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Data Centre Virtualization

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Abstract

The following paper discusses the virtualisation of data centres in UWTSD and AWS as the chosen service. AWS is one of the top cloud platforms which provide different types of services including topmost security. This paper will also discuss star topology as the best topology for the universities to adapt. It will continue with the discussion of XEN which is the type 1 hypervisor in AWS and how XEN stands for one of the most reliable and safest hypervisors. The following paper also provides information about the scalability and sustainability of AWS. Even though virtualization has some limitations but it can be a good investment for the university. It can be cheaper than other processes. Star topology is a reliable topology in which if one cable fails to work the remaining cables still work to execute the process as it is mainly focused on centralized network management which makes it the best choice for any organization. This article will conclude with research on SAN.

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Introduction

Transforming physical services into virtual data is known as data centre virtualisation. This is done by using cloud computing technology [1]. The technology centralizes the IT operations and the purpose of the operations like sharing, storing and managing data. The benefits of data centre visualisation in an organisation are discussed in the following research. AWS (Amazon Web Services) provides one of the best infrastructures for data centre virtualisation which is also known as cloud computing. The organisation does not need to pre-plan about the data as data centre visualisation already provides the plan and infrastructure for the IT services of an organisation. By using AWS technology UWTSD can access the services the storing, power and database management. This research will discuss the design and architecture of the network topology and the limitations and benefits of using AWS services in UWTSD. A storage area network (SAN) is a wide network service of storage devices that can be accessed by multiple systems at once. Mainly SAN, which is based on block storage, is used for data storage. The data centre security prepares the security for the database of an organisation and protects the data from attacks, threats and unauthorised access of the data. The scalability of data cloud computing is discussed next, which refers to the capacity to swiftly enhance or reduce the capability of IT systems. The hypervisors in cloud computing and how they work to isolate operating systems and applications will be explored in more detail. The ABC Data Ltd. Organization that operates three data Centre through virtualized technology provides cloud storage for fee-paying customers. The necessity of security policy in an organisation and ABC Data Ltd will be discussed. An organization's security policy is a written document that outlines how the organisation will protect itself against risks and assaults. The security policy clearly outlines each employee's responsibilities with the information that needs to be protected by

external threats. The major three types of security policies are Organizational, System-specified and Issue-specific policies. Storage area network (SAN) increases storage efficiency and makes it more effective. This paper will also present how SAN works in securing data from corruption and threat from outer sources and different types of DRSs (Disaster Recovery Systems). It is an organizational process of recovering access to IT infrastructure after the disaster and cyber-attacks.

Research Methodology

Information will be gathered through different journals and books on the structure of data centre virtualisation and the impact of data virtualisation. By reviewing different articles of the different organisations about AWS implementation the information of AWS will be collected. The information on different statistics of different topological impacts on organisations will be taken by following secondary research methods. The secondary research about different industrial reviews on AWS will also be used in this paper. The knowledge on SAN, security and network topology will be collected by following the e-books. By reviewing the records of AWS users from different the sustainability report will be put together and used. This type of research methodology has been chosen because it is more effective and faster than primary research methodologies. It also provides the foundations and information about every topic. Through this research methodology, the information which was already conducted by others has been gathered. This increases the efficiency of the information as it was already confirmed by different researchers.

This research will be classified as a qualitative study based on the research goals.

Data Centre Technologies

Virtualization, Standardization and Automation are the top three components of data centre technologies [2]. High availability, Storage hardware, network hardware and remote operation are also important components of data centre technologies. The data centre is combined with both physical and virtualised data resources. The physical resources refer to the hardware and its operating systems. Added the resource abstraction and virtualization layer is based on the virtualisation tools which are operational. Standardization and modularity are some of the key components of data centres as data centres are built on standardized hardware with modularly designed architectures. As standardisation and modularity inspect the economical part of the data centres like procurement, deployment and maintenance so it assists in reducing the cost and investments. And automation refers to the task department which performs the auto tasks like provisioning, patching and monitoring without any supervision support [3].

