Customer Workload Migrations
Azure Pay as you Go (PAYG)
to Cloud Solution Provider (CSP)

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Contents

1. Overview

This whitepaper is written to document the process of migrating Azure workloads from one type of subscription to another. It covers a real customer scenario where workloads were migrated from an existing Azure Pay-as-You-Go (PAYG) Subscription to an Azure Cloud Solution Provider (CSP) Subscription belonging to a Tier-1 CSP Partner. These types of scenarios are becoming more common as Microsoft Azure continues to offer different Azure Subscription models for customers and partners alike.

2. Customer Situation/Problem Definition

Customer Situation:

Prior to the workload migrations, the customer had two subscriptions, one was a PAYG subscription where several Azure Resource Manager (ARM) Resources based workloads were deployed as part their production environment, and the other was a CSP Subscription with Microsoft Office 365 deployed in production. The Office 365 subscription is not relevant to this migration effort as it is already under a CSP tenancy.

For the sake of clarity and to ensure customer information is kept private, we will assume the Pay-As-You-Go subscription has a Tenant ID of **customer1payg.onmicrosoft.com** and the intent is to move Azure Resources from this Subscription to an existing CSP Subscription under the MSP Partner's CSP Tenancy, **customer1csp.onmicrosoft.com**.

Migrating to the Partner's Tenancy will help the customer reduce their Azure consumption costs and take advantage of the managed services provided by the CSP partner. As for the partner, they can now offer this customer additional Azure services under their CSP tenancy, thereby solidifying their customer relationship.

The below table lists the total number of Resources in the Customer's PAYG Subscription – 28 distinct resources.

Resource Type	Count
Network Security Groups	1
Public IP Addresses	6
Virtual Networks	2
Network Interfaces	6

Managed Disks	6
VM Images	5
Virtual Machines	2

Problem Definition:

The migration from PAYG to CSP subscription would have been seamless if the Virtual Machines (VMs) and the associated disks were built with the traditional Azure Storage Accounts rather than Managed Disks. Since the VMs are backed by the new Azure Managed Disks, the migration between subscriptions is not as simple or straightforward because the customer was required to take a workload downtime. This was due to the need to copy the Managed Disks to the new CSP Subscription, which required the VMs to be turned off during the copy process. Also, moving the Managed Disks and their associated resources via the Azure Portal is not supported by the current implementation, although this feature might become available in the future. This meant the customer's workloads (VMs) had to be taken offline, Managed Disks associated with them copied to the new Subscription, and the VMs brought back up in the new Subscription.

3. Desired End Goal

The desired end goal with this customer (and CSP partner) was to **Migrate** all Azure ARM Resources running in **Pay-As-You-Go** Subscription to an existing partner **CSP** Subscription with zero impact on the source environment and minimal downtime or service disruption. The downtime as mentioned earlier was unavoidable due to the Managed Disks resources in the PAYG subscription, but this downtime was further minimized by running the disk copy process within Azure cloud. Services were resumed in the source environment as soon as the Managed Disks were copied and need not be down during the entire migration process. The subsequent sections will discuss the processes, techniques, and tools used to successfully complete the migration. The diagram below provides a high-level workflow of the migration process that was used for the PAYG to CSP Subscription.
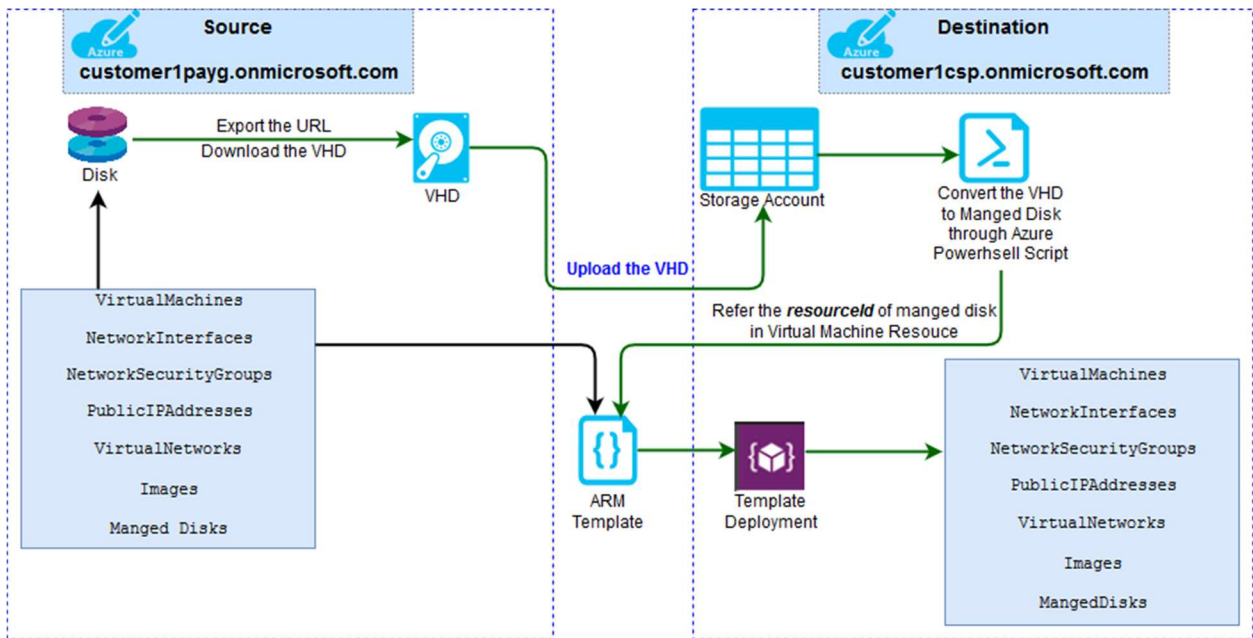
Figure 1: Migration workflow from PAYG to CSP

