

# Configuration Manual

MSc Research Project MSc Cloud Computing

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## Configuration Manual

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#### 1 Methodology

This project uses an Agile Methodology. In this method, only the particular sprint that requires change is taken into account, and the desired change is done in that particular sprint alone, rather than changing every step of the project. This makes the whole process effective from the very beginning. The agile methodology used in this project is explained as below:

• The first sprint creates a network interface. It checks if the network interface is working.

• Then, it checks if the application is present in the cloned VM. For a new VM to be created, a request is sent to Microsoft. It takes up to 6 minutes for Microsoft to accept the request and create a VM. During this process, the request waits in a loop while checking if the VM is available.

• When this process is completed, an IP address is allotted to the VM.

• Once this IP address is created, the same IP address becomes available in the endpoint in the traffic manager.

• The traffic manager acts as a load balancer here.

• Once this process is completed, the old VM and the Disk of the VM, network interface are deleted.

• This ensures that the cloning process of the VM is completed.

• Then, a new set of alerts are created for the new VM that is cloned.

• The usual process is that when there is a change in the load given to the CPU, an alert is automatically triggered in the Azure platform so that the machine is upgraded or downgraded. But as this project is using agile methodology, even before the actual process starts, a manual trigger is created once, to check if the process is working.

Now, the step by step explanation of this research project is given below.

### 2 Authentication

First step is Authentication for this Research project. In Azure active directory, app registration is done. The name of the app used here is MakeshiftCrossScaleApp.

Home > App registrations *			×		
+ New registration	?				
1 Welcome to the new and improved App registrations (now Generally Available). See what's new and learn more on	how it's changed. $ ightarrow$				
Starting June 30th, 2020 we will no longer add any new features to Azure Active Directory Authentication Library ( longer provide feature updates. Applications will need to be upgraded to Microsoft Authentication Library (MSAL)	ADAL) and Azure AD Graph. We will continue to provide technic and Microsoft Graph. Learn more	al support and securi	ty updates but we will no		
All applications Owned applications Applications from personal account					
${\cal P}$ Start typing a name or Application ID to filter these results					
Display name Application (client) ID Created on Certificates & sec					
MakeshiftCrossScaleApp f13d8427-fd36-49ea-b00f-2415f8a334f4 6/24/2020 🔮 Current					

Figure 1: App Registration

This app consists of Application ID and Directory ID.



Figure 2: MakeshiftCrossScaleApp

In this application, an application secret key is created. This key is used for authentication process in the code level.

MakeshiftCrossSca	leApp   Certificates & see	crets 🖉		>
✓ Search (Cmd+/) «	♡ Got feedback?			
<ul> <li>Overview</li> <li>Quickstart</li> <li>Integration assistant (preview)</li> </ul>	Certificates Certificates can be used as secrets to prov	ve the application's identity when requesting a to	ken. Also can be referred to as public keys.	
Manage	Thumbprint	Start date	Expires	
Branding     Authentication     Cartificates 8/ secrets	No certificates have been added for this a	application.		
Certificates a server Token configuration API permissions Certificates and API	Client secrets A secret string that the application uses t	o prove its identity when requesting a token. Also	can be referred to as application password.	
Owners	+ New client secret			
Roles and administrators (Prev	Description	Expires	Value	
0 Manifest	MakeshiftCrossScale Key Value	6/24/2021	bCW************	Ū.
Support + Troubleshooting	SecretKey	6/26/2021	.yU*****************	<b>i</b>

Figure 3: MakeshiftCrossScaleApp Secret Key

### 3 Configuration Setup

Traffic manager is also known as Load balancer, which acts as a gateway to manage the varying workloads.

