

# AWS or Azure

Which is better for you?

# Introduction

It is always important to layout assumptions. First of all, for whom is this whitepaper intended? Anybody can read this whitepaper, but it is assumed that those who will obtain the most value from this whitepaper will be those individuals who work for organizations that currently operate more than one hundred servers. These individuals can be data engineers and analysts to team leaders, directors, and C-level executives. These organizations can range from mid-level startups to multinational companies to local governments. These servers can be on-site or otherwise, but at the very least these organizations should be considering a transfer of at least some or all of their servers to the cloud. The two companies which dominate the cloud services market are Amazon with Amazon Web Services (hereafter referred to as AWS) and Microsoft with Microsoft Azure Cloud Computing Platform & Services (hereafter referred to as Azure).

Now that the initial assumptions are out of the way, the goal of this whitepaper is to answer the following question--AWS or Azure: Which is Better for You? This is an extremely simple question that has an extremely complex answer. Just as there is not a one-size-fits-all approach to business, there is not a one-size-fits-all approach to cloud computing. The answer entirely depends on the organization. Does the organization plan to replace its on-site servers completely? Does the organization intend to use Windows virtual machines? How much data does this organization use, and how often do they need to access the data? Does the organization want the brand security of the global leader in cloud computing services, or can the organization afford to opt for a close second with a chip on its shoulder? In this paper will be a layout of the pros and cons of each cloud service provider, including descriptions of the following service types: Storage, Content Delivery, Compute, Networking, Databases, Performance, Security, and Pricing. Also in this whitepaper will be recommendations for when, under given assumptions, one will be better than the other, but it is up to the executives (or engineers and analysts to convince their executives) to judge these recommendations for themselves.

AWS dominates the public cloud market, and this is easily its largest strength in the market. But why is AWS so popular? One reason is simply that it was the first player in the market to offer its cloud computing resources to other clients on a large scale, in 2006. But even more important is the stupendous scope of its operations. Of all cloud services providers, Amazon operates in the largest number of geographical regions—over twenty—as well as the largest number of services—over 160. And these numbers are still growing. One of its newest services, AWS IQ, was released on 30 September 2019 and matches customers with a custom selection of AWS's tens of thousands of certified service providers on AWS Partner Network.

Azure opened its virtual doors to customers on February 1, 2010. Azure is newer than AWS, but it still serves customers around the globe. Azure is renowned as the leader in hybrid infrastructure, Windows virtual machines, and SQL Server.

## Storage

The workhorse of AWS Storage is Amazon Simple Storage Service, also known as Amazon S3. According to the AWS website, "Amazon S3 is designed for 99.999999999% (11 9's) of durability, and stores data for millions of applications for companies all around the world." Not only is S3 trusted by millions of applications around the world, but it is also thoroughly tested to ensure the utmost durability. But this is not the only storage service that AWS offers. AWS offers many types of storage for any type of data you need to store.

Like AWS, Azure has various storage offerings at its disposal, which are located in the table below. Data Lake Storage, for example, is optimized for analytics workloads. AWS also has offerings that have this capability, but Microsoft simply names their products differently.

The winner for storage is AWS if the organization prefers the safety net of the number one player in the market, but it is truly a toss-up here as there are no truly significant service offering differences between the two.

See the table below for a list of select storage services offered by AWS and Azure.

AWS	Azure
Simple Storage Service (S3)	File Storage
Elastic Block Storage (EBS)	Disk Storage
Elastic File System (EFS)	Queue Storage
Snowball	Blob Storage
Snowball Edge	Data Lake Storage
Snowmobile	
Storage Gateway	

# Compute

Most organizations that use AWS’s compute offerings use Elastic Cloud Compute (EC2). Amazon EC2 is a commercial web service offered by AWS that allows EC2 cloud computing services to be rented by customers. EC2 provides consumers with data, distribution and web services. EC2 is a digital computing platform that allows customers to use Web service interfaces to release and load instances with a wide range of operating systems. Operating systems that are supported by AWS’s virtual machines are Windows Server (e.g., 2008, 2012, 2016, and 2019), and Linux/Unix (e.g., CentOS, Ubuntu, and RedHat).

