Report: Moving to Azure

STEP 0: Problem Background

Contoso is an online cloth merchandise company specializing in selling activewear. They have a rented space in a local data center. They have one system administrator who makes sure all servers are working properly 24x7. Their hardware is getting old and they must decide on whether they need to spend $22,000 for new hardware or move their business to the Azure cloud services. The following list represents their current on-premises infrastructure:

Server 1:	**Purpose:** WordPress web server
	CPU: 8 Cores and 60% average utilization
	RAM: 16 GB and 87% average utilization
	HDD OS: 500 GB capacity with 57 GB used
	Web URL: Contoso.com
	IP # Public: 200.200.100.50
	IP #: 10.10.1.11
	Firewall: Inbound TCP 2222-2224, 80, 443
	Usage: This is Contoso's only web server. It runs WordPress and eCommerce services. Their on-line store is always open, and they receive orders 24x7
	This server uses ports 80 and 443 for HTTP and HTTPS traffic

Server 2 & 3:	**Purpose:** Microsoft SQL 2019 **CPU:** 8 Cores and 30% average utilization x2 **RAM:** 16 GB and 87% average utilization x2 **HDD OS:** 500 GB capacity with 240 GB used x2 **HDD Data:** 2 TB SAN (Storage Area Network drive) **IP #:** 10.10.1.12 and 10.10.1.13 **SQL Cluster:** SQLCluster.Contoso.Com **IP #:** 10.10.1.14 **Firewall:** Inbound TCP 2222-2224, 1433 **Usage:** These two servers are running Microsoft SQL cluster services. SQL Always-On service is fully configured as Active-Passive nodes. The 2 servers use an external attached SAN drive for all data storage such as product descriptions, transaction logs, and clients lists. Annual data growth is negligible. These servers use the standard SQL inbound TCP port 1433
Server 4:	**Purpose:** ABC Backup and Restore server **CPU:** 8 Cores and 30% average utilization **RAM:** 16 GB and 87% average utilization **HDD OS:** 500 GB capacity with 164 GB used **HDD Backup:** 40 TB **IP #:** 10.10.1.15 **Firewall:** Inbound TCP 2222 **Usage:** The ABS backup software runs daily at 8pm. It stores the last 18 months of all the SQL data drive contents onto a local D: drive (HDD Backup) with 40 TB capacity.

Server 5:	**Purpose:** XYZ Antivirus server
	CPU: 8 Cores and 30% average utilization
	RAM: 16 GB and 87% average utilization
	HDD: 500 GB capacity with 43 GB used
	IP #: 10.10.1.16
	Firewall: Inbound TCP 2222-2224
	This server uses ports TCP 2222-2224 for the antivirus client
	Usage: The XYZ anti-virus services are essential for the security of Contoso's operations security. The server is always on and constantly running. It monitors all Contoso's servers and mitigates against viruses and hack attacks. Data grown is negligible.

STEP 1: Assessing the On-Premises Environment

Purpose: To identify the Azure services needed to ensure Contoso's business continuity in the cloud.

Current Environment Make a list of all current on-premises servers and services.	**SERVERS -** 1. WordPress Web Server 2. ABC Backup and Restore Server 3. Microsoft SQL 2019 Server 4. Microsoft SQL 2019 Server 5. XYZ Antivirus Server **SERVICES -** 1. ECommerce Service 2. Microsoft SQL Cluster Service 3. Backup Service 4. Anti-Virus Service
Matching Azure Services Match the list of on-premises servers and services to the corresponding Azure ones.	Make a list of all servers and services you would create on Azure, and why you chose each. As a hint, one of the servers is likely no longer needed. → The WordPress Server could be set up using these resources i.e 1 VM (Virtual Machine) along with a public IP, a DNS and a disk. → Instead of 2 Microsoft SQL servers we can replace them with a VM that is set up as a SQL server and a 2 TB disk can be mounted to this VM.

