

Provisioning for Azure Cost Optimization & Monitoring Project Project Starter Template



STEP 0: Problem Background

Company "X" is an engineering company that has offices in both the US East & West Coast. They currently host all their data and applications in a single East coast data center and are constantly worried about both cost and resiliency. Below is how their current servers are configured.

Server(s):	Purpose: Windows/Linux Server Environment: Physical Servers Operating System: Windows Operating System License: DataCenter Servers: 10 Procs per server: 2 Core(s) per proc: 8 Cores RAM: 256 GB Optimize By: CPU GPU: None Usage: These are the servers where all your engineering workloads happen. Currently they all are being leveraged at regular capacity.
Server(s):	Purpose: Web App Environment: Physical Servers Operating System: Windows

	<p>Operating System License: DataCenter</p> <p>Servers: 3</p> <p>Procs per server: 1</p> <p>Core(s) per proc: 8 Cores</p> <p>RAM: 64 GB</p> <p>Optimize By: CPU</p> <p>GPU: None</p> <p>Usage: These are the web app servers for your company. Currently they all are being leveraged at regular capacity.</p>
Server(s):	<p>Source: Database Server</p> <p>Database: Microsoft SQL Server</p> <p>License: Enterprise</p> <p>Environment: Physical Servers</p> <p>Operating System: Windows</p> <p>Operating System License: Datacenter</p> <p>Servers: 3</p> <p>Procs per server: 1</p> <p>Cores per proc: 16 Cores</p> <p>RAM: 64 GB</p> <p>Optimize By: CPU</p> <p>Usage: These three servers are running Microsoft SQL Server and provide the database for your engineering company. It is critical that they are always running.</p> <p>Destination</p> <p>Service: SQL Database</p> <p>Purchase Model: vCore</p> <p>Service Tier: Business Critical</p> <p>Instance Cores: 2</p> <p>SQL Server Storage: 5</p>

	SQL Server backup: 0
Storage	Purpose: Storage Type: Local Disk / SAN Disk Type: HDD Capacity: 1 TB Back-Up: None currently Archive: None
Networking	Amount of network bandwidth you currently consume in your on-premises environment: 1 GB

STEP 1: Assessing the On-Premises Environment & Generating Total Cost of Ownership (TCO) Report

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

Current Environment/ Background Make a list of all current on-premises servers and services.	There are 10 Windows VM's which are used for engineering purposes. There are 3 web apps servers which host the front end of the company. There are 3 database servers. There is a storage which is also used to store data.
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 explain why you chose each. Hint: <ul style="list-style-type: none">• For VM's and Web Apps: The operating system license is always Standard and Virtualization is always Hyper-V.• For databases: The purchase model is vCore, the Service Tier is Business Critical, and no SQL Server Backup is needed.• For networking: The defaults of 200 GB for outbound bandwidth are used.
Screenshot 1 Submit the screenshot for each of the above configurations from Azure TCO. <u>VM and Web Apps Server</u> screenshot should be submitted here.	

Screenshot 2

Submit the screenshot for each of the above configurations from Azure TCO. [Database](#) screenshot should be submitted here.

Windows/Linux Server

Workload

Windows/Linux

Environment

Virtual Machine

Operating system

Windows

Operating System License

Datacentre

VMs

10

(1 - 9999)

Virtualisation

Hyper-V

Core(s)

16

(1 - 32)

RAM (GB)

256

(1 - 448)

Optimise by

CPU

Windows Server 2008/2008 R2

Web App

Workload

Web App

Environment

Virtual Machine

Operating system

Windows

Operating System License

Datacentre

VMs

3

(1 - 9999)

Virtualisation

Hyper-V

Core(s)

8

(1 - 32)

RAM (GB)

64

(1 - 448)

Optimise by

CPU

Auto scaling

Database Server

Source

Database

Microsoft SQL

License

Enterprise

Environment

Virtual Machine

Operating system

Windows

Operating System License

Datacentre

VMs

3

(1 - 9999)