Home > Traffic Manager profiles > Traffic Manager pr « Default Directory	MakeshiftCrossSca     Traffic Manager profile	ale 🖈 🛛 ×
+ Add Stress Manage view ∨ ···· Filter by name Name ↑↓ Stress MakeshiftCrossScale ····	Search (Cmd+/)     Cmd+/)     Coverview     Activity log     Access control (IAM)     Tags     Diagnose and solve problems	▷ Enable profile       ○ Disable profile       ○ Refresh       → Move       IDelete profile         Resource group (change)       DNS name       http://makeshiftcrossscale.trafficmanager.net         Status       Monitor status         Enabled       Degraded         Subscription (change)       Routing method         Azure subscription 1       Priority         Subscription ID       B         8c1be71-fda1-43c5-bfa6-1df9610a9612
	Settings         Image: Configuration         Image: Configuration	Name       ↑↓       Status       ↑↓       Type       ↑↓       Priority       ↑.         MakeShiftIP       Enabled       Degraded       External endpoint       1

Figure 4: Traffic Manager Profile

Traffic manager is pointing to the static IP address which is 52.152.142.112. Whenever there is an IP change, traffic manager updates the IP according to the priority.

Home > Traffic Manager profiles > MakeshiftCrossScale >	
MakeShiftIP MakeshiftCrossScale	
🔄 Save 🗙 Discard 📋 Delete	
Status Disabled Enabled	
Monitor status Online	
Type External endpoint	
Target *	
52.152.142.112	
Priority *	
1	
Custom Header settings ①	



After the creation of the traffic manager, this is the only resource in the resource group.  $^{1}$  (Rohinkoul (n.d.))

Home > Traffic Manager profiles > MakeshiftCrossScale >						
(i) MakeshiftCrossScale Resource group	eRG ≠		×			
βearch (Cmd+/) «	$+$ Add $\equiv\equiv$ Edit columns 🛍 Delete resource group 🖒 Refresh $ o$ Move $\downarrow$	Export to CSV 🛛 🖉 Assign tags 📋 De	lete 🛓 Export template 🛛 🛇 Feedback			
(e) Overview	Subscription (change) : Azure subscription 1	Deployments : 1 Succeeded				
Activity log	Subscription ID : 8c1bbe71-fda1-43c5-bfa6-1df9610a9612					
Access control (IAM)	Tags (change)     : Click here to add tags					
Tags		*				
🗲 Events	Filter by name       Type == all $\times$ Location == all $\times$ $+_{\nabla}$ Add filter					
Settings	Showing 1 to 1 of 1 records.		No grouping $\checkmark$			
n Quickstart	□ Name ↑↓	Туре ↑↓	Location ↑↓			
Deployments	MakeshiftCrossScale	Traffic Manager profile	global •			
Policies						

#### Figure 6: MakeshiftCrossScaleRG

 $^{1} https://docs.microsoft.com/en-us/azure/traffic-manager/traffic-manager-overview$ 

These are static IP addresses which are being used by the VM, whenever there is a cloning process.

Home >				
Public IP addresses	\$			×
+ Add ≡≡ Edit columns 💍 R	efresh 🛛 🖉 Assign tags			
Subscriptions: Azure subscription 1				
Filter by name	All resource groups	All locations	✓ All tags ✓ No grouping	$\sim$
3 items				
Name ↑↓	Resource group $\uparrow_{\downarrow}$	Location ↑↓	Subscription $\uparrow_{\downarrow}$	
AppHosting-ip	MakeshiftCrossScaleRG	East US	Azure subscription 1	
MakeShift-IP-1	MakeshiftCrossScaleRG	East US	Azure subscription 1	
MakeShift-IP-2	MakeshiftCrossScaleRG	East US	Azure subscription 1	

Figure 7: Public IP addresses

52.188.168.121 is the first static IP address.

Home > Public IP addresses >					
Public IP addresses	« MakeShift-IP-1 Public IP address	\$			×
$+$ Add $\equiv\equiv$ Edit columns $\cdots$		] «	$^{\odot}$ Associate $ imes$ Dissociate $ o$ Move 📋	] Delete 💍 Refresh	
Filter by name         Name ↑↓         Image: AppHosting-ip         Image: AppHosting-ip         Image: MakeShift-IP-1         Image: MakeShift-IP-2	<ul> <li>Overview</li> <li>Activity log</li> <li>Access control (IAM)</li> <li>Tags</li> <li>Settings</li> <li>Configuration</li> </ul>		Resource group (change) MakeshiftCrossScaleRG Location East US Subscription (change) Azure subscription 1 Subscription ID 8c1bbe71-fda1-43c5-bfa6-1df9610a9612	SKU Basic IP address 52.188.166.121 DNS name - Associated to MakeShift-N111 Virtual machine	
	Image: Properties         Image: Construction of the second seco		Tags (change) Click here to add tags	MakeShift-VM-11	

Figure 8: MakeShift-IP-1

52.152.142.112 is the second static IP address.

