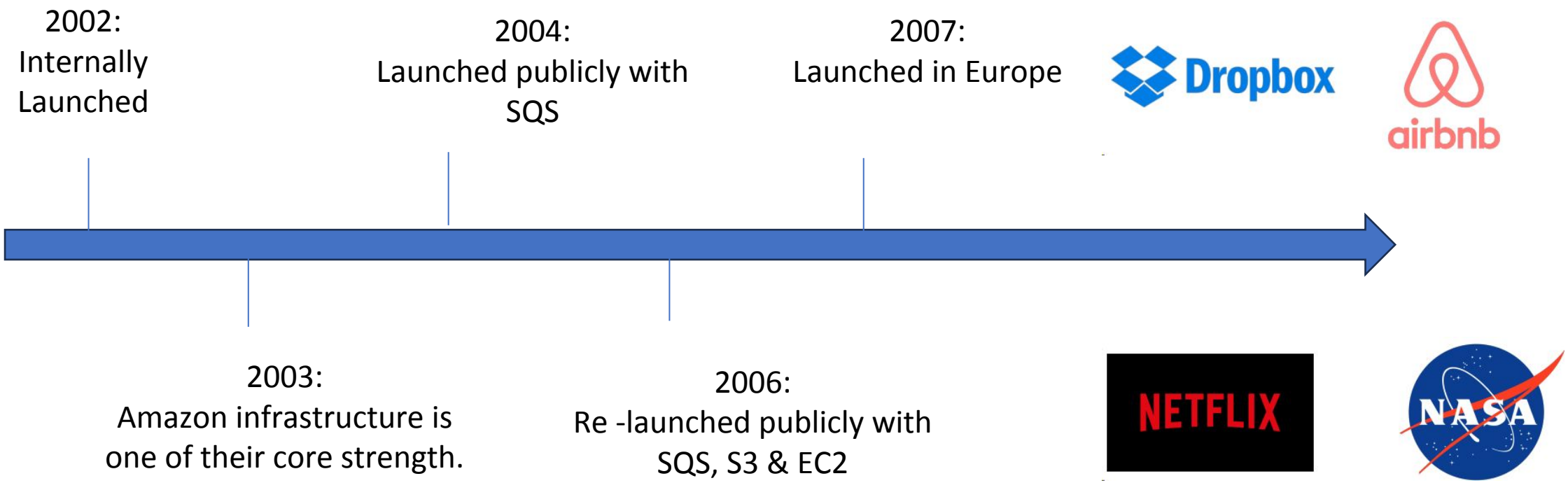
Module_3

Nilanjana G Basu, HITK

AWS Cloud History



AWS Cloud Number Facts

- In 2023, AWS had $90 billion in annual revenue
- AWS accounts for 50.1% of the market in 2024
- Pioneer and Leader of the AWS Cloud Market for the 12th consecutive year
- Over 1,000,000 active users
- AWS's server capacity is about 6 times larger than the next 12 competitors combined

AWS Cloud Use Cases

- AWS enables you to build sophisticated, scalable applications
- Applicable to a diverse set of industries
- Use cases include
  - Enterprise IT, Backup & Storage, Big Data analytics
  - Website hosting, Mobile & Social Apps
  - Gaming

AWS Global Infrastructure

- AWS Regions – 33 launched regions each with multiple availability zones in North and South America, Asia Pacific, Europe, Middle East, Africa, Australia and New Zealand.
- A region is a physical location around the world where they cluster data centers.
- For example, in Asia Pacific, regions are Singapore, Seoul, Hong Kong, Beijing, Tokyo, Osaka, Ningxia, Jakarta, Mumbai and Hyderabad
- Names can be ap-east-1, ap-west-3, ..
- AWS Availability Zones - 105
- AWS Edge Locations / Points of Presence – 600 + 13 regional edge caches

AZs

- Each group of logical data centers is an Availability Zone named like ap-southeast-2a, ap-southeast-2b and ap-southeast-2c.
- Each AWS Region consists of a usually three, minimum of three, maximum of six, isolated, and physically separate AZs within a geographic area.
- Unlike other cloud providers, who often define a region as a single data center, the multiple AZ design of every AWS Region offers advantages for customers.
- Each AZ has independent power, cooling, and physical security and is connected via redundant, ultra-low-latency networks.
- AWS customers focused on high availability can design their applications to run in multiple AZs to achieve even greater fault-tolerance.

