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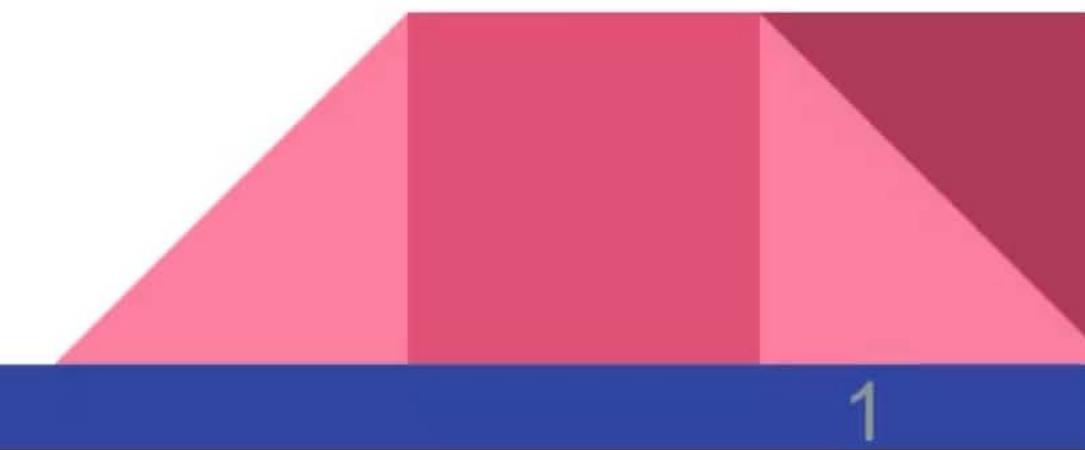
Cloud Usage Cost Metrics and SLAs

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– Center for Smart Society [CSS5] | Cluster Head Cybersecurity



School of Computer Science, Taylor's University, Malaysia



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Benefits Of Cloud Computing

Lower Costs- Help save on energy costs. (Underused servers)

Improved Security - Allows data encryption with secure storage databases and user able to control access and authentication procedures.

Maintains Business Continuity- Data Recovery implemented to ensure business still grows and all organisations should invest in cloud-based backup.

Automatic Updates- Convenient feature of cloud computing where there would be automatic updates for software and security.





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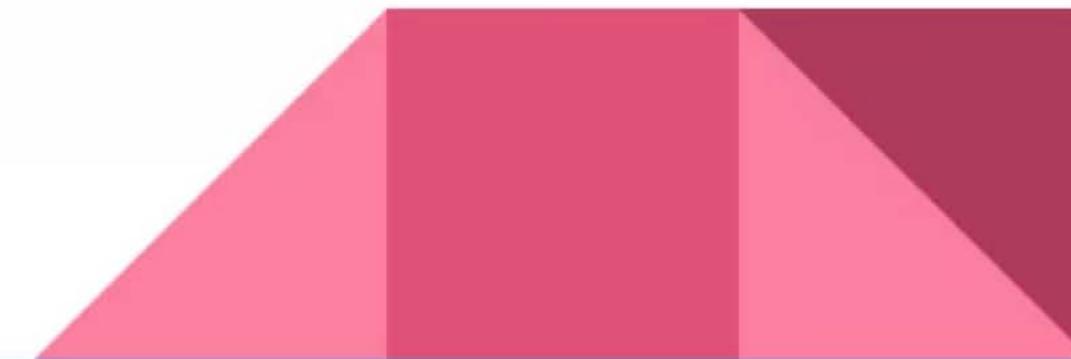
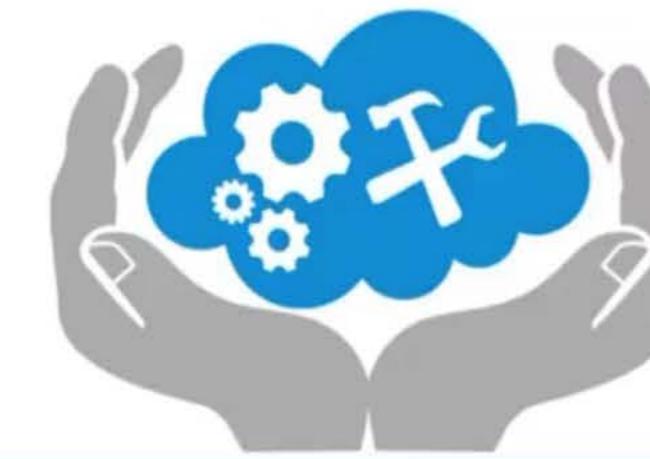
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Cloud Computing Tools for the End User

