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Case Study on AWS and to create AWS EC2 Instance

Case Study on AWS

What is AWS

Amazon Web Services, Inc. (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. These cloud computing web services provide a variety of basic abstract technical infrastructure and distributed computing building blocks and tools. One of these services is Amazon Elastic Compute Cloud (EC2), which allows users to have at their disposal a virtual cluster of computers, available all the time, through the Internet. AWS's virtual computers emulate most of the attributes of a real computer, including hardware central processing units (CPUs) and graphics processing units (GPUs) for processing; local/RAM memory; hard disk/SSD storage; a choice of operating systems; networking; and pre-loaded application software such as web servers, databases, and customer relationship management (CRM).

The AWS technology is implemented at server farms throughout the world and maintained by the Amazon subsidiary. Fees are based on a combination of usage (known as a "Pay-as-you-go" model), hardware, operating system, software, or networking features chosen by the subscriber required availability, redundancy, security, and service options. Subscribers can pay for a single virtual AWS computer, a dedicated physical computer, or clusters of either. As part of the subscription agreement, Amazon provides security for subscribers' systems. AWS operates from many global geographical regions including 6 in North America.

Amazon markets AWS to subscribers as a way of obtaining large scale computing capacity more quickly and cheaply than building an actual physical server farm. All services are billed based on usage, but each service measures usage in varying ways. As of 2017, AWS owns 33% of all cloud (IaaS, PaaS) while the next two competitors Microsoft Azure and Google Cloud have 18%, and 9% respectively, according to Synergy Group.

Features of AWS

Most functionality

AWS has significantly more services, and more features within those services, than any other cloud provider—from infrastructure technologies like compute, storage, and databases—to emerging technologies, such as machine learning and artificial intelligence, data lakes and analytics, and Internet of Things. This makes it faster, easier, and more cost effective to move your existing applications to the cloud and build nearly anything you can imagine.

AWS also has the deepest functionality within those services. For example, AWS offers the widest variety of databases that are purpose-built for different types of applications so you can choose the right tool for the job to get the best cost and performance.

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 start-ups, enterprises, and public sector organizations, are running every imaginable use case on AWS. The AWS Partner Network (APN) includes thousands of systems integrators who specialize in AWS services and tens of thousands of independent software vendors (ISVs) who adapt their technology to work on AWS.

Most secure

AWS is architected to be the most flexible and secure cloud computing environment available today. Our core infrastructure is built to satisfy the security requirements for the military, global banks, and other high-sensitivity organizations. This is backed by a deep set of cloud security tools, with 230 security, compliance, and governance services and features. AWS supports 90 security standards and compliance certifications, and all 117 AWS services that store customer data offer the ability to encrypt that data.

Fastest pace of innovation

With AWS, you can leverage the latest technologies to experiment and innovate more quickly. We are continually accelerating our pace of innovation to invent entirely new technologies you can use to transform your business. For example, in 2014, AWS pioneered the serverless computing space with the launch of AWS Lambda, which lets developers run their code without provisioning or managing servers. And AWS built Amazon Sage Maker, a fully managed machine learning service that empowers everyday developers and scientists to use machine learning—without any previous experience.

Most proven operational expertise

AWS has unmatched experience, maturity, reliability, security, and performance that you can depend upon for your most important applications. For over 15 years, AWS has been delivering cloud services to millions of customers around the world running a wide variety of use cases. AWS has the most operational experience, at greater scale, of any cloud provider.

Why is it such a big hit?

The major thrust behind the great lead for AWS in this game comes from below 8 major reasons that, I think, keeping them well-ahead of the competition. To ensure, I do not harm the reputations of other cloud providers by accidentally putting wrong data for them, I am not doing a direct comparison here vs AWS. Nevertheless, you can always check your resources to figure out the differences.

Massive Geographical Reach

With recent addition of 5 new regions in Ohio in US, Montreal in Canada, London in UK, Mumbai in India, and Tokyo in Japan, now there are 16 total continental regions across the globe. Each of these regions are having two or more Availability Zones (AZ) that are actual physical distantly located data-centre facilities to provide high availability and reliability.

In addition to the wide reach of service end-point locations above, AWS has presently 68 Content Delivery Network locations across the globe called AWS CloudFront Edge locations. These endpoints help reducing the network latency and provide great user experience for accessing Internet based services and websites irrespective of where the users are located and where the services are deployed in the world.

