BITMIN

A COMPLETE GUIDE TO GOOGLE CLOUD PLATFORM

And why Google is winning the Cloud War

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Prologue

On a day in 2006....

I still remember the day Amazon launched AWS, its cloud platform with the S3 (a storage service). It was a bright sunny day with AWS being the only cloud on the horizon.

Fast forward to now... The cloud wars are on.

It's raining cloud services and there are umpteen number of cloud providers competing as rivals for a bigger pie of the cloud market.

Each day companies add new weapons to their arsenal, hoping one of them would win them the war. Google, Amazon and Microsoft are the main rivals and battles of price, performance, reliability and innovation are fought every day. The price battle seems already won. An independent expert recently benchmarked Google as the best cloud. Google achieved this feat through its unbeatable pricing. Does this mean Google has won the Cloud war? No! Because price is only one of the variables that enterprises look at while picking the best cloud, there are a host of others and we'll introduce you to some of them here. The current state of the cloud world has been shaped by history among other things. Amazon had the early-mover advantage and used it to capture a significant share of the cloud market. But Google is catching up fast.

While we can't predict who will emerge on the top, we can look at the evolution of cloud computing and understand its current dynamics as well as future prospects. And maybe, just maybe, you'll guess who is winning the cloud war, by the time you turn to the last page.

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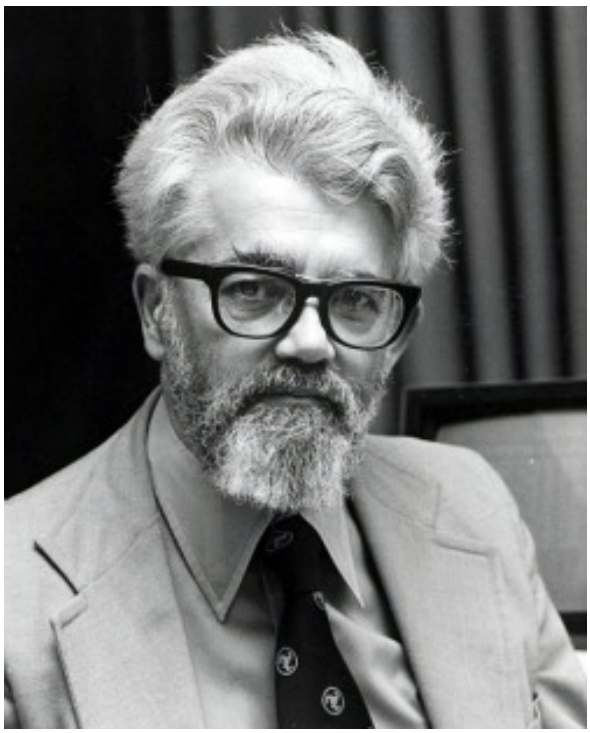
CHAPTER 1

A BRIEF HISTORY OF OUR TIME ON THE CLOUD

The story of cloud computing so far



John McCarthy
Cloud computing Scientist

When John McCarthy first spoke of computation being delivered as a public utility, it was a distant possibility. But today cloud computing is a reality; we spent a part of our lives on the cloud in our virtual avatars. As more and more services reach us via the cloud, the consumption of cloud services will continue to rise.

A host of developments paved way for the emergence of cloud computing. The advent of enabling technologies like the internet, virtualization tech, SOA architectures and widespread broadband access were crucial to the realization of the cloud computing paradigm.

How it all began

1999 After Salesforce launched enterprise applications as a service, the SaaS wave caught on and many enterprises launched their own apps via internet.

2006 The next development was the arrival of Amazon Web Services (AWS) in 2006. AWS was the first to launch a suite of cloud-based services. AWS allowed enterprises to rent both storage and computing resources through its S3 and EC2 services. Amazon is celebrating 10 years in the cloud in 2016 and is still the market leader among Public cloud service providers.

2008 Google entered the fray with its Google App Engine and is competing with other cloud vendors like AWS and Microsoft Azure in the provision of cloud services.

2009 Launch of browser-based enterprise applications from vendors like Google and Microsoft, Google Apps and Microsoft office web apps provided proof of concept for cloud enabled service delivery by demonstrating that online services were both easy to consume and reliable.

2011 Although Amazon, Microsoft and Google are primarily public cloud providers, enterprise concerns on data security and control, have pushed these vendors to experiment with other deployment models. This led to newer models like hybrid clouds, which combine the best of both public and private cloud models.

Google is a late entrant but is adding product families and new services to its cloud portfolio faster than others. Even on the price front, the massive price cuts by major cloud vendors are driving down the costs of cloud services quickly. Google is constantly lowering the cost of cloud services as a part of its avowed mission to democratize technology, especially IT.

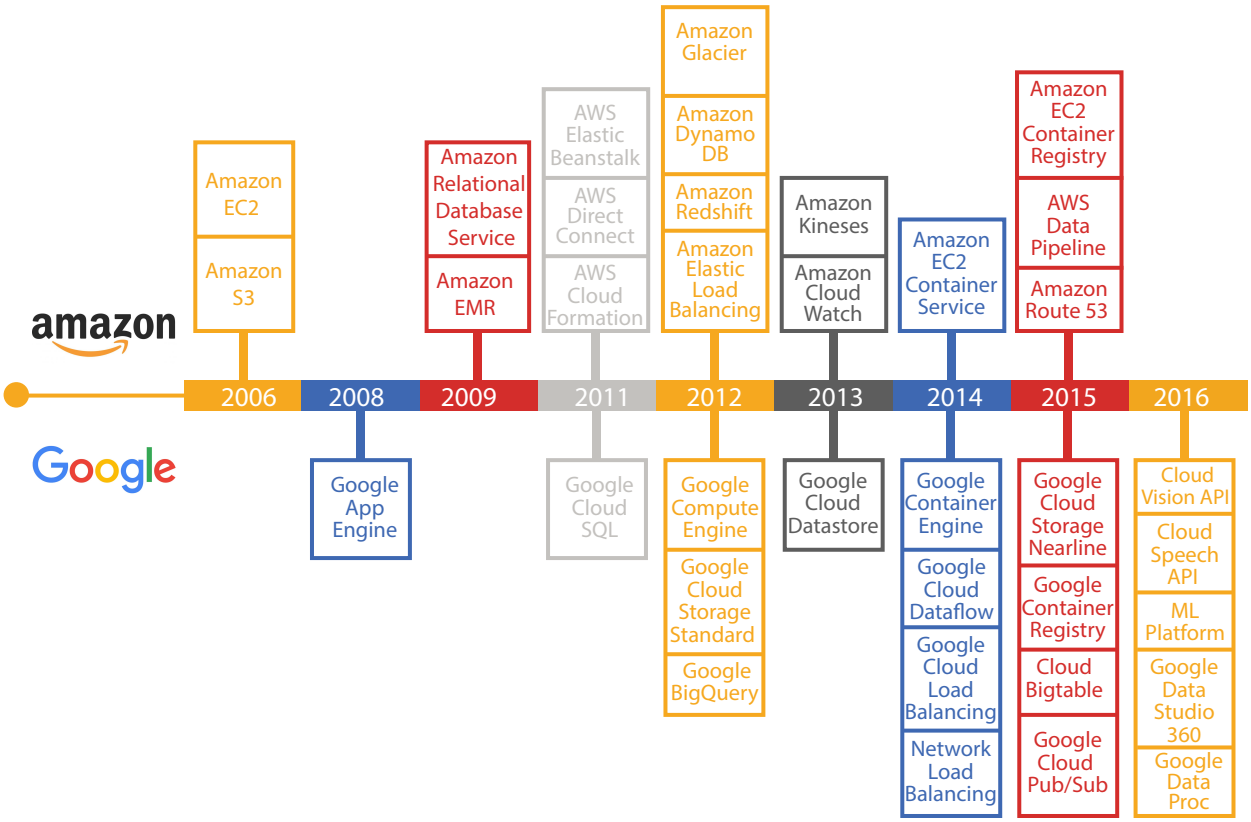
Evolution of Cloud Computing: Competing to Contribute

The massive demand for cloud services is spurring innovation through competition. Cloud providers are dropping prices and launching new products to win new clients.

The silver lining

The fierce rivalry between Amazon and Google in the cloud space, has resulted in cutting edge tech getting mainstreamed to the masses quickly. Let's look at a timeline of services launched by Google and Amazon to see how they are contributing to cloud evolution.