- Any solution built to aid cloud usage.
- Tools differ by Deployment Model, Service Model, Pricing, Scalability and especially purpose.
- Cloud Monitoring, Automation, Analytics, Business Intelligence, Data Processing tools and more...



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Cloud Monitoring Tools

These include any tools built to manage cloud resources to optimize performance and ensure the system is working within your budget.



Amazon CloudWatch



APPDYNAMICS



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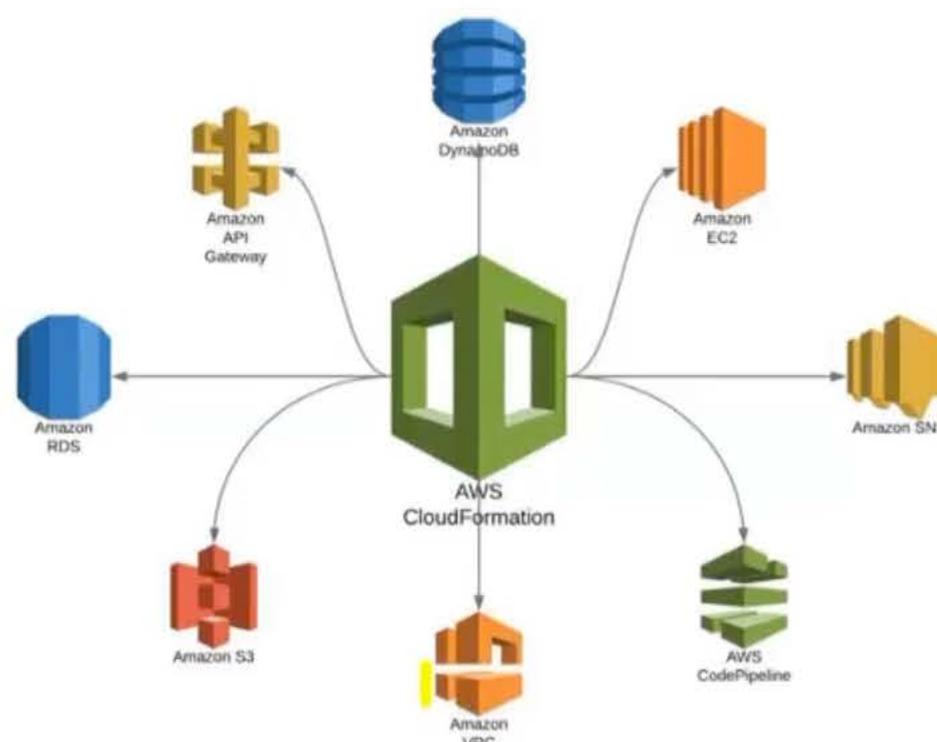
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Other Cloud Tools