The Azure equivalent of AWS EC2 is Azure Virtual Machines. Azure supports not only Windows Server but also all major Linux distribution (including the ones listed above for AWS). Here is where Azure has an obvious edge. For organizations transferring their onsite resources to the cloud, Azure can be up to five-times cheaper than AWS for Windows Server.

See the table below for a list of select compute services offered by AWS and Azure.

AWS	Azure
<b>Beanstalk</b>	Platform-as-a-service
<b>Lightsail</b>	Function-as-a-service
<b>Elastic Cloud Compute (EC2)</b>	Azure Virtual Machines
<b>VMware Cloud for AWS</b>	Azure VMware by CloudSimple
<b>Batch</b>	Batch
<b>Fargate</b>	Service Fabric
<b>Lambda</b>	Virtual Machine Scale Sets
<b>Outposts</b>	

# Database

AWS’s primary database service (where resiliency, scale, and maintenance are primarily handled by the platform) is Relational Database Service, otherwise known as RDS. RDS includes support for the following database engines: Amazon Aurora, PostgreSQL, MySQL, MariaDB, Oracle, and Windows SQL Server. As with many of AWS’s offerings, organizations can either pay-as-you-go or obtain even lower rates by purchasing reserved instances.

Azure has its equivalent in SQL Database, Azure Database for MySQL, and Azure Database for PostgreSQL.

Again, Azure has the advantage over AWS if the organization is using Microsoft SQL Server, through the Azure Hybrid Benefit. Azure Hybrid Benefit for SQL Server enables organizations to use their existing SQL Server licenses to pay a reduced rate on SQL Database. Like in the Windows VM example above, this again would cost an organization up to five-times less than if they had used AWS. As such, the advantage for Database Offerings must go to Azure if the organization in question will be using SQL Server.

See the table below for a list of select database services offered by AWS and Azure.

AWS	Azure
Redshift	SQL Database (including MySQL and PostgreSQL)
Aurora	Data Warehouse
RDS (Relational Database Service)	Server Stretch Database
DynamoDB	Cosmos DB
ElastiCache	Table Storage
Neptune	Redis Cache
Database Migration Service	Data Factory

# Backup Services

An organization would utilize data archiving and long-term backup when they have a lot of data that does not need to be accessed regularly. AWS’s main data archiving service is called Amazon S3 Glacier. Amazon S3 Glacier is a cloud storage class for data archiving and long-term backup that is powered by Amazon S3, which has been discussed previously. With S3 Glacier, there are various options for accessing the data, which range from a few minutes to up to 48 hours. That is, once the data is in the S3 Glacier, if the organization needs to access the archive, it will take up to 48 hours to finally be able to use their data. As such, this solution is only recommended for the storage of archives or hard drive backups that do not need to be regularly or immediately accessed.

In Azure, the equivalents to S3 Glacier are either Azure Archival Storage or Azure Recovery Backups, depending on whether the company needs to store an archive or a backup. The cost of S3 Glacier can be as low as \$1.00\*/TB per month, and the cost of Azure Archival Storage can be as low as \$0.99/TB per month. Each of these offers significant cost savings compared to onsite solutions, and each of these offers very similar services. Azure is slightly cheaper here for the same service, Argent’s recommendation for backup services must go to Azure.

**\* All prices are in USD**

See the table below for a list of select backup services offered by AWS and Azure.

AWS	Azure
S3 Glacier	Archival Storage
	Recovery Backups
	Site Recovery

# Network

An organization would use network services offered by cloud service providers when they wish to build applications that scale. Scalability accommodates growth, provides a good user experience for all users, and gives organizations a better ROI. The main network offering by AWS is called Elastic Load Balancing. Elastic Load Balancing dynamically distributes incoming traffic through multiple targets. Elastic Load Balancing provides three types of load balancers, all of which feature the high availability, automated scaling, and sound security to ensure that an organization’s applications remain fault-tolerant even as these applications scale to more users.

The Azure equivalent is Azure Load Balancer, which also distributes incoming traffic to ensure an organization’s applications are highly available, scalable, and secure. AWS is more mature than Azure when it comes to network offerings, but the two cloud service providers offer very similar products in this space. Here, the nod goes to AWS, but only for its maturity in the industry. Regardless, AWS and Azure each have network offerings that have the requisite high availability, automatic scaling, and robust protection to make an organization’s applications resilient to failure.

See the table below for a list of select network services offered by AWS and Azure.