Virtualization: How does it work

The process of running virtual instances on actual hardware of a computer system is virtualization stated by [4] but said it is mainly the process of running multiple operating systems on a single system simultaneously is called virtualization. The crucial software which makes virtualization possible is called the hypervisors. The hypervisors copy the available resources for the guest machines to use. The bare-metal hypervisors are called the type 1 hypervisors, a software layer that is installed directly on top of the server physically. It is an OS that assists in running virtual machines. Once the type 1 hypervisor is installed and the machine is booted up it displays the command prompt screen. This displays the hardware and networks details of the

server after connecting the monitor. It also shows the memory details, the type of CPU and the IP addresses. In AWS the type 1 hypervisor is XEN hypervisor. It virtualizes storage, CPU also manages and protects the hardware and system codes. XEN accesses full virtualisation and runs multiple OS in each OS. In each virtual machine run guest applications and OSs while the physical resources are shared. XEN stands for one of the most reliable and safest hypervisors. It furnishes the best security with the lean updated security, architecture and advanced industrial process.

Benefits of Virtualisation

The main benefit of virtualization is that increases scalability along with cost reduction and expense reduction [4]. Here are some key benefits of virtualization in the organization- using a virtual server gives more flexibility than non virtualized environment as it can transform into different types of virtual machines. It also reduces downtime and enhances the flexibility of disaster recovery situations. If an organisation faces any disaster it's easier to recover the virtualized environment comparing the actual environment. Virtualization allows the organisation to replicate the environment and so it becomes easy to recover. When organisations reduce the use of physical servers it consumes less power. It leads to organisational cost reduction and carbon footprint reduction.

Cloud Computing Implementation

Cloud computing is a revolutionary way for businesses is helping the field in different ways [5]. It allows different organizations to access the internet and other computer services even in remote areas. Agrees and added that cloud computing comes with different types of advantages and disadvantages so implementing cloud in an organisation can be difficult sometimes [6]. By following these steps an organisation can claim the full benefit of cloud computing- defining the project properly, selecting the actual platform, Stating service level agreements and Migration in different phases. In cloud computing scalability refers to the ability to easily increase or reduce the IT solution power. Scalability offers different types of benefits that an organisation required. Scalability makes cloud computing more convenient by saving time for the IT team in an organisation. It gives the administrator access to make changes as per the organisation need. The administrator can add more virtualised machines and make changes without changing the whole hardware. The scalability provides flexibility. The organisation can access high-level resources easily by adapting scalability. Another reason why organisations should adopt scalability is that it reduces the cost beforehand. In AWS the scalability detects the applications makes changes in the capacity as per the need stated by [7]. It assists in maintaining stable and pre-planned performances at minimum cost. The scalability of AWS also allows changes in multiple applications at once at a low cost. UWTSD should adopt AWS scalability as it will not only do the scaling quickly and maintain the whole performance but it also will perform the tasks at a low cost.

Scenario 1: UWTSD

Scenario Analysis

The main purpose of data centre virtualisation is to lower the dependency on a single source by creating architecture to connect multiple platforms at once in an organisation. A large part of data is handled by data centre visualisation so the security of the services becomes important. The implementation of AWS on UWTSD can assist the organisation in reducing the cost of different hardware, license and power support. It also allows the student of the university to access the information easier and faster. AWS is one of the most comprehensive cloud platforms. It provides the best services and security of those services like remote computing, server, storage and application development. The services of AWS provide different structures and models like infrastructure technologies, computation as per the organisation's requirement. To implement the data centre virtualisation plan there must a proper network topology. It is the method of how the links and nodes of a network should be organised and structured. The different types of service provided by AWS are Platform as service (PaaS), Infrastructures as service (IaaS) and packaged software as service (SaaS). To update the organisation's central IT system AWS is the best option the university can rely on. By choosing AWS the UWTSD can save the cost of hardware, license and other services like application development. The authority will have the facility to provide online education to the students. This will save time and the education of the students will not be hampered in any situation.