Cloud Services Launched by Google & Amazon

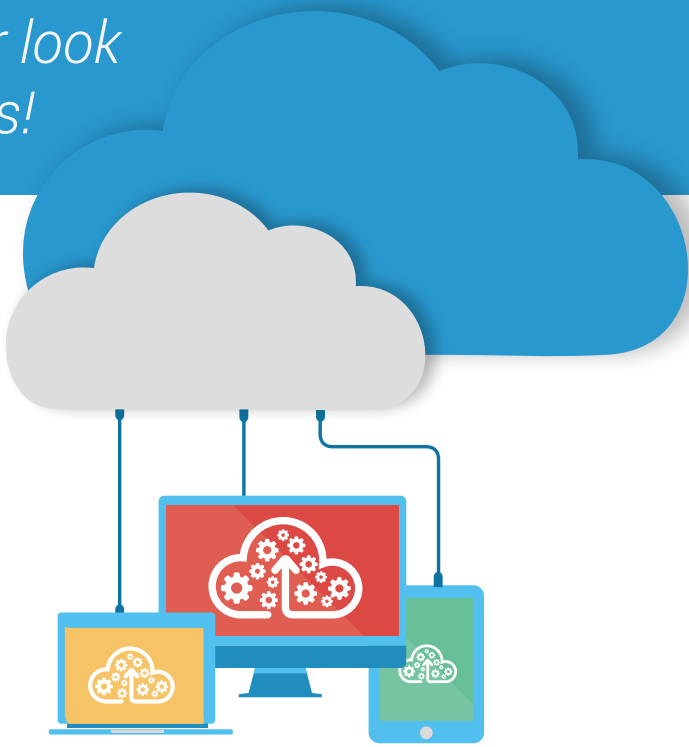


Google entered the cloud game late, but the Alphabet Inc is not one to be left behind! Google is launching new products at a rapid pace to power the next wave of cloud evolution.

CHAPTER 2

SHIFTS IN CLOUD STRATEGIES: RIVALRY / EVOLUTION?

Why it's time to take a closer look at enterprise cloud strategies!



The Cloud race is getting hotter; the New Year began with major cloud vendors like Amazon and Microsoft announcing price cuts. Google responded to these price changes by announcing that its platform was still the most economical option through a company blog. So is the cloud rivalry all about pricing? Definitely not! So what shapes an enterprise cloud strategy if not pricing? The past few months saw some high-profile enterprises make changes in their cloud strategy. They tell the story of how the cloud space is evolving and how enterprises are getting over their fears of storing restricted data on somebody else's servers, as the cloud keeps getting more secure.

Let's take Amazon, it not only pioneered cloud computing but has spent the last decade popularizing the concept in the enterprise world.

Amazon Web Services (AWS) has a product release schedule that's enviable! It rolls out new features and services to millions of its users every year. News of high profile AWS users like Spotify and Apple shifting to Google has generated a lot of debate in the recent months.

From a Trickle to a Roar

When Spotify announced its plans to migrate to Google Cloud Platform, it left everyone baffled. The company had often been cited as a reference customer for amazon services. What was dismissed as a one-off instance by supporters of Amazon, soon turned into a headache when reports of Apple following spotify to Google Cloud surfaced.

So, are AWS users really looking for a better host?

Not really, unless you believe the overexcited folks on twitter who see this as the beginning of an end to Amazon's dominance over the cloud market.

Let's take a reality check

1. Dropbox reduced its use of Amazon's storage service (s3) as it was pursuing an on-premise cloud strategy, which would require most of it users' data to be stored in in-house data centers.

2. Apple may have shifted some of its workloads to Google Cloud Platform but it still continues to use AWS too. Apple also runs some of its operations on Microsoft Azure cloud. In Apple's case, it's simply following a multi-provider cloud strategy.

What is driving the shift in Cloud strategies?

The proponents of cloud computing marketed the paradigm as a solution to all, if not most enterprise IT challenges. Moving operations off-premise was not only going to bring significant cost and time savings but would also free enterprises from vendor lock-in. Adoption of cloud services would imply enterprises could shift all or part of their workloads to rival vendors if they were delivering better value on cost, performance and security aspects. This was the promise of Cloud computing. Enterprises are now seeing this promise delivered.

Why you need a fluid cloud strategy?

Cloud technology is only a decade old and is still evolving. Different vendors in cloud space are accumulating advantages in niche segments. For example, Google is leveraging its strengths in data processing to establish its dominance in big data segment. A small enterprise might do better with a vendor that's having an edge in a particular segment. While large enterprises may use different vendors for different product/service lines for the same reasons. Shifts in consumer preferences, data laws and disruptive tech innovations are all capable of

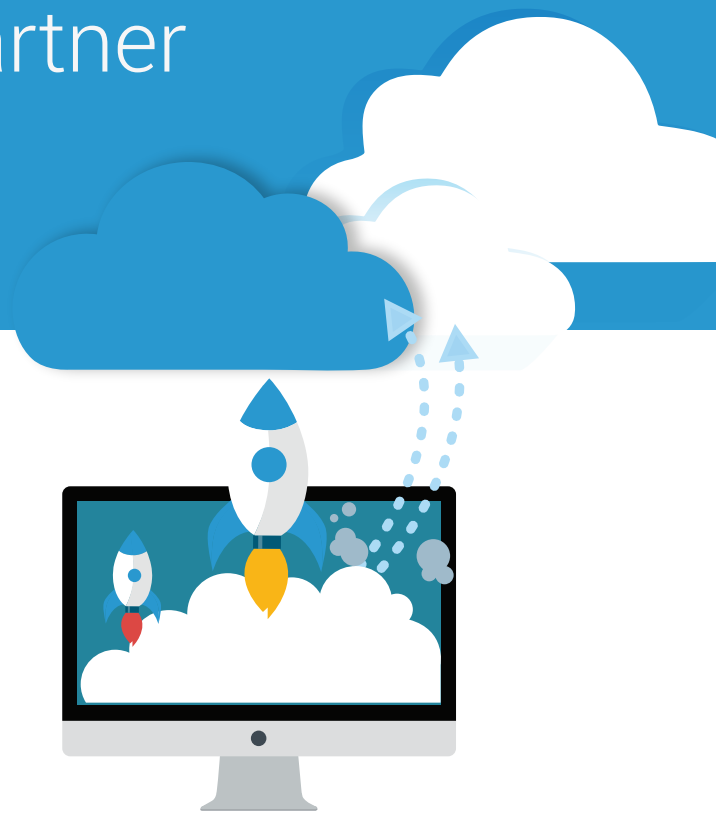
engineering a change in an enterprise cloud strategy and are unrelated to vendor-side dynamics. Most companies are still experimenting with their supplier and product strategy to figure the best vendor mix for their product/service matrix. Therefore it's pointless to discuss enterprise cloud strategies in absolute terms. All of the enterprise IT workloads may not operate on the cloud, only some of them might be. Similarly, an enterprise may have multiple cloud vendors servicing its different product or service lines. The reality is, firms are keeping their cloud strategy fluid to respond to changes in vendor and business environments. A fluid strategy also has a positive impact on the cloud ecosystem as it pushes providers to innovate.

But one thing is certain, as prices of cloud services continue to drop and providers add more functionality and features to their cloud platforms we will see greater adoption of cloud services in the future.

CHAPTER 3

Starting Your Cloud Journey With The Right Partner

Why startups must adopt a Cloud-First Strategy!



The cloud computing space is evolving. Vendors are finding their niche segments and owning them. But, why should all of this brouhaha about cloud migration matter to you? Is the 'Anytime, Anywhere, Any Device' computing model for everyone?

Is there a compelling business case for universal cloud adoption?

Find Out!

Moving to the cloud is not just about adopting newer tech but there is a compelling business case to make the shift.

Business Drivers for Cloud Adoption

1) The Cost Argument

Cloud computing is an efficient and cost-effective way to deploy IT. Large cloud providers leverage economies of scale to deliver low-cost computing resources to cloud users. If you are operating on a cloud platform, you pay for the exact amount of resources you

consume. For SMBs and startups working on a lean model, avoiding expenditure on installation, maintenance, upgrades and support costs can make a lot of difference.

2) Investment

Startups and SMBs are often constrained by tight budgets and using the cloud to deliver services will imply costs are incurred as operational expenditure instead of capital expenditure. Operating on the cloud will also mean they don't have to worry about infrastructure provisioning. The cloud provider would take over the responsibility of upgrading infrastructure and maintaining it, letting the enterprise focus on application development.

3) Scalability

Easy scalability is another advantage of cloud adoption. Cloud providers offer automatic scaling whenever computing needs peak. If not for the cloud, firms would have to create the infrastructure to meet peak traffic demands and keep it idle for most of the year. Being able to avoid over-provisioning is a significant advantage of moving to the cloud.

4) Enterprise mobility

Cloud adoption furthers enterprise mobility by allowing users to work from anywhere, at any time, and from any device. Cloud-based business collaboration tools are efficient and easy-to-use. Cloud-delivered enterprise mobility management systems allow companies to implement Bring-Your-Own-Device (BYOD) policies without worrying too much about data security.

5) Speed

Virtual computing resources can be commissioned in a few hours whereas traditional mode of setting up IT infrastructure takes weeks, if not months. For startups with ideas that need to be out in the market yesterday, adopting a cloud-first strategy is the only means to speed up product development.

