AWS vs Azure vs Google

Amazon Web Services (AWS): With 11 years in operation, AWS is one of the oldest players in the cloud market. Their computing services are extensive and cover important cloud sections such as deployment, mobile networking, etc. Amazon manages AWS.

Google Cloud Platform (GCP): GCP started their journey on October 6, 2011. With only 5 years in operation, they have created good presence in the market. The initial push was done to power their own services such as YouTube and Google. Later on, they built enterprise services and enabled anyone to host in the cloud. Google manages GCP.

Microsoft Azure: Azure is also 6 years old and has shown great promise in the market. They can easily be associated with the leader group in the market with AWS. Azure also provides a complete set of cloud services. Microsoft manages Azure.

Comparison in term of Compute, storage, databases and networking

For compute, AWS' main offering is its EC2 instances, which can be tailored with a large number of options. It also provides related services such as Elastic Beanstalk for app deployment, the EC2 Container service, AWS Lambda and Autoscaling.

Meanwhile, Azure's compute offering is centred around its Virtual Machines (VMs), with other tools such as Cloud Services and Resource Manager to help deploy applications on the cloud, and its Azure Autoscaling service.

Google's scalable Compute Engine delivers VMs in Google's data centres. They are quick to boot, come with persistent disk storage, promise consistent performance and are highly customisable depending on the needs of the customer.

All three cloud providers support relational databases - that's Azure SQL Database, Amazon Relational Database Service, Redshift and Google Cloud SQL - as well as NoSQL databases with Azure DocumentDB, Amazon DynamoDB and Google Bigtable.

AWS storage includes its Simple Storage (S3), Elastic Block Storage (EBS), Elastic File System (EFS), Import/Export large volume data transfer service, Glacier archive backup and Storage Gateway, which integrates with on-premise environments.

Microsoft's offerings include its core Azure Storage service, Azure Blob block storage, as well as Table, Queue and File storage. It also offers Site Recovery, Import Export and Azure Backup.

All three typically offer excellent networking capabilities with automated server load balancing and connectivity to on-premise systems.

The competition is heating up in the public cloud space as vendors regularly drop prices and offer new features. The three giants of the cloud are: Amazon Web Services (AWS), Google Cloud Platform (GCP), and Microsoft's Azure. While AWS has a significant head start on the others, Google and Microsoft are far from out of the race. They've both got the power, money, technology, and marketing to attract individual and enterprise customers. Let's compare these three big players by service category: compute, storage, networking, and pricing structure.

AWS vs Azure vs Google: cloud players

AWS vs Azure vs Google: Compute

AWS's EC2 (Elastic Compute Cloud) provides Amazon's core compute service, allowing users to configure virtual machines using either pre-configured or custom AMIs (machine images). We can select the size, power, memory capacity, and number of VMs and choose from among different regions and availability zones within which to launch. EC2 also allows load balancing (ELB) and auto scaling. ELB

distributes loads across instances for better performance, and auto scaling allow users to automatically scale available EC2 capacity up or down.

In 2012, Google introduced their computing cloud service: **Google Compute Engine** (GCE). Google Compute Engine lets users launch virtual machines, much like AWS, into regions and availability groups. However GCE didn't become available for everyone until 2013. Since then Google has added its own enhancements, like load balancing, extended support for Operating Systems, live migration of VMs, faster persistent disks, and instances with more cores.

Also in 2012, Microsoft introduced their compute service as a preview, but didn't make it generally available until May 2013. Azure users choose a VHD (Virtual Hard Disk), which is equivalent to Amazon's AMI, to create a VM. A VHD can be either predefined by Microsoft, by third parties, or be user-defined. With each VM, you need to specify the number of cores and amount of memory.

Table1 shows Big Three compute options:

	Instance Families	Instances types	Regions	Zones
AWS	7	38	Yes	Yes
GCE	4	18	Yes	Yes
Azure	4	33	Yes	

Table1: AWS vs Azure vs Google: Compute

AWS vs Azure vs Google: Storage and databases

AWS provides ephemeral (temporary) storage that is allocated once an instance is started and is destroyed when the instance is terminated. It provides Block Storage that is equivalent to hard disks, in that it can either be attached to any instance or kept separate. AWS also offers object storage with their S3 Service, and archiving services with Glacier. AWS fully supports relational and NoSQL databases and Big Data.

Google's Cloud Platform similarly provides both temporary storage and persistent disks. For Object storage, GCP has Google Cloud Storage. GCP supports relational DBs through Google Cloud SQL.

Technologies pioneered by Google, like Big Query, Big Table, and Hadoop, are naturally fully supported. Google's Nearline offers archiving as cheap as Glacier, but with virtually no latency on recovery.

Azure uses temporary storage (D drive) and Page Blobs (Microsoft's Block Storage option) for VM-based volumes. Block Blobs and Files serve for Object Storage. Azure supports both relational and NoSQL databases, and Big Data, through Windows Azure Table and HDInsight.

Table2 shows a comparison of the three clouds in storage and DBs.