One Stop for All Needs

With addition of 24 big new scale service enhancements in Re-Invent 2016, AWS now has over 85 different services to offer, which include almost all aspect of computing, DevOps, storage, network, security, analytical and artificial intelligence needs. All these services are mainly categorized in below listed areas of technology. Every single service can play a major role for a specific area of work.

Speed of Innovation

AWS has added 24 new services in their offering in just one year - 2016! They are not only expanding their hardware infrastructure very rapidly but also adding on their service ability areas every single day. As per the Re-Invent 2016 conference data, AWS has added over 1000 new enhancements in their services by end of November only. That means, 1000 new additions in their features in just less than 336 days, meaning almost 3 new feature additions daily!

Great Success Stories for Reference

The client list for AWS is growing bigger and bigger day by day including many big enterprises like GE, Capital One, BMW, Airbnb, Adobe Systems, Comcast, NASA, US Federal and many other giants. In addition to the successful adoption of all these big names, there are also many other technology companies, which got evolved on AWS platform since inception and turned into huge successful businesses in a very small span. Such examples include communication innovator, Twilio and mapping service provider Map Box. These names might not sound very familiar but almost all of us would have used their services directly or indirectly. Finally, who doesn't know the success story of Netflix, which 100% runs on AWS!

Rock-solid Security

The primary and most significant concern people might have to go and stay on cloud is various kind of security threats. As a result, AWS takes this concern very seriously. You will be amazed to know at what level they have gone to protect their customers with physical, hardware and software level security measures. They have a huge list of security standard compliance to stay on top of it. They very well understand that the public cloud business can only be successful on a level of trust of their customers.

Very Competitive Pricing

AWS is in constant effort to optimize their own operations with the use of maximum automation and process excellence to make their pricing cheap to cheaper. They have been announcing price-cuts for many of their services in past including various compute, storage, and analytics services. They very well know that their customers will sustain on their platform only if it will be a win-win situation. And it is no surprise that the first most important reason for any existing enterprise to consider cloud migration is to reduce their IT cost.

Additionally, the free-tier offering of AWS is really a deal-maker thing for many start-ups. As in this segment, AWS offers a big chunk of services for free for one year! Both, you, and me, are also eligible for this!

Superior Availability and Reliability

After security, if something is the most important thing to be considered on a public cloud then it is the availability and reliability. And AWS seems fully committed to that as per the measures they have taken to handle any catastrophic situation. Below are some pointers to give you the idea of the same.

- They have built more than two geographically and logically separate data centres in all the regions called the Availability Zones (AZ). So that, the downtime for one AZ cannot impact the other. They even have separate utility, network, and other service providers for such AZs, so that they can avoid full region impact because of an issue of 3rd party service provider.
- They have a very robust and automated monitoring, backup and restore processes for all their infrastructure and managed services like S3, RDS, DynamoDB and many more. Their S3 reliability SLA is 99.9999999%!
- They have built their own hardware, network devices and other equipment to avoid reliance on their vendors. They have even developed and customized the firmware of such devices to their needs. As a result, they are completely independent of any 3rd party supplier or vendor for any modification or troubleshooting needs making them super responsive to any problems.
- Finally, to my biggest surprise, all the orange lines in above map is AWS's own private network with not a single 3rd party vendor involved for any level of service! How amazing is that! Majority of these connectivity is under the sea. Their simple fund is that if more parties are involved in delivering their packets, there are more chances of a failed delivery. Isn't such a huge infrastructure investment very difficult to match?

AWS Services Overview

Compute Services

AWS EC2

AWS EC2 is one of the most used and important services offered by AWS. It allows you to bring up virtual instances - i.e., your own computers/ servers in the cloud. You can configure the hardware of these instances and then connect to them via the terminal.

Often, EC2 instances are used as web servers but you can in fact execute any code or application on them, you're not limited to serving websites at all!

EC2 Auto Scaling is related to EC2, it simply allows you to configure rules which will automatically add or remove new EC2 instances as your demand grows/ shrinks (e.g., request spikes).

Elastic Load Balancing is also related to this - it ensures that incoming requests are evenly distributed across your running EC2 instances.

AWS Elastic Container Services

The container services help you with managing and deploying Docker containers.

AWS Elastic Beanstalk

A very interesting service is Elastic Beanstalk. It could be called a "meta service" because it makes using a couple of other services (like EC2) easier. It's built for developers who want to deploy their web app without spending hours or days learning how to set up and configure an EC2 instance, a database etc. It gives you default settings, some customization options, and a bunch of best practices.