AZs

- All AZs in an AWS Region are interconnected with high-bandwidth, low-latency networking, over fully redundant, dedicated metro fiber providing high-throughput, low-latency networking between AZs.
- All traffic between AZs is encrypted.
- The network performance is sufficient to accomplish synchronous replication between AZs.
- AZs make partitioning applications for high availability easy.
- If an application is partitioned across AZs, companies are better isolated and protected from issues such as power outages, lightning strikes, tornadoes, earthquakes, and more.
- AZs are physically separated by a meaningful distance, many kilometers, from any other AZ, although all are within 100 km (60 miles) of each other.

How to choose an AWS Region?

- Most AWS services are region-scoped
- Compliance with data governance and legal requirements: data never leaves a region without explicit permission
- Proximity to customers: reduced latency
- Available services within a Region: new services and new features aren’t available in every Region
- Pricing: pricing varies region to region and is transparent in the service pricing page

Local Zones, Wavelength and Outposts

- AWS Local Zones place compute, storage, database, and other select AWS services closer to millions of end-users in a large metro area.
- With AWS Local Zones, you can easily run highly-demanding applications that require single-digit millisecond(<10) latencies to your end-users such as media & entertainment content creation, real-time gaming, reservoir simulations, electronic design automation, and machine learning.
- AWS Wavelength enables developers to build applications that deliver single-digit millisecond latencies to mobile devices and end-users.
- Run workloads over mobile networks

Local Zones, Wavelength and Outposts

- An Outpost is a pool of AWS compute and storage capacity deployed at a customer site to meet the ultra-low latency(<1 millisec).
- You can create subnets on your Outpost and specify them when you create AWS resources such as EC2 instances, EBS volumes, ECS clusters, and RDS instances.
- Outposts rack and outposts servers
- Unlike Outposts, which you deploy within your datacenter or a co-location of your choice, Local Zones are owned, managed, and operated by AWS.
- Local Zones eliminate the need for you to manage power, connectivity, and capacity using the exact same set of APIs and tools that you are already using for an AWS Region.

Few Services of AWS

- AWS has Global Services:
  - Identity and Access Management (IAM)
  - Route 53 (DNS service)
  - CloudFront (Content Delivery Network)
  - WAF (Web Application Firewall)

- Most AWS services are Region-scoped:
  - Amazon EC2 (Infrastructure as a Service)
  - Elastic Beanstalk (Platform as a Service)
  - Lambda (Function as a Service)
  - Rekognition (Software as a Service)

AWS Identity & Access Management (AWS IAM)

IAM: Users & Groups

- IAM = Identity and Access Management, Global service
- Root account created by default, shouldn’t be used or shared
- Users are people within your organization, and can be grouped
- Groups only contain users, not other groups
- Users don’t have to belong to a group, and user can belong to multiple groups

IAM: Permissions

- Users or Groups can be assigned JSON(Java Script Object Notation) documents called policies
- These policies define the permissions of the users
- In AWS you apply the least privilege principle: don’t give more permissions than a user needs

