

1802975 Cloud Cloud Computing Computing Architecture

by Sam Jackson

Submission date: 27-Jan-2023 01:37PM (UTC+0000)

Submission ID: 196290815

File name:

12026_Sam_Jackson_1802975_Cloud_Cloud_Computing_Computing_Architecture_460442_694158717.docx
(41.06K)

Word count: 2445

Character count: 13554

Title	Cloud Computing Architecture
Assignment	Cloud Computing Architecture Assignment 1
Lecturer	Mike Dacey
Student Number	1802975
Course name	Cloud Computing

Cloud Computing Assignment One:

Virtualisation: Virtualisation is the process of creating virtual forms of typically physical computing resources, entirely on a cloud hosted Service, also known as a virtual environment, using a cloud service provider such as Microsoft Azure or Amazon Web Services (AWS). Recourses such as storage devices, servers, even a network of these virtual devices. “Virtual means “not physically existing as such but made by software to appear to do so.”” [1] By having a cloud network with multiple devices and resources allows the user to easily manage and scale their network. This makes the management of an IT network much more efficient.

Virtualisation can be done in many ways,

Native or bare-metal virtualisation (Type 1 Hypervisor): This Method involves running directly on the host's hardware, making them highly efficient and ideal for enterprise use. Examples include VMware, Microsoft Hyper-V.

Hosted hypervisors (Type 2 Hypervisor): These run on the top of a host operating system, which can require additional resources to run the host operating system, this can lead to reduced performance and increased system management difficulty however type 2 can also provide additional functionality. Examples include Oracle VirtualBox and VMware Workstation.

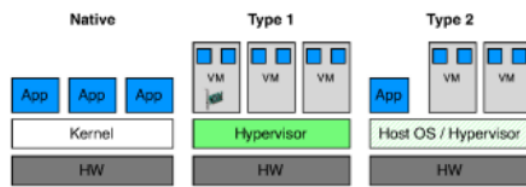


Figure 1 Diagram depicting Hypervisor Types [2]

Storage Virtualisation: The Virtualisation of storage involves creating virtual storage devices, such as hard drives within a cloud-based environment. This allows multiple virtual storage devices to share the same physical resources, RAID is an example of a physical resource method, allowing for a more efficient use of storage and very beneficial ability to grow the capacity of the storage resource as it is required, this makes the management of storage more efficient. Most cloud storage providers offer a Pay-as-you-go option that means originations only pay for the storage they are using. Storage Virtualisation is also a solution to disaster recovery, as organisations can use what is known as glacier storage in AWS, an “unlimited scalability” [3] storage option, meaning that unlimited data amounts of backups can be stored in the cloud for a very low rate and user will only pay the premium if they request the data to be pulled down form the cloud.

Server Virtualisation: Server virtualisation is a very common type of virtualisation. It allows multiple virtual servers to run on a single physical server, hosted by a 3rd party cloud provider. Usually in a reginal datacentre, this enabling a more efficient use of resources and better flexibility in the deployment and management of servers. This can be achieved through the use of either Type 1 or Type 2 hypervisors as discussed above.

Virtual machines (VM): Are a software-built simulation of a physical computer system. In the context of cloud computing, a virtual machine is a segmented amount of compute resource from a

larger computer system that runs its own operating system and applications, just like a physical computer would.

Virtual machines are created and managed using a hypervisor, both type 1 and 2 as explained in the virtualisation segment of this report. Hypervisor sits on top of the physical hardware and manages the allocation of resources to the various virtual machines. such as CPU, memory, storage, and network, and allocates them to the virtual machines as needed.

Virtual machines have many benefits, such as:

Isolation: Virtual machines work off isolated environments used for applications this improves security by reducing the impact of a security breach.

Portability: Virtual machines can be easily moved between physical resources; they can also be backed up and resorted this improves disaster recovery options for business continuity without majorly effecting uptime.

Cost-effective: Virtual machines can be created and deleted if and when needed, this allows for efficient use of resources and reduces costs, as well as scalability, cloud service providers will only charge for the resources used by the VM's meaning that during a quiet period for a website for example when the site is not receiving visits the resources utilisation will be low, this also works in reverse so during a peak time the resource can grow to cope with the demand, this will give the users a better experience when using services housed via cloud solutions.

However, there are some drawbacks, such as the need for a skilled workforce to manage, build and deploy the cloud environments/ VM's created.

Essay:

My task is to assess the advantages of migrating the companies on-premises application to the cloud. As we are a small or medium enterprise (SME) that runs an Ecommerce website and web Service, I have considered various cloud services available. In this essay, I will explain the differences in each Service, IaaS, Paas and SaaS, as well as outline their benefits and drawbacks. Additionally, I will explore factors like costs incurred, support offered by the cloud services, and required knowledge & skills needed for each approach.