Virtualisation

Hyper-V

Core(s)

16

(1 - 32)

RAM (GB)

64

(1 - 448)

Optimise by

CPU

SQL Server 2008/2008 R2

Destination

Service

SQL Database

Purchase Model

vCore

Service Tier

Business Critical

Instance cores

2

SQL Server storage

5

GB

(5 - 4000)

SQL Server backup

0

GB

(0 - 5000000)

+ Add database

Screenshot 3

Submit the screenshot for each of the above configurations from Azure TCO. [Storage configuration](#) screenshot should be submitted here.

Storage

Enter the details of your on-premises storage infrastructure. After adding storage, select the storage type and enter the remaining details.

Storage

Storage type ⓘ

Disk type ⓘ

Capacity ⓘ

Backup ⓘ

Archive ⓘ

Local Disk/SAN

HDD

1

TB

(1 - 5000)

0

TB

(0 - 5000)

0

TB

(0 - 5000)

+

 Add storage

Screenshot 4

Submit the screenshot for each of the above configurations from Azure TCO. [Networking configuration](#) screenshot should be submitted here.

Networking

Enter the amount of network bandwidth you currently consume in your on-premises environment.

Outbound bandwidth ⓘ

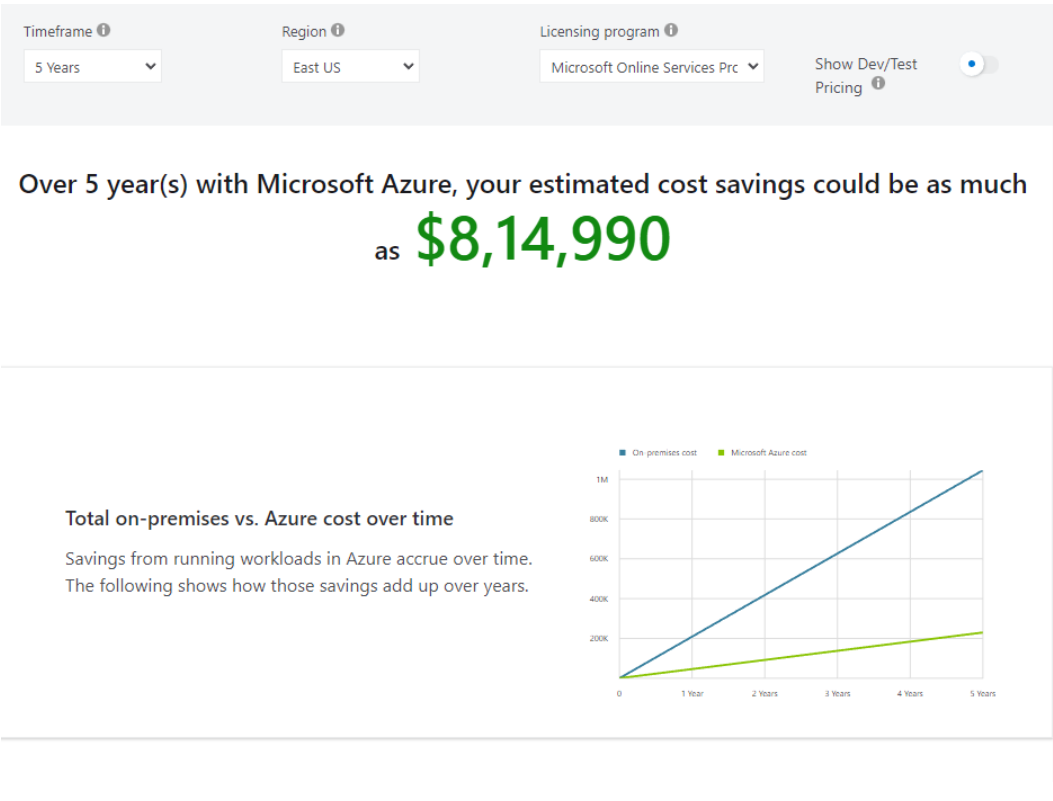
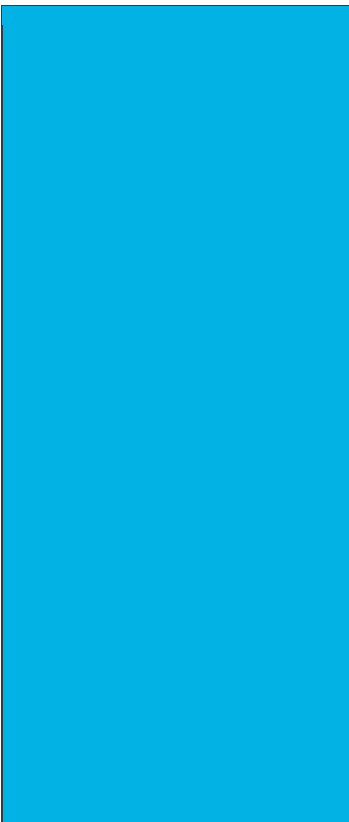
1