Finally, each enterprise will differ in why it embraces cloud computing. Irrespective of why you migrate to the cloud, the approach to cloud adoption must be properly planned and executed. It begins with choosing the right vendor for your firm.

So, how to find your cloud match?

What you must look for in a cloud vendor

1) Performance & Uptime

For high-speed delivery of applications, network performance is crucial. Check if your cloud provider has a low uptime.

Not all cloud providers are made equal. Apart from the above attributes, it's also important to check which cloud vendor matches your business objectives and your enterprise philosophy best.

2) Service Level Agreements and Reliability

Some cloud providers offer higher levels of service and customer support to differentiate themselves from their competitors.

3) Costs

Some cloud providers charge you for the actual number of servers you use, whereas others charge you for the amount of time you keep them online. Few vendors compute costs per hour whereas others compute costs by the minute.

4) Technology Stack

Cloud providers have services that work on particular software stacks. If your app is built on a particular software stack, you can simplify your cloud migration by choosing a provider that supports the same software stack.

5) APIs and Vendor lock-in

It is better to choose APIs backed by multiple providers and vendors as it reduces chances of vendor lock-in. This makes cloud migration from one provider to another easier.

6) Security and compliance

Data security concerns weigh heavily on the minds of enterprises wanting to migrate to the cloud. Make sure that your cloud platform provider is compliant with security standards and data safety regulations.

7) Deployment models

For most large enterprises uprooting their entire on-premise cloud workloads and migrating them to a public cloud maybe challenging and unneces-sary. Enterprises may choose to migrate only some of their workloads to the cloud and work with a hybrid cloud strategy. It's important to check if your cloud provider supports hybrid cloud configurations.

8) Regional support

If business requirements or data safety laws mandate data localization in a particular country or region, then it is necessary to check for regional avail-ability of your cloud provider.

9) Autoscaling

Autoscaling is important for applications that are likely to experience demand peaks and troughs. Bringing more servers online for handling higher workloads and taking them offline when not necessary ensures you pay-as-you-use.

10) Network connectivity

Evaluating your cloud provider's network connectivity is crucial, particularly so if you are running latency-sensitive applications on the cloud.

CHAPTER 4

ARCHITECTURE OF A CLOUD PLATFORM

Piecing the Cloud Puzzle together

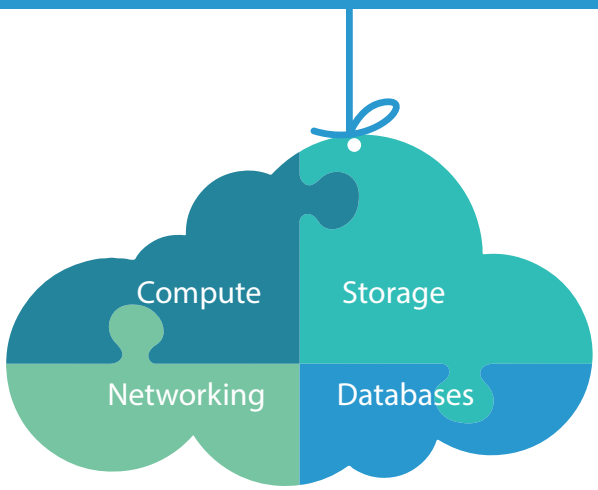
What is a Cloud Platform?

A Cloud is a comprehensive platform providing services that support application development and hosting. The services offered by a cloud platform may be categorised into fundamental services and higher level services. The higher level services are built on top of the fundamental layer.

Let's explore the essentials and add-ons of a cloud services suite:

A. Building-block services

Any self-respecting cloud provider will have these fundamental services in his arsenal.



The fundamental services offered by Amazon and Google Cloud platforms are:

- Compute
- Storage
- Networking
- Databases

B. Higher-level services

Both vendors also offer higher level Services built on top the core stack of services. The services provided are diverse and mostly meant to make working on cloud easy by offering an additional layer of abstraction or easier management of deployments.

- Application services

Function: To optimise applications using the cloud.

Examples: AWS SNS and Google Cloud Pub/Sub.

- Data services

Function: To enable processing of Big Data.

Examples: Amazon Kinesis and Google Cloud Dataflow

- Management services

Function: To track performance of applications running on the cloud

Examples: Amazon CloudWatch and Google Cloud Monitoring

Both Amazon and Google cloud platforms are backed by a robust set of basic services. But that's not all! Both are constantly innovating to strengthen core architecture further and add higher level services. Both Amazon and Google recently launched machine learning services as a new product family. Machine Learning is expected to power the next wave of enterprise IT products. Offering such cutting edge tech as a cloud service is the fastest way to mainstream its benefits, as developers everywhere can now build apps that harness its potential.

Google entered the cloud game late, but the Alphabet Inc is not one to be left behind! Google is launching new products at a rapid pace to power the next wave of cloud evolution.

CHAPTER 5

The 'Compute'

In Cloud Computing

Cloud computing, as the name suggests, refers to the provision of computing power over the internet. Let's compare what our favorite vendors Amazon and Google offer in the IaaS-PaaS segment.

Amazon's IaaS is called Elastic Compute Cloud (EC2) and Google's IaaS is known as Google Compute Engine (GCE)

Both IaaS services are robust and offer similar features under different names.

Feature	Amazon Elastic Compute Cloud	Google Compute Engine
Virtual Machines VMs	Instances	Virtual Machines, Instances
VM template	Amazon Machine Image	Image
Temporary VMs	Spot Instances	Preemptible VMs
Firewall	Security Groups	Google Compute Engine Firewall Rules
Scale-out	Auto Scaling	Autoscaler
Local attached disk	Ephemeral disk	Local SSD

Virtual machines (VMs)

Both EC2 and GCE let you launch and terminate VMs/instances as required. Users have complete control over the instance. Both platforms support several instance types.

Instance types

Both EC2 and GCE provide some standard instance types each of which has defined amounts of CPU, RAM and network assigned to it. GCE also allows customised instances that you can configure to fit your particular workload.

Let's look at the common instance types offered by both services:

Machine Type
Shared Core VMs for tasks that don't require too many resources but have to stay online for longer durations.
Standard VMs which provide a fine balance of compute, network and memory resources
High Memory VMs for tasks that need more memory relative to CPU resources
High CPU VMs for tasks that require more virtual CPUs relative to memory
GPU VMs that come with discrete GPU's. Google doesn't have this machine type.
SSD Storage VMs that come with SSD local storage
Dense Storage VMs that support greater amounts local HDD storage. Not Available in Google

GCE and AWS support many of the same families of instance types but Google doesn't offer two specialised families: GPUs and Large magnetic storage.

Operating system support

Both support a variety of operating systems and charge licence fees. Google lists the OS price separately, whereas Amazon lists the combined cost of OS plus instance.

Firewall

Both services offer programmable firewalls based on software-defined networking. You can configure a firewall to protect virtual machines and networks used by your applications.

Scale-out

Auto scaling brings elasticity to cloud deployments. Both services support auto-scaling that scale up or down in response to conditions set out in Scaling Plan or Policy. These instances are launched from pre-defined templates. The auto-scaling in Amazon can be set in motion in three ways: Manually, scheduled to start based on time or dynamically based on an Alarm (Cloudwatch/SQS queue). But Google offers only dynamic auto-scaling option.

Local attached storage

In both EC2 and GCE, users can commission disks local to a VM instead of network connected ones to enjoy faster transfer rates. The number and size of disks offered to users by both services are fixed and not adjustable. Using a Local SSD in place of instance storage incurs extra cost.

Virtual machine import

Both AWS and GCP allow you to import VM images created on other platforms to their platform. The actual import process is easier in AWS whereas Google requires conversion to compatible format and upload to Google cloud storage to allow import. But VM import ensures the workloads run on on-premise servers are usable and need not be repeated.

Pricing model

EC2 and GCE offer very similar pricing models. Both services only charge you for instances for the length of time that you use them. With Amazon, each instance type is charged per hour, and in Google you are charged by the minute.

Both offer discounts for long duration usage but differ in how they do it. Amazon lets you barter flexibility for a lower price through its Reserved instances (RIs). RIs work by asking you to commit to a certain number of instances for 1-3 years and also pay upfront. The discount is proportional to

the term and amount of upfront payment.

Google's discounts work automatically without any upfront payments or long-term commitments. Google applies a discount proportional the length of instance usage once the instance runs for a specified duration. It calls this a Sustained Use discount and the savings from this sometimes amount to almost 30% off on the standard on-demand rate. No wonder Google is winning the price war!