AWS	Azure
Elastic Load Balancing	Load Balancer
AWS Transit Gateway	Virtual Network
AWS VPN	Traffic Manager
Amazon CloudFront	Azure DNS
Amazon Route 53	Application Gateway
Amazon VPC	
AWS PrivateLink	

# Security

AWS and Azure each offer support for Identity Access Management, key-based encryption of data, service monitoring, and much more. The security capabilities of each cloud service provider are essentially identical. However, there is at least one minor difference: only AWS allows its users to manage their encryption keys. Azure does not support customer-managed keys, but they are planning to add support for this in the near future. Most organizations do not need this anyway, so the comparison is like splitting hairs to find some difference between the two. However, in late October of 2019, AWS was hit by a Distributed Denial of Service (DDoS) attack, and its customers were left without access for eight hours. As such, it would be difficult to recommend AWS for security, so Argent recommends Azure at this time.

AWS	Azure
AWS Artifact	Azure Active Directory
AWS Certificate Manager	Azure Role-Based Access Control
AWS CloudHSM	Azure Subscription Management
AWS Firewall Manager	
AWS Guard Duty	
AWS Identity Access Management (IAM)	
Amazon Macie	
AWS Security Hub	
AWS Shield	
AWS Single Sign-On	
AWS Web Application Firewall (WAF)	



# Price Comparison: AWS vs Azure

In the below price comparison of AWS and Azure, Argent outlines assumptions made to generate a monthly estimate for the total cost of operation. For an organization with many offsite servers, this may be the expected monthly operating cost for AWS and Azure. The two offerings are essentially identical, but it is clear that Azure is roughly \$2,000 cheaper per month than AWS. Thus, Azure wins on price in this instance

	AWS	Azure
Capacity	250 TB	250 TB
Underlying Storage	151.75 TB	151.75 TB
VM Type	r5.2xl	DS5_V2
High Availability?	No	No
Disk Type	ST1	Standard HDD
<b><i>Estimated Monthly Cost (USD)</i></b>	<b><i>\$27,346</i></b>	<b><i>\$25,359</i></b>

# Conclusion

In conclusion, AWS and Azure offer essentially identical cloud services, differing essentially by their flairs and styles. Azure is more suitable for customers who already have existing software agreements with Microsoft and who wish to utilize an enterprise-focused approach. AWS is at times more difficult to set up, but it can deliver more control and customization in niche cases. On the other hand, Azure was founded with a hybrid infrastructure in mind, aware of the needs of its customers and the pitfalls of AWS. As a result, due to the fact that Azure is cheaper than AWS, simpler to operate, and still offers the same types of services that AWS does, Argent recommends Microsoft Azure Cloud Computing Platform & Services over Amazon Web Services, but as Wellington remarked after Waterloo, "it was a damn close run thing." Only in a few very niche cases will AWS be better for an organization, as Argent has laid out. Each offers a wide variety of services and applications for any organization, but Azure edges out its competition due to its cost and relative ease of use.

# Definitions of Terms

# Storage Offerings

**Petabyte:  $10^{15}$  or, strictly,  $2^{50}$  bytes**

**Exbyte:  $10^{18}$  or, strictly,  $2^{60}$  bytes**

## **AWS Simple Storage Service (S3)**

Provides a web service interface for storing objects. Amazon uses this flexible processing system for its worldwide e-commerce network.

## **AWS Elastic Block Storage (EBS)**

Provides continuous block storage volumes in the AWS Cloud for use with Amazon EC2 instances.

## **AWS Elastic File System (EFS)**

Cloud storage platform that was built to provide flexible, elastic, compliant, and encrypted file storage for use with both AWS Cloud and on-site assets.

## **AWS Snowball**

A petabyte-scale data transmission system that uses tools designed to ensure that massive amounts of data can be transmitted to and from the AWS Cloud.

## **AWS Snowball Edge**

Has all the capabilities of AWS Snowball, as well as support for durable local storage, local compute with AWS Lambda, Amazon EC2 compute instances, use in a cluster of devices, and transfer of files with a GUI.

## **AWS Snowmobile**

An exabyte-scale data transfer system used to transfer massive amounts of data to AWS.

## **Azure File Storage**

Cloud data storage method that provides data access to servers and applications via shared file systems.

## **Azure Disk Storage**

Organizations use Azure Windows VMs to manage their storage accounts.