4. Migration Scenarios & Considerations

Migrating Azure resources depends on a variety of factors and there are multiple ways to accomplish the actual migrations. Depending on the type of resources needed to be migrated and the source and target destinations, there are a couple of ways to execute a migration project:

- Migration between the same Tenants
- Migration between different Tenants

The goal for this migration effort was to minimize the service disruptions for customers and their clients and to ensure that the migrations were successful by testing and validating the process end to end. The process of migrations was automated to the maximum extent possible by using the right tools and processes.

4.1. Migration between same Tenants

If both the source and target subscriptions belong to the same tenant, the simplest way is to use the Azure Portal to seamlessly migrate resources.

Pros:
- Seamless and easy
- Migration can be achieved through the Azure Portal, no tools required.

- Zero downtime
- Same Public IPs can be retained.

Cons:

The following resources can't be migrated through Azure Portal at this time.
- Microsoft. Compute/images. A custom VM image resource cannot be moved.
- Microsoft. Compute/disks. Managed disks and their associated resources like VMs, NICs, VNETs, Subnets, Public IPs, etc. The screenshot below shows the error message that is displayed when these types of resources are migrated using the portal.
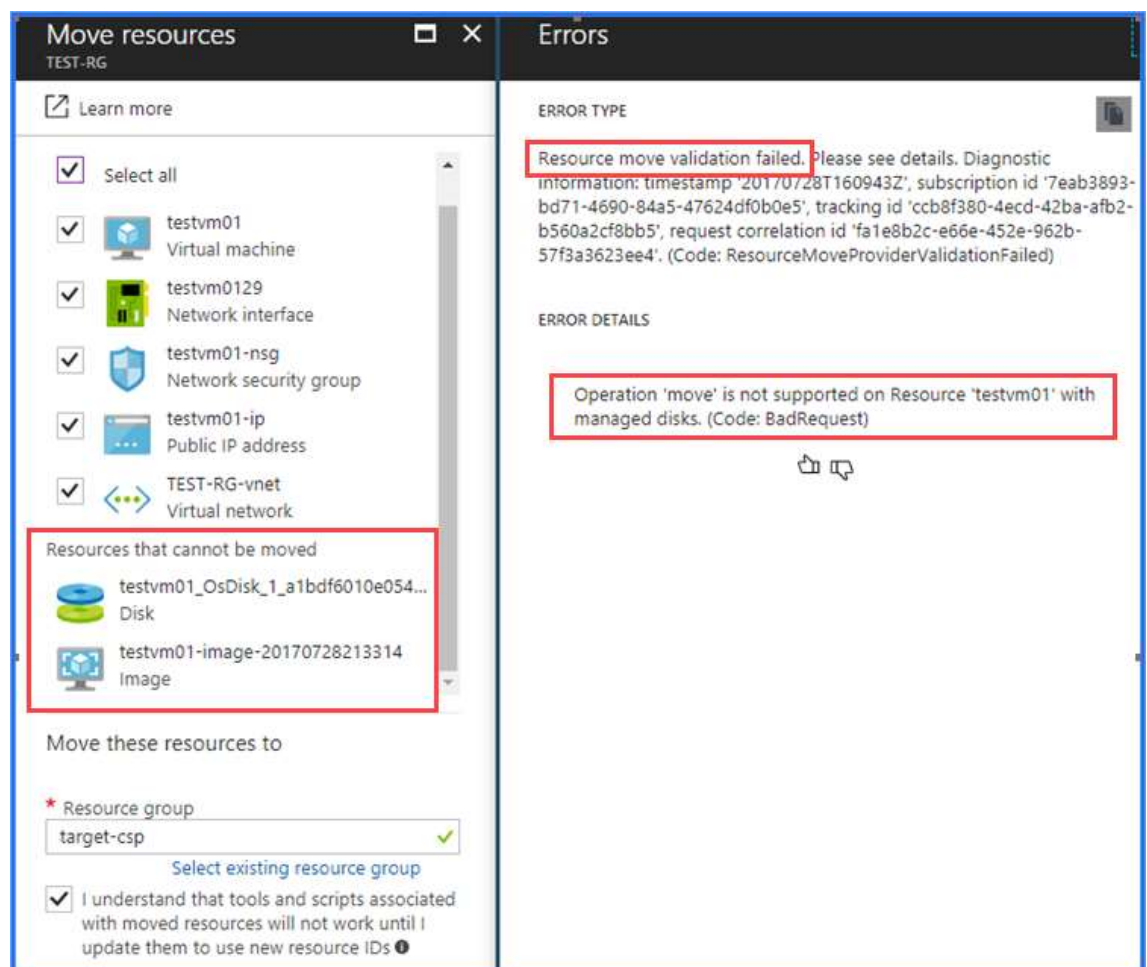

