Skill Based Mini Project on

"AWS CASE STUDY"

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Submitted To:

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(NAAC Accredited With A++ Grade)

CERTIFICATE

This is certified that Aishwary kumar nahak (0901CS211010) has submitted the skill based mini project file report titled "AWS Case study" under the mentorship of **Dr. Smita Parte** in partial fulfilment of the requirement for the award of degree of Bachelor of Technology in Computer Science and Engineering from Madhav Institute of Technology and Science, Gwalior.

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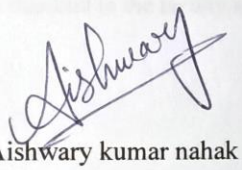
DECLARATION

I hereby declare that the work being presented in this skill based mini project file report, for the partial fulfilment of requirement for the award of the degree of Bachelor of Technology in Computer Science and Engineering at Madhav Institute of Technology & Science, Gwalior is an authenticated and original record of my work under the mentorship of **Dr. Smita Parte.**

I declare that I have not submitted the matter embodied in this report for the award of any degree or diploma anywhere else.



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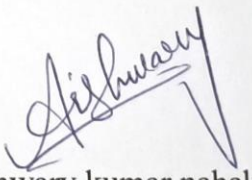

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ABSTRACT

This case study examines Amazon Web Services (AWS), a leading cloud computing platform, through the lens of its suitability for video streaming applications with high bandwidth demands (Gbps). It explores how AWS provides a flexible and scalable solution that eliminates the need for upfront investments in physical infrastructure. The analysis likely delves into specific AWS services like Amazon EC2 (Elastic Compute Cloud) and Amazon S3 (Simple Storage Service) to demonstrate how they can handle data storage, retrieval, and compute power required for video streaming. The abstract could also mention the pay-as-you-go pricing model of AWS, potentially highlighting its cost-effectiveness for businesses with fluctuating video streaming traffic.

सार

यह केस स्टडी उच्च बैंडविड्थ मांग (जीबीपीएस) के साथ वीडियो स्ट्रीमिंग अनुप्रयोगों के लिए उपयुक्तता के लेंस के माध्यम से अग्रणी क्लाउड कंप्यूटिंग प्लेटफॉर्म अमेज़ॅन वेब सर्विसेज (एडब्ल्यूएस) की जांच करती है। यह पता लगाता है कि AWS कैसे एक लचीला और स्केलेबल समाधान प्रदान करता है जो भौतिक बुनियादी ढांचे में अग्रिम निवेश की आवश्यकता को समाप्त करता है। यह विश्लेषण संभवतः Amazon EC2 (इलास्टिक कंप्यूट क्लाउड) और Amazon S3 (सिंपल स्टोरेज सर्विस) जैसी विशिष्ट AWS सेवाओं पर प्रकाश डालता है ताकि यह प्रदर्शित किया जा सके कि वे वीडियो स्ट्रीमिंग के लिए आवश्यक डेटा स्टोरेज, पुनर्प्राप्ति और गणना शक्ति को कैसे संभाल सकते हैं। सार में AWS के पे-एज़-यू-गो मूल्य निर्धारण मॉडल का भी उल्लेख किया जा सकता है, जो संभावित रूप से उतार-चढ़ाव वाले वीडियो स्ट्रीमिंग ट्रैफ़िक वाले व्यवसायों के लिए इसकी लागत-प्रभावशीलता को उजागर करता है।

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1.INTRODUCTION

1.1 Overview of Cloud Computing

Cloud computing is the on-demand availability of computer system resources, especially data storage (cloud storage) and computing power, without direct active management by the user. The term is generally used to describe data centres available to many users over the Internet. Large clouds, predominant today, often have functions distributed over multiple locations from central servers. If the connection to the user is relatively close, it may be designated an edge server.

There are many Cloud Platforms in the market but AWS is one of the most popular clouds.

1.2 Introduction to Amazon Web Services (AWS)

Amazon Web Services (AWS) is a subsidiary of Amazon providing on-demand cloud computing platforms and APIs to individuals, companies, and governments, on a metered pay-as-you-go basis.

Amazon Web Services (AWS) is the world's most comprehensive and broadly adopted cloud platform, offering over 175 fully-featured services from data centres globally. Millions of customers — including the fastest-growing startups, largest enterprises, and leading government agencies — are using AWS to lower costs, become more agile, and innovate faster.