IAM: Permissions

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": "ec2:Describe*",
            "Resource": "*"
        },
        {
            "Effect": "Allow",
            "Action": "elasticloadbalancing:Describe*",
            "Resource": "*"
        },
        {
            "Effect": "Allow",
            "Action": [
                "cloudwatch:ListMetrics",
                "cloudwatch:GetMetricStatistics",
                "cloudwatch:Describe*"
            ],
            "Resource": "*"
        }
    ]
}
```

IAM Policies inheritance

- One user can belong to different policy groups and inherit multiple access policies.

IAM Policies Structure

- Consists of
- Version: policy language version, always include “2012 -10 - 17”
- Id: an identifier for the policy (optional)
- Statement: one or more individual statements (required)
- Statements consists of
- Sid: an identifier for the statement (optional)
- Effect: whether the statement allows or denies access (Allow, Deny)
- Principal: account/user/role to which this policy applied to
- Action: list of actions this policy allows or denies
- Resource: list of resources to which the actions applied to
- Condition: conditions for when this policy is in effect (optional)

IAM Policies Structure

IAM – Password Policy

- Strong passwords = higher security for your account
- In AWS, you can setup a password policy:
- Set a minimum password length
- Require specific character types: including uppercase letters, lowercase letters, numbers, non-alphanumeric characters
- Allow all IAM users to change their own passwords
- Require users to change their password after some time (password expiration)
- Prevent password re-use

Multi Factor Authentication - MFA

- Users have access to your account and can possibly change configurations or delete resources in your AWS account
- You want to protect your Root Accounts and IAM users
- MFA = password you know + security device you own
- Main benefit of MFA: if a password is stolen or hacked, the account is not compromised

MFA devices options in AWS

Virtual MFA device

Google Authenticator
(phone only)

Authy
(multi-device)

Support for multiple tokens on a single device

Universal 2nd Factor (U2F) Security Key

YubiKey by Yubico (3rd party)

Support for multiple root and IAM users using a single security key

MFA devices options in AWS

Hardware Key Fob MFA Device

Provided by Gemalto (3rd party)

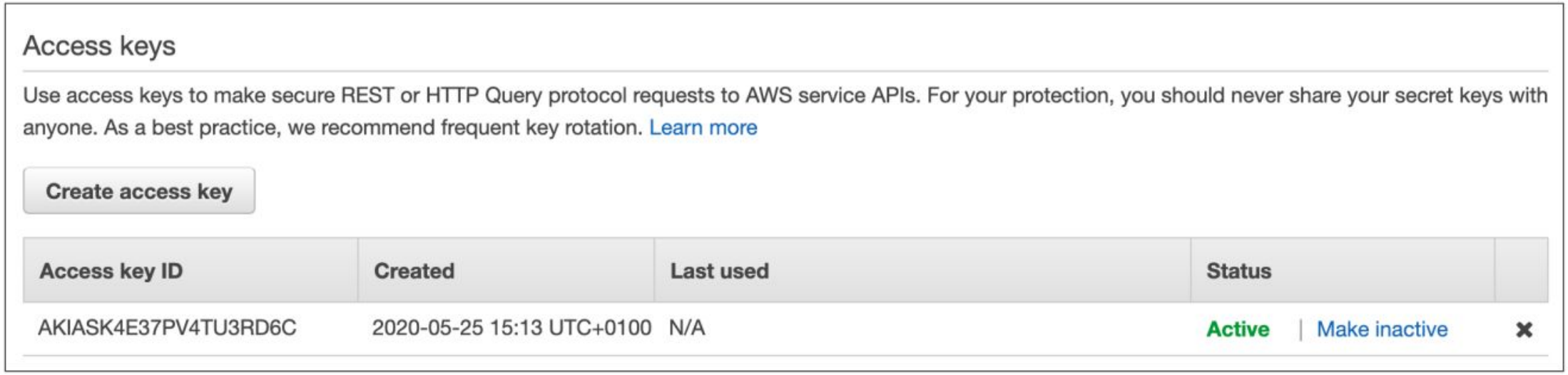
Hardware Key Fob MFA Device for AWS GovCloud (US)

Provided by SurePassID (3rd party)

How can users access AWS ?

- To access AWS, you have three options:
  - AWS Management Console (protected by password + MFA)
  - AWS Command Line Interface (CLI): protected by access keys
  - AWS Software Developer Kit (SDK) - for code: protected by access keys
- Access Keys are generated through the AWS Console
- Users manage their own access keys
- Access Keys are secret, just like a password. Don’t share them
- Access Key ID ~= username
- Secret Access Key ~= password

Example (Fake) Access Keys



Access keys

Use access keys to make secure REST or HTTP Query protocol requests to AWS service APIs. For your protection, you should never share your secret keys with anyone. As a best practice, we recommend frequent key rotation. Learn more

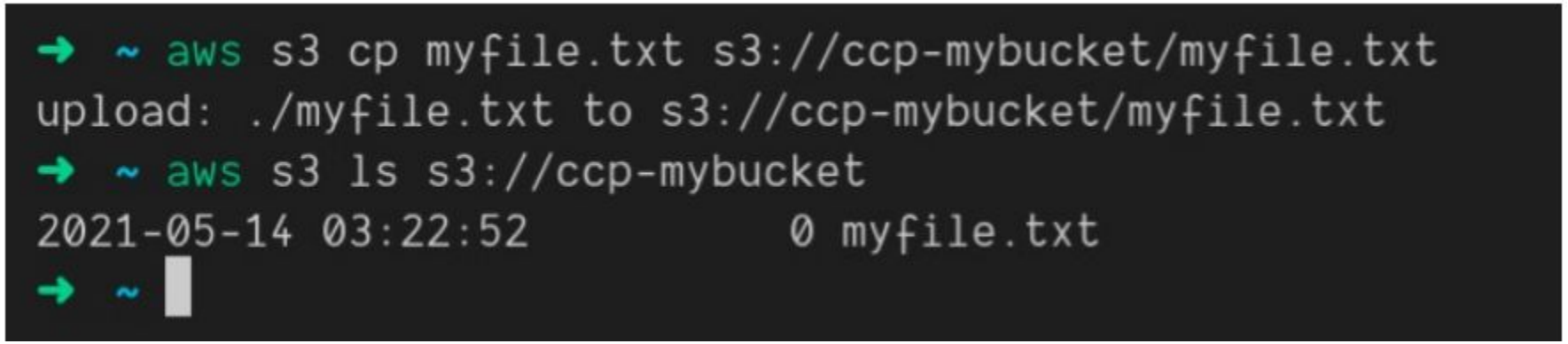
Create access key

Access key ID	Created	Last used	Status	
AKIASK4E37PV4TU3RD6C	2020-05-25 15:13 UTC+0100	N/A	Active | Make inactive	✖

Access key ID: AKIASK4E37PV4983d6C
Secret Access Key: AZPN3zojWozWCndIjhB0Unh8239a1bzbzO5fqqkZq
Remember: don’t share your access keys

What’s the AWS CLI?

- A tool that enables you to interact with AWS services using commands in your command-line shell
- Direct access to the public APIs of AWS services
- You can develop scripts to manage your resources
- It’s open-source https://github.com/aws/aws-cli
- Alternative to using AWS Management Console



What’s the AWS SDK?

- AWS Software Development Kit (AWS SDK)
- Language-specific APIs (set of libraries)
- Enables you to access and manage AWS services programmatically
- Embedded within your application
- Supports
  - SDKs (JavaScript, Python, PHP, .NET, Ruby, Java, Go, Node.js, C++)
  - Mobile SDKs (Android, iOS, …)
  - IoT Device SDKs (Embedded C, Arduino, …)
- Example: AWS CLI is built on AWS SDK for Python named Boto

IAM Roles for Services

- Some AWS service will need to perform actions on your behalf
- To do so, we will assign permissions to AWS services with IAM Roles