Apart from these basic services, both Google and amazon offer greater abstraction through their Platform-as-Service (PaaS) services, AWS's Elastic Beanstalk and GCP's App Engine. AWS Elastic Beanstalk (EBS) and App Engine (GAE) are similar services with slightly different approaches. Both the services offer auto-scaling, load balancing and monitoring services. EBS requires the kind of system administration that raw VMs require whereas GAE is a fully managed service in which all admin tasks are managed by provider. EBS gives greater control and flexibility to developers whereas GAE is easier to manage and can be launched quickly. GAE frees developers from routine tasks of infrastructure management and lets them focus on developing product features.

The choice of a particular IaaS/PaaS will hinge on the requirements of a specific workload and the preference of developer team for greater/lesser control over the underlying infrastructure. Take the case of Snapchat, they needed their product to be launched quickly and choose a fully managed service, GAE to fulfill this objective.

CHAPTER 6

Don't Grab a Passing Cloud (to stash your data)

Learn which cloud storage solutions are the best!

Cloud vs. Cloud: Where to Keep Your Valuables

Data is the new currency; we live in a digitised world that generates Zettabytes of data each year. The world's biggest enterprises are sitting on vast data gold mines. But, enterprises are struggling to safely store the increasing amounts of data coming their way. They have to commit a lot of resources to building, maintaining and upgrading enterprise storage infrastructure. Here, the cloud comes to their rescue!

Cloud storage is akin to leasing a bank vault. Vendors maintain these for enterprises at low costs. Additionally, moving data to cloud storage automatically ensures data redundancy and data security.

Why, enterprises are moving to on-cloud storage solutions is no-brainer!

Quick deployment, low operational burden, zero maintenance headaches and Pay per use costing offered by the Cloud are hard to ignore.

Both Amazon and Google offer cloud-based storage solutions as part of their cloud platform services. Their services are roughly similar with no clear frontrunners in pricing, performance and reliability aspects as of now.

Types of Cloud Storage Classes

Cloud providers offer different cloud storage classes that can be grouped into four tiers: Hot, Warm, Cool and Cold. These services differ in parameters like speed of access, cost, frequency of use and durability.

HOT – object storage for frequently accessed data
- Amazon S3 Standard
- Google Cloud Storage standard

WARM – frequently accessed non-critical reproducible data
- Amazon S3 RRS
- Google Cloud Storage DRA

COOL – less frequently but rapidly accessible data
- Amazon S3 Standard I/A
- Google Cloud Storage Nearline

COLD – data archiving
- Amazon Glacier

Comparing the Storage services of AWS and GCP

First, let's compare the 'cold storage' services provided by Amazon and Google:

A. Google Nearline vs. AWS Glacier

Google launched Nearline in 2015 with a promise of very quick retrieval time at a very low cost. Nearline's 2-5 second retrieval time created a stir among users, but we all know when something's too good to be true, right? Nearline limits data retrieval to 4MB/sec for every TB stored, while Amazon has no such restrictions. What this caveat means for users is: downloads will start within 2-5 secs but will take a long time to complete. Unless users are working with massive amounts of data, Amazon Glacier will deliver better on retrieval times than Nearline.

Google recently released a feature called on-demand I/O to address this challenge. On-demand I/O lets users increase throughput when they have to retrieve content at a faster rate than the default 4MB/s.

A more detailed comparison of Nearline and Glacier:

1. In Retrieval and Transfer of data, Glacier is better

Amazon gives 5% free retrieval on amount of data stored and has a low charge after that, Google's costs are higher. But though it's cheaper than Nearline, Amazon has different pricing for different regions unlike Google which offers the same price world-wide.

2. In Data Override and Deletion, Nearline is the winner

If you need to delete data often, say every month or two, then Nearline is the better option as it charges lower for early deletion.

3. In Data Access Time, Nearline provides hassle-free access

No need to request access and wait for a couple of hours for the data to be made available, in Nearline the data can be accessed at will in 3secs!

4. In Download Speed, Nearline beats Glacier for larger datasets but is a poor performer otherwise.

Amazon's Glacier has long been the industry standard when it comes to secure, low-cost storage services used for data archiving and online backups.

While Nearline is the winner in accessibility and speed, there is no real big difference in price between the two services. Would Nearline kill Amazon's Glacier service? Not in the near future. The war has just begun in this segment; and enterprises should watch out for upgrades.

Now let's make a quick comparison of S3 and Google Cloud Storage services:

B. Amazon S3 vs. Google Cloud Storage

Both S3 and Cloud Storage are similar services with some minor differences, let's consider the important ones:

1. Google supports chunked encoding and resumable uploads. Both of these features are handy when you are streaming.

2. Amazon gives users more regions to choose from, while Google only supports US and EU at the moment.

3. Google lacks explicit regional control like S3.

4. The best part about S3? It is well integrated with other AWS services like CloudFront and EC2. But, Cloud Storage is mostly a standalone service. Amazon also allows free access between S3 and EC2, unlike Google, which charges users for accessing its

Cloud Storage from App Engine. Amazon's Simple Storage Service (S3) has long been the industry standard for object storage. Google has to offer something far better than what it does now to really make a dent in Amazon's armour.

Tips to help pick the right Cloud Storage service:

Once the features and pricing are considered, the final item on an enterprise checklist should be the ease of management inherent in a solution. The best cold storage architecture will offer a well-developed management layer. Enterprises must look for innovative products that allow intelligent management of data and its seamless integration with other business processes.

If you are an enterprise looking to move to cloud-based storage:

1. Don't let capacity pricing lead your decision process.
2. Don't forget to consider transaction and management costs
3. Lastly, look at the provider ecosystem and how it fits your cloud adoption plan.

Here are some criteria to consider when choosing a cloud storage service:

1. Durability
2. Availability
3. Performance
4. Capacity cost
5. Monitoring and Access
6. Life Cycle Management

Google came to the storage segment late but is trying to stand out by shining on the price front. Having been around longer, AWS has a larger set of partners, integrators and network providers working with it compared to Google. Google will need some 'Killer' upgrades to popularize its storage services among non-GCP users.

CHAPTER 7

Why Networking Matters

The right network is fast, reliable and scalable

When the Music Stops Playing

'The show must go on' is what Netflix users might say to Amazon regarding its network outage last June. The brief outage took down popular services like Netflix and pinterest for almost an hour.

Network outages are an issue for most public cloud providers. Google which prides itself on its strong networking architecture also experienced an outage just this month (April 11, 2016). Google's outage affected users in all zones but went mostly unnoticed. Reason?

1. Google has a relatively small market share in the cloud space
2. Very few GCP clients run low-latency interactive web traffic applications unlike Amazon which hosts popular apps like Netflix.

Is Networking the Achilles heel of cloud vendors?

The Google cloud outage on April 11, 2016 was a setback for Google's efforts to win over enterprise IT customers. The outage didn't just affect one availability zone, but all regions. In comparison, rival Amazon has suffered regional outages but has so far avoided its entire platform going down. These episodes tell us that:

Sending your IT ops to the cloud carries significant risk.

The curious case of empty inboxes

Outages are not new to the cloud world, some of the worst ones saw users logging into empty email accounts wiped of all data. Vendors could restore the data in some cases and not in the others. So what do the networking failures of the past teach enterprise cloud users? Let's find out!

Lesson 1: Assume it will fail

It's natural for networks and data centers to suffer glitches. Just because your cloud provider is now handling network reliability doesn't mean it will never fail. While planning your cloud strategy ensure adequate redundancy by avoiding over-reliance on any single vendor or service to drive your core architecture.

Lesson 2: Build Redundancy

Reliability is dependent on redundancy. Multiple copies of data spread across different availability zones are key to weathering a cloud failure storm.

Lesson 3: Have a Contingency Plan

Even the most sophisticated disaster recovery systems are not completely fool-proof. It's ok to be paranoid here, go ahead and create backups of your important data independently. When it comes to crucial data, never assume someone else is automatically protecting you.

Lesson 4: Even the best laid plans don't work

Google had anticipated the problems that caused the April 11, 2016 outage. It has the necessary measures in place to avoid disruptions, but they failed to work. In rare but real instances bugs can bypass safety mechanisms and multi-layered data protection networks to cause significant damage. Test your safety measures rigorously.

Lesson 5: Don't keep all your eggs in one basket

We have talked a lot about redundancy. You already have crucial data tucked away on multiple servers, in different regions, there seems to be nothing more you can do! Well, it never hurts to go the extra mile and spread it across vendors too, as the ultimate failsafe.

Feel like revisiting your decision to migrate?

The whole point of getting on the cloud was to sign away the 'grunt work' of infrastructure and network

maintenance to your cloud host. The responsibility for building a resilient cloud network certainly rests with the cloud provider. So, while choosing a cloud vendor cross-check the level of redundancy they offer to users.

Outages or Not, the cloud is here to stay!

Service disruptions due to cloud outages may make the cloud seem unreliable, which is not true. The cloud will continue to have a lot more operational success than an individual enterprise network. But since the cloud operates web scale its failures often get amplified.