Virtualized Data Centre migration

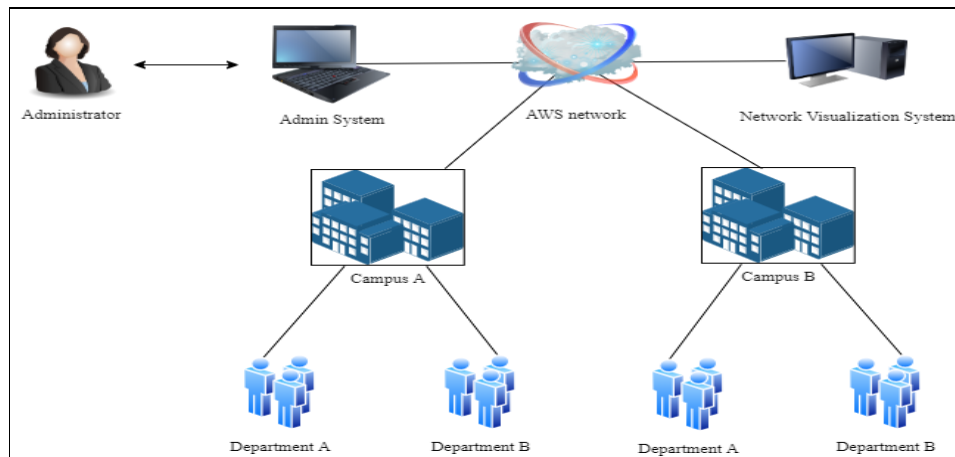
Data centre migration helps the assets of the data centre to move from one place to another also known as the data centre relocation. Data centre migration works in three steps data centre migration, application migration, data migration. By following these key areas an organization can perform the data migration- Contractual obligations is the step where the individuals need to review the terms and conditions, Hardware inventory where the individuals need to make a plan of the hardware that needs to be replaced, application inventory where the individuals need to inspect the applications and the hardware in which those applications are running and communication inventory where the individuals inspect about the all non-tangible networks and configurations that are required to replaced or moved. IP addresses, internet networks are included in those resources. When it comes to migration there are various solutions depending on the requirements like- Multiple cloud portfolios can simplify and enhance IT performances, The scalability and efficiency are enhanced by the Hyper-converged infrastructure (HCI). It allows the integration of the multiple components in one unit and produces the preconfigured result before the last deployment step. The traditional and modernized data keeps the entire data safe on the site. It also provides greater control over the data by involving a third party.

Challenges and different approaches

The consideration that must organizations keep in mind before implementing virtualization is- Virtualization can come up with security sometimes. While implementing data security must be one of the top priorities. Being data most important parts of an organization or industry data get targeted easily [8]. In virtualization, it becomes hard sometimes to operate the whole thing several links work together to perform a single task. Even though the process of virtualization is fast but sometimes it creates delay because of some extra steps that need to be taken to finish some specific tasks. The cost of virtualization can be high sometimes for the universities as it requires hardware and software and some applications which need to be manufactured or developed. Even though virtualization has some limitations but it can be a good investment for the university. It can be cheaper than other processes. Virtualization costs are predictable so it becomes easy for the organizations to manage the budget. It reduces the workload of the IT staff of an organization as the hardware and software are updated automatically. The IT staff do not need to work individually for the updates and installation. Providing resources will become easier and faster with virtualization. It does not need physical machines or other IT component sets. Cloud migration becomes easy with virtualization and the recovery speed is better.

Recommendations

Being the top platform for cloud computing AWS is currently adopted by most organizations. It provides the required and on-demand services like computation, databases, security. Through AWS these can be accessed by using the internet without monitoring the resources. Choosing AWS gives the organization pledge of having the latest designs and security for the data centre. Through the research, it is clear that AWS is more reliable than any other service as it offers better security and more features. AWS also offers more power and flexibility than any other service. To make changes in the organization with AWS, the organization must have a change management plan for the assurance of the services. The change management plan will make the process easy to make the plan less risky. The plan will include the development of capability layers. In each layer, there will be AMIs (Amazon Machine Images). The change management plan will not only deliver the cost of the project for UWTSD but also will balance the risk against the project. That will maximize productivity and will reduce waste [9]. The plan includes integration, automation and other categorized tools for making small changes in the process to lower the risks. Determination of scope, analyzing the risks, review of the process and pre-testing and validation, by following these steps the change management plan can be implied. The organization needs to standardize the way of change implementations. The change implementation plan should include the network topology changes too [10]. By choosing the star topology the organization gets a reliable topology in which if one cable fails to work the remaining cables still work to execute the process as it is mainly focused on centralized network management. The star topology is also highly efficient and scalable which makes it a safe choice for the organization for the data centre virtualization plan.