Figure 2: Example of resources that can't be migrated using the Azure Portal

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4.2. Migration between different tenants

If the source and target Subscriptions belong to different tenants, the Azure Portal cannot be used to migrate resources. Instead, additional tools and techniques need to be employed to migrate across tenants. The Customer and Partner in question had resources in two different tenancies and that was the basis for this migration scenario.

Cons:

- Not Seamless, manual intervention is needed.
- Migration can't be achieved through the portal, additional tools required.
- Same Public IPs cannot be retained.
- Some downtime is unavoidable. (Approx. 15-25 mins per VM based on the size).

4.3. Tools

With the current customer and partner situation, the migration process required migrating resources across different tenants. Leveraging tools to automate the process was the recommended approach. Some of the key tools used are listed below.

MigAz:

MigAz is a tool created by Paulo Ramos from Microsoft, that is based on a simple but powerful idea. Rather than migrate your resources manually, MigAz builds a new ARM Template that represents the ARM equivalent of the chosen Azure resources. This is useful for a few reasons.

First, one can select whatever combination of resources desired, and since they get represented in a single ARM Template, it means they will ultimately become a single ARM Resource Group in the destination. This gives partners (and customers) an opportunity to create meaningful Resources Groups during migrations, which simplifies management and deployments in the future. Additionally, one can leave out resources that are no longer needed.

Second, since the output is just a JSON file, it is easy to customize as little or as much as needed before deploying. Don't like the name of the resource? Change it. Want to change the way Cloud Services are represented with ARM concepts like Load Balancers and Availability Sets? Change it. Because ARM Templates can be redeployed over existing Resource Groups, this process can be used to improve things iteratively.

Finally, since MigAz creates an ARM template, it is an artifact that can be checked in to source control system to treat "configuration as code" in DevOps parlance. This means one can deploy solutions to multiple environments without manual effort or risk

of inconsistencies or errors. (To get the most out of this approach, it will be useful to evolve templates to include environment-specific Parameters files). In this customer/CSP case, an Azure ARM Template will be created for the resources selected in the source subscription by the MigAz tool. The ARM Template was used at the target Subscription **(customer1csp.onmicrosoft.com)** to bring the same set of resources from the source Subscription (**customer1payg.onmicrosoft.com**)

Azure PowerShell:

Azure PowerShell provides a set of cmdlets that uses the Azure Resource Manager model for managing (creating, updating, and changing) Azure resources. In this customer case/scenario, Azure PowerShell cmdlets are used to convert VHDs to Managed Disks at the target CSP subscription after they are copied.