Home > Public IP addresses >					
Public IP addresses	«	■ MakeShift-IP-2 Public IP address			×
+ Add $\equiv \equiv$ Edit columns $\cdots$			${}^{\odot}$ Associate $\times$ Dissociate $\rightarrow$ Move	🔟 Delete 💍 Refresh	
Filter by name		Cverview	Resource group (change) MakeshiftCrossScaleRG	SKU Basic	
Name ↑↓       AppHosting-ip		<ul> <li>Activity log</li> <li>Access control (IAM)</li> <li>Tags</li> </ul>	Location East US Subscription (change)	IP address 52.152.142.112 DNS name	
MakeShift-IP-1		Settings	Subscription ID 8r1bbe71-fda1-43r5-bfa6-1df9610a9612	- Associated to	
		Configuration Properties		Virtual machine -	
		Locks     Export template	Tags (change) Click here to add tags	*	

Figure 9: MakeShift-IP-2

#### 4 Creation of VM and its image

This is the initial VM where the test application is hosted for checking downtime while up-scaling or down-scaling the VM. Azure subscription 1 and MakeshiftCrossScaleRG is selected as the Subscription and Resource group in the below image respectively. These are the mandatory fields that are marked in red asterick.

Iome > Traffic Manager profiles > Ma Create a virtual machir	keshiftCrossScale > Makeshift	CrossScaleRG > N	lew >	
Basics Disks Networking Ma	nagement Advanced Ta	gs Review + cre	eate	
Create a virtual machine that runs Linux o image. Complete the Basics tab then Revi for full customization. Learn more I	r Windows. Select an image from ew + create to provision a virtual	Azure marketplace machine with defau	or use your own custor It parameters or review	nized each tab
Project details				
Select the subscription to manage deploy your resources.	ed resources and costs. Use reso	urce groups like fold	lers to organize and ma	inage all
Subscription * 🕕	Azure subscription 1			$\sim$
Resource group * ii	MakeshiftCrossScaleRG			$\sim$
	Create new			
Instance details				
Virtual machine name * 🕕				
Region * ①	(Middle East) UAE North			$\sim$
Review + create < Prev	ious Next · Disks >			]

Figure 10: VM Creation

MakeShiftVM is selected as the name of the VM. Any region can be selected for the Region column. Windows Server 2019 Datacenter is the image of the VM. Any size can be chosen for VM. Then, Username and Password is created for the user to access the VM.

 $\times$ 

k

Home > Traffic Manager profiles > Ma	${\sf keshiftCrossScale} \ > \ {\sf MakeshiftCrossScaleRG} \ > \ {\sf New} \ >$	
Create a virtual machir	ie	
virtual machine name 🗧 🕕	IviakeShintvivi	× .
Region * ①	(Europe) West Europe	$\sim$
Availability options ①	No infrastructure redundancy required	$\sim$
Image * 🛈	Windows Server 2019 Datacenter	$\sim$
	Browse all public and private images	
Azure Spot instance ①	🔿 Yes 💿 No	
Size * 🕕	Standard_DS1_v2 - 1 vcpu, 3.5 GiB memory (Price unavailable)	$\sim$
Administrator account		
Username * 🕕	AzureUser	~
Password * ①		

Figure 11: VM Creation

Below image consists of all the properties of the existing VM and acts as a backup for the cloning process in the future.