Star topology diagram for UWTSD

Network topology is a systematic way to arrange the links and nodes of networks. In computer networks, the different types of topologies are – Mesh, Bus, Star, Hybrid and Ring [11]. For this research, the chosen network topology is Star topology. In star topology, the physical elements are connected to a centralised hub. The main reason star topology should be implied in UWTSD is because it is easy to set up and reliable. It is less expensive than the topologies. As all the nodes are connected individually with the central hub so the central hub functions even if the other nodes stop working. In this topology, after getting permission from the administrator the central hub takes action to transfer the messages. Any new site can be added to this topology by updating the central hub only [12]. It will be easier for UWTSD to operate one central hub rather than operating multiple hubs at once.

Scenario 2: ABC Limited

Scenario Analysis

The security policy refers to the written documentation of procedures which will protect the organization from outer threats and attacks [13]. The security policy provides the company's beneficial reports along with the threats to those benefits. The security policy must outline the main items of organizations that need to be protected from outer threats [14]. In an organization when there are chances of threat attacks, the company should prepare the protection from those threats. Security policy creates a plan for the organizations about the procedures that need to do when a threat occurs. CIA (Confidentiality, Integrity and Availability) is the main principle of the security policy. Confidentiality refers to the protection of the data from unauthorized sources. Integrity ensures the authenticity and accuracy of the data and information and protection against unauthorized modifications. Availability is the protection of the information from unauthorized destruction and it ensures that the data can be accessed only when it is required. The information security policy refers to the collection of statements that are made to guide the staff gestures regarding the organization security [15]. Insecurity policy there are three types of policies those are- Organizational, System-specified and Issue-specific policy. The organizational security policy refers to the set of rules which are inflicted by an organization or company to protect important data. The security policy arrangement only allows authorized users to access information from the systems or organizations. The security policy also limits the access and modification of the information to authorized resources. The limitation of the authorization depends on the sensitivity of the information and user profiles [16]. The security policy defines the requirement security of the employees. It reflects the direction for the control framework

creation for an organization to provide security. The policy also holds the instructions for the staff to provide guidelines for the staff behaviour regarding the policies. IF there are some possibilities for the ABC Data Ltd. Regarding the work, the organization must provide a security policy to identify and detect the threats and possible solutions regarding the risk. The security policies of ABC Data Ltd. should also provide clear, well-structured plans regarding the access of the organization's system [17]. There different types of organizational policies, which assists the organization are- Acceptable use policy (AUP), Disaster recovery plan, Business sustainability plan, remote access policy and access control policy [18].

Security Policy of ABC Limited

The clean, comprehensive and set of well-planned rules which manage an organization's system and information is referred to as the security policy [19]. The main purpose of the security policies is to protect the employees and data and to save the organization from unauthorized access. By having a security policy, the organization ABC Data Ltd. can avoid the penalties. The security policy also helps an organization in improving its reputation and value. The violation of data and information can hamper the reputation of an organization. The security policies make sure that no employee from the organization takes any step to violate the reputation or guidelines. The maintenance of policy with data protection is checking and tracking the confidential information and what the employees are accessing. The ability to access and change the information accused by the employees will lower the risk of data violation. ABC Data Ltd can build a brand image and improve the organizational culture by adapting the security policies which provides the customer's privacy policy. As security policies allow people with proper

credentials to access the information. The security policy of ABC Data Ltd. will make sure that only the organization level can access the systems of the company and organizational activities are documented in a proper way that can be tracked easily by the administrators. Security policy provides a viewpoint of the organizational benefits. Once the employees get familiar with the security policies; it increases the operational performance of the staff [20].