Comparing the Networking Services of Google and Amazon

AWS networking and Google Cloud Platform (GCP) networking have considerable differences in their design. GCP networking is global and is available to all its services unlike Amazon which limits it to compute instances. GCP boasts of a software-defined networking architecture based on Google's Andromeda. This architecture allows the creation of networking elements at any level and supports customization of the network to your needs.

Things you can do with GCP

- Create secure firewalls for VMs in Google Compute Engine
- Design faster connections between database nodes in Cloud Bigtable
- Provision network resources for faster delivery of query results in BigQuery

Comparing the Networking Product Suites of AWS & GCP

I. Load balancing

Load balancers when configured properly distribute incoming traffic across multiple VMs making apps more fault tolerant.

Scaling pattern

Both Amazon's Elastic Load Balancer (ELB) and Google Compute Engine Load Balancer respond to traffic by scaling up or down the amount of capacity necessary to meet the traffic being passed through it. Google Compute Engine Load Balancer responds in real time without a delay or pre-warming unlike Amazon's ELB.

Pricing model

Both load balancing services use the same pricing model. An hourly rate for load balancer and a separate charge on the amount of traffic handled by the load balancer are billed to customers.

II. Peering

A peering service allows customers to connect to a cloud service directly over a network.

The peering services offered by AWS & GCP

Feature	AWS	Google Cloud Platform
Virtual Private	VPC-VPN	Cloud VPN
Network		
Carrier Peering	Direct Connect	Carrier Interconnect
Direct Peering	N/A	Direct Peering
CDN Peering	N/A	CDN Interconnect

A. Virtual private network

Creating a virtual private network, or VPN, from one location to another allows you to create a secured, private link between two networks over the public internet. Both AWS and Google Cloud Platform offer this as a service.

B. Carrier peering

Sometimes connecting to a cloud through a VPN won't satisfy your speed/ security needs, in which case, leasing a private network connection with guaranteed capacity assigned to it is beneficial. Both Amazon and Google offer this service in conjunction with partners.

C. Direct peering

In Direct peering you directly connect to your cloud provider through a private, dedicated line, and not via a 3rd party provider. Amazon does not offer this service, Google does.

D. Content delivery network (CDN) peering

Content delivery network (CDN) peering is similar to carrier peering but instead of peering your facility with the cloud provider, it connects your cloud resources to a CDN. Google offers this service through CDN Interconnect and Amazon through its own CDN service, Cloudfront.

Pricing of Peering Services

AWS and GCP charge for VPN services the same way, at an hourly rate.
For peering services, Google is the more economical option, as it does not charge for direct peering and CDN Interconnect.

III. DNS

DNS translates domain names into a numeric IP that servers can use to connect with each other. Managed DNS services like Amazon Route 53 and Google Cloud DNS are close in feature parity. However, Amazon offers two additional routing options not available to GCP users, geography-based routing and latency-based routing.

Pricing

Both services charge similar prices but AWS charges higher for geographic-based routing or latency-based routing queries.

IV. BONUS! Live Migration in GCP

Another advantage of working with GCP networking is the availability of live migration. Hardware failures happen in all data centers; in the event of a hardware failure GCP can move VMs from affected hardware to functioning hardware automatically without customer intervention.

All major vendors suffer the occasional network glitches that affect their Service Levels. A recent benchmarking of cloud providers by an independent expert ranked Amazon higher for "Service Level". But Google ranked best on pricing, making it clear that GCP offers the best networking performance for the money.

CHAPTER 8

Why DBaaS is in Demand

Demand New Enterprise Warehouse Address: ***'The Cloud'***

Database as a service (DBaaS) joins the ranks of IaaS, SaaS and PaaS on the list of enterprise favourite cloud services. Why? Because, DBaaS lets you have 'IT' your way and solves challenges inherent in the traditional on-premise model.

Learn how DBaaS does database management better

• DBaaS reduces database sprawl. You probably have your data spread across many collections, and operating in silos, if you are working with a legacy data warehousing model. With DBaaS, you move your data out of silos to a single powerful database cloud.

• DBaaS supports rapid provisioning and auto-scaling to any size.

• DBaaS enhances security.

• Centralised management of databases is also made possible by automation. Cloud Databases are undoubtedly the future of enterprise database systems.

Let's take a look at the cloud database model:

Cloud Database

A cloud database runs on a cloud computing platform. Cloud users can purchase access to a database service managed by a cloud provider.

Database as a Service (DBaaS) model

In this model, DBaaS provider takes responsibility for installing and maintaining client's database and, application owners will have to pay according to their usage.

Architecture of DBaaS Service

DBaaS service lets end user launch, configure and track database instances through a web-based console. The user communicates with the database instance using an API, and can perform maintenance and scaling operations.

A managed service vests the responsibility of ensuring scalability and high availability with the service provider.

Why should enterprises shift to DBaaS from on-premise legacy systems?

Because DBaaS:

1. Is a scalable on-demand platform

2. Is more manageable

3. Provides improved security

4. Has monitoring capabilities to track performance, issue alerts on threats.

5. Supports simple data analytics

6. Offers better Price-to-performance ratio than legacy systems

What is "managed" by the Provider?

If you sign a DBaaS provider to manage your enterprise database, it does:

1. Patches and Updates

2. Manages Backups

3. Configures replication

4. Provides for automatic failover in event of zone outage

5. Ensures data security through auto-updating security and data encryption. Additionally, in Google DBaaS users get to achieve a high level of customization. The user can configure availability, replication and backups to suit a particular database instance need. For example, users can skip replications and automatic failover for

development instances while keeping production instances fully protected.

Cloud databases are of two types:

1. Relational (SQL) databases

2. Non-relational (NoSQL) databases

Comparing Amazon & Google cloud platform DBaaS services

Amazon and Google's DBaaS services were born out of their internal database management models. Both Amazon and Google offer differentiated products in this category:

AWS has three main database services lined up for its clients

• Amazon Relational Database Service (RDS)

• Amazon DynamoDB
• Amazon Simple DB

Google also offers three DBaaS products that are equivalent to AWS services

A. Google Cloud SQL

An Easy-to-use, fully managed MySQL database service. Amazon offers a similar service, Amazon RDS.

Cloud SQL is flexible on three important fronts:

• Flexible scaling, something not usually associated with relational databases.

• Flexible connectivity from any application, running anywhere. Users can connect to their database from any application (e.g. Compute Engine, Managed VMs, etc.,) through the internet.

• Flexibility in launch and termination of database instances. This can be accomplished using the Cloud console provided by the service.

Flexibility helps deliver cost savings by keeping databases live only when needed.

Google also has a strong partner ecosystem to help make Cloud SQL use easier. Itspartners have launched tools that streamline the loading of data into Cloud SQL, besides monitoring and visualisation tools to help better CloudSQL implementation.

Amazon's RDS service is similar to Google's Cloud SQL in its feature set. Google, however, has a better price-performance ratio.

B. Cloud Datastore

Cloud Datastore is a NoSQL database service. Like other Google DBaaS

services it is highly Scalable and has high availability and reliability. It is designed to easily integrate with other Google Cloud Platform Apps.

C. Google Cloud Bigtable

Google uses this NoSQL database service to power its own core services like search, analytics, maps and Gmail. It is a tried and tested tool for handling large analytical and operational workloads. It can handle big data workloads at low latency and deliver high throughput. BigTable was introduced in 2015. Amazon has an equivalent service in Dynamo DB, which was launched much earlier in 2012. DynamoDB was Amazon's second managed NoSQL service after SimpleDB (2007).

Comparing BigTable and DynamoDB when used on-demand

Bigtable is the cheaper option and unlike its counterpart Amazon charges the same price for an operation irrespective of its nature. Amazon, charges more for writes than reads and consistent reads are more expensive than eventually consistent reads.

Google doesn't have differentiated pricing for read-heavy and write-heavy applications, making its services cheaper. Additionally, Google's Bigtable scales seamlessly and is well integrated with the rest of the Google Cloud Platform services like Cloud Dataproc and BigQuery.