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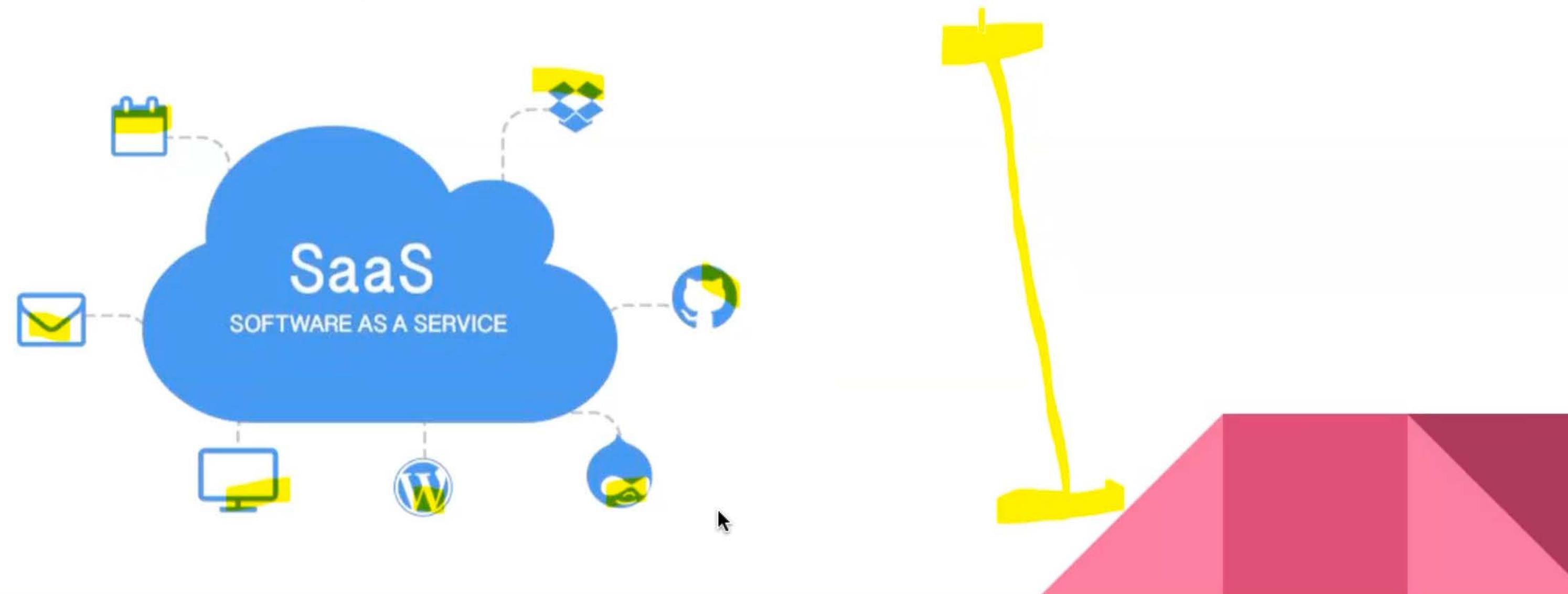
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Software-as-a- Service (**SaaS**)

Cloud service for gaining access to cloud-based software.



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Infrastructure-as-a-Service (IaaS)

Cloud service used to gain access to certain computing resources like servers, networking, and storage.



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Top 50+ AWS Services





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AWS vs Azure vs GCP

Can we really draw conclusions easily?

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AWS vs Azure vs GCP

**Former Name:**

Amazon ecommerce-as-a-service

Official Launch:

2006

**Former Name:**

Windows Azure

Official Launch:

2010



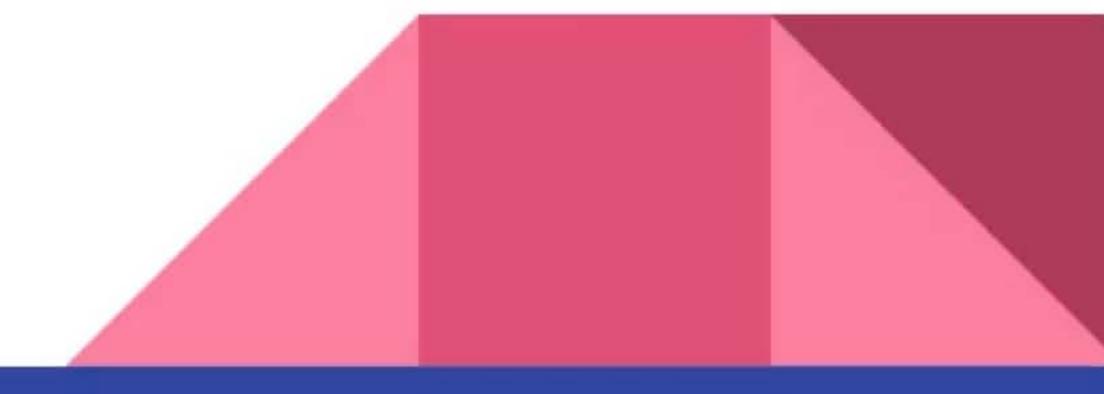
Google Cloud Platform

Former Name:

Google App Engine

Official Launch:

2011



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AWS vs Azure vs GCP - Similarities

PRODUCT	aws	Microsoft Azure	Google Cloud Platform
Virtual Servers	Instances	VMs	VM Instances
Platform-as-a-Service	Elastic Beanstalk	Cloud Services	App Engine
Serverless Computing	Lambda	Azure Functions	Cloud Functions
Docker Management	ECS	Container Service	Container Engine
Kubernetes Management	EKS	Kubernetes Service	Kubernetes Engine
Object Storage	S3	Block Blob	Cloud Storage
Archive Storage	Glacier	Archive Storage	Coldline
File Storage	EFS	Azure Files	ZFS / Avere
Global Content Delivery	CloudFront	Delivery Network	Cloud CDN
Managed Data Warehouse	Redshift	SQL Warehouse	Big Query

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AWS vs Azure vs GCP - Services

**Total Services:**

200+

Specialization:

Web App

Uniqueness:

Quality, some with services extra features

**Total Services:**

600+

Specialization:

Management

Uniqueness:

Variety, freedom, room for creativity



Google Cloud Platform

Total Services:

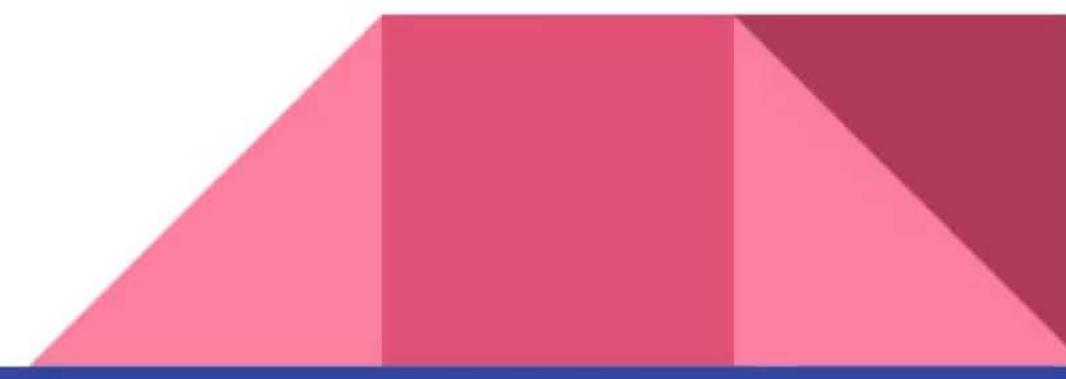
100+

Specialization:

AI & ML

Uniqueness:

Great at mobile dev and ML



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AWS vs Azure vs GCP - Products & Tools

**IDE:**

AWS Cloud9

Debugging:

AWS X-ray

CLI:

AWS CLI, Elastic Beanstalk CLI,
ECS CLI, CloudShell, Copilot,
Amplify CLI

**IDE:**

Visual Studio, Visual Studio Code

Debugging:

Storage Emulator, Cosmos DB
Emulator, Azurite

CLI:

Azure PowerShell, Azure CLI,
Cloud Shell, AzCopy



Google Cloud Platform

IDE:

Cloud Code (IDE Plugin)

Debugging:

Firebase Crashlytics

CLI:

Cloud tools for PowerShell

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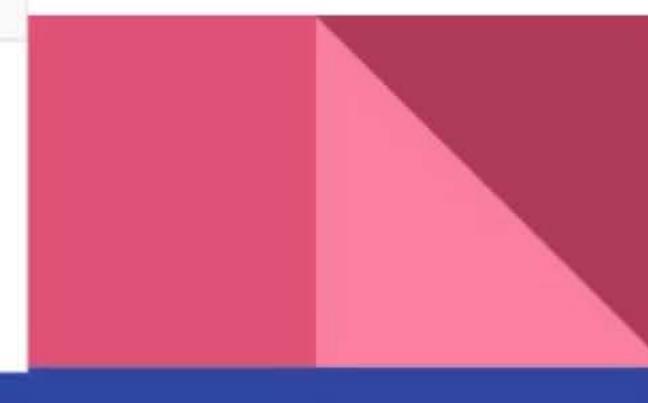
AWS vs Azure vs GCP - Pricing & Costs



Detail	AWS	Azure	GCP
Smallest Instance	2 virtual CPUs, and 8 GB of Ram will price you around – USD 69/month	2 virtual CPUs, and 8 GB of Ram will price you around – USD 70/month	2 virtual CPUs, and 8 GB of Ram will price you around – USD 52/month
Largest Instance	3.84 TB Ram, 128 vCPUs will price you around – USD 3.97/hour	3.89 TB Ram, 128 vCPUs will price you around – USD 6.97/hour	3.75 TB Ram, 160 vCPUs will price you around – USD 5.32/hour
Type of Discount	Reserved Instances (RIs)	Reserved Instances (RIs)	Committed Use Discount (CUD) Sustained Use Discount (SUD)
Commitment	1 or 3 years	1 or 3 years	Committed Use Discount (CUD) – 1 or 3 years Sustained Use Discount (SUD) – no commitment
Discount percentage	Up to 75 percent	Up to 72 percent	Committed Use Discount (CUD) – for 1 year up to 37 percent or 3 years up to 55 percent Sustained Use Discount (SUD) – up to 30 percent



Google Cloud Platform



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AWS vs Azure vs GCP - Pricing & Costs



Google Cloud Platform

Is cancellation available?	Yes, it offers to sell your products on the marketplace	Yes, they will charge a 12% cancellation fee	No cancellation is available
Payment options	3 options are available on AWS – no up-front, partial up-front, all up-front	All up-front	No up-front
High Profile Customers	LinkedIn, Facebook, BBC, Airbnb, Twitch, Netflix, Adobe, ESPN, Lamborghini, etc.	Apple, HP, Coca-Cola, LG Electronics, Verizon, Xbox, Fujifilm, etc.	Twitter, Intel, Yahoo, PayPal, eBay, Target, 20th Century Fox, etc.