Azure Storage Explorer

Azure Storage Explorer is a standalone app that enables users to easily work with Azure Storage data. It works in various ways by connecting to and managing Azure storage accounts and allows users to browse storage elements like Blob data and other storage elements.

4.4. Prerequisites

The following prerequisites were completed before starting the Migration of ARM Resources from Source PAYG Subscription to Target CSP Subscription.

1. Customer should be registered with Azure Resource Providers for target CSP Subscription before commencing the migration.
2. **MigAz Tool** should be installed to help create ARM template(s) of selected Azure Resources from Source Subscription.
3. **Azure PowerShell** should be installed either on On-Prem/Azure to convert VHDs to Managed Disks on the target side.
4. **Azure Storage Explorer** should be installed to upload the VHD to the Target Subscription Storage Account.
5. **Owner Access,** *at least one* user should have owner access on both PAYG and CSP Subscriptions
6. **Storage Accounts,** Ensure the Target Subscription (CSP) has storage accounts created to hold the VHD/VHDX files from the source VMs.

5. Migration Steps (Process)

Migrating the ARM Resources from PAYG to CSP involves several steps and can be accomplished both manually or automatically, based on the scenario and comfort levels with tools and ARM templates. The following section explains the step-by-step process to migrate the ARM resources from PAYG to CSP using tools and manual intervention.

  ➢ Powering down the Source VMs.
  ➢ Copying the Source Managed Disks
  ➢ Provisioning the destination resources using ARM template(s)
  ➢ Deploy ARM template

Note – The following migration steps can be used for both type of migration scenarios.

5.1. Copying the source Managed Disk(s)

Before migrating the VM resources to the Target subscription, Managed Disks which were associated with the source VM's were first copied to Target CSP Subscription.

Note – As mentioned before, Managed disks cannot be copied directly to Target CSP Subscription if subscriptions are in different tenants.

The following section describes the steps to copy Managed disks from Source Subscription to Target Subscription.

  1. **Power off the Source VM**

     The source VM needs to be turned off to download the VHD file from managed disks (if this was a traditional VHDX file managed within the Blob storage account, the storage account needs to be accessed first and then initiate the copy process)

  2. **Download the VHD files**

     Once the VM is deallocated in the PAYG (source) subscription, download the VHDs using the URL provided by Azure. The screenshot below shows the step in more detail.
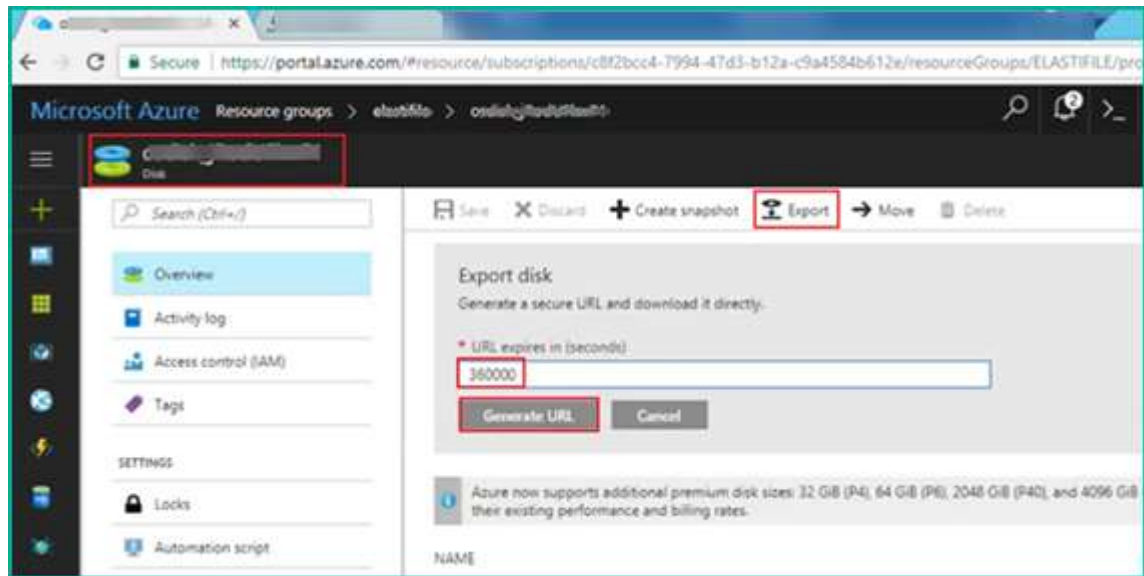
Figure 3: How to generate VHD URL