Home > Images >					
MakeShift-image-2	\$			>	~
	🕂 Create VM 📋 D	elete			
👰 Overview	NAME				
Activity log	MakeShift-image-2				
Access control (IAM)	SOURCE VIRTUAL MACH	INE			
🗳 Tags	MakeShift				
Settings	OS DISK				
🔒 Locks	OS type	Source blob URI	Storage type	Caching	
🛃 Export template	Windows		Premium SSD	Read/write	
Support + troubleshooting	DATA DISKS This image doesn't conta	in any data disks.			
Rew support request	RESOURCE GROUP				
	MakeshiftCrossScaleRG				
	LOCATION				
	East US				
	ZONE RESILIENCY				
	Disabled				

Figure 12: Image of the VM

### 5 Scaling up process: Cloning and Deletion of VMs

This is the sample web application hosted inside the VM and the traffic manager points to this application. Whenever there is a cloning process, this application is used to check the downtime. To simulate the workload, there is a functionality in the application which gets activated by clicking the button (Increase CPU % to 80%) in the front-end.



Figure 13: Sample web application

The 'Makeshift Cross Scale Algorithm' is hosted in the App Service which is the PaaS solution. It consists of two end-points such as Scale up and Scale down. Whenever the CPU percentage goes more than 80% or less than 20%, respective alerts are triggered and the algorithm is called.



Figure 14: App Service: MakeShiftCS

When the workload in the CPU reaches more than 80%, and remains for 1 minute. There is an alert for scaling up and it calls the API endpoint.

Metrics						×
- New chart 🕐 Refresh 😰 Share 🗸	🗸 🙂 Feedback 🗸				Local Time: Last 30 minut	es (Automatic - 1 min
CPU (average) 🖉						
★ Add metric * Add filter * Applied Applie	oply splitting			🔛 Line chart 🗸 🔒 Dril	ll into Logs 🗸 📮 New alert rule 🦻	Pin to dashboard …
AkeShift-VM-01, Percentage	CPU, Max 💿					
100%						
90%						
80%						
70%						
60%						X
50%						>
40%						
30%						
20%						
10%						
0%						
1:10	1:15	1:20	1:25	1:30	1:35	UTC+04:00
Percentage CPU (Max) makeshiftvm-01 87.8500 %						



The alert 'MakeShift-ScaleUp01' gets triggered when the CPU % goes greater than 80%.

All Alerts											×
+ New alert rule     ≡≣ Edit columns	lanage alert rules 🛛 📮 View classic alert	C Refree	sh   ~	🗸 Change state   🙂 Pro	ovide feed	lback					
Don't see a subscription? Open Directory + Sub	scription settings										
Subscription * ①	Resource group ①	Res	source typ	oe 🕕		Resource ①		Time range	D		
Azure subscription 1 V	2 selected	✓ 9	selected		$\sim$		$\sim$	Past 24 hour	s		$\sim$
Monitor service ①	Monitor condition	Sev	verity 🕕			Alert state ①		Smart group i	id (	)	
0 selected V	2 selected	✓ Se	ev 3		$\sim$	3 selected	$\sim$	Smart group	id		
Selected subscriptions > Selected resource groups	;										
All alerts by smart group (preview)											
1 Action rules (preview) allows you to define a	actions at scale as well as suppress actions. L	arn more abo	out this fun	ctionality here							×
Search by name (case-insensitive)											٦
Name ↑↓ Severity	$\uparrow \downarrow$ Monitor condition $\uparrow \downarrow$ Ale	t state	$\uparrow_{\downarrow}$	Affected resource $\uparrow \downarrow$	Monitor	service Signal type	Fired t	ime 1	۰.	Subscription	
MakeShift-ScaleUp01 Sev3	🛕 Fired Net	<i>,</i>		📮 makeshift-vm-01	Platform	m Metric	8/4/20	20, 1:36 PM		Azure subscription 1	
MakeShift-ScaleUp11 Sev3	🔥 Fired Net	/		nakeshift-vm-11	Platforr	m Metric	8/3/20	20, 7:42 PM		Azure subscription 1	
MakeShift-ScaleDown11 Sev3	🔺 Fired Net	/		nakeshift-vm-11	Platforr	m Metric	8/3/20	20, 7:32 PM		Azure subscription 1	

Figure 16: Alerts Triggered

This is the resource group named 'MakeshiftCrossScaleRG'. As the cloning process starts, the name of the new VM and its resources namely network interface and disk are added in the resource group.