**Azure Queue Storage**

Organizations use this to develop modular frameworks and separate roles to increase performance across broad workloads

**Azure Blob\* Storage**

Microsoft Azure's blob storage feature allows developers to store unstructured data in the cloud. Audio, video, and text can be accessed from anywhere in the world. Blobs are organized into user-related "containers."

\* **B**inary **L**arge **O**bject

**Azure Data Lake Storage**

Allows users to collect data of any scale, form, and velocity for functional and exploratory analysis in one location.

# Compute Offerings

## **AWS Beanstalk**

Helps organizations deploy & manage web applications in the AWS cloud.

## **AWS Lightsail**

Cloud platform that provides organizations with everything they need to build a website or application. Essentially, a slimmer version of AWS EC2.

## **AWS Elastic Cloud Compute (EC2)**

Cloud platform offering stable, scalable cloud computing capability.

## **AWS VMware Cloud**

An integrated cloud offering developed jointly by AWS and VMware, providing a highly scalable, reliable and unique service that allows organizations to seamlessly migrate and extend their on-site VMware vSphere-based environments to the AWS cloud.

## **AWS Batch**

Allows developers, scientists, and engineers to run hundreds of thousands of batch computing jobs on AWS easily and efficiently.

## **AWS Fargate**

Computing engine that lets users run containers without needing to run servers or clusters.

## **AWS Lambda**

Allows organizations to run code without provisioning or managing servers. Users only pay for the time that code is running.

## **AWS Outposts**

Acts as a hybrid cloud, enabling users to host a cloud-like environment on-site.

## **Azure Platform-as-a-Service**

Cloud delivery and development environment offering simple cloud-based applications for complex, cloud-enabled applications. PaaS is designed to support the entire develop, check, deploy, manage and upgrade web-application lifecycle.

**Azure Function-as-a-Service**

Provides a platform for consumers to create, operate and manage software functionality without the difficulty of building and maintaining the infrastructure typically associated with the creation and release of an app.

**Azure Virtual Machines**

Gives organizations virtualization's flexibility without purchasing or maintaining the actual hardware running the virtualization.

**Azure VMware by CloudSimple**

An integrated cloud offering developed jointly by Azure and VMware by CloudSimple, providing a highly scalable, reliable and unique service that allows organizations to seamlessly migrate and extend their on-site VMware vSphere-based environments to the Azure cloud.

**Azure Batch**

Cloud-based job scheduling and management system allowing the efficient operation of large-scale parallel and high-performance cloud computing applications.

**Azure Service Fabric**

Cloud service designed to facilitate the development, deployment, and management of highly scalable and customizable applications for Azure.

**Azure Virtual Machine Scale Sets**

Allows organizations to create and manage a group of identically balanced load VMs. In response to demand or a given schedule, the number of VM instances can automatically increase or decrease.

# Database Offerings

## **AWS Redshift**

A fully managed data warehouse service. This service is heavily used by Data Scientists when training their machine learning models.

## **AWS Aurora**

A relational database engine. This service is compatible with MySQL but delivers five times the throughput of standard MySQL running on the same hardware.

## **AWS RDS (Relational Database Service)**

This service simplifies the setup, operation, and scaling of a relational database. Automatically manages administrative processes, such as patching database software and backing up databases.

## **AWS DynamoDB**

A fully managed NoSQL database service. This service is a key-value store, which works quite well when retrieving individual records based on key lookups; however, complex queries are tricky even to developers with prior NoSQL experience in MongoDB (a document database, unlike DynamoDB).

## **AWS ElastiCache**

A fully managed in-memory data store and cache service. This service simplifies the setup, operation, and scaling of open-source in-memory caching engines such as Memcached and Redis.

## **AWS Neptune**

A fully managed graph database service. Supports open graph APIs for Gremlin and SPARQL.

## **AWS DMS (Database Migration Service)**

This service helps migrate your data to and from most widely-used commercial and open-source databases to AWS.

## **Azure SQL Database (including MySQL and PostgreSQL)**

General-purpose relational database-as-a-service (DBaaS) based on the most recent version of Microsoft SQL Server.



**Azure Data Warehouse**

Uses Massively Parallel Processing (MPP) to run queries across up to petabytes of data.

**Azure Server Stretch Database**

Combines warm and cold access from SQL Server so that organizations can have longer data retention times.