Click **Export** option under **Managed Disks Overview Section** to export the VHD file. The download URL will be available in the portal as shown in Figure 3 above. The time limit of the download URL availability can be increased if more time is needed to download the VHD.
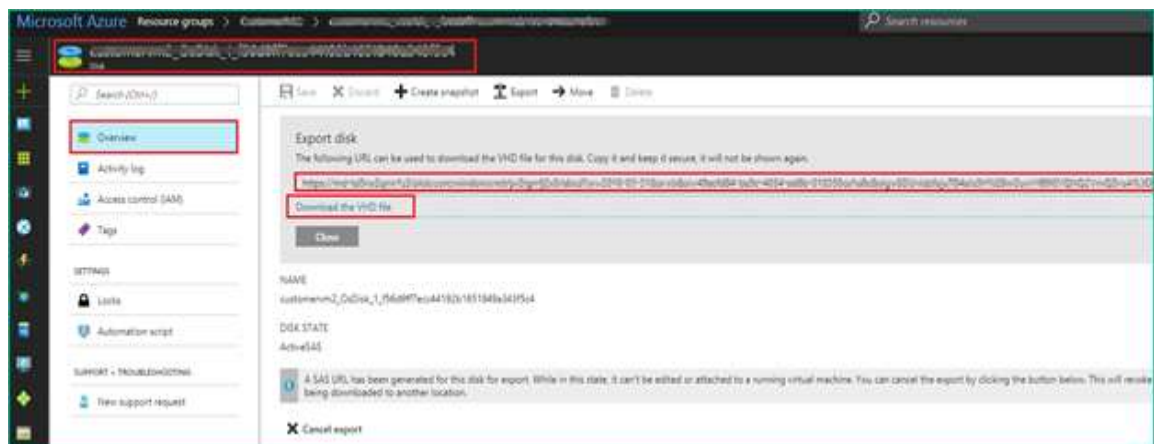

Figure 4: Download the VHD from Managed Disk

3. Upload the VHD files

Upload the VHD files that was just downloaded to a Storage Account which was already created in Target CSP Subscription (**customer1csp.onmicrosoft.com**) using the Azure storage explorer. The section below describes the steps needed to upload the VHDs.

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1. Open Azure Storage Explorer and login to the CSP (Target) Subscription
2. Browse the storage Account → Blob Containers → Select the Container that was created to hold the VHDs from the source.
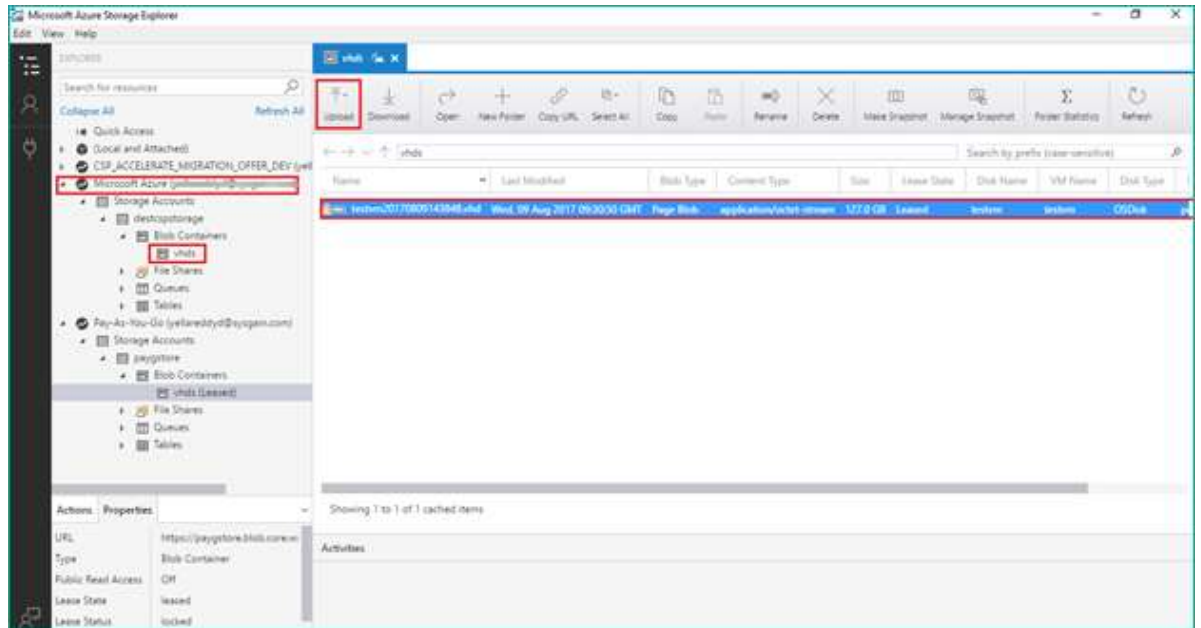