	→ The ABC Backup & Restore Server can be replaced by a VM using Azure Backup Service. → The XYZ Antivirus server can be set up using Azure VM and NSG can be used to filter traffic to other VMs from the Antivirus server.
Discussion Question #1 A - How can you verify the running programs and services on each of your on-premises servers? List the steps taken to identify the services running for each server. B - List your migration plans.	**A - Using Azure Migrate** ● Deploy & Configure the Azure Migrate appliance to start and initiate discovery on-premises. ● Any deployment method can be used for configuration as per the environment (VMware or Hyper-V). ● After deploying, we need to register it with the project and configure it to initiate the discovery. ● Discovery and Assessment Tool in Azure Migrate discovers and assesses on-premises VMware VMs, Hyper-V VMs, and physical servers for migration to Azure. **B - Steps for Migration** 1. Assess the current on-premises environment. 2. Look for similar or the same options on Azure. 3. Using the Price Calculator provided by Azure estimate the cost benefits and share them with the Stakeholders. 4. Once the stakeholders approve it, train people so that they work with the new system. 5. After planning how the migration can be done start testing on a small scale. 6. If it is successful then slowly migrate using Azure Migrate. 7. Always look for optimisations and improvements.
Discussion Question #2 On your on-premises servers: A - How can you find the listing of all windows firewall port exceptions? B - Do these firewall port exceptions have to match the NSG firewall exceptions? Please explain.	**A - Port Exceptions** → Control Panel > System and Security > Windows Defender Firewall > Allow an app or feature through Windows Defender Firewall. → List all active apps and running services - Control Panel > Programs > Programs and Features **B -** → Yes, the port exceptions must match the NSG firewall exceptions as it is an external firewall through which packets go through before reaching their destination. → If the port used for sending is opened on the windows server while being closed on the NSG then it will be discarded by the NSG firewall and vice-versa.
Optional Discussion Looking at the new Azure server farm, what will you change and why?	

STEP 2: Cost Estimates

Purpose: To provide the CIO with a monthly cost estimate after the migration to Azure.

Use Azure Pricing Calculator to provide the CIO with a monthly cost estimate, including:
- The number of VMs needed
- The RAM and CPU needed for each VM
- The amount of storage needed
- Any Azure services such as anti-virus, back-up, database, etc.
- Build a list/table that includes VM type (you may use the template below or create your own)

Build / fill out the table providing your current server farm and its corresponding Azure farm. List the potential Azure replacement for each of the on-premises servers, the VM type and monthly cost. Assume your company has Hybrid benefits and are willing to commit to 3-year agreements. Use the East US Azure zone. Show the cost of all servers with a three year commitment after applying Azure Reservations cost reduction. Compare the VMs prices with and without Azure Reservations.

Server Name	CPU Cores	RAM/HD	VM Type	Monthly Cost
WordPress Web Server	8	16/512 GB	F8s v2: 8vcpus, 16 GB ram, 64 GB temporary Storage; Compute Optimised	$133.48
SQL Server	8	16/512 GB + 2 TB	F8s v2: 8vcpus, 16 GB ram, 64 GB temporary Storage; Compute Optimised	$133.48 + $77.87
Not required				
ABC Backup & Restore Server	8	16/512 GB + 2 TB	F8s v2: 8vcpus, 16 GB ram, 64 Gb temporary Storage; Compute Optimised	$133.48+ $563.54
XYZ Antivirus Server	8	16/512 GB	F8s v2: 8vcpus, 16 GB ram, 64 Gb temporary Storage; Compute Optimised	$133.48

Discussion Question #1	→ Although Azure provides 99.9% availability, these 4 servers won't provide HA/DR for Contoso.
Discussion Question #1 Will these 4 Azure servers provide HA/DR for Contoso? Will their site be available 24x7, 365 days?	→ Although Azure provides 99.9% availability, these 4 servers won't provide HA/DR for Contoso. → Their site won't be available/up 24*7,365 days as it's possible that the servers may go for maintenance or also due to a data center outage due to a disaster or any other reason or other unforeseen reasons. → Still 100% availability can be achieved with help of DR and availability zones. **Azure guarantees 95% SLA for a single Virtual Machine and 99.95% SLA for 2 or more Virtual Machine Instances in the same availability set.** So in this case of the four servers above, we can conclude that- - The WordPress server will have at least 95% uptime. - The SQL server will have at least 99.95% uptime - The Backup server will have at least 95% uptime
Discussion Question #2 Can you change the VM type (upgrade or downgrade the configurations based on needs)? Try to downgrade one of the Azure VMs. Also, please provide a screenshot of the VM Overview settings, including VM name and size.	Yes, definitely the sizes of the VM can be scaled up or down depending on the needs but the functionalities, the previous one was providing must also be provided with the new one.
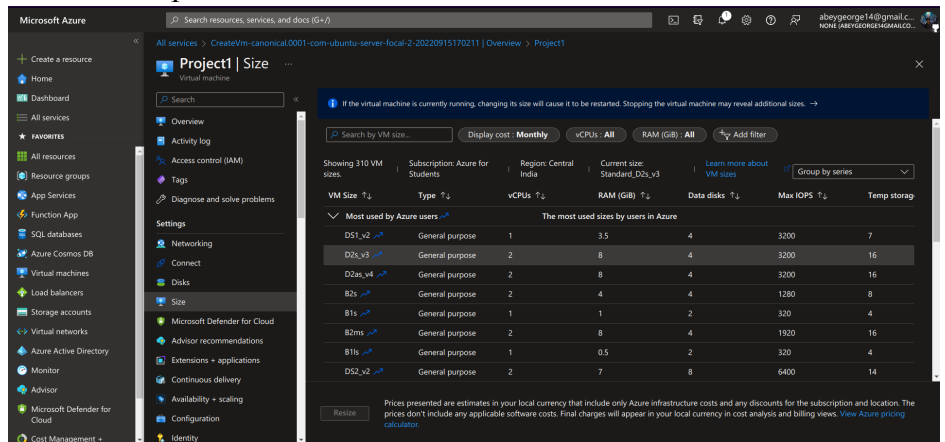
Since B1s don't support accelerated networking hence the VM resize failed. Therefore I have downgraded it by resizing it to DS1_v2.