- Common roles:
  - EC2 Instance Roles
  - Lambda Function Roles
  - Roles for CloudFormation
- For example, an EC2 Instance is just like a virtual server. This EC2 Instance may want to perform some actions on AWS and to do so, we need to give permissions to our EC2 Instance.
- To do so, we're going to create an IAM Role and together they're going to make one entity.
- Once the EC2 Instance is trying to access some information from AWS, then it will use the IAM Role. And if the permission assigned to the IAM Role is correct, then we're going to get access to the call we're trying to make.

IAM Security Tools

- IAM Credentials Report (account-level)
  - a report that lists all your account's users and the status of their various credentials
- IAM Access Advisor (user-level)
  - Access advisor shows the service permissions granted to a user and when those services were last accessed.
  - You can use this information to revise your policies as AWS believes in granting least privileges.

Shared Responsibility Model for IAM

AWS(Responsible for all the infrastructure they provide)	You(Responsible for how you use it)
• Infrastructure (global network security) • Configuration and vulnerability analysis of the services they offer • Compliance validation they are responsible for	• Users, Groups, Roles, Policies management and monitoring • Enable MFA on all accounts • Rotate all your keys often • Use IAM tools to apply appropriate permissions • Analyze access patterns & review permissions

AWS Well-Architected Framework

- The AWS Well-Architected Framework documents a set of foundational questions that enable you to understand how a specific architecture aligns with cloud best practices.
- Based on the state of your architecture, the framework suggests improvements that you can make to better achieve those qualities.
- The framework is based on six pillars: operational excellence, security, reliability, performance efficiency, cost optimization, and sustainability.

AWS Well-Architected Framework

- Creating a software system is a lot like constructing a building. If the foundation is not solid, structural problems can undermine the integrity and function of the building.
- When architecting technology solutions, if you neglect the six pillars, it can become challenging to build a system that delivers on your expectations and requirements.
- A **workload** identifies a set of components that deliver business value. The workload is usually the level of detail that business and technology leaders communicate about. Examples of workloads include marketing websites, ecommerce websites, the backend for a mobile app, and analytic platforms. Types: quantitative/overload, qualitative, underload
- An application is designed to fulfill specific tasks or business needs while a workload represents the computational effort/resources required to run those applications or tasks.

AWS Well-Architected Framework

- The Operational Excellence pillar includes the ability to support development and run workloads effectively, gain insight into their operations, and to continuously improve supporting processes and procedures to deliver business value. Perform operations as code, make small, frequent and reversible changes, anticipate failures and learn from failures.
- The Security pillar includes the ability to protect data, systems, and assets to take advantage of cloud technologies to improve your security.
- The reliability pillar encompasses the ability of a workload to perform its intended function correctly and consistently when it's expected to. This includes the ability to operate and test the workload through its total lifecycle.

AWS Well-Architected Framework

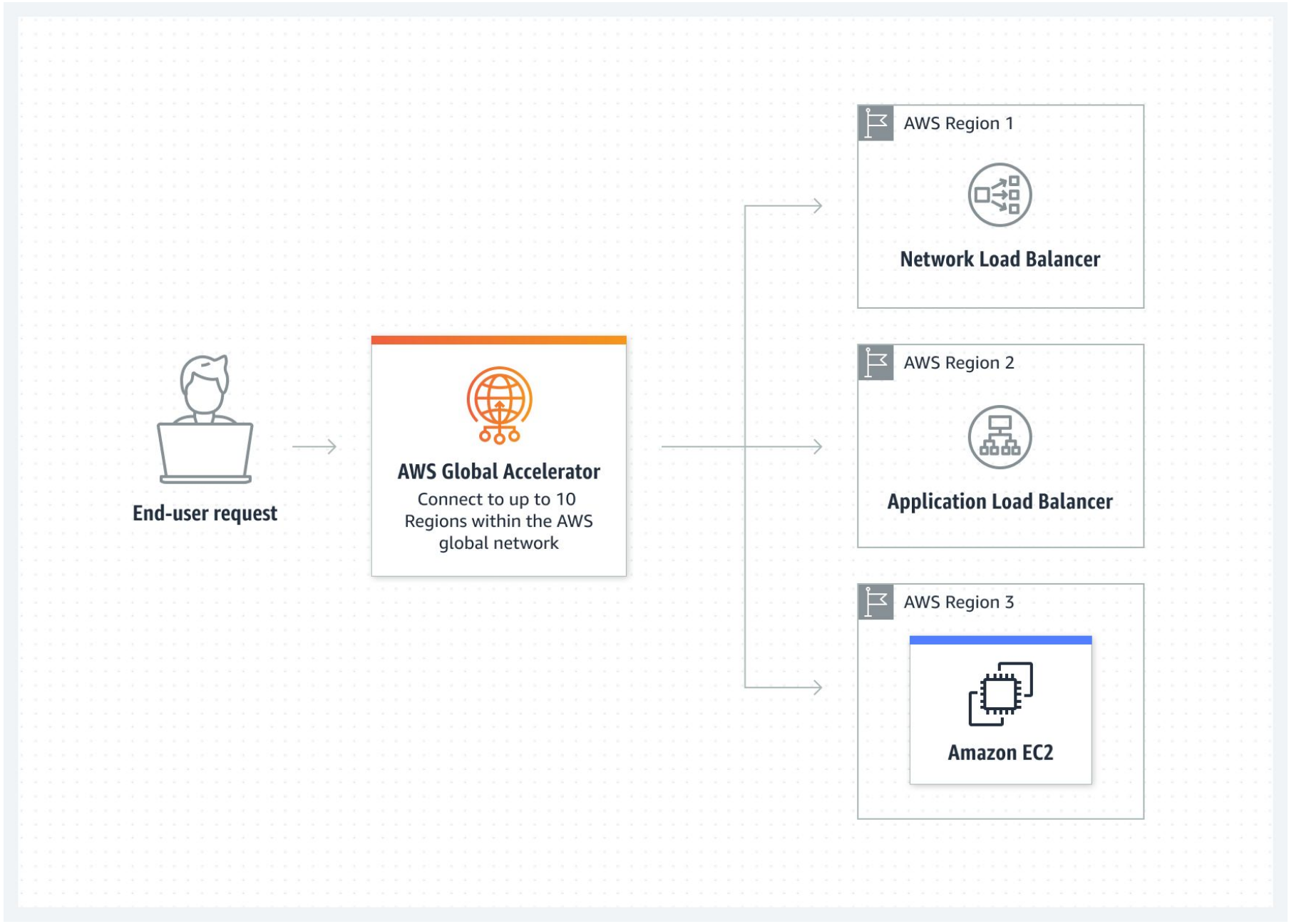
- The Performance Efficiency pillar includes the ability to use computing resources efficiently to meet system requirements, and to maintain that efficiency as demand changes and technologies evolve.
- The Cost Optimization pillar includes the ability to run systems to deliver business value at the lowest price point.
- The Sustainability pillar addresses the long-term environmental, economic, societal impact of your business activities. The development that meets the needs the present without compromising the ability of future generations to meet their own needs is the sustainable development.

AWS Well-Architected Framework

- When designing a workload, you make trade-offs between these pillars based on your business needs.