Figure 5 Upload the VHDs using Storage explorer

3. Upload the VHD to this Container.

4. Convert VHD to Managed Disk

The next step is to convert the VHD files copied to the Target Storage Account to Managed Disks. This is done using Azure PowerShell. Azure PowerShell cmdlets shown below were used to convert VHDs to Managed Disks.

1. Login to Azure using Azure PowerShell command with your Portal Credentials.

   Login-AzureRmAccount

2. Get the lists of Subscription you have under your ID

   Get-AzureRmSubscription

3. Select the Target CSP Subscription

   Select-AzureRMSubscription -SubscriptionName <Sub_Name>

4. Declare the following PowerShell variables and provide the target Resource group name, location, disk name, disk VHD URL

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```
$rgname = '<target_rg_name>'
$location = '<storage_account_region>'
$diskName = '<disk_name>'
$vhdUri = '<disk_url>'
```
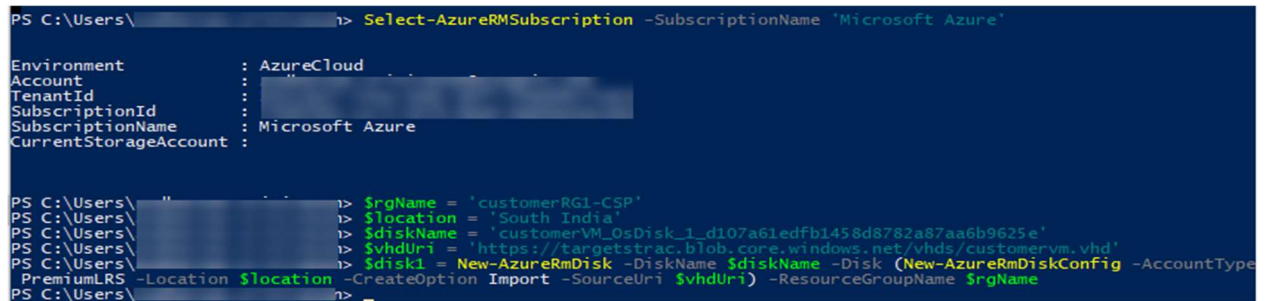
5. Finally, run the command shown below to convert the copied VHD disks to Azure Managed Disks

