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A comparison of Azure, AWS, and Google cloud services

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AWS, Azure, and Google are all huge names in the cloud space, offering everything from big data in the cloud to serverless computing options and more, but their services are not created equal, and are better suited for certain use cases over others.

So, what separates these 3 players in the cloud market?

Read on for a vendor-neutral comparison of these three providers to determine which combination – if any – best fits your organization's infrastructure requirements.

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http://searchcloudcomputing.techtarget.com/tip/Compare-AWS-vs-Azure-vs-Google-big-data-services

The cloud market is evolving quickly, with an ever-changing set of big data services. While this makes cloud vendor comparisons difficult, it's worth the attempt, because the offerings from the top three cloud providers -- Amazon Web Services, Microsoft Azure and Google -- aren't created equal.

Big data in the cloud is an area of the market where Google's immense experience in search has synergies, but Amazon Web Services (AWS) and Azure are attracting some interesting startup companies to add value.

The result is a vibrant spectrum of big data services that is increasingly attractive from both a capability and an economic perspective. Cloud users ultimately win from the big data competition between the big three -- and that looks to continue for years to come.

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Here's a closer look at the big data services today from AWS vs. Azure vs. Google.

Amazon Web Services

AWS has a broad spectrum of big data services. Amazon Elastic MapReduce, for example, runs Hadoop and Spark while Kinesis Firehose and Kinesis Streams provide a way to stream large data sets into AWS. Users can store data in Redshift, a petabyte-scale data warehouse, with data compression to help reduce costs. Amazon Elasticsearch is a service to deploy the open source Elasticsearch tool in AWS for analytics such as click-through and log monitoring. Kinesis Analytics complements this by analyzing data streams.

AWS has a larger set of data storage choices compared to Google. In addition to the massive AWS Simple Storage Service farm, it has DynamoDB, a low-latency NoSQL database; DynamoDB for Titan, which provides storage for the Titan graph database; Apache HBase, a petabyte-scale NoSQL database; and relational databases.

AWS also has a business intelligence (BI) service, QuickSight, which uses parallel, in-memory processing to achieve high speeds. This is complemented by Amazon Machine Learning and the AWS Internet of Things (IoT) platform, which connects devices to the cloud and can scale to billions of devices and trillions of messages.

While Google has an edge with search and analytics engines, AWS has a broader spectrum of services, as well as BI and graphics processing unit (GPU) instances.

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Microsoft Azure

For analytics, Azure has Data Lake Analytics, which uses proprietary U-SQL with SQL and C++, as well as HDInsight, a Hadoop-based service. There is also an Azure Stream Analytics service, a Data Catalog that identifies data assets using a global metadata system, and Data Factory, which interlinks on-premises and cloud data sources and manages data pipelines.

Azure's big data storage service is Data Lake Store, a Hadoop file system. The cloud provider has a broad set of general purpose storage offerings, including StorSimple, SQL and NoSQL databases and storage blobs.

Azure also has Power BI and machine learning, lining up with AWS, and features an IoT Hub. The cloud platform also includes a search engine. Microsoft's Cortana suite and Cognitive Services provide more advanced intelligence capabilities.

Documentary examines benefits of big data

Download this podcast

The PBS documentary *The Human Face of Big Data*, which aired in 2016, sparked a lot of conversation on social media, and it's not hard to see why. The documentary provides a general-interest look at the benefits of big data, and suggests that big data is having a major impact on nearly every industry, including retail, manufacturing and marketing.

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Google

Google's BigQuery data service uses a SQL-like interface that is intuitive for most users -- even nontechnical ones -- to learn. It supports petabyte databases and can perform data streaming at 100,000 rows per second as an alternative to running data from cloud storage. BigQuery also supports geographic replication and users can select where they store their data.

BigQuery is a pay-as-you-go service without a dedicated infrastructure of instances, which allows Google to use a large number of processors to maintain fast query times. Integration with Spark, Hadoop, Pig and Hive is also supported. Organizations can also use Google Analytics and DoubleClick -- a tool for the advertising industry that gathers statistics to feed BigQuery -- as data sources. Google Cloud Dataflow allows users to sequence cloud data services.

Other big data services offered by Google include Cloud Datastore, a NoSQL database for nonrelational data; Cloud BigTable, a massively scalable NoSQL database; Cloud Machine Learning, a managed platform for machine learning; and ancillary tools such as translators and speech converters.

One notable offering that Google is lacking for big data is the GPU instance. Writing GPU code for data analytics is a high-value skill, given the incredible performance boosts that GPUs offer. Google's lack of a GPU instance family is somewhat puzzling, especially with AWS having the feature since 2011 and Azure adding it in 2015.