One of the most significant advantages to moving to cloud computing is flexibility. By having our services in the cloud, we can quickly deploy and manage resources, enabling us to test new features and functionalities more effectively. Furthermore, by hosting our services in the cloud we will have access to the built-in disaster recovery strategies available such as data replication and automated backups which guarantee improved availability alongside increased reliability for the eCommerce and associated web services.

Moving an on-premises application to the cloud we will have total scalability. Cloud services make it easy to adjust resources like CPU, memory, and storage when necessary - this is especially beneficial for eCommerce websites that experience traffic surges during peak times. Additionally, opting for cloud services allows us to take advantage of the pay-as-you-go option offered by the cloud providers. This makes it more affordable than maintaining inhouse infrastructure. This can be particularly useful for SMEs looking to cut down costs related with power consumption and cooling requirements.

Infrastructure as a Service (IaaS) offers virtualised computing resources, like virtual machines (VM's), storage, and networking. These services will especially benefit our eCommerce website and web services as it will enable us to create independent environments for different applications or customers. IaaS is cost effective and flexible; IaaS providers offer a huge range of pre-configured VM types, Amazon offer 50+ different types [4] however it requires specialised skills and tools in order to manage the virtualised resources properly, hence the most commonly associated issue with IaaS being network infrastructure management [5].

Platform as a Service (PaaS) Is a great option when it comes to ease of developing, testing, and deploying applications. This type of cloud service option can be particularly beneficial to an eCommerce website; PaaS is a cheaper option to IaaS, it also allows for ease of deployment and resources management so that new features and functionalities can easily be tested and deployed. However, it's important to acknowledge some potential drawbacks such as limited control over the underlying infrastructure as these aspects are managed by the cloud providers.

Software as a Service (SaaS) is a cloud computing model that hosts applications through the internet. These services are usually hosted and maintained by third-party cloud providers, granting users the ability to use them without needing installation, maintenance or updating on their own devices – this enables users to access the software/ web services from anywhere. SaaS is a developer friendly method to hosting a service on the cloud, due to the fact that SaaS follows standard technical principles for programming interfaces and exchange of data, “usually simple and standardized, relying on the Internet HTTP protocol.” [6]. SaaS is becoming increasingly popular because it's convenient to develop, deploy and access - making it a widely adopted cloud service. However, one major issue with SaaS is that you need a quality and dependable internet connection in order to utilise its services; something which may prove difficult for people working remotely.

Migration of our on-premises eCommerce and web service to Infrastructure as a service (IaaS)

In order to move our eCommerce website and web services to Infrastructure as a Service (IaaS) I will be working with virtual machines (VMs) while striving for high availability and zero data loss, I will outline the methods used in this migration process. Additionally, I will be basing this off the IT industry standard of four 9s availability: an accepted measure of service levels that guarantees 99.99% uptime.

To ensure an acceptable level of availability, We will be utilising multiple virtual machines in a cluster. If one VM fails for any reason, the other VMs seamlessly take over its load using tools such as auto-scaling groups and load balancers. Additionally, replicating data across multiple servers in different Availability zones and regions allows us to guarantee that our information is always accessible even if there's a disaster. Availability zones are physical locations within a certain area. For example, Microsoft has two Availability Zones, UK South with the data centre located in London and UK West and it's data centre located in Cardiff.[7] Each availability zone is an individual data centre with redundant power, cooling, and networking systems to ensure optimal operation. This gives you the capacity to operate workloads throughout various availability zones so that if one encounters problems, it will be easy for them to switch to another seamlessly. Regions are usually separated into different countries; each Region has various availability zones within them. This allows for the capability of running workloads across multiple regions so if there is a natural disaster like an earthquake or flooding, your workload can be rapidly shifted to another region.

To meet the industry-standard four 9's availability, IT systems must remain available 99.99% of the time, or a maximum of 52 minutes downtime per year. This can be accomplished by utilising several

layers of redundancy such as multiple VMs, regions/availability zones and network infrastructure components along with regular testing and maintenance to ensure that all systems are operating optimally, and any potential issues are quickly addressed. So by setting up a disaster recovery plan and testing it regularly is essential to guarantee that it functions properly when an emergency arises.

After taking into consideration the cloud services discussed and available budgets for the two projects the follow cloud structures are how they would be setup in migration to IaaS.