	Ephemeral (Temporary)	Block Storage	Object Storage	Relational DB	Archiving	NoSQL and Big Data
AWS	Yes	EBS	S3	RDS	Glacier	DynamoDB, EMR, Kinesis, Redshift
GCP	Yes	Persistent disks	Google Cloud Storage	Google Cloud SQL	Nearline	Cloud Datastore, Big Query, Hadoop
Azure	Temporary Storage – D Drive	Page Blobs	Block Blobs and Files	Relational DBs		Windows Azure Table, HDInsight

Table 2: AWS vs Azure vs Google: Storage and databases

AWS vs Azure vs Google: Networking

Amazon's Virtual Private Clouds (VPCs) and Azure's Virtual Network (VNET) allow users to group VMs into isolated networks in the cloud. Using VPCs and VNETs, users can define a network topology, create subnets, route tables, private IP address ranges, and network gateways. There's not much to choose between AWS vs Azure on this: they both have solutions to extend your on-premise data center into the public (or hybrid) cloud. Each Google Compute Engine instance belongs to a single network, which defines the address range and gateway address for all instances connected to it. Firewall rules can be applied to an instance, and it can receive a public IP address.

AWS is unique in providing Route 53, a DNS web service.

Table 3 compares the three clouds from a networking point of view.

	Virtual network	Public IP	Hybrid Cloud	DNS	Firewall/ACL
AWS	VPC	Yes	Yes	Route 53	Yes
GCP	subnet	Yes			Yes
Azure	VNet	Yes	Yes		Yes

Table 3: AWS vs Azure vs Google: Networking

AWS vs Azure vs Google: Pricing Structure

AWS charges customers by rounding up the number of hours used, so the minimum use is one hour. AWS instances can be purchased using any one of three models:

- **on demand** – customers pay for what they use without any upfront cost
- **reserved** – customers reserve instances for 1 or 3 years with an upfront cost that is based on the utilization
- **spot** – customers bid for the extra capacity available

GCP charges for instances by rounding up the number of *minutes*used, with a minimum of 10 minutes. Google recently announced new *sustained-use pricing* for compute services that will offer a simpler and more flexible approach to AWS's reserved instances. Sustained-use pricing will discount the on-demand baseline hourly rate automatically as a particular instance is used for a larger percentage of the month.

Azure charges customers by rounding up the number of minutes used for on demand. Azure also offers short-term commitments with discounts.

Table 4 shows the comparison in Pricing and Models between the three public clouds.

	Pricing	Models
AWS	Per hour – rounded up	On demand, reserved, spot
GCP	Per minute – rounded up (minimum 10 minutes)	On demand – sustained use
Azure	Per minute – rounded up	On demand – short term

	commitments (pre-paid or monthly)	commitments (pre-paid or monthly)

Table 4: AWS vs Azure vs Google: Pricing and Models

All this isn't to say that there aren't many other ways to compare the three giants, like support levels, management, security and access. However this is a pretty good start.

The public cloud war drags on. As cloud computing is still in an early, maturing stage, no one can predict exactly how things will change in the near future. But what we can say, is that prices will continue dropping and attractive features will continue appearing. Cloud computing is here to stay and the way we all use computers will follow along with it.

Compute

Calculate, process, and compute—a computer's fundamental role. In addition, the right cloud provider can scale to thousands of processing nodes for you in just a few minutes.

Service	Amazon Web Services	Google Cloud Platform	Microsoft Azure
Deploy, manage, and maintain virtual servers	Elastic Compute Cloud (EC2)	Compute Engine	Virtual Machines Virtual Machine Scale Sets
Platform-as-a-Service	Elastic Beanstalk	App Engine Standard Environment App Engine Flexible Environment	Cloud Services

Virtual private servers made easy	Lightsail		Virtual Machine Images
Management support for Docker/Kubernetes containers	EC2 Container Service (ECS) Kubernetes (EKS)	Kubernetes Engine Container Engine	Container Service Container Service (AKS)
Docker container registry	EC2 Container Registry (ECR)	Container Registry	Container Registry
Orchestrate and manage microservice-based applications		App Engine	Service Fabric
Integrate systems and run backend logic processes	Lamda	Cloud Functions (Beta)	Functions Event Grid Web Jobs
Run large-scale parallel and high-performance batch computing	Batch		Batch
Automatically scale instances	Auto Scaling	Instance Groups	Virtual Machine Scale Sets App Service Scale Capability (PAAS) AutoScaling

Storage

A key function of cloud services is its storage capabilities. While AWS' storage services are the longest running, Google's and Microsoft Azure's are also very respectable and reliable options.