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AWS vs. Azure vs. Google: A close race in big data

In many ways, the big three cloud providers are in lockstep on big data services, though there are under-the-hood differences in performance and ease-of-use that require some hands-on testing to discern. While Google likely has an edge in search, it lags behind on the BI front, where Microsoft has an edge with Cortana. Google's lack of GPU instances is also a notable difference.

As with any broad spectrum of products, and because all these big data services are in their relative infancy, there will be differences that are use case- or data-dependent. It can be difficult to choose between AWS vs. Azure vs. Google. One way to determine the best cloud service for you is to try them in a sandbox for a few weeks to get a sense of what works and what the price will be.

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The battle for public cloud market supremacy has turned into a two-horse race between Amazon Web Services and Microsoft Azure. Currently, Amazon is comfortably in the lead, but the vendor has lowered pricing to ward off the competition -- a strategy that may have negative long-term financial effects. Meanwhile, Microsoft Azure continues to add new services to its public cloud arsenal.

Here's a look at AWS vs. Azure, and how users can get a better glimpse into the services they offer.

AWS vs. Azure: Two different approaches to cloud

Amazon Web Services (AWS) continues to rapidly expand its service offerings and has an array of infrastructure as a service and platform as a service features. In April, the company added AWS Application Discovery Service, which helps users and systems integrators map out application migration plans. The service automatically identifies applications running in on-premises data centers, their associated dependencies and their performance profile to help facilitate migration to the AWS cloud.

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Such enhancements have appealed to potential customers. In the fourth quarter of 2015, AWS had 31% market share of the global cloud infrastructure services market, while Microsoft Azure had 9%, according to data from Synergy Research.

When comparing AWS vs. Azure, remember that the two vendors approach the cloud market from different vantage points. In general, AWS focuses on delivering commodity services to small- and medium-sized companies, but recently ramped up its high-end services. For example, Amazon Relational Database Services for SQL Server supports near-real time monitoring of 26 system metrics, such as average load in one minute increments, and the number of tasks running at any time. Building off of a virtualized cloud platform, AWS services also feature a high degree of automation and scalability.

Microsoft Azure takes a different approach to cloud, emphasizing the integration between its large base of on-premises technologies and its public cloud services. Microsoft provides management tools and a consistent user interface, which appeals to enterprises that want to minimize the number of vendors and systems they use. The company has moved aggressively to match AWS by enhancing its services and building up the array of industry standard offerings found in its Azure Marketplace. Enterprises and partners have invested a great deal of money, time and effort into Microsoft's products, which has created a loyal customer base -- and could eventually tip the AWS vs. Azure scale.

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Crunching the numbers

To maintain its top position, AWS' strategy has been clear: cut prices. Since 2008, AWS has lowered its prices more than 50 times. This has helped the company maintain its market position, but could potentially impact its financials.

In the fourth quarter of 2015, AWS brought in $2.4 billion in revenue. While that number represented a year-over-year increase of 69%, it was a lower growth rate than the 78% increase the company reported for the prior quarter. In the first quarter of 2016, AWS posted $2.6 billion in revenue, an increase of 64% year over year.

Microsoft released its third quarter earnings in April 2016 and, while revenue decreased 6% to $20.5 billion, the cloud business picked up steam, with a growth of 120% for Azure revenue.

Price check

Both vendors have aggressively courted potential customers and conduct free trials so users can test their services. Microsoft offers $200 in services for 30 days, while Amazon offers 12 months of access to the AWS Free Tier.

As for AWS vs. Azure price comparisons, there is no standard menu because each business' needs are different. To help potential customers estimate costs, both suppliers provide online service calculators:

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Amazon's Simple Monthly Calculator: Allows companies to gauge pricing based on items like the number of Elastic Compute Cloud instances, the number of Elastic Block Store volumes, IP addresses, data transfer information and load balancing. To get a clear pricing picture, customers need to navigate their way through the firm's growing list of services, such as Amazon Glacier, Amazon Kinesis, Amazon Redshift and Amazon SES.

Microsoft Azure Pricing Calculator: Allows organizations to sift through a variety of applications, such as compute, Web and mobile, data and storage and analytics. Azure looks less intimidating because it has fewer fields, but offers similar services, such as Azure Cool Blob Storage, Azure Event Hubs and Azure SQL Data Warehouse.

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Despite the advantages of cloud services, such as Amazon Web Services and Microsoft Azure, they still come with overhead. Whether its virtual servers, object storage buckets or SQL databases, you must provision resources before using them. While that seems like an obvious requirement, it does add cost, time and friction to the cloud experience.

But what if the system could automatically provision services and execute jobs in response to events, such as a message from another application? That's the principle behind serverless applications, also referred to as cloud functions. Let's explore the details of two serverless computing options: AWS Lambda and Microsoft Azure Functions.