Project 1: Would be created in Microsoft Azure, Availability zones and regions will be fully utilised. This will be achieved by deploying multiple VMs, using Azure's managed disk replication features and backup solutions across different availability zones within a region. This is highly effective and allows for maximum uptime, as if one zone goes down, the workload can still be handled by those operating in other areas, by having this many available zones in use this project will accrue a large cost.

Project 2: Due to the reduced budget Project 2 will follow the same setup, by using Azure to deploy multiple VMs, managed disk replication features and backup solutions however they will remain within the same availability zone. This is still highly effective and allows for maximum uptime, if server within the datacentre fails, the others will be able to seamlessly pick up the workload and service will remain unaffected, however has discussed previously if that data centre was to go down due to a natural disaster, then it would cause a temporary service interruption. It is worth noting that Microsoft over a service level agreement that is compliant within the four 9's industry standard [8]

Authorisation and authentication are fundamental for a safe online environment, especially when it comes to the cloud. By authenticating users in public services and restricting access to resources, we can reduce cyber-security risks significantly.

Authorisation is the process of assessing whether a user or system has access rights or abilities to a certain resource. This is often done by determining the user's required access privileges. This can be based on their role and duties users may be allowed access to certain files, abilities such as read, write and edit or of an application.

Authentication is the method to verifying an individual's identity. This can be achieved by asking for a username and password combination or using more sophisticated strategies such as biometrics E.g Face ID and fingerprint recognition and other methods. The purpose of authentication is clear: ensure that only those with permission are able to access the system.

To protect digital systems from potential cyber-attacks, multi-factor authentication (MFA) has become a must when it comes to security. It requires users to provide multiple forms of identification, such as passwords and biometrics like fingerprints; making it nearly impossible for hackers to gain access even if they know someone's password. Utilising MFA is an essential part in ensuring the safety and integrity of our systems.

Restricting user permissions to the least amount required is an essential security measure. This implies that a user should only be allocated access to complete their job and nothing more. For example, if someone just needs to review documents, they don't need permission to edit them — this makes it difficult for potential attackers who have gained access from getting hold of sensitive information. This also minimises the amount of damage an individual can accidentally cause due to lack of training or awareness.

Network security groups (NSGs) are an essential when it comes to managing and protecting a network. They enable administrators to create rules that allow or deny traffic dependent on criteria like IP address, protocol, and port—ultimately safeguarding the system from malicious external cyber-attacks like DDoS and unauthorised users.

References

- [1] G. A. A. Santana, "Data center virtualization fundamentals". Indianapolis, Ind: Cisco Press, 2014. [Accessed November 2022]
- [2] C. Dall, S.-W. Li, J. T. Lim, and J. Nieh, "ARM Virtualization: Performance and Architectural Implications," *Operating systems review*, vol. 52, no. 1, pp. 45–56, 2018, doi: 10.1145/3273982.3273987. [Accessed November 2022]
- [3] Amazon Web Services, Inc. or its affiliates. "Amazon S3 Glacier storage", Amazon, 2022. [Online] Available: [Amazon S3 Glacier Storage Classes | AWS](#) [Accessed November 2022]
- [4] Amazon Web Services, Inc. or its affiliates "Amazon EC2 Instance Types", 2022, [online] Available: <http://aws.amazon.com/ec2/instance-types/>.
- [5] Sunilkumar S. Manvi, Gopal Krishna Shyam, "Resource management for Infrastructure as a Service (IaaS)", *Journal of Network and Computer Applications*, 2014 [Online] Available: <https://www.sciencedirect.com/science/article/pii/S1084804513002099>
- [6] M.A. Cusumano, "The Changing Software Business: Moving from Products to Services," *IEEE Computer* 41, 1 (Jan. 2008), 20–27. [Online] Available: [Cloud computing and SaaS as new computing platforms \(acm.org\)](#)
- [7] Microsoft Azure, "Azure geographies" Azure. [Online] Available: [Choose the Right Azure Region for You | Microsoft Azure](#)
- [8] Microsoft Azure "General availability: Azure Availability Zones in UK South" Azure. [Online] Available: [General availability: Azure Availability Zones in UK South | Azure updates | Microsoft Azure](#)

1802975 Cloud Cloud Computing Computing Architecture

GRADEMARK REPORT

FINAL GRADE

84/100

GENERAL COMMENTS

Instructor

Virtualization/VM: 21

Cloud Services: 22

Availability: 19

Security: 22

Feedback:

++++++

I would liked a little more discussion of the components of a VM.

I would have liked a little more on the benefits/drawbacks of the different types of services.

You could have expanded on the meaning of locations, availabiltiy zones and resource groups.

Generally this is a good discussion of the concepts.

PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5
