Computer Systems Engineering

Information Security and Networking

Cloud Computing

Bibliographic Research 2 - In what cloud and in what model

Marco Ricardo Cordero Hernández

Edgar Guzmán Claustro

Jal., November 13, 2023

Index

Introduction....1
Related works....2
  Cloud model....2
  Cloud providers....2
    AWS....3
    IBM Cloud....3
    Microsoft Azure....4
Discussion....4
References....5

Introduction

A small business is looking for the best solution to adapt their current sales model to modernity. They need an online store, trying to make their sales rate bigger during the winter season and they're searching for simple, elastic, and affordable updates. They know about cloud services and the whole features that cloud providers can bring to the table. The owners only have three simple necessities to cover in order to keep the business working: make it faster than the old on-premises infrastructure, capacity to store information, and a straightforward way to manage user's credentials. All of these without the average IT support to manage and patch the services.

Some cloud providers that they have in mind are Amazon Web Services (AWS), IBM Cloud and Microsoft Azure. In this report, a detailed documentation about the services that are required to meet customers' needs will be explained. Having the impartial criteria to decide over the best service provider, looking for the one that gives facilities to deploy and manage services, the one with the cheapest price and the one with the best service operation.

Clarifying the services that are needed to solve the problem without naming them with a specific cloud provider term are:

Compute service

- Public IP
- Linux (e.g., Ubuntu Server, Fedora server, Arch)
- Minimum 32 GB of disk space
- Minimum 8 GB of RAM
- 4 CPU

External Storage

- Needs to be size scalable (vertical)

MySQL Database

- Minimum 100GB of storage
- Current version of the platform
- Secure
- Connected or inside the compute service
- 2 CPU
- 8 RAM

Related works

Cloud model

The case proposed for the current theoritical implementation supposes one of the most basic case analyses, in which the resources found within the client's implementation majorly need to be publicly accessible. For example, if one of the main goals stated is to increase the user traffic through reliable means, their online store has little to no alternatives other than being deployed through a web platform.

Zhang et al. [1] detail at least four different types of clouds: public, private, hybrid, and virtual private. A public cloud such as Amazon Web Services [2] or Google Cloud [3] offers multiple services for multiple purposes to a general public, meaning that as long as their users can cover up the prices, all resources would be available.

Private clouds are devoided of providers, rather implementing all infrastructure within the organization or acquiring the services of a *virtual private cloud*, this being accessing the resources of a public cloud through secure connection means such as a VPN. This type of cloud might be useful for governmental agencies that need to assure the integrity and privacy of what's being stored inside their network.

Virtual private clouds, as already discussed, are a subset of *hybrid clouds*, in which the best of public and private clouds are taken into a single infrastructure that can provide the required privacy and automatic scaling as needed.

After briefly reviewing several types of clouds, a question arises: what cloud model would be suitable in the current case? An online store would often consider two major components: users and transactions, highly connected between them. To ensure historical purchases and ease of access data, user information would need to be stored inside a highly available database, which is a whole topic on its own; also, transactions involve the most valuable asset inside a capitalist society: money, thus, it's guarding would be highly desired. Transactions would often be passed to a third party, so their storing wouldn't be advisable inside businesses databases, and for this, secure connections are needed to carry out the communications securely.
At this point, both public and private parts of the commerce have been discussed, pointing at a probable hybrid cloud implementation as the way to go, however, the gist of said type of cloud needs a public cloud provider and private on-premises resources such as servers and network hardware. If the owners of this store aren't tech savvy (as hinted in "without […] IT support" part), why should the burden of installing and administering physical infrastructure exist when a public cloud would already be in use? In fact, public cloud solution is the most effective way of implementation regarding the relationship of cost and effectiveness (this will be discussed in the next section).

To summarize, the most suitable cloud for the current case would be ***public cloud***.

Cloud providers

AWS

Amazon Web Services (AWS) [2] is a comprehensive and widely used cloud computing platform provided by Amazon. It offers a vast array of computing services, including computing power, storage options, and databases, along with tools for machine learning, analytics, and Internet of Things (IoT). AWS enables businesses and individuals to access scalable and flexible computing resources on a pay-as-you-go basis, eliminating the need for substantial upfront investments in physical hardware.