- In development environments, you might optimize to reduce cost at the expense of reliability.
- In mission-critical solutions, you might optimize reliability and be willing to accept increased costs.
- In ecommerce solutions, you might prioritize performance, since customer satisfaction can drive increased revenue.
- Security and operational excellence are generally not traded off against the other pillars.

AWS Global Accelerator

- It is a networking service that helps you improve the availability, performance, and security of your public applications.
- Global Accelerator provides two global static public IPs that act as a fixed entry point to your application endpoints, such as Application Load Balancers, Network Load Balancers, Amazon Elastic Compute Cloud (EC2) instances, and elastic IPs.


End-user request
AWS Global Accelerator
Connect to up to 10 Regions within the AWS global network
AWS Region 1
Network Load Balancer
AWS Region 2
Application Load Balancer
AWS Region 3
Amazon EC2

AWS Global Accelerator

- AWS Global Accelerator has a fault-isolating design that increases the availability of your applications.
- When you create an accelerator, AWS Global Accelerator allocates two static IPv4 addresses for you that are serviced by independent network zones.
- Similar to Availability Zones, these network zones are isolated units with their own set of physical infrastructure and service IP addresses from a unique IP subnet.
- If one IP address from a network zone becomes unavailable, due to network disruptions or IP address blocking by certain client networks, your client applications can retry using the healthy static IP address from the other isolated network zone.

AWS Global Accelerator

- AWS Global Accelerator allows you to bring your own IP addresses (BYOIP) and use them as a fixed entry point to your application endpoints.
- You can bring up to two /24 IPv4 address ranges and choose which /32 IP addresses to use when you create your accelerator.
- If you only bring one /24 IP address range, when you create an accelerator, Global Accelerator will assign a second /32 IP address from the Amazon IP address pool as the other static IP for your accelerator.

Categories of Cloud Storage

- Cloud storage can be either unmanaged or managed.
- Unmanaged storage is presented to a user as if it is a ready-to-use disk drive.
- The user has little control over the nature of how the disk is used.
- It is unmanaged storage in the sense that the storage is preconfigured for you, you can't format as you like, nor can you install your own file system, or change drive properties such as compression or encryption.
- Most user-oriented software such as file-sharing and backup consume unmanaged cloud storage.
- Applications using unmanaged cloud storage are Software as a Service (SaaS) Web services.
- Examples: Google Docs, Dropbox, Box.net, Freedrive, 4Shared, Adrive etc.

Categories of Cloud Storage

- Managed storage involves the provisioning of raw virtualized disk and the use of that disk to support applications that use cloud-based storage.
- Storage options involved in formatting, partitioning, replicating data, and other options are available for managed storage.
- In a managed cloud storage system, the user provisions storage on demand and pays for the storage using a pay-as-you-go model
- Applications using managed cloud storage are Infrastructure as a Service (IaaS) Web services.
- Examples: AWS S3(Simple Storage Service), Google Storage for developers, IBM Smart Business Storage Cloud, EMC Atmos etc.

Categories of Cloud Storage

- Block Storage – AWS EBS [Enterprise applications like databases or enterprise resource planning (ERP) systems often require dedicated, low-latency storage for each host. In this case, you can use a cloud storage service that stores data in the form of blocks. Each block has its own unique identifier for quick storage and retrieval.]
- Object Storage – AWS S3 [Organizations have to store a massive and growing amount of unstructured data, such as photos, videos, machine learning (ML), sensor data, audio files, and other types of web content, and finding scalable, efficient, and affordable ways to store them can be a challenge. Object storage is a data storage architecture for large stores of unstructured data.]
- File Storage – AWS EFS [File-based storage or file storage is widely used among applications and stores data in a

Google: quick look at Google Applications Portfolio