I hope the example showed the VM can be downgraded.

Optional Discussion	The SQL Managed Instance cost is $855.26 whereas the SQL server on VM cost is $266.
Is Contoso better off with a SQL Managed Instance? Check Azure Pricing.	Therefore Contoso with a SQL server is fine to save cost.

Note: *If you are using Udacity Cloud Labs, you will be allowed to create a few VM sizes only. Visit* this *link to see all the possible VM sizes and go through the classroom instructions for more details.*

STEP 3 (OPTIONAL): Creating a VPN

Purpose: Build and set up a point-to-point (site to site) VPN connection between Contoso's on-premises and Contoso's Azure environments.

Note: *This step is entirely optional, and may take a considerable amount of time to implement. Therefore, it is suggested that you only attempt this step on your own after having satisfactorily completed all other project steps. You may find [this site](#) helpful in completing this optional step.*

STEP 4: An Additional Server

Purpose: Use Azure Resource Manager (ARM) to deploy one additional WordPress web server. This additional web server should provide web services redundancy and improve the web site's response time.

Create a replica of the WordPress server configuration.

The process is summarized as:
- The current WP server settings were saved as a template during the creation process. If not, you will need to add it to your Template store.
- Deploy a new VM from a template. In the Azure portal search for TEMPLATES and run that service.
- The WP server template should be listed there. Select it.
- Make sure you load and edit the parameters file and change the values for the new VM as needed. Values such as Name, Password, etc. should be unique. Use the Azure Template Services.
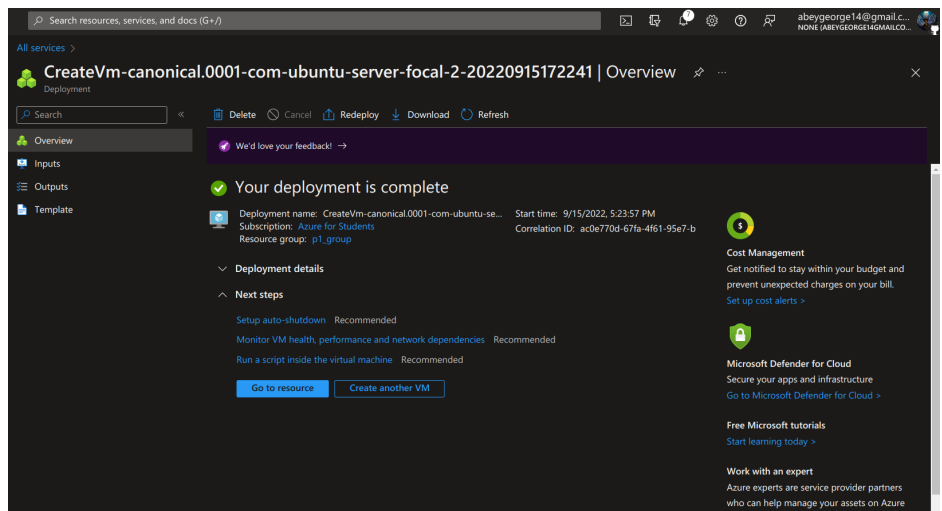
Make sure you already have a resource group to place the VM in. You may need to create a Servers-RG resource group if one does not exist.