AWS Lambda

Lambda is an absolute core and must-know service offered by AWS! It allows you to run code on demand. This means, that you don't need to select and spin up an EC2 instance. Instead, you just deploy your code, attach events that should trigger it and you're good to go. The rest will be handled by AWS.

You also only pay for the executions - you don't pay any idle time. Services like this one are called "Serverless services" because you don't need to manage servers on your own (there are - of course - still servers involved behind the scenes).

Storage Services

AWS S3

The most important data storage service is AWS S3. It's the service AWS originally started with and it's an object storage service.

That means, that it's built to store files of all kinds - images, videos, text documents. You could use it as your own personal cloud file storage, or you access it via your code running on AWS EC2 or Lambda or through one of the other services offered by AWS.

EBS & EFS

AWS EBS and EFS are storages you can attach to EC2 instances. Such instances do have some built-in storage but if you need more space or need to access one and the same filesystem from multiple instances, EBS and EFS allow you to add exactly those functionalities.

Glacier

Glacier is AWS' long-term archiving service. You can store data on it very cheaply, the downside is that you can't retrieve it instantly. Instead, you can issue a "data pull request" and then wait for a couple of hours until data is restored. It's a great solution for any kind of data you need to archive for a very long time though.

AWS Snowball & Snowmobile

These are services that help customers migrate (huge amounts of) data into the cloud. This might sound trivial but if you got petabytes or even exabytes of data to transfer, then these services will help you get your data into the cloud.

Database Services

Aurora & RDS

RDS stands for Relational Database Service, and it allows you to bring up a database server running engines like MySQL or MSSQL. Aurora is AWS' custom database engine - an especially powerful and cost-efficient solution indeed.

You can choose from different configurations (CPU, memory, ...) and then connect to your database from an EC2 instance, Lambda code, your code running on your own datacentre or any other application you might be running somewhere.

DynamoDB

Maybe you don't want a relational/ SQL database. DynamoDB is AWS' serverless NoSQL alternative. It offers all the benefits of NoSQL databases and its serverless nature ensures that you only pay for what you use.

ElastiCache

Often, you need to cache some data on the server-side. This can speed up the response time of your application and ElastiCache is a powerful managed caching service offered by AWS.

Redshift

Redshift is AWS' data warehouse offering. As such, it's built to store data that you might import into your BI tools. It's not the database you directly connect to your application - i.e., not the database that stores authenticated users etc. It's mainly meant for analytics or archiving purposes.

Neptune

I mentioned graph databases earlier. Graph databases are databases optimized for storing relations - something like users who have posts that have comments by other users. You can retrieve such connected data in a highly optimized and very efficient way with such databases. Neptune is AWS' managed graph database service that you could add to your application if you got a lot of complex relations to store.

Migration Services

This category is explained easily: It's all about getting your data and applications into the cloud. All these services are meant to support customers move from their on-premises solutions to AWS' services.

Networking & Content Delivery" Services

Amazon VPC

VPC stands for Virtual Private Cloud and it's a service that enables you to create "fences" around your services. VPC helps you group services together, control inbound and outbound traffic and create separated "clouds in the cloud".

CloudFront

CloudFront is AWS' CDN and it therefore is extremely important for ensuring that your content is served to your users efficiently. It speeds up the content delivery and allows you to easily add SSL encryption to your app as well.

Route 53

Every web app needs a domain of course. Route 53 is AWS' domain registrar - you can therefore use it to both register new domains and manage existing domains. You can define what's getting served if a certain domain is entered by the user.

API Gateway

API Gateway is an extremely awesome service as it allows you to create a REST API without writing any code.

Instead, you can define endpoints (URLs + Http verbs) and what should happen when a request reaches such an endpoint. You can interact with S3, run Lambda code, and do other useful things. It plays an especially important role when creating a serverless backend for your frontend.

Developer Services

Cloud9

Cloud9 is AWS' cloud-based IDE. You can use it instead of local IDEs like Visual Studio Code and it mostly shines because it has tight integration with other AWS offerings like Lambda.

Code Build, Code Deploy & Code Pipeline

These services help you with CI/CD, i.e., you can use them to configure deployment processes that build and test your code and push it into production automatically.