- **Google Ads(Formerly known as AdWords)** is an online advertising platform developed by Google, where advertisers bid to display brief advertisements, service offerings, product listings, and videos to web users.
- It can place ads in the results of search engines like Google Search (the Google Search Network), mobile apps, videos, and on non-search websites.
- Services are offered under a pay-per-click (PPC) pricing model.
- Google Ads is the main source of revenue for Alphabet Inc., contributing US$224.47 billion in revenue in 2022.

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- Google launched AdWords in the year 2000.
- In 2005, Google started a campaign management service known as "Jumpstart".
- In 2007, Google acquired DoubleClick for $3.1 billion.
- In 2008, Google launched the Google Online Marketing Challenge.
- Google retired the DoubleClick and AdWords brands in 2018 to simplify entry points for advertisers and ad sellers. The core product was renamed Google Ads, providing access to inventory on Google Search, its YouTube video service, the Google Play app store, and AdSense website publisher partners.

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- Google Ads' system is based partly on cookies[text files with small pieces of data — like a username and password, sent to your browser by a website you visit and used to identify your computer as you use a network] and partly on keywords determined by advertisers.
- Google uses these characteristics to place advertising copy on pages that they think might be relevant.
- In 2023, Google introduced Topics API, which allows targeting ads based on browsing history stored in browser, to Google Chrome.
- Advertisers pay when users divert their browsing to click on the advertising copy. Adverts can be implemented locally, nationally, or internationally.

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- Every time a user conducts a search on Google, Google Ads runs an auction in real time determines which search ads are displayed on the search results page as well as the ad's position.
- The cost of a Google Ads campaign therefore depends on a variety of factors, including the maximum amount an advertiser is willing to pay-per-click of the keyword, and the quality score of the ad (based on its relevance and click frequency and ad extensions).
- Quality Score is a diagnostic tool meant to give you a sense of how well your ad quality compares to other advertisers.
- Ad extensions are additional pieces of information that can be added to your online ads, such as phone numbers, links, or location details, to make them more informative and compelling to potential customers.

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- **Google Analytics** is a web analytics service that provides statistics and basic analytical tools for search engine optimization (SEO) and marketing purposes.
- SEO means the process of improving your website to increase its visibility in Google, Microsoft Bing, and other search engines whenever people search for:
  - Products you sell.
  - Services you provide.
  - Information on topics in which you have deep expertise and/or experience.
- The better visibility your pages have in search results, the more likely you are to be found and clicked on. Ultimately, the goal of search engine optimization is to help attract website visitors who will become customers, clients or an audience that keeps coming back.

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- The service is part of the Google Marketing Platform and is available for free to anyone with a Google account.
- Google Analytics is used to track website performance and collect visitor insights.
- It can help organizations determine top sources of user traffic, gauge the success of their marketing activities and campaigns, track goal completions (such as purchases, adding products to carts), discover patterns and trends in user engagement and obtain other visitor information such as demographics.

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- Google Analytics acquires user data from each website visitor through the use of page tags.
- A JavaScript page tag is inserted into the code of each page. This tag runs in the web browser of each visitor, collecting data and sending it to one of Google's data collection servers.
- The page tag functions as a web bug or web beacon, to gather visitor information. However, because it relies on cookies, the system can't collect data for users who have disabled them.