Configuration Process Provide a screenshot of the template configuration process.	
Discussion Question #1 List the benefits (at least three) of using ARM templates. Think of when, why and how you can benefit from this Azure service.	The three benefits are as follows- 1. **Policy as code** - This code (ARM template) allows you to automate governance. When you use Azure policies, policy remediation is done on non-compliant resources when templates are used. 2. **Built-in validation** - The template is deployed only after passing validation. The resource manager checks the template before starting the deployment to make sure the deployment will succeed. 3. **Modular files** - The templates can be broken into smaller, reusable components and link them together at deployment time. Also, the templates can be nested inside another template. → Arm templates come under Infrastructure as a Code, basically, it means that you can create a configured or bare minimum configured Infrastructure like Virtual Machines, Networking services, disks etc via code.

Discussion Question #2

What is the difference between an ARM template and a server image? When will you use each and for what purpose? Make sure you consider each of the two.

ARM Template	Server Image
ARM Template is a JSON file that outlines your project's infrastructure and configuration. You specify the resources to deploy as well as their characteristics in the template. The declarative syntax is used in the template, which allows you to state what you want to deploy without having to write the programming commands to do so.	A VM/Server image is an executable image file of a virtual machine that is stored in a specific format. By uploading the image file to The hardware, we can create a new virtual machine.
The ARM template is just a piece of code so its size is negligible as compared to a Server Image. (template size limit is 4 MB)	The size of the executable image file is huge.
It is an Infrastructure as a Code.	It is an Infrastructure as a Service.

For general purposes, Server Image is used and also it supports up to 20 simultaneous deployments whereas Arm template is used when a specific service or a set of services are needed for which an image is not available for such case the required services can be installed via ARM Template and it supports up to 800 Resource Group Creation, basically it is used for large and/or specific Infrastructure Creation Automation.

Optional Discussion

Visit GitHub (https://github.com/azure/azure-quickstart-templates) and look at all available templates. Can you find a template that deploys 2 web servers, a load balancer, and a Resource Group? Send the link to the template or a screenshot clearly highlighting the one you will select.

STEP 5: Backup and Recovery

Purpose: Use the Azure backup services to setup recurring full daily backup jobs of your products and client's data. Test the backup process. No back is fully verified until you perform a successful restore.

You want to ensure your VMs are all backed up. You want to ensure a working replica of each of them is saved somewhere safe. The steps are:
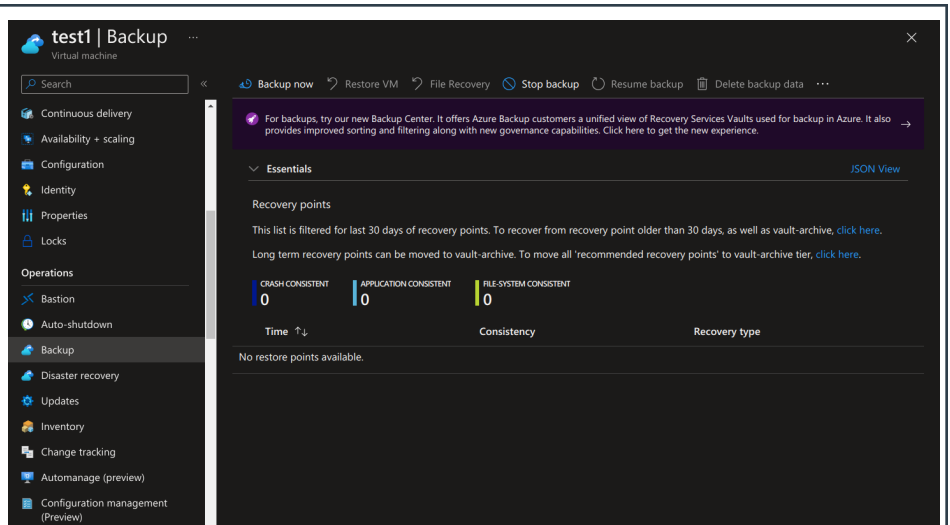1. Create a backup vault. Call it "ServersBackup".
2. Install Azure Backup Extension on the target VM.
3. Create a backup policy in the vault. Set retention policy and daily backup points.
4. Now it is time to link the target VM to the backup policy. Click on the target VM, select Backup from the Operations tab. Then select the newly created backup policy.
5. Alternatively, you can select Recovery Services Vault from the left navigation bar. Select all the VMs you want to add to the backup.