1.3 Problem Statement

The growing demand for high-quality video streaming presents a significant challenge for businesses. Traditional on-premises infrastructure often struggles to keep pace with fluctuating traffic demands and requires significant upfront investments. These limitations can hinder scalability, lead to buffering issues for viewers, and ultimately impact user experience. Additionally, managing and maintaining physical infrastructure can be resource-intensive and expensive.

This problem statement outlines the key challenges faced by businesses offering high-bandwidth video streaming:

- Scalability Limitations: Traditional infrastructure may not be able to handle sudden spikes in viewers, leading to buffering or outages.
- High Upfront Costs: Building and maintaining an on-premises infrastructure for high-bandwidth video streaming requires significant investment.
- Poor User Experience: Buffering and outages due to inadequate infrastructure can negatively impact user experience.
- Resource-Intensive Management: Managing and maintaining physical infrastructure for video streaming can be a drain on resources.

2.CASE STUDY ON AWS

2.1 History of AWS

Amazon launched its first cloud computing service, Simple Storage Service (S3) in March of 2006. But the idea for the public cloud began germinating at the company several years earlier.

A popular myth says that Amazon began selling public cloud computing services because it had "excess capacity" from running its eCommerce website. Executives have repeatedly contradicted that story, saying that Amazon Web Services was designed from the ground up as a service for outside customers. However, the company's experiences with eCommerce did help lay the groundwork for AWS.

In the early 2000s, Amazon.com's internal development team had a problem. They were adding a lot of software engineers, but despite the growing headcount, the pace of development was staying about the same. The issue was that each developer was setting up new and unique compute, storage and database resources for each project. The IT group realized that if they could standardize those resources and simplify the process of deploying new IT infrastructure, they might be able to speed things up.

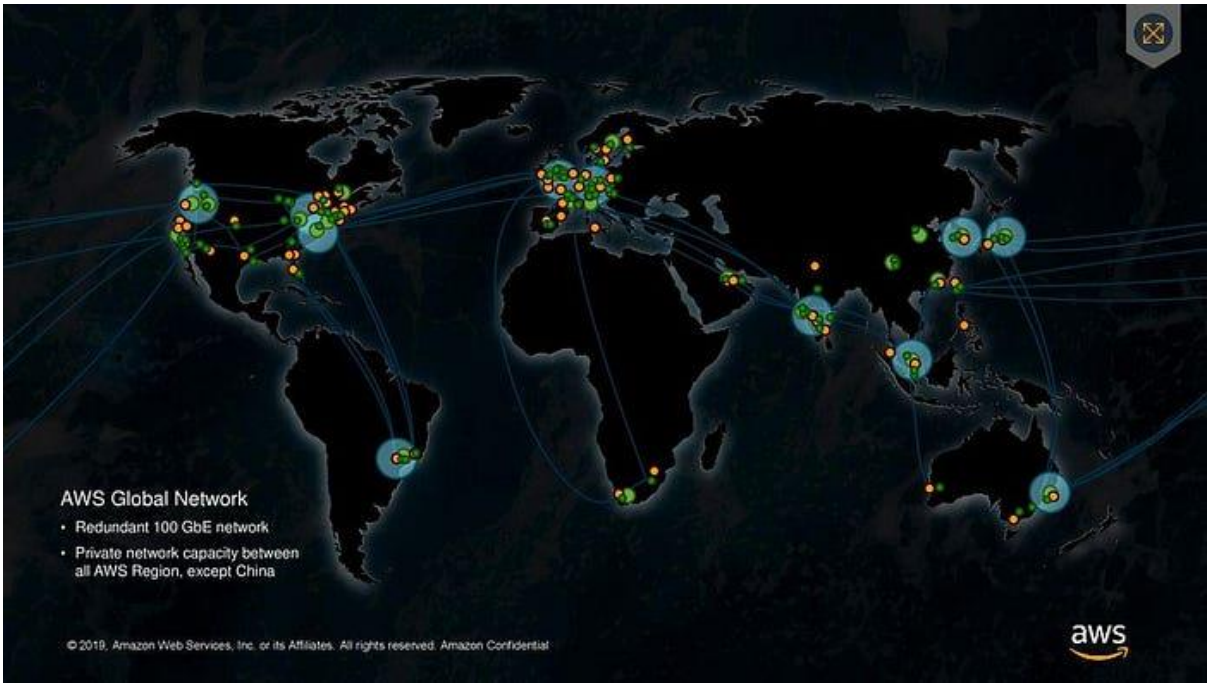
In 2003, former Amazon employee Benjamin Black and his boss Chris Pinkham wrote a paper for Amazon founder and CEO Jeff Bezos. It described "a vision for Amazon infrastructure that was completely standardized, completely automated, and relied extensively on web services for things like storage." In a blog post, Black explained, "Near the end of it, we mentioned the possibility of selling virtual servers as a service."