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- Google Analytics can then generate customizable reports to track and visualize data such as
- The number of users(Unique or new to the website),
- Bounce rates(The percentage of visitors who viewed only a single page. These visitors only triggered a single request to the Google Analytics server),
- Average session durations(How long on average each visitor stays on the site),
- Sessions by channel(The number of website sessions that have been initiated by different marketing channels such as organic search, referral, direct, social, and others)
- Page views(Total no of pages viewed),
- Goal completions(The number of times visitors complete a specified, desirable action. This is also known as a conversion) and more.

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- **Google Web Toolkit (GWT)** is a development toolkit for building and optimizing complex browser-based applications.
- Its goal is to enable productive development of high-performance web applications without the developer having to be an expert in browser quirks, XMLHttpRequest, and JavaScript.
- GWT is used by many products at Google, including Google AdWords and Google Wallet.
- It is intended for developers interested in contributing to GWT, and for keeping people informed on new and upcoming changes to GWT, GWT related events and other news.

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- It is an open source Java software development framework that makes writing AJAX applications easy.
- With GWT, you can develop and debug AJAX applications in the Java language using the Java development tools of your choice.
- When you deploy your application to production, the GWT compiler translates your Java application to browser-compliant JavaScript and HTML.
- It's open source, completely free, and used by thousands of enthusiastic developers around the world. In fact, all of GWT's source code is available under the Apache 2.0 open source license.

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- **Google App Engine (GAE)** is a platform-as-a-service (PaaS) product that enables web app developers and enterprises to build, deploy and host scalable, high-performance applications in Google's fully managed cloud environment without having to worry about infrastructure provisioning or management.
- GAE is Google's serverless application development platform.
- It handles all the work of uploading and running the code on Google Cloud.
- GAE's flexible environment provisions all the necessary infrastructure based on the central processing unit (CPU) and memory requirements specified by the developer.

Google: quick look at Google Applications Portfolio

- With GAE, developers can create applications in multiple supported languages or run custom containers in a preferred language or framework.
- Each language has a software development kit (SDK) and runtime to enable app development and testing.
- It also provides a wide range of developer tools to simplify app development, testing, debugging, deployment and performance monitoring.
- It is ideal for applications designed using a micro-services architecture.

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- Disadvantages:

1. Vendor Lock-in: Tightly integrated with Google Cloud services, which can result in vendor lock-in.
2. Limited Flexibility: Might be less flexible for certain configurations compared to other cloud platforms.

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	AWS ELASTIC BEANSTALK	GOOGLE APP ENGINE
LANGUAGE OR RUNTIME SUPPORT	■ Apache Tomcat (J2EE) ■ Go ■ Java SE ■ .NET Core on Linux ■ .NET Core on Windows Server ■ Node.js ■ PHP ■ Python ■ Ruby	■ Go ■ Java ■ Node.js ■ PHP ■ Python ■ Ruby ■ Custom runtimes for other languages
CONTAINER SUPPORT	■ Docker containers using Amazon Linux 2 platform	■ Docker containers with App Engine flexible environment
STORAGE AND DATABASES	■ Amazon S3 ■ Amazon RDS ■ Amazon DynamoDB ■ Microsoft SQL Server ■ Oracle ■ Other relational databases running on EC2	■ Cloud Storage ■ Cloud Firestore ■ Cloud SQL for MySQL ■ Cloud SQL for PostgreSQL ■ External databases from other public providers with proper configuration

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TRAFFIC ROUTING, LOAD BALANCING AND SCALING	■ Elastic Load Balancing ■ Amazon EC2 Auto Scaling based on configured application policies ■ Supports multi-Availability Zone deployments	■ Uses External HTTP(S) Load Balancing ■ Cloud CDN ■ Automatic, Basic and Manual scaling