Pricing

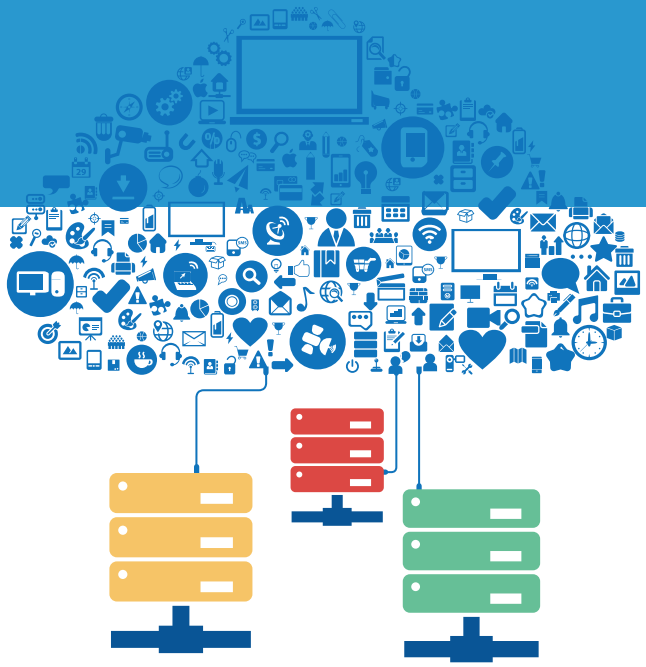
Cloud Bigtable has two pricing parameters: price per node and price for the amount of data stored. DynamoDB charges users based on the amount of data stored. As usual, Amazon offers discounted prices for DynamoDB Reserved Capacity (RC). But, RC requires an upfront payment and 1-3 year commitment. Google is yet again the economical option thanks to its sustained use discount model and no upfront charges or long-term signup clauses.

Google is fast closing the gap with rival Amazon in the cloud computing space. Google's busy launch calendar sees it debut products similar to AWS in all major product families throughout the year. Despite being a late entrant, Google has quickly risen to deliver the best performance for the price in the DBaaS segment too.

CHAPTER 9

BIG DATA ANALYTICS:DATA DRIVEN BUSINESS SUCCESS

Don't be data rich & Insight Poor anymore!



Data is growing exponentially and more of it is generated every day and the trend shall continue in future. Enterprises are struggling to stay on top of this data deluge! The IoT revolution is set to further fan this data avalanche. So, what does the future hold?

Well, companies like to hoard data, atleast the ones with resources do. Unfortunately, data has a limited lifespan within which it can generate actionable business intelligence for enterprises. But, getting meaningful insights from terabytes of data requires computing and storage muscle, something only large enterprises could afford until sometime ago.

Then came...

Democratization of Big Data

Public cloud data processing services from vendors like amazon and google put big data analytics within the reach of startups and SMBs. This move towards democratization of Big Data is gaining steam with major players competing along cost and innovation fronts. A lot of this innovation is fuelled by the digital transformation happening in enterprise landscape.

So, why are enterprises betting big on 'Big data'?

Companies are now looking to improve savings and increase ROI through evidence based decision making, largely driven by Big Data Analytics. Firms are now making resource allocation decisions and judging marketing effectiveness using real-time analysis of consumer behavior.

Use cases of Google's Big Data Analytics

1.Spotify

Take the case of Spotify, Spotify uses Google's Big data analytics services like Big query and Dataflow to generate personalized music recommendations for its users.

2.Dominos

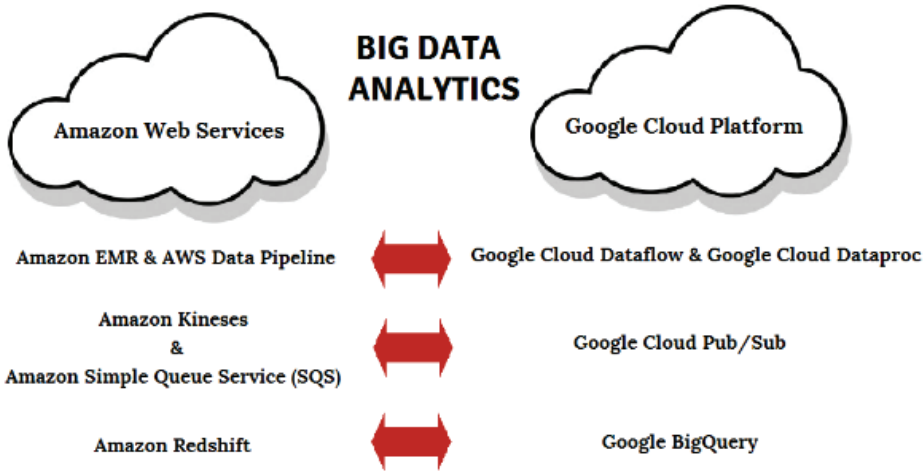
Dominos aggregates all the data from its multi-channel distribution network and uses Google analytics premium services and BigQuery to ascertain which of its marketing campaigns are working.

The massive demand for analytics services means that all the major cloud vendors now offer real-time data stream processing and analytics to their consumers. Google has gone further and launched a unified programming model that combines batch and stream processing in one product, Google's cloud Dataflow.

Google is adding new features and cutting down prices in its Data warehousing and analytics segment. It announced a reduction in the prices of BigQuery at the NEXT customer conference in 2016. The change made long term storage cheaper for its customers by automatically reducing storage price by 50% after 90 days. Google also keeps simplifying the analytics game by adding sophisticated data visualization tools like Google Data Studio 360 that aggregate all analytics workflows into one tool.

Comparing Google's Analytics services with Amazon

Both Amazon and Google offer comparable services in analytics segment.



Often comparisons are drawn between Amazon's RedShift and Google BigQuery, but both differ in pricing, ease of use and flexibility.

Amazon's Redshift runs on a self-provisioning model and you pay for the amount of time that the servers are kept online.

In Google BigQuery, there is automatic provisioning of resources as it is a completely abstracted system that works on a No Ops model. The pricing is more economical when compared to amazon. And with the recent drop in prices for long term storage, Google surely wins the price battle vis-a-vis other Big Data Cloud Service vendors. Plus, Google strengths lie in data management and its data centers are optimized for scaling and analytics. The reason cited by Spotify for its shift to Google cloud platform also talks of google's superiority in the provision of data services.

"Spotify chose Google in part because its **services for analyzing large amounts of data,** tools like BigQuery, **are more advanced** than data services from other cloud provides."

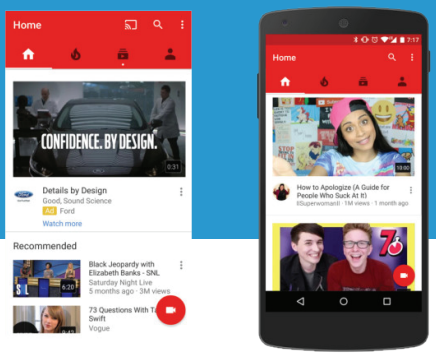
-Nicholas Harteau, VP of Infrastructure, Spotify

The next round of cloud adoption will be driven by enterprises launching IoT products. Since IoT products are inherently data-intensive, they will drive further adoption of Google cloud platform services.

CHAPTER 10

The (Machine) Learning Enterprise

Why plain ole SaaS is passé



IBM Is About to Become the Best Weather Forecaster Ever – WIRED, 10.28.15

Machine learning technique boosts lip-reading accuracy – TechCrunch, Mar 24, 2016

How Google's AI Auto-Magically Answers Your Emails – WIRED, 03.17.16

The Next Wave Of Enterprise Software Powered By Machine Learning – TechCrunch, Jul 27, 2015

Machine Learning (ML)….you can't ignore the buzz around it these days. Every tech conference you attend people are waxing eloquent about how it's the future of enterprise IT. Tech magazines too seem to be fishing for reasons to write another article around machine learning possibilities. Google is adding to the buzz with the launch of its machine learning platform and ML email app Inbox.

Before we compare how public cloud mega vendors like Amazon and Google are mainstreaming this powerful tech for everyone, everywhere, let's understand what Machine Learning (ML) is and does:

Machine learning is the science of recognizing patterns in large data sets and making predictions based on mining Big Data. ML applications work with not just large but wide data to

generate predictive and prescriptive insights to guide enterprise decision-making. ML algorithms improve over time and with every use.

ML is powering many services we use ranging from the recommendation engines on Netflix, Youtube to the Smart Reply feature in Gmail.

Looks like machine learning will be the magic potion that spices up the next wave of apps we use.

Now let's compare AWS and GCP Machine learning Services:

Amazon launched its machine learning services in April 2015 for existing AWS customers.

Some features of Amazon ML

1. Amazon ML includes a wizard that helps those with little or no-prior introduction to ML get started with the service.

2. Amazon ML is designed to work with other AWS services like Redshift and S3. But if you are not an AWS user you will first need to move your data to Amazon to use its ML service.

3. Amazon ML offers limited data cleaning and data transformation capabilities

4. It currently doesn't allow extension/creation of algorithms and also has limited settings for tuning the algorithm for optimization.

5. Amazon ML also supports evaluation of algorithms using performance metrics

Now let's see what Google did for cloud machine learning…

Google launched its Machine learning Platform at the GCP NEXT conference in 2016. Google's ML services include Google Prediction API and its pre-trained models Cloud Vision API, Cloud Speech API and Cloud Translate API. It also open sourced the machine learning technology that powers its apps to developers all over the world. Google TensorFlow machine learning library can now be used by developers to build sophisticated new algorithms.