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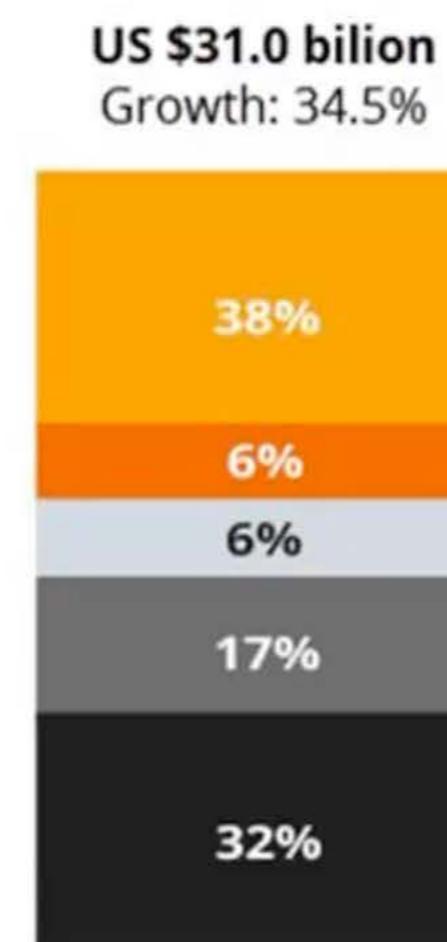
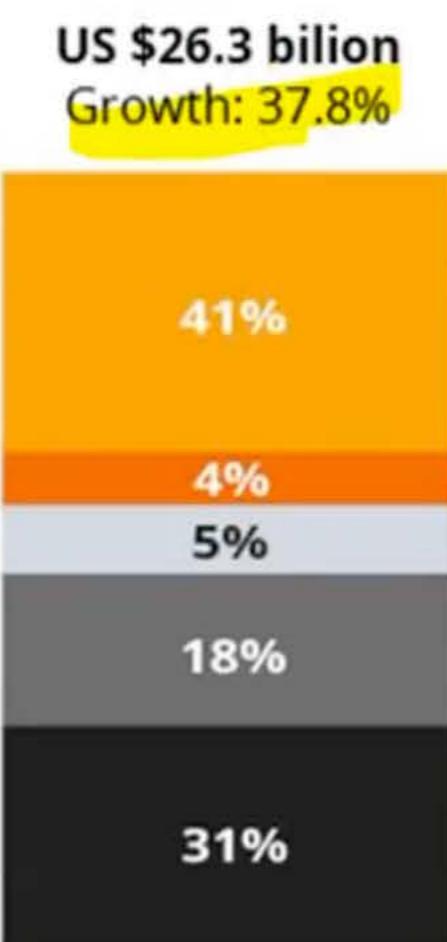
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AWS vs Azure vs GCP - Market Share



- Others
- Alibaba Cloud
- Google Cloud
- Microsoft Azure
- AWS

Source: Canalys estimates, July 2020



Google Cloud Platform

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AWS vs Azure vs GCP - Market Share

■ Google Cloud Platform ■ Amazon Web Services ■ Microsoft Azure ■ Alibaba Cloud



Google Cloud Platform

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AWS vs Azure vs GCP - Free-tier Registration

**Free Services:**

39

**Trial:**

Complete free - 1 year,

39 services free trial - 1 year

Credit Card:

Yes

**Free Services:**

40+

Trial:

\$200 Credit - 1 month,

12 popular services - 1 year free

Credit Card:

No, for student/work emails



Google Cloud Platform

Free Services:

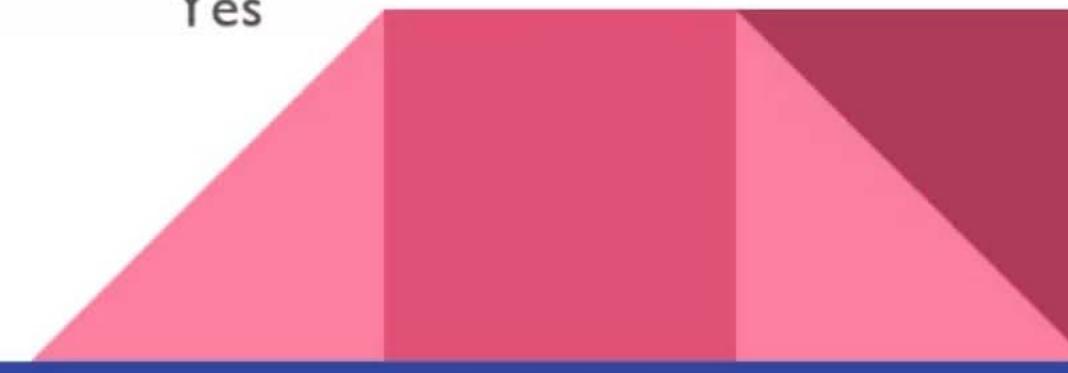
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Trial:

\$300 Credit - 3 month

Credit Card:

Yes



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AWS vs Azure vs GCP - Evaluation



Justification:

- More Services (600+)
- No Credit Card for students
- Great tools & products
- 40+ free services
- Integrations with industry standard tech
- Fast market-growth rate
- Great dedicated learning hub

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Comparison - AWS

When it comes to cloud computing, Amazon Web Services (AWS) is by far the most comprehensive, with more than two hundred universally featured resources covering everything from basic infrastructure to advanced machine learning. These modular systems' flexible configurations make them ideal for enhancing your application's functionality in ways such as content distribution, data storage, and more.

	Services and products	Cost Overview	Tools
Amazon Web services	1. Elastic cloud computing[7]	o \$0.09/GB for first 10TB/month[7].	Amazon Corretto
	1. Amazon RDS(Relational Database Services)	o \$0.016/hour for DB.t4g.micro instances[7].	AWS Cloud9
	1. Amazon S3(Simple Storage Service)	o \$0.023/GB for first 50 TB/month[7].	AWS CloudShell
	1. Amazon Lambda[7]	o \$0.20 per 1M requests, \$0.0000133334 per GB-second	AWS CodeArtifact
	1. Amazon cloud Front	o \$0.085 per 10 TB	AWS CodeBuild
	1. Amazon VPC	o Free (optional features payable)	AWS CodeCommit
	1. Amazon DynamoDB	o \$0.02/100,000 data reads[7].	AWS X-Ray
	1. AWS Beanstalk	o AWS Elastic Beanstalk is free[7].	AWS CodePipeline
	1. AWS Autoscaling	o Free	AWS CodeStar
	1. AWS IAM	o Free	AWS Fault Injection Simulator

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Another Possible Opinion

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	Services and products	Cost Overview	Tools
Google Cloud Platform	Compute: GCP provides scalable, customizable computing options. It has customizable virtual machines, as well as direct or container code deployment[10].	Google provides pay-as-you-go and no cancellation penalties. Google slashes prices and adds features like right-sizing. Their website has a price calculator. Cost-estimating tool for customers. As pricing differs by service, compare costs throughout the platform.	Google Kubernetes Engine[11].
	Storage and Databases: Storage services include the following[10]: <ul style="list-style-type: none"> ➤ Google Cloud Storage ➤ Cloud SQL ➤ Cloud Big Table ➤ Google Cloud Datastore ➤ Persistent Disk 		Network Analyzer [11].
	Big Table: Storage domain encompasses big data services: <ul style="list-style-type: none"> ➤ Google BigQuery ➤ Google Cloud Dataproc ➤ Google Cloud Dataflow ➤ Google cloud Pub/Sub 		Vertex AI Tubular Workflow[11].
	1. Machine learning: Storage domain machine learning services include: <ul style="list-style-type: none"> ➤ Cloud Machine Learning ➤ Vision API ➤ Speech API ➤ Natural Language API ➤ Translation API ➤ Jobs API 		Manufacturing Data Engine[11].
	1. Identity and Security: Storage domain security services include[10]: <ul style="list-style-type: none"> ➤ Google Cloud Resource Manager ➤ Cloud IAM ➤ Cloud Security Scanner ➤ Cloud Platform Security 		Cloud HPC Toolkit[11].
	1. Management and Developer Tools		Cloud fleet Routing API[3].
	1. Developer Tools		Google Workspace SAP Integrations[11].
			Google Distributed Cloud Virtual
			Confidential GKE Nodes
			Manufacturing Connect



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Comparison - Azure

According to Saran [8] Microsoft Azure is a public cloud computing platform that provides various cloud computing services, including infrastructure as a service (IaaS), software as a service (SaaS), platform as a service (PaaS), and a serverless approach. Microsoft Azure is a constantly expanding hybrid cloud used by almost all Fortune 500. The platform has kept its integrity and popularity by providing first-rate Azure services.