GB

(1 - 2000000)

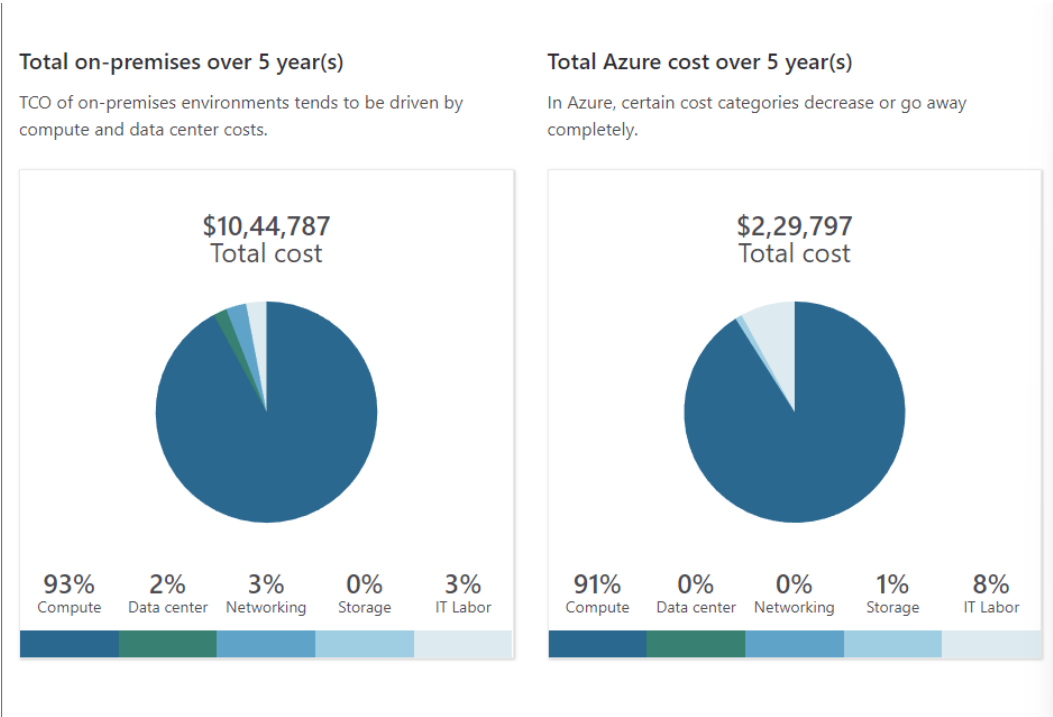
Screenshot 5

Once the TCO Report is generated, submit a screenshot of the price comparison graph (line graph) here.



Screenshot 6

Once the TCO Report is generated, submit a screenshot of the price comparison graph (pie chart) here.