Google Machine Learning Platform

The platform has two main parts

1. One which allows developers to build ML models from their own data

2. Another offers developers pre-trained models

Google ML allows developers to train their ML models by allowing easy access to other Google Cloud services.

Developers can access data from services like Dataflow, Bigquery, Dataproc, Cloud Storage and Cloud Datalab and train their algorithms on this data.

Some of the pre-trained models offered on GCP.

- Cloud Vision API
- Translate API
- Cloud Speech API

Several apps built atop these pre-trained models are already being launched to customers.

The Buzz seems real and looks like Machine Learning as a Service will drive the next round of enterprise cloud adoption. Google is the clear frontrunner vis-à-vis rival Amazon in Machine Learning Services.

CHAPTER 11

Why Google Cloud?

Hear what Spotify & Snapchat say!

Spotify - Google Music to ears

Spotify, a popular music streaming service announced a shift to GCP in Feb 2016.

The story of Spotify's shift to Google in their own words:

Note: Excerpts from Spotify's company blog explaining the shift have been used.

Let us introduce ourselves:

Company most often associated with amazing music recommendations and awesome parties

We are:

Announcing Spotify Infrastructure's Googley Future

Why it's a big deal:

At Spotify we are obsessed with providing a streaming experience that feels as though you have all the music in the world on your phone.

How we did it until now:

Historically, we've taken a traditional approach to doing this: buying or leasing data center space, server hardware and networking gear as close to our customers as possible.

Why not use the Cloud like others?

Operating our own data centers may be a pain, but the core cloud services were not at a level of quality, performance and cost that would make

cloud a significantly better option for Spotify in the long run. As they say: better the devil you know…

What changed now?

Recently that balance has shifted. The storage, compute and network services available from cloud providers are as high quality, high performance and low cost as what the traditional approach provides. This makes the move to the cloud a no brainer for us.

Why Google?

What really tipped the scales towards Google for us however has been our experience with Google's data platform and tools. Good infrastructure isn't just about keeping things up and running it's about making all of our teams more efficient and more effective and Google's data stack does that for us in spades.

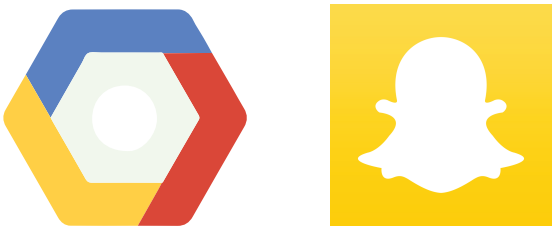
The one thing that tipped the balance:

Google has long been a thought leader in this space (data warehousing & analytics), and this shows in the sophistication and quality of its data offerings. From traditional batch processing with Dataproc, to rock solid event delivery with Pub/Sub to the nearly magical abilities of BigQuery, building on Google's data infrastructure provides us with a significant advantage where it matters the most.

Our Final thoughts:

We're pretty excited about our Googley future and hope you'll find it interesting too.

Snapchat - Google



Snap & Share via Google!

Unlike others of its ilk, Snapchat, the de facto social platform for millennials built its wildly successful app on Google bypassing AWS.

Here is what Snapchat co-founder Bobby Murphy said about why they chose to develop on Google's App Engine:

Easy to Use

"App Engine enabled us to focus on developing the application. We wouldn't have gotten here without the ease of development that App Engine gave us."

Bobby Murphy CTO and co-Founder

Auto Scaling

"Cloud Platform gives you upfront ease of use with the added comfort of knowing whatever you are building, if it needs to, will scale ad infinitum."

— Bobby Murphy, CTO, and co-founder

Launch Quickly

"And, at the time, obviously our biggest priority was to get a product in the

hands of users in the world - in the real world - as quickly as possible"

-Bobby Murphy, CTO, and co-founder

Let us focus on Adding New features

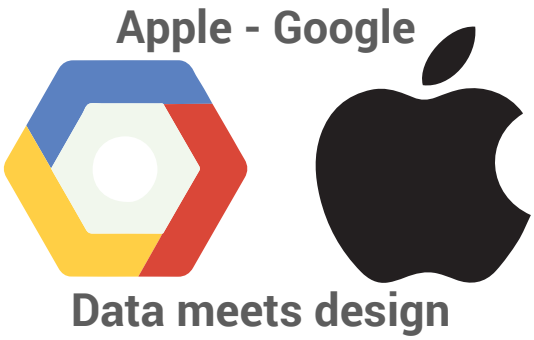
"Biggest benefit is just the fact that we can focus much less on maintaining infrastructure, and much more on building new stuff."

-Bobby Murphy, CTO, and co-founder

Update: Snapchat is now the third most popular social app among millennials.

#Snapchat: 100 million active users, 9000 snaps shared every second Click to Tweet

Despite rapid growth, the app built on Google App Engine hasn't experienced any major outages



Tech news site CRN reported that Apple signed a deal with Google to use the search giant's Cloud Platform for some of its iCloud services in March 2016. The news generated a lot of interest, with some speculating that it signaled an end to Amazon's domination of the cloud computing world.

But truth is, Apple has not migrated to Google Lock, stock and barrel. It still uses AWS, Microsoft Azure alongside its own data centers to host its inter-net services.

In Feb 2016, Morgan Stanley had reported that Apple spent around $1 billion per year on Amazon's AWS. A part of this money will now flow to Google's coffers.

But, Apple's move to GCP should be seen as a diversification strategy instead of a competitive defection.

Why?

- It still uses AWS and Microsoft Azure platforms besides GCP and its own data center

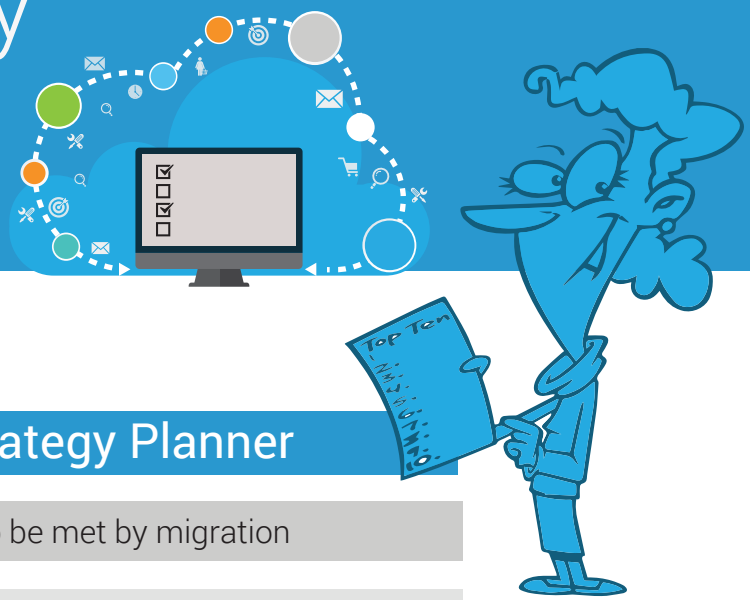
- It is spending billions of dollars on building new data centers to reduce its dependence on cloud vendors.

But Apple's move is a 'shot in the arm' for Google. The deal said to be worth $400-$600 million in revenue, comes at a time when Google is trying hard to win new enterprise clients to its platform. The deal puts a stamp of approval on Google's Cloud services from its major rival Apple.

CHAPTER 12

Planning Your Enterprise Cloud Strategy

What You Should Put On Your Wish List!



Enterprise Cloud Strategy Planner

Identify business objectives to be met by migration

Design a Cloud strategy
(Hire an outside specialist if required)

Identify applications/workloads that can be moved to the cloud

Decide upon a cloud deployment model
(Private/Public/Hybrid)

Decide on a vendor strategy
(Single or Multi-vendor)

Select Cloud Platform(s) & Implementation Partner

Create a Roadmap
- Break strategy into a set of actionable items
- Map each actionable item to accompanying benefits
- Identify quick wins for early implementation

Develop Benchmarks to assess Cloud success

Startup?

Let's tweak the plan a little....

1. Set out the Idea

2. Explore both on-cloud and off-cloud development options

3. List business objectives to be met by cloud adoption

4. Find the Right Cloud Vendor (Hire a Cloud tech specialist)

5. Make a list of requirements (Current, Future)

6. Identify Cloud Platform that meets your needs

7. Product development process

    1. In-house
        a. If you are not familiar with technology, this is a bad idea
    2. Outsource
        a. Outsource it and focus on core business functions like marketing and sales.

8. What to look for in your Product Development Partner?

    a. Comes through a referral/ Has good client testimonies

    b. Has handled similar projects in the past

    c. Offers competitive pricing

    d. Has some understanding of business/industry being targeted

    e. Takes ownership of development, testing and deployment.

    f. Agrees to meet quality bench marks

    g. Promises timely delivery

    h. Can ensure coordination and regular progress updates

    i. Look for a long-term partner who will handle post-launch product upgrades

9. Launch Product/Service

Conclusion

Now, we are nearing the end....