Service	Amazon Web Services	Google Cloud Platform	Microsoft Azure
Object storage service for use cases	Simple Storage Services (S3)	Google Cloud Storage	Storage (Block Blob)
Virtual server disk infrastructure	Elastic Block Store (EBS)	Compute Engine Persistent Disks	Storage (Page Blobs)
Archive storage	S3 Infrequent Access (IA) Glacier	Nearline Coldline	Storage (Cool) Storage (Archive)

	Data Archive		
Create and configure shared file systems	Elastic File System (EFS)	ZFS / Avere	Files
Hybrid storage	Storage Gateway	Egnyte Sync	StorSimple
Bulk data transfer solutions	Import/Export Disk Snowball Edge Snowmobile	Storage Transfer Service	Import/Export Azure Data Box
Backup	Object Storage Cold Archive Storage Storage Gateway		Backup
Automatic protection and disaster recovery	Disaster Recovery	Disaster Recovery Cookbook	Site Recovery

Networking and Content Delivery

Each provider offers different networks and partners which interconnect their data centers across the globe using a variety of different products to achieve this.

Service	Amazon Web Services	Google Cloud Platform	Microsoft Azure
Isolated, private cloud private networking	Virtual Private Cloud	Virtual Private Cloud	Virtual Network
Cross-premises connectivity	API Gateway	Cloud VPN	VPN Gateway
Manage DNS names and records	Route 53	Google Cloud DNS	Azure DNS Traffic Manager
Global content delivery networks	CloudFront	Cloud Interconnect Cloud CDN	Content Delivery Network
Dedicated, private network connection	Direct Connect	Cloud Interconnect	ExpressRoute
Load balancing configuration	Elastic Load Balancing	Cloud Load Balancing	Load Balancer

			Application Gateway

Database

All three providers allow you to implement both SQL and NoSQL solutions. Alternatively, if you don't need a database, go for their caching capabilities instead.

Service	Amazon Web Services	Google Cloud Platform	Microsoft Azure
Managed relational database-as-a-service	RDS	Cloud SQL Cloud Spanner	SQL Database Database for MySQL Database for PostgreSQL
NoSQL (Indexed)	DynamoDB	Cloud Datastore Cloud Bigtable	Cosmos DB
NoSQL (Key-value)	DynamoDB SimpleDB	Cloud Datastore	Table Storage
Application or Memory Caching	ElastiCache	Mem Cache	Redis Cache
Database migration	Database Migration Service		Database Migration Service
Managed data warehouse	Redshift	Big Query	SQL Data Warehouse

Management and Monitoring

Each of the top three offers a range of management and monitoring services which provide visibility into the health, performance, and utilization of applications, workloads, and infrastructure.

Service	Amazon Web Services	Google Cloud Platform	Microsoft Azure
Cloud advisor capabilities	Trusted Advisor	Cloud Platform Security	Advisor
DevOps deployment orchestration	OpsWorks (Chef-based)	Cloud Deployment	Automation

	CloudFormation	Manager	Resource Manager VM extensions
Cloud resources management & monitoring	CloudWatch X-Ray Management Console	Stackdriver Monitoring Cloud Shell Debugger Trace Error Reporting	Portal Monitor Application Insights
Administration	Application Discovery Service Systems Manager Personal Health Dashboard	Cloud Console	Log Analytics Operations Management Suite Resource Health Storage Explorer
Billing	Billing API	Cloud Billing API	Billing API

Security

Here, we cover the range of capabilities provided to protect services and data.

Service	Amazon Web Services	Google Cloud Platform	Microsoft Azure
Authentication and authorization	Identity and Access Management (IAM) Organizations	Cloud IAM Cloud Identity-Aware Proxy	Active Directory Active Directory Premium
Information Protection			Information Protection
Protect and safeguard with data encryption	Key Management Service		Storage Service Encryption
Hardware-based security modules	CloudHSM	Cloud Key Management Service	Key Vault

Firewall	Web Application Firewall	Application Gateway
Cloud security assessment and certification services	Inspector Certificate Manager	Security Center App Service Certificates
Directory services	AWS Directory Service	Active Directory Domain Services
Identity management	Cognito	Active Directory B2C
Support cloud directories	Directory Service	Windows Server Active Directory
Compliance	Artifact	Service Trust Portal
Cloud services with protection	Shield	DDoS Protection Service

Developer Tools

And finally, the tools you need to build, deploy, diagnose, debug, and manage multiplatform, scalable applications and services.

Service	Amazon Web Services	Google Cloud Platform	Microsoft Azure
Media transcoding	Elastic Transcoder		Media Services
Improve and optimize workflow	Simple Workflow Service (SWF)		Logic Apps
API management	API Gateway	Cloud Endpoints	API Management
App testing	Device Farm	Cloud Test Lab	DevTest Labs (backend)
Git Repositories	AWS Source Repositories	Cloud Source Repositories	Azure Source Repositories
DevOps	CodeBuild		Visual Studio Team Services
Programmatic access	Command Line Interface	Cloud Tools for Powershell Cloud SDK	Command Line Interface (CLI) PowerShell

Predefined templates	Quick Start		Quickstart templates
Managed hosting platforms	Elastic Beanstalk	App Engine Standard Environment	Web Apps (App Service) Cloud Services API Apps (App Service)
Application deployment	CodeDeploy CodeCommit CodePipeline		Visual Studio Team Services
Developer Tools	Developer Tools		Developer Tools