For the principal requirements of the business, this cloud service provider can easily cover the necessities.

Compute service: EC2 instance [5]. Amazon offers a various diversity of compute types of instances. The best solution for this case is the c7g.xlarge type. This instance has 4 vCPU, 8 GB of RAM and the disk space can be specified when it is created, also the public IP. Also, the network Bandwidth is up to 12.5 Gbps and the EBS (Elastic Block Storage) used to store the OS is up to 10 Gbps.

External Storage: S3 bucket [6]. The service that the provider recommends for this type of purpose is a simple bucket with no limitation space to store files. The user only needs to pay for the current space usage. As an additional thing, there are six types of buckets. Each one was designed for a different purpose depending on the specification requirement.

MySQL database: Amazon RDS [7]. Amazon provides a relational database; this service is designed to work without complex configuration and management. Using the PaaS (Platform as a Service), just providing the functionality to the user. The customer can select MySQL engine with resizable storage db.t3.large.

The additional value of this cloud provider is that it can enable the customer's infrastructure to be scalable. The best application for this scenario where the web store is expecting a high traffic during the season, a scalability service can be added, in this service the resources are added when needed and being disable when they are no longer require. Another important service that can be added for security and management purposes is the VPC (Virtual Private Network) [8].

The cost for this implementation will consider the three first services. Also, considering 24/7 usage. The monthly cost of the three services would be **211.45 USD** and yearly **2537.40 USD**. The calculation was made using the AWS calculator [9], considering the US Virginia region.

IBM Cloud

IBM Cloud is a suite of cloud computing services offered by IBM (International Business Machines Corporation) [10], one of the world's largest technology and consulting companies. IBM Cloud provides a variety of infrastructure, platform, and software-as-a-service (IaaS, PaaS, and SaaS) solutions to help organizations build, deploy, and manage applications and services.

Compute: Virtual Server [11]. IBM Cloud provides diverse types of Virtual servers. For this application, a bx2-2x8 virtual server is used with Ubuntu Server 2vCPU, 8 GB of RAM with a minimum storage of 100GB. Note that the instance configuration can be updated any time or be configured with elasticity.

External Storage: Cloud Object Storage [12]. Having the same capacities of AWS S3 bucket, the only difference is that the bucket's classes are less. The user only pays for the storage that is inside the bucket.

MySQL: Database for MySQL [13]. Database that is designed to run with MySQL engine. The problem using PaaS with IBM Cloud is the diversity of infrastructure types. They only offer three diverse types of servers, having the smallest one 12GB of RAM and 120GB of space, 3 cores and 3 administrator accounts.

The cost calculation for the three services was performed using IBM Cloud's comprehensive estimation tool [14]. The projected expenses amount to a monthly sum of **363 USD**, with an annual total reaching **4365.24 USD**.

Microsoft Azure

Microsoft Azure, commonly referred to as Azure, is a cloud computing platform and service provided by Microsoft [15]. It offers a wide range of cloud services, including computing power, storage, networking, databases, analytics, artificial intelligence (AI), Internet of Things (IoT), and more. Azure enables businesses and individuals to build, deploy, and manage applications and services through Microsoft's global network of data centers.

Compute: Virtual Machines [16]. Like the competitors, Microsoft Azure provides diverse types of instances with a diversity of OS and types. The selected for this case is a F4 instance with 4 vCPU, 8 GB of RAM and 64 GB of disk space.

External Storage: Blob Storage [17]. This is the direct equivalent of AWS S3 storage type, in which data lakes can be created to address multiple purposes for different business needs. Azure assures scalability, durability, and availability for almost permanent access to remote objects. In this case, Azure does provide several types of storage types with corresponding pricing.

MySQL: Azure Database for MySQL [18]. This Database is based on the PaaS model, the owner does not need to directly manage the database. Service similar to the competitors. The database that was selected was D4as 4vCore. Covering all the necessary amount of data in a simple instance.

The final cost for the current Microsoft Azure implementation was calculated using the pricing calculator provided by Microsoft [19]. Having the same conditions of usage for the three cloud providers, the monthly cost will be **458.84 USD** and a yearly cost of **5506.08 USD.**

Discussion

Now that three different public cloud providers have been explored and equivalences of the same services across all of them have also been compared, the decision has been made, and ***AWS*** prevails over the others, as now it has several information sources and knowledge databases to implement and maintain their services; but mostly, the cost schema and pricing surpasses substantially other vendors.