Backups

Provide screenshots of 1) the backup vault and 2) the backup policy.

| **Discussion Question #1**

What is the difference between Azure backup and site recovery? When would you use each service and for what reason? | The difference between Azure backup and Site recovery is that backup ensures data is safe and recoverable whereas Site recovery will keep the data available when an outage takes place. In layman's terms, it means that the workload will be shifted to an availability zone until the data center is back up.

Azure Backup is used to save time-based checkpoints of data or machine states which may be used for recovery.

Site Recovery is used during an outage or a disaster in a data center for high availability. |
| **Discussion Question #2**

Restore Time Objective (RTO) and Restore Point Objective (RPO) have similarities and differences.
A - How are they different? Make sure you consider each of the two.

B - Which backup strategy consumes more disc space? | **A -**
RPO - It indicates how recent the data is when it is recovered. The RPO refers to the amount of data that will be lost following an outage. It is the metric for the amount of acceptable loss of data if recovery needs to be done.

RTO - It is the amount of downtime a company can endure. In banking servers and others, a few seconds of downtime can cost thousands of dollars loss whereas in other cases it won't cause much of a problem hence RTO is used to decide **how long can services be down.**

B -
In workload recovery, the os and data disks will be replicated so will other infrastructure hence RTO defines a time the organization can endure.

RPO consumes more disk space as it saves all backups from before and decides by the policy which backup is to be used for the recovery. |

STEP 6: Antivirus Communication

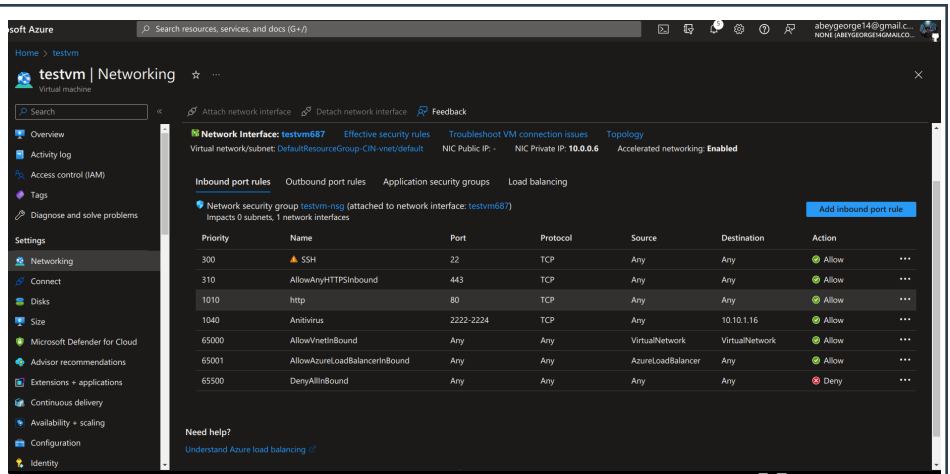Purpose: Enable the antivirus server to communicate with client VMs.

The XYZ antivirus server requires TCP ports 2222-2224 to communicate with the target client VMs. A firewall exception on the target VM is necessary to allow the XYZ server to scan and update the clients. Assuming Contoso will want to continue using their XYZ antivirus server, how will you alter the NSG (network security group) to allow all Contoso's Azure servers port: TCP 2222-2224 in from the antivirus server?

Each of the Azure servers you created have a unique internal (not public) IP address. Each one of these VMs has its own Network Security Group (nsg) associated with it as well. **Your task is to adjust the nsg of each server to allow for traffic coming from the antivirus server**. The steps are:

1. Make a list of each server and it's internal IP.
2. For each server's nsg, modify the settings to allow for TCP 2222-2224 from the antivirus server's IP number.
3. Test your work by trying to deploy the antivirus agent on one of the target servers.

| **Inbound Rules**

Provide a screenshot of the modified nsg firewall inbound rules.	
Discussion Question #1

Will you need to create an inbound port exception on your Windows OS? | Yes, an inbound rule should be added to the Windows OS Firewall. NSG is an external firewall to a Virtual Machine hence Windows is an internal firewall, ports on both should be open for communication to take place. |

Note: Once you have completed your report, feel free to shut down your Azure resources to avoid charges!