(     MakeshiftCrossSc Resource group	aleRG 🖈			×
	$+$ Add $\equiv\equiv$ Edit columns 📋 Delete resource group 🖒 Refresh $\rightarrow$ Move $\downarrow$	Export to CSV 😚 Open query	🖗 Assign tags 🛍 Delete 🞍 Export templat	te ···
() Overview	Subscription (change) : Azure subscription 1	Deployments : 2 Failed, 10	Succeeded	
Activity log	Subscription ID : 8c1bbe71-fda1-43c5-bfa6-1df9610a9612			
Access control (IAM)	Tags (change) : Click here to add tags			
🗳 Tags		*		
🗲 Events	Filter by name     Type == (all) × Location == (all) × + Add filt	er		
Settings	Showing 1 to 22 of 22 records.		No grouping V List view	$\sim$
📣 Quickstart	$\square$ Name $\uparrow_{\downarrow}$	Type ↑↓	Location $\uparrow \downarrow$	
1 Deployments	MakeShift-IP-2	Public IP address	East US	
Policies	MakeShift-NI01	Network interface	East US	
😂 Properties	🗌 🐻 MakeShift-NI11	Network interface	East US	
🔒 Locks	🔲 🌒 MakeShift-nsg	Network security group	East US	
🖳 Export template	MakeShift-VM-01	Virtual machine	East US	
Cost Management	MakeShift-VM-11	Virtual machine	East US	
s Cost analysis	🗌 🔞 MakeshiftCrossScale	Traffic Manager profile	Global	
Cost alerts (preview)	MakeshiftCrossScaleRG-vnet	Virtual network	East US	

Figure 17: MakeshiftCrossScaleRG during cloning

The below image contains the information of the old VM, while the cloning process is taking place.



Figure 18: Old VM during cloning

The below image shows the creation of the new VM, while the cloning process is going on.  $^2$  (Rloutlaw1 (n.d.))

Home >				
Virtual machine	\$			:
	🖉 Connect 🕞 Start	C <sup>*</sup> Restart     ☐ Stop     Stop     Capture     Delete     C <sup>*</sup> Refresh     □	Share to mobile	
📮 Overview	Resource group (change)	: MakeshiftCrossScaleRG	Operating system	: Windows
Activity log	Status	: Creating	Size	: Basic A2 (2 vcpus, 3.5 GiB memory)
Access control (IAM)	Location	: East US	Public IP address	: 52.188.168.121
Tags	Subscription (change)	: Azure subscription 1	Virtual network/subne	t : MakeshiftCrossScaleRG-vnet/default
<sup>(2)</sup> Diagnose and solve problems	Subscription ID	: 8c1bbe71-fda1-43c5-bfa6-1df9610a9612	DNS name	: Configure
2 Diagnose and solve problems	Tags (change)	: Click here to add tags		
Settings		*		

Figure 19: Creation of new VM during cloning

This is the sample application which points to the IP address 52.152.142.112, and while the cloning process is going on the sample web application is up and running without any downtime. This confirms that the VM being cloned is running.

Make Sh	ift Cross Scale	
Manage CPU % Increase CPU % to 80% Decrease CPU % to 20%	IP Address - 52.152.142.112	

Figure 20: Sample application during cloning

 $^{2} https://docs.microsoft.com/en-us/rest/api/compute/virtualmachines/createorupdate$ 

The cloning of the MakeShift-VM-11 is completed with the new scaled up size of the VM .i.e., Basic A2 and it's in the running mode.

MakeShift-VM-11	¢				:
	🖉 Connect 🕞 Start	🤇 Restart 🔲 Stop 🔯 Capture 📋 Delete	C Refresh	Share to mobile	
Overview	Resource group (change)	: MakeshiftCrossScaleRG		Operating system	: Windows
Activity log	Status	: Running		Size	: Basic A2 (2 vcpus, 3.5 GiB memory)
Access control (IAM)	Location	: East US		Public IP address	: 52.188.168.121
🔷 Taos	Subscription (change)	: Azure subscription 1		Virtual network/subne	t : MakeshiftCrossScaleRG-vnet/default
	Subscription ID	: 8c1bbe71-fda1-43c5-bfa6-1df9610a9612		DNS name	: Configure
Diagnose and solve problems	Tags (change)	: Click here to add tags			
Settings			*	*	
A					

Figure 21: New cloned VM

When the old VM gets deleted, the resources associated with it such as network interface and disk are also deleted. This is done in order to avoid any unnecessary utilization of resources. <sup>3</sup> (Rloutlaw (n.d.)).