You know all about Google Cloud Platform and how it compares to Amazon Web services. You now have the tools to script a successful cloud strategy for your firm. It's finally time to begin your cloud journey!

Wait! Don't leave before you read this cautionary tale....

This was a time when the social gaming wave was sweeping the world. Zynga, a social gaming firm saw its user base skyrocket. The company was using AWS for its services. Both surprised and pleased with its phenomenal success, its top management decided it was time to ditch the hired accommodation. They set out on an ambitious plan to build their own datacenters. But in their excitement they forgot two facts:

> **Consumer loyalty is a fickle thing.**
> **The next big disrupt or is just around the corner**

While the executives at Zynga were busy changing their strategy, their customers were busy acquiring a new preference, a love for mobile gaming. The demand for Zynga's desktop and browser-based games soon crashed. Thankfully, Zynga could abandon its plans of building datacenters and return to the safe confines of AWS. The Cloud was after all the better place for Zynga.

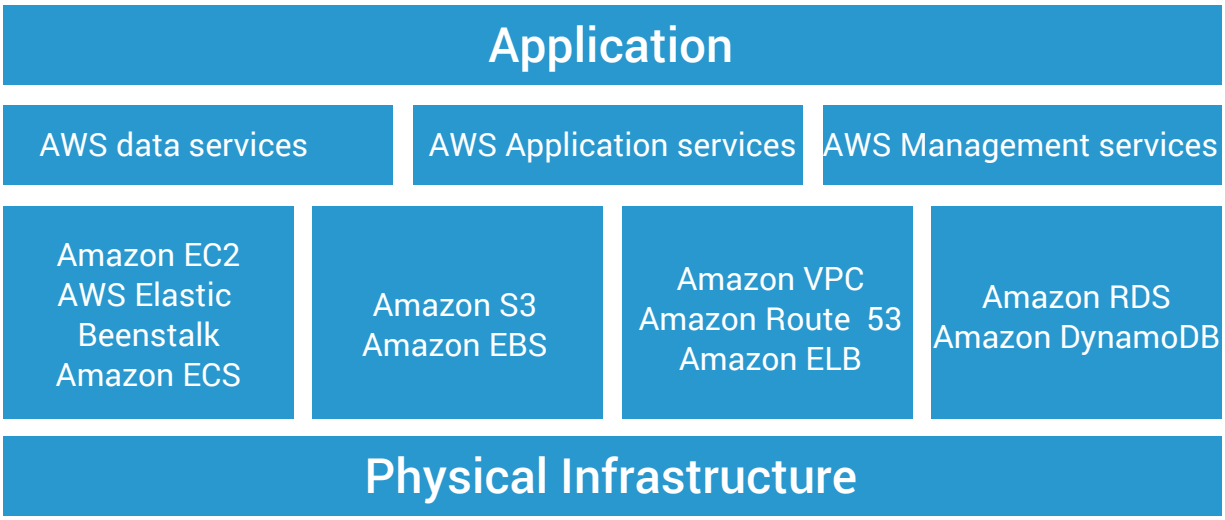
Annexure A

AWS building-block services

The fundamental AWS products are:

- Amazon Elastic Compute Cloud for virtual compute
- Amazon Simple Storage Service and Amazon Elastic Block Store for storage
- Amazon VPC for networking
- Amazon RDS and Amazon DynamoDB for databases

Higher-level building block services are built on these fundamental services. These can range from a platform as a service (PaaS), such as AWS Elastic Beanstalk, to more abstract services, such as Amazon Kinesis.

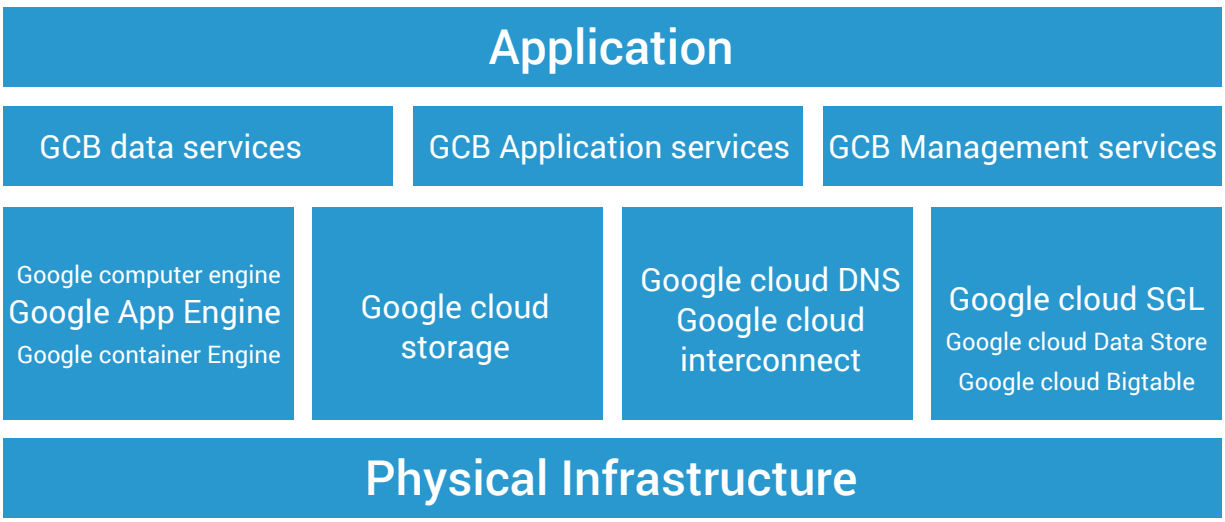


Google Cloud Platform building-block services

The fundamental Google Cloud Platform services are:

- Google Compute Engine and Google App Engine for virtual compute
- Google Cloud Storage, which allows you to store large or unstructured data objects
- Google Cloud DNS and Google Cloud Interconnect for networking basics
- Google Cloud SQL, Google Cloud Datastore, and Google Cloud Bigtable for databases.

Like AWS, GCP too layers a number of higher-level services on top of these fundamental ones.



Some higher level services offered by Google include: Stackdriver for monitoring cloud operations, the Cloud Deployment manager and Google's Machine Learning Platform.

Mapping services of AWS to GCP

Service Category	Service	AWS	Google Cloud Platform
Compute	IaaS	Amazon Elastic Compute Cloud	Google Compute Engine
	PaaS	AWS Elastic Beanstalk	Google App Engine
	Containers	Amazon Elastic Compute Cloud Container Service	Google Container Engine
Network	Load Balancer	Elastic Load Balancer	Google Cloud Load Balancing
	Peering	Direct Connect	Google Cloud Interconnect
	DNS	Amazon Route 53	Google Cloud DNS
Storage	Object Storage	Amazon Simple Storage Service	Google Cloud Storage
	Block Storage	Amazon Elastic Block Store	Google Compute Engine Persistent Disks

Service Category	Service	AWS	Google Cloud Platform
	Cold Storage	Amazon Glacier	Google Cloud Storage Nearline
	File Storage	Amazon Elastic File System	ZFS / Avere
Database	RDBMS	Amazon Relational Database Service	Google Cloud SQL
	NoSQL: Key-value	Amazon DynamoDB	Google Cloud Bigtable
	NoSQL: Indexed	Amazon SimpleDB	Google Cloud Datastore
Big Data & Analytics	Batch Data Processing	Amazon Elastic Map Reduce	Google Cloud Dataproc, Google Cloud Dataflow
	Stream Data Processing	Amazon Kinesis	Google Cloud Dataflow
	Stream Data Ingest	Amazon Kinesis	Google Cloud Pub/Sub

Service Category	Service	AWS	Google Cloud Platform
	Analytics	Amazon Redshift	Google BigQuery
Application Services	Messaging	Amazon Simple Notification Service	Google Cloud Pub/Sub
Management Services	Monitoring	Amazon CloudWatch	Google Cloud Monitoring
	Deployment	AWS CloudFormation	Google Cloud Deployment Manager

Note: The contents of this annexure have been sourced from Google

BitMin is a global cloud advisory and technology services firm. It is primarily looking to serve clients interested in Google Cloud Platform. The company can work on fulfilling enterprise cloud needs, whatever they maybe. From handling cloud application development to Google marketplace integration of existing apps, BitMin has done it all. Some of their startup clients have trusted BitMin with bringing their ideas to life by outsourcing the entire product development to them. Enterprises large and small have also availed BitMin's in-house expertise in cloud planning and in scripting successful cloud strategies. The company has some of the best talents in cloud computing space working with it and is able to leverage them to deliver world-class solutions for its clients. As a Google Cloud Partner, BitMin publishes regular blogs, newsletters and e-books to inform its audiences of the developments in the cloud computing space and also gives helpful advice on navigating any changes.

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