That idea cropped up again that same year when Amazon executives were attending a retreat at Bezos' house. As current AWS CEO Andy Jassy tells the story, the group was working to identify their core competencies when they realized they had become pretty good at running IT infrastructure. They began to

consider the idea of offering those IT services to other companies. The idea gained momentum, and in 2004, Black, Pinkham and their team began work on the project that eventually became AWS. After the launch of S3 in the spring of 2006, AWS followed up by taking its Simple Queue Service into production and launching its Elastic Compute Cloud (EC2) that summer. By the following year, the company amassed a reported 180,000 developers as customers.

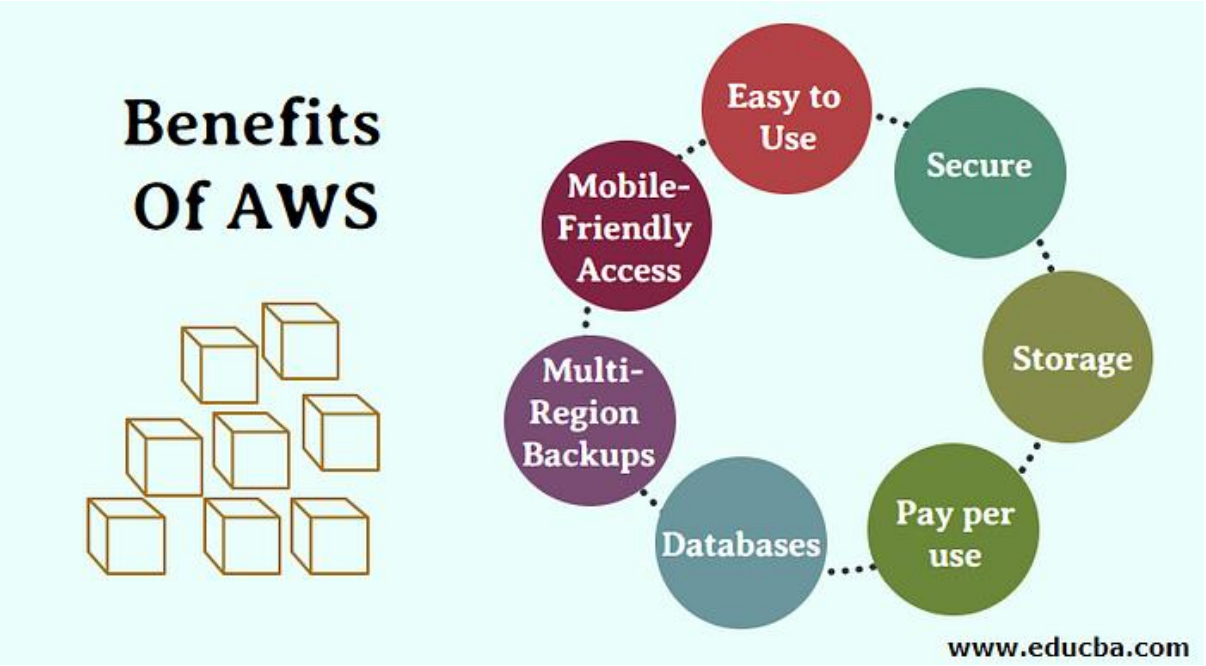
In the years that followed, Amazon's cloud quickly expanded with additional services and more regions. In 2010, Netflix became the first company to announce publicly that it would run all of its infrastructure on AWS. After that, customers began to sign up even more quickly, and AWS developed the market share that put it far ahead of all the other competitors who began to offer their own cloud computing services.

2.2 AWS Regions



2.3 Data Centres of AWS

2.4 Benefits of AWS



The largest community of customers and partners -AWS has the largest and most dynamic community, with millions of active customers and tens of thousands of partners globally. Customers across virtually every industry and of every size, including startups, enterprises, and public sector organizations, are running every imaginable use case on AWS.

Agility- The cloud gives you easy access to a broad range of technologies so that you can innovate faster and build nearly anything that you can imagine.

Elasticity -With cloud computing, you don't have to over-provision resources upfront to handle peak levels of business activity in the future. Instead, you provision the number of resources that you actually need.

Cost Savings-The cloud allows you to trade capital expenses (such as data centres and physical servers) for variable expenses and only pay for IT as you consume it.