MakeShift-VM-01	\$			
✓ Search (Cmd+/) «	🖉 Connect 🕞 Start	C Restart 🗌 Stop 🕱 Capture 🗊 Delete 🕐 Refresh	Share to mobile	
Overview	Resource group (change	): MakeshiftCrossScaleRG	Operating system	: Windows
Activity log	Status	: Deleting	Size	: Basic A1 (1 vcpus, 1.75 GiB memory)
R Access control (IAM)	Location	: East US	Public IP address	: 52.152.142.112
Tags	Subscription (change)	: Azure subscription 1	Virtual network/subne	: MakeshiftCrossScaleRG-vnet/default
	Subscription ID	: 8c1bbe71-fda1-43c5-bfa6-1df9610a9612	DNS name	: Configure
C Diagnose and solve problems	Tags (change)	: Click here to add tags		
Settings		*		
*				

Figure 22: Deletion of the Old VM

<sup>3</sup>https://docs.microsoft.com/en-us/rest/api/compute/virtualmachines/delete

The cloning of the VM is completed and now the downtime of the application is also eliminated. The traffic manager points out to the new cloned VM's IP address .i.e., 52.188.168.121. The sample application is hosted in the new cloned VM.



Figure 23: New IP address of the cloned VM

Lastly, after the cloning of the new VM and the old VM's deletion with its resources, this is how the resource group looks like.

	caleRG ☆			×		
	$< ~~+~ {\rm Add} ~~\equiv {\rm Edit~columns} ~~ iii {\rm Delete~resource~group} ~~ \bigodot {\rm Refresh} \to {\rm Move} ~~ {\rm Starter}$	Export to CSV 😚 Open query	⊘ Assign tags 📋 Delete 🚽 Export template			
(i) Overview	Subscription (change) : Azure subscription 1	Deployments : 2 Failed, 10	Succeeded			
Activity log	Subscription ID : 8c1bbe71-fda1-43c5-bfa6-1df9610a9612					
Access control (IAM)	Tags (change)     : Click here to add tags					
🗳 Tags		*				
🗲 Events	Filter by name     Type == (all) ×     Location == (all) ×     the Add fill	ter				
Settings	Showing 1 to 19 of 19 records. Show hidden types ①		No grouping $\checkmark$ List view	$\sim$		
📣 Quickstart	□ Name ↑↓	Type ↑↓	Location ↑↓			
Deployments	MakeShift-IP-2	Public IP address	East US			
Policies	MakeShift-NI11	Network interface	East US			
😂 Properties	MakeShift-nsg	Network security group	East US			
🔒 Locks	MakeShift-VM-11	Virtual machine	East US			
Export template	MakeshiftCrossScale	Traffic Manager profile	Global			
Cost Management	☐ < MakeshiftCrossScaleRG-vnet	Virtual network	East US			
a Cost analysis	🔲 🚍 makeshiftcrossscalergdia	Storage account	East US	••••		
Scost alerts (preview)	MakeshiftCrossScaleVM1-nso	Network security group	East US	•••		
( Pudente	< Previous Page 1 V of 1 Next >					

Figure 24: Updated Resource Group

The results obtained from this project are:

- Downtime is eliminated.
- Cloning time of the VM in average is 8.8 minutes approximately.
- Deletion of the old VM and its resources takes place in 4.5 minutes approximately.

#### References

- Rloutlaw (n.d.). Virtual machines delete (azure compute). URL: https://docs.microsoft.com/en-us/rest/api/compute/virtualmachines/delete
- Rloutlaw1 (n.d.). Virtual machines create or update (azure compute). URL: https://docs.microsoft.com/en-us/rest/api/compute/virtualmachines/createorupdate

Rohinkoul (n.d.). Azure traffic manager.