The second option of implementation is at debate, as Azure would often have a better quality of their services than IBM's, however, the former's prices even doubles AWS' costs. The debate or discussion for this auxiliary fallback resides at the main goal of this hypothetical implementation: a new online store. This scenario generates several aspects of consideration, one in which the previously existing commerce already has previous sales and a successful economic background, meaning that money liquidity wouldn't be a problem for the initial investment of cloud implementation. The other case would be that of emerging operations, for both sales operations and online presence, meaning that without monetary resources, the cheapest solution is preferred.

The previous dilemma is an outstanding decisive factor when selecting cloud vendors, because almost every action and every service implemented comes with a cost, previsible? Yes, it can get out of hand quickly? Also, yes. The thing in these initial steps is that the clients must state clearly what they want, as this apparently simple discussion can determine the success or failure of the project, and this isn't restricted to only cloud implementations, this can be seen all over several industries, most predominantly in the technological sector.

In this occasion, the recommendation for the supposed client is to go for a cloud-based infrastructure, contrary to on-premises solutions, and just a few of the vast cloud market vendors were explored, but the current analysis is just a demonstration of a study case that could be seen in the real world, having to dissect what's currently being offered in order to maximize usability and reduce costs.

References

[1] Zhang, Q., Cheng, L. and Boutaba, R. (2010) 'Cloud computing: State-of-the-art and research challenges', *Journal of Internet Services and Applications*, 1(1), pp. 7–18. doi:10.1007/s13174-010-0007-6.

[2] Aws.amazon.com. 'AWS'. [Online]. Available: https://aws.amazon.com/.

[3] Google.com. 'Google Cloud'. [Online]. Available: https://cloud.google.com/.

[4] Aws.amazon.com. 'AWS Cloud Products'. [Online]. Available: https://aws.amazon.com/products/?aws-products-all.sort-y=item.additionalFields.productNameLowercase&aws-products-all.sort-order=asc&awsf.re%3AInvent=*all&awsf.Free%20Tier%20Type=*all&awsf.tech-category=*all.

[5] Aws.amazon.com. ‘Amazon EC2’. [Online]. Available: https://aws.amazon.com/ec2/.

[6] Aws.amazon.com. ‘Amazon S3’. [Online]. Available: https://aws.amazon.com/s3/.

[7] Aws.amazon.com. ‘Amazon Relational Database Service’. [Online]. Available: https://aws.amazon.com/rds.

[8] Aws.amazon.com. ‘Amazon Virtual Private Cloud’. [Online]. Available: https://aws.amazon.com/vpc/.

[9] Aws.amazon.com. ‘AWS Pricing Calculator’. [Online]. Available: https://calculator.aws/.

[10] IBM. ‘What is the IBM Cloud platform?’. [Online]. Available: https://cloud.ibm.com/docs/overview?topic=overview-whatis-platform.

[11] IBM. ‘Virtual Servers’. [Online]. Available: https://www.ibm.com/es-es/cloud/virtual-servers.

[12] IBM. ‘Getting started with IBM Cloud Object Storage’. [Online]. Available: https://cloud.ibm.com/docs/cloud-object-storage?topic=cloud-object-storage-getting-started-cloud-object-storage.

[13] IBM. ‘IBM Cloud Database solutions mean results’. [Online]. Available: https://www.ibm.com/cloud/databases.

[14] IBM. ‘Cost estimator’. [Online]. Available: https://cloud.ibm.com/estimator.

[15] Microsoft. ‘Azure’. [Online]. Available: https://azure.microsoft.com.

[16] Microsoft. ‘Azure Virtual Machines’. [Online]. Available: https://azure.microsoft.com/en-us/products/virtual-machines.

[17] Microsoft. ‘Azure Blob Storage’. [Online]. Available: https://azure.microsoft.com/en-us/products/storage/blobs.

[18] Microsoft. ‘Azure Database for MySQL’. [Online]. Available: https://azure.microsoft.com/en-us/products/mysql.

[19] Microsoft. ‘Pricing calculator’. [Online]. Available: https://azure.microsoft.com/en-us/pricing/calculator/