	Services and products	Cost Overview	Tools
	1. Azure Active Directory		AzurePing
Microsoft Azure Services	1. Azure Content Delivery Network	In contrast to rivals like Amazon Web Services, Azure does not publish prices for its individual core services. Services are instead charged by aggregating the costs of their individual tools, templates, resources, data analysis methods, and so on. Usually Azure's cost begins at \$29 per month for a basic subscription, or \$0.004 per hour for a Linux virtual machine.	Cloud Explorer for Visual Studio
	1. Azure Data Factory		Cloud combine
	1. Azure SQL		SQL Database Migration Wizard
	1. Azure Function		Azure Blob Studio
	1. CosmosDB		Microsoft Azure Storage Connected Service
	1. DevOps		Graph Engine VSExtension
	1. Azure Backup		Docker
	1. Logic Apps		Azure developer portal
	1. Virtual Machine		Azure Grid



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Individual Assessment (May Varies)

	Service-focused	Price Concerning	Individual Suggestion
Google Cloud Platform	Fewer services, but superior AI/ML and data analytics tools.	Gartner praises GCP's customer-centric pricing, huge savings, and flexible contracts.	
Microsoft Azure	Strong hybrid-cloud infrastructure.	Discounts based on a customer's unique circumstances necessitate evaluation.	Google Cloud Platform is the "latest craze" compared to Amazon Web Services and Microsoft, but their products are worth paying attention to.
Amazon Web Services	Vast possibilities, but centered on public cloud solutions, thus hybrid adoption may be difficult)	Gartner suggests a third-party tool to assess price.	

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Another Possible Opinion

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Cost Analysis

- Costs associated with different infrastructures (I – initial, M-Monthly)

	Internal-I	Cloud-I	Internal-M	Cloud-M
Rack	\$3,000	\$0	\$500	\$0
Switches	\$2,000	\$0	\$0	\$0
Load balancer	\$20,000	\$0	\$0	\$73
Servers	\$24,000	\$0	\$0	\$1,206
Firewalls	\$3,000	\$0	\$0	\$0
24/7 Support	\$0	\$0	\$0	\$400
Mgt. software	\$0	\$0	\$100	\$730
Expected labor	\$1,200	\$1,200	\$1,200	\$600
Degraded.PERF	\$0	\$0	\$100	\$0
Totals	\$53,200	\$1,200	\$1,900	\$3009

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Cost Analysis

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AWS Pricing Philosophy



💡 Pay as you go

- No minimum commitments or long-term contracts required
- Capex -> Opex
- Turn off when you don't need it

💡 Pay less per unit when you use more

- Tiered Pricing and Volume Discounts

💡 Pay even less when you reserve

- Reserved pricing

💡 Pay even less as AWS grows

- Efficiencies, optimizations and economies of scale result in passing the savings back to you in the form of lower pricing

💡 Custom Pricing

<https://slideplayer.com/slide/3406583/>

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Cost Calculator

aws pricing calculator

Contact Sales Feedback English Create an AWS Account

AWS Pricing Calculator

Estimate the cost for your architecture solution.

Configure a cost estimate that fits your unique business or personal needs with AWS products and services.

Create an estimate

Start your estimate with no commitment, and explore AWS services and pricing for your architecture needs.

Create estimate

How it works

More resources

- User guide
- FAQs
- Pricing assumptions and variations
- Need help with estimation? Connect with AWS certified expert on AWS IQ

AWS Modernization Calculator for Microsoft Workloads

Estimate the cost of transforming Microsoft workloads to a modern architecture that uses open source and cloud-native services deployed on AWS.

<https://calculator.aws/#/?key=new>

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