Benefits of SAN

A storage area network (SAN) is a high-speed network that provides free network access to the storage. It provides block-level network access [21]. The SAN is the combined network of storage elements, hosts and switches which are interconnected with different types of technologies and protocols. It is mainly used in enhancing the performance of the networks, better availability and storage effectiveness and utilization. SAN plays a vital role in maintaining the sustainability of a business by maintaining the business activities. The infrastructure of SAN shows the ability to identify the weaknesses of an organization and implement proper security [22]. SAN analyses the infrastructure of the for the possible loopholes and weaknesses of an organization. SAN follows the specific techniques which are- Encrypting the stored data, isolating or categorizing the users, providing communication and network interface security, removing the single failure points and reducing the weakness and possible risk chances of the networks. There are two types of working processes of SAN, it either works on FC (Fiber channel technology) or iSCSI (Internet small computing system interface) [23].

Importance of SAN in ABC Limited's data protection

SAN follows the data replication process by which the data of ABC Data Limited can be protected. SAN will connect the storage with the network of ABC Data Limited to inspect the storage and locate the security storage properly where it is required to be stored. This type of operation will be done by the SAN physically by using the storage subsystems like the storage array of ABC Data Limited. SAN will perceive the process of data protection in three layers- Host layer which refers to the servers that are directly attached to the network, the Fabric layer which refers to the cable attached to the network and the Storage layer which refers to the various types of storage devices collection [24]. By adapting SAN ABC Data Ltd. can have the following benefits- Improvement of bandwidth. As SAN structures are mainly focused on bandwidth bottlenecks so it assists in the reduction of bandwidth problems by reducing the performance time and increasing the traffic stated by [25]. SAN will make it possible for ABC Data Ltd. to have consistent data security and protection. The organization will have the accessibility of the data whenever required.

Disaster Recovery System

Disaster recovery is the method of an organization that can regain the accessibility and functionality of the organization's infrastructure after a natural disaster event [26]. Disaster Recovery will focus on the replication of data from the premises which will be affected by the disaster of ABC Data Ltd. organization. It will create copies of the lost data from the cyber-attack or failure of equipment of ABC Data Ltd. Disaster recovery plans make it possible for the organizations to get the data back to where it is required after backup. Some of the processes of the disaster recovery plan which ABC Data Ltd. should follow to improve the services and protection of the services are- Creating a disaster recovery team with the specialist of this field. Each member of this team will manage the disaster recovery plan by executing assigned duties [27]. Analyzing the risk on the organization and planning the strategies to prevent the possible risks. This plan will also create proper documentation of ABC Data Ltd.'s important information. ABC Data Ltd. will be able to plan and categorize and relocate the data which need to be protected. RPO (Recovery point objective) analyses the maximum loss ABC Data Ltd. can face after a disaster. The analysis will create a guideline for ABC Data Ltd. with the selected IT strategies. Testing and optimizing can be another step for any organization, in this step the team needs to keep the process constant by updating the plan continuously and by responding to the attacks immediately. Disaster recovery saves the cost of an organization. So, adapting the disaster recovery system ABC Data Ltd. can reduce the business cost including the fast recoveries.

Conclusion

Data centre virtualization is a transformation of physical services into virtual data. This article argues that a correct network topology, which is a systematic manner of arranging network links and nodes, is required to accomplish the data centre virtualisation strategy. Mesh, Bus, Star, Hybrid, and Ring are the many types of topologies in computer networks, and star topology is the safest topology to pick for an organisation since it is dependable and less expensive than the other topologies. This paper also concluded that the XEN server is the type 1 hypervisor in AWS which virtualizes storage and the CPU also manages and protects the hardware and system codes. In today's generation, it is important to use real-time data from the core physical assets. AWS allows the organisation to access unlimited secure computing resources. AWS provides UWTSD with the pledge of having the latest designs and security for the data centre for the future as AWS is one of the top energy purchasers internationally. The security policy plays an important part in an organization's structures and designs. Organizational, System-specified and Issue-specific policies are the main three security policies. The organizational security policy will protect ABC Data Ltd. when the chances of threat or attacks will occur on the company and will prepare the protection of from those threats. The relevance of SAN in enterprises was also explored in this research, as well as how SAN may help with organisational security by linking storage devices to networks. SAN asp assesses the organization's potential risk. Through this paper, it has been shown how SAN and disaster recovery will assist ABC Data. Ltd in protecting data and preventing data loss.

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