2.5 Key Services of AWS

Amazon Web Services (AWS) offers a wide range of cloud computing services to cater to various business needs. Here are some key services provided by AWS:

1. **Compute Services:**
    - **Amazon Elastic Compute Cloud (EC2):** Provides resizable compute capacity in the cloud. Users can launch virtual servers (instances) with varying configurations to run applications.
    - **AWS Lambda:** A serverless compute service that runs code in response to events, automatically managing the compute resources required.
    - **Amazon EC2 Auto Scaling:** Automatically adjusts the number of EC2 instances to maintain application performance at a desired level.
2. **Storage Services:**
    - **Amazon Simple Storage Service (S3):** Offers scalable object storage for data storage and retrieval. It is highly durable, secure, and can be integrated with other AWS services.
    - **Amazon Elastic Block Store (EBS):** Provides block-level storage volumes for EC2 instances. It is suitable for persistent data storage.
    - **Amazon Glacier:** A low-cost storage service for long-term backup and archival of data.

3. **Database Services:**
    - **Amazon Relational Database Service (RDS):** Managed relational database service that supports multiple database engines like MySQL, PostgreSQL, Oracle, SQL Server, and more.
    - **Amazon DynamoDB:** Fully managed NoSQL database service for applications that require single-digit millisecond latency at any scale.
    - **Amazon Redshift:** Fully managed data warehouse service for analytics, designed to handle large-scale data sets and complex queries.
4. **Networking Services:**
    - **Amazon Virtual Private Cloud (VPC):** Enables users to launch AWS resources into a virtual network that they define. It provides control over network configuration, including IP addressing, subnets, and routing.
    - **Amazon Route 53:** Scalable domain name system (DNS) web service designed to route end users to internet applications.
    - **AWS Direct Connect:** Establishes a dedicated network connection from the user's premises to AWS, bypassing the internet.
5. **Security & Identity Services:**
    - **AWS Identity and Access Management (IAM):** Manages access to AWS services and resources securely. It enables users to create and manage AWS users and groups and control their access.
    - **Amazon Inspector:** Automated security assessment service that helps improve the security and compliance of applications deployed on AWS.

- **AWS Key Management Service (KMS):** Managed service that makes it easy for users to create and control encryption keys to encrypt their data.

6. **Management Tools:**
    - **Amazon CloudWatch:** Monitoring and observability service for AWS resources and applications. It collects and tracks metrics, monitors log files, sets alarms, and automatically reacts to changes in AWS resources.
    - **AWS CloudFormation:** Infrastructure as Code service that allows users to create and manage AWS resources using templates.
7. **AI & Machine Learning Services:**
    - **Amazon SageMaker:** Fully managed service that enables developers and data scientists to build, train, and deploy machine learning models quickly.
    - **Amazon Rekognition:** Deep learning-based image and video analysis service for object and scene detection, facial recognition, and more.
    - **Amazon Comprehend:** Natural language processing (NLP) service that extracts insights and relationships from text data.

These are just a few examples of the many services offered by AWS. Depending on specific business requirements, AWS provides a wide array of tools and services to support virtually any workload or application.

2.6 AWS Use Cases

Millions of customers — including the fastest-growing startups, largest enterprises, and leading government agencies — are using AWS to lower costs, become more agile, and innovate faster.

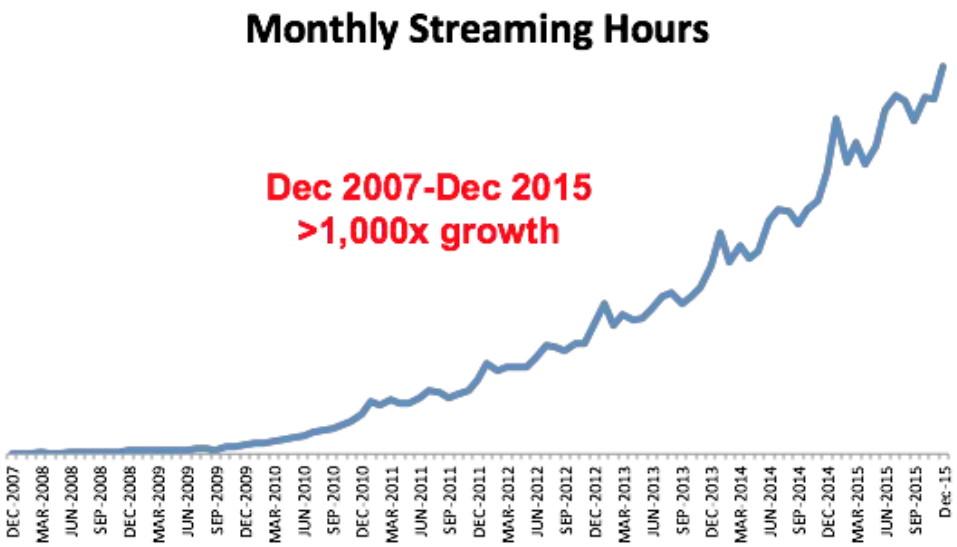
In every field, the AWS service is used. Below are some areas and some top companies use AWS.