MONITORING AND LOGGING	■ Amazon CloudWatch ■ AWS CloudTrail ■ AWS X-Ray	■ Cloud Monitoring ■ Cloud Logging ■ Cloud Debugger ■ Error Reporting
APP VERSION CONTROL	■ Automatically creates an application version whenever source code is uploaded. Deletes old versions according to an application life-cycle policy. Also supports tagging resources to identify different stages of development, allocate costs or control access.	■ Each application consists of one or more services. Each service can be configured to use different runtimes and to operate with different performance settings. Each service also supports multiple versions.
SECURITY	■ Supports VPC deployments ■ Access controls via EC2 security groups ■ User and group ID via integration with AWS IAM	■ Supports VPC deployments ■ Supports role-based access controls using OAuth 2.0, Google Workspace domain accounts or user-managed service accounts in Cloud IAM ■ App Engine Firewall

Google: quick look at Google Applications Portfolio

- The categories of Google's APIs:
- Ads and AdSense: These APIs allow Google's advertising services to be integrated into Web applications. Examples: AdWords, AdSense, and Google Analytics.
- AJAX: The Google AJAX APIs provide a means to add content such as RSS feeds, maps, search boxes, and other information sources by including a snippet of JavaScript into your code. [Really Simple Syndication Feeds are an easy way to stay up to date with your favorite websites, such as blogs or online magazines. If a site offers an RSS feed, you get notified whenever a post goes up, and then you can read a summary or the whole post.]

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- Browser: Google has several APIs related to building browser-based applications, including four for the Chrome browser. This category includes the Google Cloud Print API, the Installable Web Apps API for creating installation packages, the Google Web Toolkit for building AJAX applications using Java, and V8, which is a high-performance JavaScript engine.
- Data: The Data APIs are those that exchange data with a variety of Google services. The list of Google Data APIs includes Google Apps, Google Analytics, Blogger, Base, Book, Calendar, Code Search, Google Earth, Google Spreadsheets, Google Notebook, and Picasa Web Albums.

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- Geo: A number of APIs exist to give location-specific information hooking into maps and geo-specific databases. Some of the more popular APIs in this category include Google Earth, Directions, JavaScripts Maps, Maps API for Flash, and Static Maps.
- Search: The search APIs leverage Google's core competency and its central service. APIs such as Google AJAX Search, Book Search, Code Search, Custom Search, and Webmaster Tools Data APIs allow developers to include Google searches in their applications and web sites.
- Social: Many Google APIs are used for information exchange and communication tools. They support applications such as Gmail, Calendar, and others, and they provide a set of foundation services. The popular social APIs are Blogger Data, Calendar, Contacts, OpenSocial, Picasa, and YouTube.

Dark Web

- The term dark web refers to encrypted online content that is not indexed by conventional search engines.
- Accessing the dark web can only be done using specific browsers, such as TOR Browser.
- There is a great deal of privacy and anonymity that comes with using the dark web compared to traditional websites.
- As such, most of the attention is placed on online marketplaces for drugs, exchanges for stolen data, and other illegal activities when people think of the dark web.
- Despite this, there are often very legitimate reasons why people choose to use the dark web, including political dissidents and people who want to keep certain information private.

Dark Web

- As its name implies, the dark web is a secret network that exists underground.
- It's made up of a series of websites that are hidden from the general public. This means they aren't accessible through traditional search engines, such as Google.
- Traditional search engines return results because they contain indexes of links to websites. These are ranked based on keywords and relevancy.
- The dark web, on the other hand, uses information that isn't available on these other search engines, such as content from individual accounts, such as email, social media, banking, along with personal and professional databases, and documents (legal and medical).