Triggers and languages

Although cloud functions are a new concept, there are already several service options. AWS Lambda is the leader, but there is also IBM Bluemix OpenWhisk, Google Cloud Functions and Microsoft Azure Functions.

Microsoft Azure Functions, still in preview, builds on Azure's existing platform as a service features, notably App Service and WebJobs, which simplify the

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development of back-end components for mobile- and browser-based applications. Microsoft Azure Functions is a set of code modules written in JavaScript, C#, Python and PHP that only execute when triggered by an external event, such as changes in storage containers, activity on a message queue or access from an exposed HTTP API. Triggering events aren't confined to Azure; they can come from a third-party or on-premises system.

Triggers in AWS Lambda are called event sources, which can also come from other AWS services or external applications. Users configure mapping between event sources and AWS Lambda functions. For example, a function might execute each time a user creates an object in a Simple Storage Service (S3) bucket and has permission to run the AWS Lambda code. Supported AWS Lambda events include S3, DynamoDB, SNS notification and CloudWatch activity.

Users can also invoke functions on-demand, using, for example, a mobile app with the AWS SDK to execute an exposed AWS Lambda API. AWS Lambda functions can be written in Node.js, Python or Java.

The role of containers

Both Microsoft Azure Functions and AWS Lambda run in a container; however, the implementations and limitations are different. Azure cloud functions are built using the Azure App Service container architecture, but users can deploy them as either part of an App Service plan or individually as a Dynamic Service plan. The former runs functions in the context of a dedicated VM that is always available, regardless of whether the code is executing.

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Dynamic functions run independently and can automatically scale across multiple VMs. Dynamic functions are best for intermittent jobs that execute for a short time, while App Service functions are better for functions that run for long periods and run on underutilized VMs.

AWS Lambda functions also run in containers, in which users specify the amount of memory and maximum execution time. When the function triggers, AWS Lambda launches a new container based on that configuration. Since container setup and booting take time, Lambda maintains a container for a while -- AWS doesn't specify the details -- in case the same function is repeatedly invoked to minimize execution latency. Each container also has some temporary disk space that is frozen and available for reuse. However, AWS warns that users shouldn't assume Lambda always reuses the container because, in some instances, it will choose to create a new one.

Microsoft Azure Functions and AWS Lambda pricing

The beauty of cloud functions, whether Microsoft Azure Functions, AWS Lambda or a third-party alternative, is their efficiency and scalability. In Azure, users pay only for code execution time and the total number of executions. Time is measured as gigabytes per second (GBps), calculated by multiplying the function's memory size by the total execution time in seconds.

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How to calculate the cost of Azure Functions

A 1,536 megabyte Function App in the West US region takes one second to execute and executes 2,000,000 times in one month, resulting in a cost of $19.20 for execution time.

- Execution time = (1,536/1,024) * (2,000,000-400,000) * $0.000008 = $19.20

â—‹ Where the function memory size is converted to gigabytes and the charged execution time is the total used, minus 400,000 available free and the regional cost is 0.8 millicents.

- Requests = (2,000,000-1,000,000) / 1,000,000 * $0.20 = $0.20

â—‹ Where the charged execution count is normalized to millions with one million free grant deducted multiplied by a price of $0.20 per million.

- **The executions cost of $0.20 is added to the $19.20 for execution time to arrive at a total cost for the function of $19.40/month.**

Pricing will vary, as the function in this example has a large memory allocation and a low number of executions.
AWS Lambda pricing is also based on the total execution time with a rate based on memory allocation, less a tier of one million requests and 400,000 GBps of compute time per month. Using the parameters from our Azure example, a

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function using 1,536 MB of memory, taking one second to execute and running 2 million times a month would cost:

How to calculate the cost of AWS Lambda

- **Compute Charges**

â—‹ Rate: $0.00002501 per GBps
â—‹ Total compute = 2,000,000 seconds * 1536/1024 = 3,000,000 GBps - 400,000 free = 2,600,000 GBps

â—‹ **Compute charges = 2,600,000 * $0.00002501 = $65.03**

- **Request Charges**

â—‹ Rate: $0.20 per 1 million less 1 million free
â—‹ Billable requests = 2,000,000 - 1,000,000 = 1,000,000

â—‹ **Request Charges = 1,000,000 * $0.20/M = $0.20**

- **Total Charges = $65.03 + $0.20 = $65.23**

Functions have become a standard feature of the major infrastructure as a service providers, but they're a new and rapidly evolving category. Watch for developments as providers add features, language support and integration with development environments and continuous delivery tools. One area of change will likely be the configuration dashboards, which can be confusing, given the number of event sources and function mappings.

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In general, existing AWS users should experiment with AWS Lambda before trying other function products, while the converse is true for Azure users. Likewise, Java developers will need AWS Lambda until Azure supports Java for functions, while C# coders must stick with Azure.

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