- Aerospace (NASA, Maxar, ESA etc.)
- Gaming (MPL, FanFight, Gammation etc.)
- Education (Coursera, BYJU's etc.)
- Telecommunication (Pinterest, Vodafone, Aircel etc.)
- Entertainment (Netflix, Hotstar etc.)
- Media (BBC, The Hindu, Punjab Kesri etc.)
- Software (Share chat, Slack etc.)

3. NETFLIX CASE STUDY(AWS)

Netflix was originally a DVD shipping business where they would send out DVDs of your chosen programs to you. This was going well until 2008 where they experienced a major database loss and for 3 days could not ship out any DVDs to their customers. That was when the senior management at Netflix realized that they had to shift from continuous vertical scaling which leads to single points of failure to a more reliable and scalable horizontal scaling system. They chose Amazon Web Services despite having Amazon as a competitor (Amazon has their own streaming service known as Amazon Prime) because AWS provided them with the greatest scaling capabilities and the biggest set of available features. It took 7 years of migration for Netflix to shut down their last remaining data centres and move completely to the cloud.

Moving to the cloud has allowed Netflix to keep its existing members well engaged with overall viewing growing exponentially.



Netflix itself has continued to evolve rapidly by using many new features and relying on ever-growing volumes of data. Supporting this fast growth would not be possible earlier using their own in-house data centres. Netflix could not have racked the servers fast enough to support their own growth. While Cloud brings elasticity, which allows Netflix to add thousands of virtual servers and petabytes of storage within minutes which makes the whole process easier.

As of January 2016, Netflix has expanded into 130 new countries. It uses multiple AWS Cloud regions which are spread all over the world to create a better and more enjoyable streaming experience for Netflix members wherever they are.

Netflix relies on Cloud for all its scalability, computing and storage needs (not only video streaming) — Netflix business logic, distributed databases, big data processing, analytics, recommendations, transcoding and hundreds of other functions that are used by Netflix all go through their Cloud infrastructure.

Netflix also has its own Content Delivery Network (CDN) known as Netflix Open Connect which is used to deliver videos globally in an efficient manner.

When Netflix was using their own data centres, they faced a lot of outages. Cloud Computing is not perfect either, even though Netflix has hit some rough patches in the cloud, a steady increase in the overall availability has been noticed. Failures are ultimately unavoidable in any large-scale distribution system, even a cloud one. However, a Cloud-based system allows you to create redundancy measures while become quite helpful. Cloud Computing has made it possible to survive failures without impacting the member experience.

Netflix did not shift to cloud for cost reduction reasons, but Netflix's cloud costs ended up being a fraction of their cost which was a pleasant surprise. This was due to the elasticity factor of cloud computing, enabling Netflix to continuously optimize instances to grow and shrink as per requirement without the need to maintain large capacity machines. Economies of Scale helps Netflix in this scenario.

The benefits are very clear, but it still took seven years for Netflix to complete the migration. Moving to the cloud is a lot of work and a lot of factors need to be considered. Netflix could easily move all of its existing systems to AWS but bringing existing systems also brings all the problems and limitations that were present. So, Netflix took the cloud-native approach, they rebuilt all of their technology and fundamentally changed the way they operate the whole company. Netflix migrated from a single application to thousands of micro-services.

4. ANALYSIS AND DISCUSSION

4.1 Performance Considerations

- **Bandwidth Demands**: Analyze the bandwidth requirements for video streaming on AWS, considering factors such as video resolution, bitrate, and the number of concurrent viewers. Evaluate the need for high-speed connections to ensure smooth streaming experiences.
- **AWS Network Infrastructure**: Discuss AWS's high-performance network infrastructure, including its global network of data centers and content delivery networks (CDNs) like Amazon CloudFront. Highlight how AWS optimizes network routing to minimize latency and improve throughput for video delivery.
- **Scaling Strategies:** Explore scaling strategies for handling spikes in demand, such as auto-scaling instances with Amazon EC2 and leveraging AWS Direct Connect for dedicated network connections. Evaluate the use of AWS Edge Locations to cache content closer to end-users for faster delivery.
- **Monitoring and Optimization**: Discuss the importance of monitoring network performance metrics using tools like Amazon CloudWatch. Implement optimization techniques such as caching, compression, and content delivery optimizations to maximize bandwidth efficiency and reduce costs.