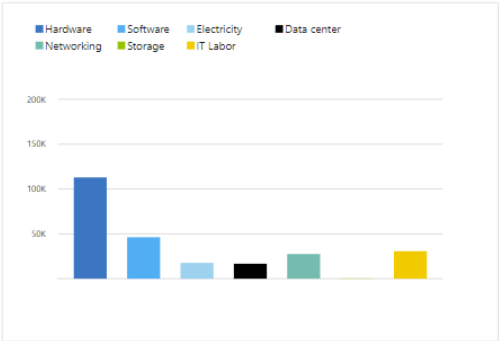


Screenshot 7

Once the TCO Report is generated, submit a screenshot of the price comparison chart (tabular format) here.

Total on-premises cost breakdown

In Azure, several of the cost categories from the on-premises environment are consolidated and decrease with the efficiency that comes with the cloud.

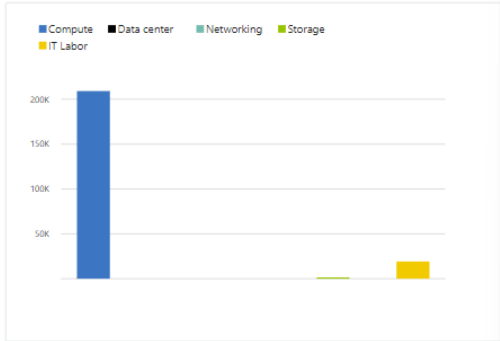


\$10,44,787

Cost over 5 year(s)

Total Azure cost breakdown

In Azure, several of the cost categories from the on-premises environment are consolidated and decrease with the efficiency that comes with the cloud.



\$2,29,797

Cost over 5 year(s)

On-premises cost breakdown summary		Azure cost breakdown summary	
Category	Cost	Category	Cost
Compute	\$9,69,745.70	Compute	\$2,09,202.00
Hardware	\$1,12,868.00	Data Center	\$0.00
Software	\$46,162.50	Networking	\$0.60
Electricity	\$17,592.00	Storage	\$1,427.40
Virtualisation	\$25,459.20	IT Labor	\$19,167.05
Database	\$7,67,664.00		
Data Center	\$16,624.85		
Networking	\$27,441.77		
Storage	\$307.20		
IT Labor	\$30,667.05		
Total	\$10,44,787.00	Total	\$2,29,797.00
Estimated on-premises cost (5 year(s))		Estimated Azure cost (5 year(s))	

Explanation 1

Explain the breakdown of the costs and show your understanding of how on-prem costs versus Azure compare

According to above screenshots we can clearly see right from the start we can see a drastic saving slope in the graph, for some cases one may have to wait some time for maintenance, hardware, Software, IT personnel savings to show up, but in this case clearly from the start we can see a saving slope.

Compute Cost:

On Premise	Azure
<p>Hardware Cost here are costs of physical servers which need to be replaced and maintained from time to time with the needs of the organization.</p> <p>Once the organization has purchased hardware it is stuck with it, they either have to use it or sell it for (obviously a lower price). If one has to scale up on premises then he cant go upto 416 cores, they could but 2 "x" cored servers would cost more than 1"2x" cored server.</p>	<p>Hardware Costs here are none as, Azure being a Cloud Provider (Paas), has this included in the charges of its compute services, as soon as new hardware is released Azure buys it and makes it available for its clients. It also maintains it so the only cost a client pays for is the compute cost.</p> <p>If the client's requirements change, they can change the hardware or scale horizontally/vertically (up/down). (Upto 416 VCPUs)</p> <p>Reserving Hardware on Azure can lead to more savings.</p>
<p>Software, Costs may be OS licenses, such as Microsoft SQL server license or Windows 10 Pro OS License.</p> <p>Each License can be used only on 1 machine on premises.</p>	<p>Windows / SQL images does require Licensing on Azure too but there is a hybrid benefit here, one can use his on prem Licenses and not pay for additional Licensing. In our case a Datacenter License costs less.</p> <p>For Azure deployments of HUB (Hybrid user benefit) , each eligible license has an entitlement to run Windows Server VM's at the lower non-Windows VM rates. Through leveraging HUB, some deployments in Azure can offer end-customers a savings up to 50%. as compared to a standard one.</p> <p>Windows Server Datacenter licenses can utilize the Hybrid Use Benefit</p>

