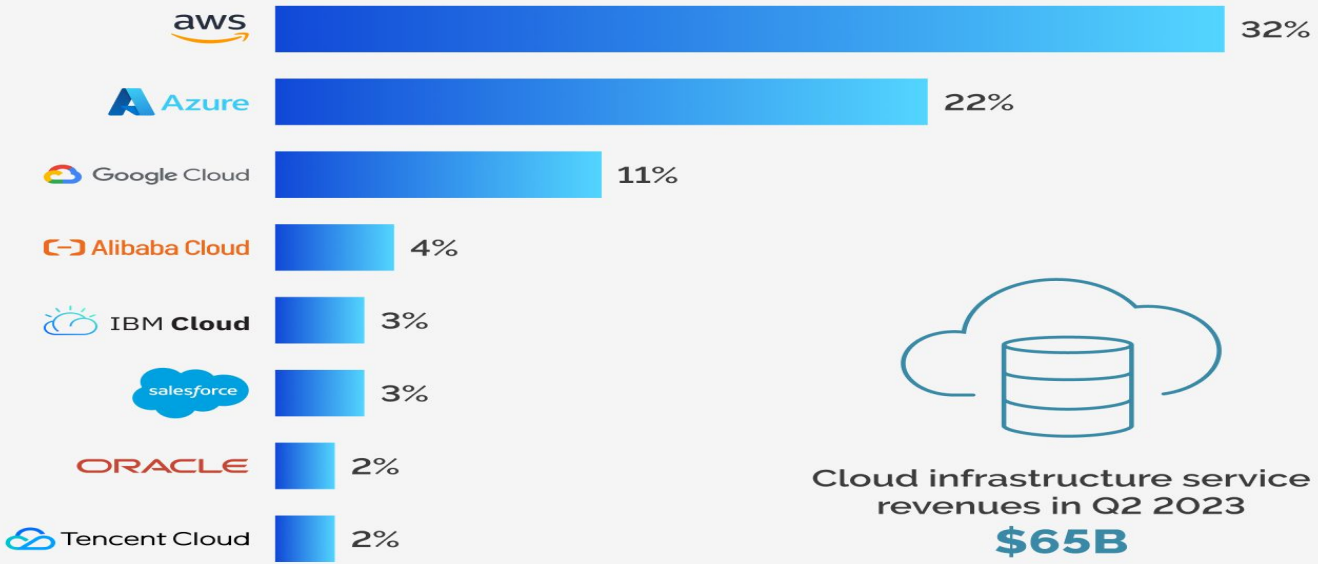
Google Cloud CDN (equivalent to Amazon CloudFront):

Google Cloud CDN is a content delivery network service in Google Cloud Platform (GCP) that caches and delivers web content, videos, and APIs to users globally with low latency and high performance, similar to Amazon CloudFront in AWS.

- Google Cloud CDN leverages Google's global network infrastructure and edge locations to cache and serve content closer to end users, reducing latency and improving user experience.
- Key features of Google Cloud CDN include caching policies, caching rules, origin settings, HTTPS support, load balancing integration, real-time logs and metrics, and integration with Google Cloud Storage, Compute Engine, and Kubernetes Engine.

Amazon Maintains Lead in the Cloud Market

Worldwide market share of leading cloud infrastructure service providers in Q2 2023*



Cloud infrastructure service revenues in Q2 2023

$65B

* Includes platform as a service (PaaS) and infrastructure as a service (IaaS) as well as hosted private cloud services

Source: Statista (Synergy Research Group)

Intellisoft

Networking

Service	AWS	AZURE	GCP
• Virtual Network	Virtual Private Cloud (VPC)	Virtual Network (Vnet)	Virtual Private Cloud (VPC)
• Load Balancing	Elastic Load Balancer	Azure Load Balancer	Google Cloud Load Balancing
• Firewall	AWS Firewall / Web Application Firewall	Azure Firewall	Google Cloud firewalls
• DNS	Route 53	Azure DNS	Google Cloud DNS
• CDN	Amazon CloudFront	Azure Content Delivery Network (CDN)	Cloud CDN

Conclusion

THANK YOU!