**Azure Cosmos DB**

Globally distributed database service that allows organizations to respond in real-time to large changes in usage at peak hours.

**Azure Table Storage**

Key-value store via NoSQL for fast development with large semi-structured data sets.

**Azure Redis Cache**

Cache service via the Redis server that offers lower latency by storing data in memory instead of on disk.

**Azure Data Factory**

Hybrid data integration service that helps organizations to integrate existing data silos with Azure Hybrid data integration service.

# Backup Services

## **AWS S3 Glacier**

An S3 storage class for data archiving and long-term backup.

## **Azure Archival Storage**

Cloud storage with flexible latency criteria for seldom accessed data

## **Azure Recovery Backups**

Helps organizations use Azure VM recovery data from recovery points stored in Azure Backup Recovery Services vaults.

## **Azure Site Recovery**

Replicates workloads running on physical and virtual machines (VMs) from a primary site to a secondary location.

# Network Offerings

## **AWS Load Balancing**

Distributes incoming traffic to ensure an organization's applications are highly available, scalable, and secure.

## **AWS Transit Gateway**

Helps to scale connectivity across many Amazon VPCs, AWS accounts, and onsite networks.

## **AWS VPN**

Allows organizations to access both their onsite and cloud networks from anywhere.

## **Amazon CloudFront**

Programmable content delivery network (CDN). An organization would use a CDN to securely deliver data, videos, applications, APIs and more to its users.

## **Amazon Route 53**

A Domain Name System that routes end-users to web applications.

## **Amazon VPC**

Helps organizations to provision logically isolated sections of the cloud for use in their applications, either for internal use or for user-facing applications.

## **AWS PrivateLink**

Ensures that services hosted on AWS keep their network traffic within their AWS networks.

## **Azure Load Balancer**

Distributes incoming traffic to ensure an organization's applications are highly available, scalable, and secure.

## **Azure Virtual Network**

Provides a private, isolated cloud environment. Users control their virtual networking environment, including selecting their IP address range, creating subnetworks, and setting up route tables and network gateways.

**Azure Traffic Manager**

Hosts domain names, routes users to web applications, connects users to data centers, manages application traffic, and adds automatic failover capability.

**Azure DNS**

A Domain Name System that routes end-users to web applications.

**Azure Application Gateway**

Protects applications from common web exploits. Aids in monitoring an organization's web applications.

# Security Offerings

## **AWS Artifact**

Offers organizations on-demand access to audit artifacts, which are the security and compliance records of AWS.

## **AWS Certificate Manager**

Allows organizations to easily provision, manage, and deploy Secure Sockets Layer/Transport Layer Security (SSL/TLS) certificates.

## **AWS CloudHSM**

Takes advantage of specialized Hardware Security Module (HSM) tools in the AWS Cloud to help organizations fulfill data security compliance requirements.

## **AWS Firewall Manager**

Security management tool that makes it easier for all your accounts and applications to centrally configure and maintain AWS WAF rules.

## **AWS Guard Duty**

Managed threat detection service that allows organizations to monitor and protect their AWS accounts and workloads more accurately and easily.

## **AWS Identity Access Management (IAM)**

Enables users to manage access to services and resources in a secure manner while ensuring information security and protection. Organizations can use permissions to create and manage users and groups to authorize or deny access to resources.

## **Amazon Macie**

Machine learning-powered security service to aid in the classification and protection of sensitive data.

## **AWS Security Hub**

Provides organizations with a comprehensive view through AWS accounts of their high-priority security warnings and enforcement statuses.

**AWS Shield**

Safeguards web applications running on AWS from Distributed Denial of Service (DDoS) attacks.

**AWS Single Sign-On (SSO)**

Makes SSO access to multiple AWS accounts and business applications easy to manage centrally.

**AWS Web Application Firewall (WAF)**

Web Application Firewall that helps organizations secure their web applications from common exploits.

**Azure Active Directory**

Enables users to manage access to services and resources in a secure manner while ensuring information security and protection. Organizations can use permissions to create and manage users and groups to authorize or deny access to resources.

**Azure Role-Based Access Control**

Helps organizations control who has access to Azure assets, what they can do with these assets, and what places they have access to.

**Azure Subscription Management**

Security policy and task management for multi-account jobs.

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