4.2 Security Considerations for Video Streaming on AWS:

- **Data Encryption:** Highlight the importance of encrypting video content both in transit and at rest using AWS services like Amazon S3 Server-Side Encryption and AWS Key Management Service (KMS). Discuss the use of HTTPS and SSL/TLS protocols for secure data transmission.
- **Access Control**: Implement granular access controls using AWS Identity and Access Management (IAM) to restrict access to video assets based on user roles and permissions. Utilize Amazon CloudFront Signed URLs and Cookies to control access to streaming content.
- **Content Protection**: Implement Digital Rights Management (DRM) solutions to protect copyrighted content from unauthorized distribution. Evaluate AWS Elemental MediaPackage for secure packaging and delivery of DRM-protected video streams.
- **Network Security**: Implement network security best practices such as configuring security groups and network ACLs to control inbound and outbound traffic to EC2 instances. Utilize AWS WAF (Web Application Firewall) and AWS Shield for DDoS protection.
- **Monitoring and Compliance**: Implement continuous monitoring of security events and compliance with industry standards such as PCI DSS, HIPAA, and GDPR using AWS services like Amazon GuardDuty and AWS Config. Conduct regular security audits and penetration testing to identify and mitigate vulnerabilities.

4.3 Cost Optimization Strategies for Video Streaming with AWS

- **Resource Sizing and Selection**: Right-size EC2 instances, Amazon RDS databases, and other AWS resources based on workload requirements to avoid over-provisioning and optimize costs. Utilize AWS Cost Explorer to analyze resource usage and identify opportunities for optimization.
- **Reserved Instances and Savings Plans**: Take advantage of AWS Reserved Instances and Savings Plans to commit to a specific usage volume and receive significant discounts on instance usage. Evaluate the use of Reserved Capacity for Amazon CloudFront to reduce data transfer costs.
- **Content Delivery Optimization:** Optimize content delivery costs by leveraging AWS Edge Locations, Amazon CloudFront caching, and Amazon S3 Transfer Acceleration for efficient data transfer. Implement compression techniques and cache control policies to minimize data transfer costs.
- **Cost Allocation and Tagging:** Implement cost allocation tags to track spending by project, department, or resource group. Utilize AWS Cost and Usage Reports to analyze cost trends and identify cost-saving opportunities. Implement cost control measures such as budgets and alerts to prevent cost overruns.
- **Auto-Scaling and Spot Instances:** Implement auto-scaling policies to dynamically adjust resource capacity based on demand, minimizing idle resources and optimizing costs. Utilize Spot Instances for non-critical workloads to take advantage of spare AWS capacity at significantly reduced prices.

By addressing performance considerations, security considerations, and cost optimization strategies for video streaming on AWS, businesses can build a robust, secure, and cost-effective streaming infrastructure that delivers high-quality video content to viewers worldwide.

CONCLUSION

In conclusion, Amazon Web Services (AWS) stands as a pioneer and giant in the world of cloud computing, offering an extensive array of services and unmatched scalability. Its success is not only attributed to its robust infrastructure but also to its constant innovation and adaptability to the evolving needs of businesses. AWS's history, from its inception with services like Simple Storage Service (S3) to its growth into a comprehensive cloud platform with over 175 services, demonstrates its commitment to providing reliable, secure, and cost-effective solutions.

The case study of Netflix's migration to AWS exemplifies the transformative power of cloud computing. By transitioning from traditional data centres to AWS, Netflix achieved greater reliability, scalability, and agility, leading to improved customer experiences and business growth. This success story reflects the broader trend of organizations across industries leveraging AWS to innovate, reduce costs, and enhance operational efficiency.

As cloud computing continues to evolve and expand, AWS remains at the forefront, offering a versatile platform for startups, enterprises, and government agencies alike. Its vast ecosystem, coupled with a strong focus on security, innovation, and customer satisfaction, solidifies AWS's position as a leader in the cloud computing market, poised to shape the future of digital transformation for years to come.

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