In modern applications, you typically deploy changes frequently (sometimes multiple times per hour) and hence such automated flows are a great help.

X-Ray

X-Ray is a service that allows you to trace the flow of data through your connected services - i.e., it can help you with debugging issues.

Code Star

Code Star is another “meta service” that simply builds up on the other development services and allows you to configure a cloud development environment and workflow without having to become an expert on the individual services. Think of it as Elastic Beanstalk for setting up a development workflow.

Management Services

All these services help you manage your AWS account and the service infrastructure you built up in it.

You can trace who (you probably got multiple users working in your account) did what, you can dive into logs of your (web) applications, and you can generally understand which services you’re using (and how).

Media Services

The media services offered by AWS allow you to work with video and audio files and do things like encoding or streaming of such.

That indeed are the main things you do with these services. Either encode your media files in the cloud or serve them to your customers as streams or downloads.

Encoding in the cloud is interesting if you’re working with huge amounts of data or high-resolution content. Chances are that your local machine quickly reaches its limit then.

And streaming content as well as adding ads to it is of course a crucial part of any media-based, customer-facing business.

Machine Learning Services

AWS does not just offer services that allow you to build web apps. It has a lot of services built with the aim of helping you implement machine learning and artificial intelligence solutions. That includes both the development and training of models as well as the deployment of such.

Sage Maker

Sage Maker is a fully managed service that abstracts away many of the complexities of machine learning processes. It allows you to focus on your data and not so much on setting up the appropriate resources and models. You can instead choose from a set of pre-defined services, prepare your data, and set up how to apply the algorithm on it and then create and test your model. Once an optimized model is found, you can also directly deploy it into production.

Lex, Polly, Rekognition

These services take it one step further. They give you less freedom/ configuration possibilities, but they offer you solutions to common AI problems that work out of the box.

To be precise, you can add speech and image recognition as well as Alexa-like bots relatively easy to your applications with these services.

Translate & Transcribe

The names of these services are self-explanatory. You work with them to transcribe media (i.e., convert it to text) and/ or to translate your text into other languages. You can combine these services with other services of course (e.g., to create a real-time translator bot).

Analytics Services

Where machine learning services focused on giving you models that allow you to add smart predictions etc to your apps, the “Analytics” services can be used to analyse data (or prepare it for that) internally.

Some of these services (e.g., Redshift) can be connected to BI tools like Power BI, others give you in-cloud BI analytics (Quick Sight).

Kinesis

Kinesis is worth pointing out as it makes analysing streamed data (e.g., a smart device streaming temperature data) easy. Typically, that would be challenging since the data continuously updates, with that service it’s made simple

Security Services

Security always matters - both for your AWS account and your (web) applications you build with it.

This category of services gives you everything you need to secure both.

AWS IAM

The “Identity and Access Management” service is probably THE most important service offered by AWS. With it, you can configure fine-grained access control for users of your AWS account and even the services used in there.

Cognito

Whilst IAM helps you secure your account, Cognito is a service that makes the addition of user authentication (login + signup) to your (web) apps a breeze.

It gives you useful things like email verification, password reset and safe storage of user data. Extremely useful!

Mobile Services

Pinpoint

Pinpoint is the analytics and user communication (newsletter mails, SMS campaigns) service offered by AWS.

AppSync

AppSync is a managed, serverless GraphQL service, giving you the possibility to easily set up a GraphQL API with the help of AWS. It’s basically an alternative to API Gateway which allows you to set up REST APIs instead.

Mobile Hub

Mobile Hub is another “meta service”. If you know Firebase, you can basically think of Mobile Hub as AWS’ answer.

It combines other services like API Gateway, DynamoDB or Lambda to allow users to build powerful backends without having to dive deeply into all these services.

AR & VR Services

Augmented Reality (AR) and Virtual Reality (VR) are exciting technologies that can be used in a variety of applications.

AWS Sumerian is a service that helps you with creating and running such experiences.

Application Integration Services

SQS

The “Simple Queue Service” allows you to manage a job queue. A job is simply a data package holding any information of your choice. You can consume it with a couple of other services that simply poll the job queue and pull these information packages from it.

For example, you could have a user authentication (e.g., implemented via AWS Cognito and AWS Lambda) that includes the uploading of a user photo. That photo probably should be checked and resized, but you want to do this after the primary authentication flow.

With SQS, a job can be posted on the queue and some other worker process (e.g., another Lambda function) runs every 5 minutes to poll that queue and handle any “photo checking” jobs it finds there.