```
$disk1 = New-AzureRmDisk -DiskName $diskName -Disk (New-AzureRmDiskConfig -AccountType PremiumLRS -Location $location -CreateOption Import -SourceUri $vhdUri) -ResourceGroupName $rgName
```

6. Repeat steps 1-5 to convert all your VHD to Managed disks.

Figure 6: Convert the VHD to Managed Disk

5.2. Preparing the ARM Template to Provision Resource(s) in CSP Subscription

Once Managed disks have been created from VHDs, prepare the ARM template using the MigAz tool with resources like VM, VNET, Subnet, NIC, Public IP, NSG, etc.

The following items were built into or accounted for in the ARM Template that were the same as the Source PAYG resources.

1. Managed Disks that were created in the previous step were referenced in the ARM Template to create the VMs from the Managed Disks.
2. VNET Address Range was the same as Source Subscription VNET.
3. Subnet Address Ranges were the same as Source Subnets.
4. Private IP's of Source VMs had to be the same as Target VM's under Network Interface section of the ARM Template (NIC).

5. Same Inbound and Outbound ports were opened in the Target Network Security Groups as were in the Source.
6. Same VM Sizes were declared under VM Section of template to ensure Target VM sizes matched the Source.
7. Reference(s) to the VHD files under the Image section of the template were updated to bring the same Source VM Images to the Target.

Please refer to the "Additional Resources" section for more information on the ARM Resources, Templates and other details.

The MigAz tool was used to create the template and minimize the manual effort required to build the ARM template. The screenshot below shows the MigAz tool in action.
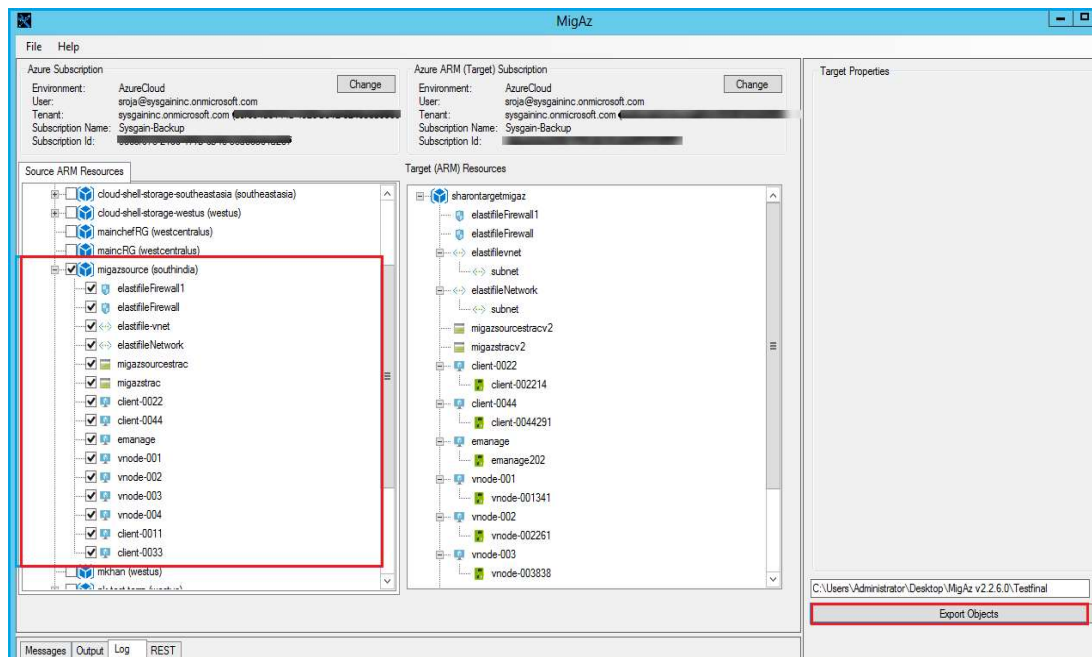

Figure 7 How to create template using MigAz

As of this writing, MigAz tool does not support exporting Managed Disks and Images. This was done manually once the tool generated the ARM Template. Below screenshot refers to the section of the template that was updated to handle the addition of Managed Disks and Images.

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```
"type": "Microsoft.Compute/virtualMachines",
"name": "customerVM",
"apiVersion": "2016-04-30-preview",
"location": "southindia",
"scale": null,
"properties": {
    "hardwareProfile": {
        "vmSize": "Standard_DS3_v2"
    },
    "storageProfile": {
        "osDisk": {
            "osType": "Windows",
            "name": "[concat('customerVM','_OsDisk_1_d107a61edfb1458d8782a87aa6b9625e')]",
            "createOption": "Attach",
            "caching": "ReadWrite",
            "managedDisk": {
                "storageAccountType": "Standard_LRS",
                "id": "[resourceId('Microsoft.Compute/disks', 'customerVM_OsDisk_1_d107a61edfb1458d8782a87aa6b9625e')]"
            }
        },
        "dataDisks": []
    },
```

Figure 8 Referring the Managed disk in ARM Template

```
"resources": [
    {
        "type": "Microsoft.Compute/images",
        "apiVersion": "[variables('computeApiVersion')]",
        "name": "[parameters('imageName1')]",
        "location": "westus",
        "properties": {
            "storageProfile": {
                "osDisk": {
                    "osType": "Linux",
                    "osState": "Generalized",
                    "blobUri": "[parameters('sourceImageVhdUri1')]",
                    "storageAccountType": "Premium_LRS"
                }
            }
```

Figure 9 Image reference in ARM Template

5.3. Deploy the ARM template

Deploy the ARM template in the CSP (target) subscription (**customer1csp.onmicrosoft.com**) that creates all resources similar to the source (PAYG) subscription using following process.

