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Letterkenny Institute of Technology

Assignment 1

Lecturer:	John O'Raw
Report Title:	Assignment 2
Submit to:	Blackboard with all files as specified in the assignment, submitted as a single ZIP folder.
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Programme of Study:	M.Sc. in Cloud Technology
Module:	Private Cloud Technology

Please refer to the Institute's Quality Assurance Handbook, Version 3.0, September 2018

1. Practical work, forming part of the CA of a module, will only be assessed if the student has attended the relevant practical classes.
2. CA work must be completed within the schedules and specifications (specified in the CA brief). Students who submit CA late may forfeit some or all the marks for that wor
   k.
   a. The total marks available for an assessment be reduced by 15% for work up to one week late; i.e. a grade of 50% would become (50*0.85) = 42.5%
   b. The total marks available be reduced by 30% for work up to two weeks late i.e. a grade of 60% would become (60*0.7) 42%
   c. Assessment work received more than two weeks late should receive a mark of zero.

   Work is deemed late when an unauthorized missing of a deadline has occurred.
3. CA must be the student's own work, refer to Plagiarism Policy, in section 5.7 of the QA manual.

Technical Description

A SAN (Storage Area Network) solution based on iSCSI was chosen for storage requirement. It is a network that connects various storage devices, which are accessed by a network of servers and can be managed together by a common web interface. There are two main types of technologies used for SAN – Fiber Channel and iSCSI. Incase of Fiber Channel, Host Bus Adapters along with Fiber Channel Switches are used for connecting Storage devices and servers, which form a dedicated storage network. iSCSI on the other hand, uses same switches, cables, adapters as incase of an ethernet network and there is no need for a separate network for a storage solution based on iSCSI. Target and Initiators are configured in iSCSI where target is the storage source and initiator a server initiating access request to storage device. For this project, an iSCSI-based SAN solution from Synology, Unified Controller UC3200 which is an active-active IP SAN was chosen. UC3200 has dual controllers which can be managed using a single portal and provide high availability such that if one controller goes down, other one will take over. It is designed for virtualization environments and supports platforms like VMWare vSphere 6.5, Microsoft Hyper-V, Citrix Xen Server and OpenStack Cinder. For this project, Microsoft Hyper-V was used. The solution is scalable, has 12 drives by default and can be scaled to have 36 drives using expansion unit – RXD1219sas, which is a 2U expansion unit and ideal for upgrading UC3200 storage solution. It also has redundant power supplies. Each controller has its own memory and maximum memory capacity of 64 GB per controller is possible. Over 140,000 4K Random Write IOPS are present. By default, 12 SAS drives bays are available which is scalable to 500TB using expansion units. UC3200 will be connected to two ethernet switches for redundancy and two Add-In Card, E10G18-T1 which has one 10GBASE-T port were ordered for extra ports. Supported RAID (Redundant Array of Independent Disks) types are RAID 0, 1, 6, 5, 10. RAID technology provides protection while storing data on multiple disks and also improves performance. Disk capacity was calculated considering RAID 10, which uses a combination of disk mirroring (RAID 1) and disk striping (RAID 0). RAID 1 duplicates data using disc mirroring and RAID 0 stripes data across various drives to increase performance. UC3200 supports SED (Self Encrypting Drive) to encrypt data to hard drives and thus provides security at hardware level. It has a SATA DOM which separates operating system from the rest of the data present in the drive. Snapshot Replication using Btrfs file system can be used to create snapshots for volumes providing instant recovery of VMs present in iSCSI LUNs if a disaster happens.

UC3200 uses dual CPUs and provides performance of 140000 4K random write IOPS with low latency. Consultant had specified 100 IOPS/VM and the storage solution chosen provides 140 IOPS/VM which is more than required. IOPS/GB specified by consultant was 10IOPS/GB and with the solution used getting 7 IOPS/GB initially when the total disk space is 20TB. As the disk space used increases, peak performance will reduce. Another UC3200 can be added for extra IOPS if required. Calculations done for storage, IOPS, peak performance, VM disk space etc. are shown below.

Calculation of Storage Sol Requirement In 5 years

No of VMs (Virtual Machines)	No of Applications	No of Instances of Applications	Total Storage for VMs	Total Storage for Database	Storage Requirement In 5 Years
1000	100	10	20 TB	80TB	100TB

Initial Phase Storage Sol Requirement Calculation

No of VMs	No of Applications	No of Instances of Applications	Total Storage for VMs	Total Storage for Database	Total Storage
100	10	10	2TB	8TB	10TB

IOPS Calculation		
Total IOPS Present	**No Of VMs**	**IOPS/VM**
140000	1000	140

Peak Performance Calculation

Total IOPS	Disk Space	Peak Performance (Initial Phase)
1,40,000	20TB	140000/20000=7IOPS/GB

No of VMs and Servers Calculation

Dell R440 servers of 256GB RAM, 2X240GB SSD are provided by vendor and five of them will be used in a cluster. It has been assumed that Linux Operating System will be used and disk space of 20GB per VM has been considered. Since, initially 2TB of disk space has been allocated for VMs (Check table above), 2TB/20GB = 100 VMs will be possible with 2TB space.

Dell R440 – Total Disk Space – 480GB

Considering each VM needs roughly 20GB, 480/20 = 24 VMs per Dell R440 possible. Since, we are planning 100 VMs initially, we would need 5 servers as each server can support roughly 24 VMs. Let's assume, 20 VMs per Dell R440. More Dell Servers will have to be provided as number of VMs increase.