SNS

SNS is comparable to SQS but instead of managing a job queue which gets pulled by other services (“pull approach”), you got a push service here.

This means that you can push new information (e.g., a data package describing some tasks that should be performed) to some other service (e.g., a Lambda function).

AppSync

AppSync was described earlier - it doesn’t really fit that well into this category to be honest. It’s not so much about letting services communicate, it’s a managed GraphQL API service instead.

Step Functions

Got multiple Lambda functions that depend on each other? Step Functions is a service that helps you orchestrate these functions.

You can pass results between functions, run them in parallel or connected through conditions and therefore, you can maintain control over your execution flow.

Customer Engagement Services

Amazon Connect

This is a service that allows you to set up a callcenter, manage and assign incoming calls and in general provide support to your customers.

Pinpoint

Pinpoint is AWS’ analytics and marketing service. You can keep track of all kinds of events in your application (e.g., a customer clicked a button) and reach out to your users via email or text message campaigns.

Simple Email Service (SES)

Pinpoint already allows you to send emails as part of marketing campaigns. SES is a more general emailing service. You can use it to send emails to your users as needed by your applications. That can be bulk emails (e.g., newsletters) but can also be transactional notifications (e.g., “Thanks for signing up!”).

Business Services

All the services listed in this category are end-user services rather than services you use to build your own applications or run your own logic.

Work Mail is basically AWS’ alternative to Gmail for example.

You got different services for managing workspaces and desktops in the cloud or working with documents.

Internet of Things (IoT) Services

The internet of things is all about smart devices (e.g., a toothbrush that tells you when to stop).

AWS provides services that you can use to connect your smart devices to the cloud OR run logic directly on the devices (AWS Greengrass allows you to do that). So, these are not just cloud services - instead, you find services that help you with IoT-devices in general.

Game Development Services

Lumberyard is a complete game engine (like Unity or Unreal Engine), Game Lift provides reliable game server hosting.

AWS Marketplace

You can build services on top of many AWS services (e.g., provide certain images for EC2 instances) and a lot of people already did so.

The AWS Marketplace is the place where you can sell or buy such services.

Cost Management Services

Obviously, you want to know how much you're paying on all your AWS services. There are various cost management services that help you with understanding how much you're paying for what.

AWS Pricing

Pay-as-you-go

Pay-as-you-go allows you to easily adapt to changing business needs without overcommitting budgets and improving your responsiveness to changes. With a pay-as-you-go model, you can adapt your business depending on need and not on forecasts, reducing the risk of overprovisioning or missing capacity.

Save when you commit

For AWS Compute and AWS Machine Learning, Savings Plans offer savings over On-Demand in exchange for a commitment to use a specific amount (measured in \$/hour) of an AWS service or a category of services, for a one- or three-year period.

Pay less by using more

With AWS, you can get volume-based discounts and realize important savings as your usage increases. For services such as S3, pricing is tiered, meaning the more you use, the less you pay per GB. AWS also gives you options to acquire services that help you address your business needs.

Future of AWS

AWS holds a global 69% of the cloud computing market share because of the following things:

- AWS was started way early in the year 2006, when no company, literally no company was ready to set foot in the cloud computing industry, because of the risk, since no one ever tried it!

This basically means AWS as a cloud provider has more experience in the field of cloud computing, and hence becomes an obvious choice when people are looking for a reliable cloud provider.

1. The provisioning capacity of AWS is 6 times, read it again, 6 TIMES than the server capacity of all its competitors combined.
2. Flexible pricing was an option that AWS came up with i.e., pay-as-you-go, now a days every cloud provider is a copy of what AWS came up with.
3. Reliability, AWS is a subsidiary of Amazon Inc. which is also an e-commerce giant. The fact that it has hosted its own e-commerce application on AWS, gives people a “trust” feeling on their cloud product.

On the other hand, all of this was before Microsoft Azure and Google Cloud came into the picture. Though, they are still lagging by a huge number, still with the kind of advancement Google (GCP) has shown in its cloud product, it's just a matter of time, that both these giants may become equal in the cloud industry.

Therefore, AWS has it all covered for its future; its competitors have built up their game. It will be exciting to see these giants i.e., Microsoft, Google and AWS fight the ultimate battle of cloud!

Conclusion

Hence, we were able to do a Case Study on AWS (Amazon Web Services).