1. Login to the Azure Portal.
2. Click on **New** →, then select '**Template Deployment**'

3. Custom deployment → then **Edit Template** → Paste the ARM Template generated by the MigAz tool and that was updated to add resources like Managed Disks and Images.
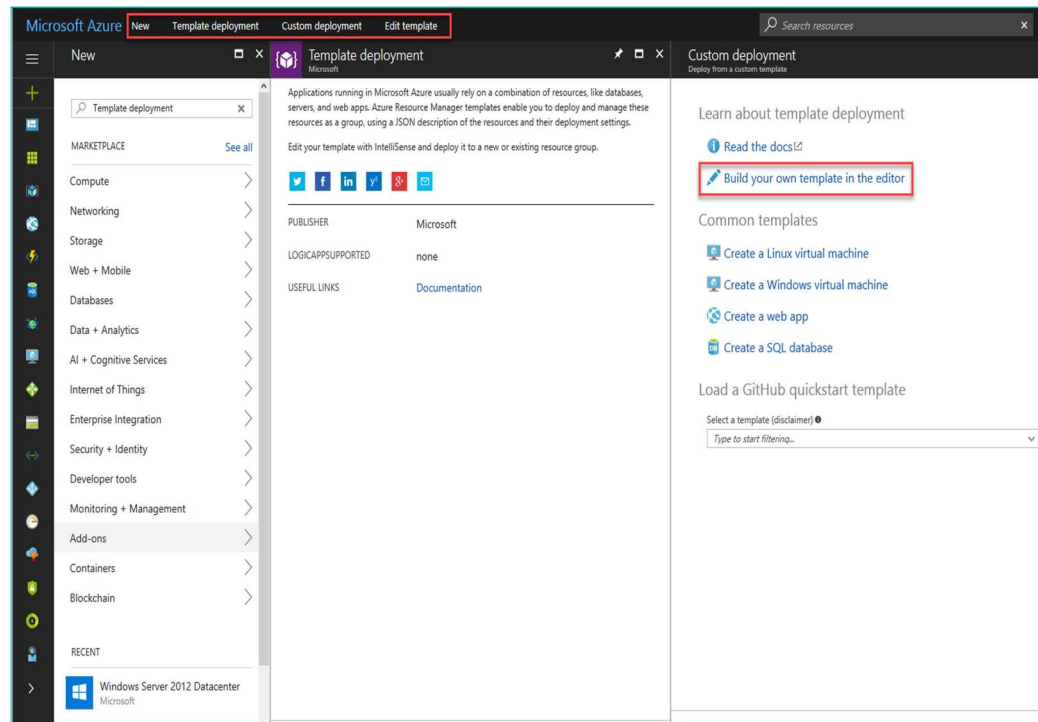

Figure 10 Deploy the ARM Template

4. Click on **Save** and then click **Purchase.**

5.4. Validation

Once the migration was completed from a validation standpoint, the customer was asked to validate to ensure all the Azure Services (resources) were present and running and functioning as expected, within the CSP Subscription. This included access to resources, NSG (Network Security Groups) rules, and if the service/application is working as expected. Once the customer was convinced that the Target Subscription was working as intended, the Source resources were permanently decommissioned. This process may vary depending on the complexity and testing/validation sets employed by the customer.

5.5. Migration Execution Span

Even though the migration between subscriptions only took a few hours, there were a few weeks of preparation and planning that went into ensuring that this migration project went smoothly.

The total time taken to migrate all resources from PAYG to CSP Subscription was around 4 hours. Below is the time taken for single VM at each step (Please note: these are approximate timeframes and can vary depending on size, location, and other factors)

1. **Power Off the VM -** 1-2 mins.
2. **Download the VHD files –** 15–25 mins for 127GB, again it depends on disk size and **bandwidth.**
3. **Upload the VHD files –** 15-25 mins, again it depends on disk size and bandwidth.
4. **Convert VHD to Managed Disk –** 3-5 mins.
5. **ARM Template deployment –** 10-15mins.

6. Additional Resources

Azure CSP – https://azure.microsoft.com/en-in/offers/ms-azr-0145p/

MigAz – https://github.com/Azure/migAz

Azure PowerShell Overview –

https://docs.microsoft.com/en-us/powershell/azure/overview?view=azurermps-4.2.0

Copy Managed Disks Azure CLI –

https://docs.microsoft.com/en-us/azure/storage/scripts/storage-linux-cli-sample-copy-managed-disks-to-same-or-different-subscription

VHD to Managed Disks –

https://docs.microsoft.com/en-us/azure/virtual-machines/windows/create-managed-disk-ps

ARM Templates –

https://github.com/Azure/azure-quickstart-templates