		and continue to be deployed in parallel on-premises. This can help the company if some resources are required to be on premises.
	Electricity Costs would be of the servers computing which would be a lot as all work would be done on-prem servers	Electricity Costs here are the pcs which use azure resources, so the computational costs are generally just for networking, basically just the computational costs of sending commands and data to the cloud server. Electricity costs on azure are lower than general costs as azure data centers also use green energy from power plants owned by Microsoft.
	Data Center Cost:	
	On Premise	Azure
	On premise would have Data center costs, the place, cooling, maintenance etc, costs	There are no Datacenter costs on Azure, its free or may also say that it's already included in the paid services cost.
Networking Cost:		
On Premise	Azure	
Networking Costs here would be via a ISP and VPN service, this may be vary depending on the provider. Optional: Basic VPN costs about \$10-20 per month but it does not provide support for many devices.	Free until 100 GBs per month \$0.0875 per GB until next 10 TBs per month Optional: VPN may cost on Azure; it costs about \$27 for a basic VPN on azure while it supports over 10 Site to Site tunnels and 128 Point to site tunnels.	

		This Pricing may be high but supports more points/sites.
	Storage Costs:	
	On Premise	Azure
	On premise Storage Costs are initial hardware costs or purchasing more HDDs/SSDs. Here Storage is Scalable but the hardware, maintenance cost adds.	Azure Storage costs are based on storage capacity and transactions. Storage here is Scalable, only usage will be priced.
IT Labor Costs:		
	On Premise	Azure
	On premise IT Labor is there to maintain and manage infrastructure, and for a huge workload one may need more people on prem.	IT Labor Cost decreases due to virtualization of Hardware, Azure (Paas) makes Administration easy with many of its other free services. example – Azure Policies.

STEP 2: Azure Pricing Calculator Cost Estimates

Purpose: You want to only move the engineering workloads (so just your VM's) to Azure first to try and understand how Azure cloud works. In addition, this will also help you demonstrate to your CIO that by doing that small migration your company can achieve resiliency. You want to provide precise monthly costs to your CIO.

Use the Azure Pricing Calculator to submit the following screenshots.

Task 1

Matching Azure Services: Match the list of on-premises servers and services to the corresponding Azure ones.

Here is the VM configuration you will pick.

- 5 VM's will be in US East Coast, and 5 will be in US West Coast.
- The instance will be B16MS in both regions (16 vCPUs, 64 GB RAM, 128 GB Temporary Storage, \$0.73 per hour).
- Compute Option will be pay-as-you-go; so, there are no upfront costs.
- The default of 730 hours is selected.

Screenshot 1

Submit the screenshot for each of the above configurations from the Azure Pricing Calculator. Submit the US East Coast monthly costs here.

Virtual Machines

5 B16ms (16 vCPUs, 64 GB RAM) x 730 Hours (Pay a... Upfront: \$0.00 Monthly: \$2,664.55

Virtual Machines 5 B16ms (16 vCPUs, 64 GB RAM) x 730 Hours (Pay a... Upfront: \$0.00 Monthly: \$2,664.55

Virtual Machines

REGION: East US 2 OPERATING SYSTEM: Windows TYPE: (OS Only) TIER: Standard

CATEGORY: All INSTANCE SERIES: Bs-series INSTANCE: B16ms: 16 Cores, 64 GB RAM, 128 GB Temporary storage, \$0.730/hour

Virtual machines 5 x 730 Hours

Savings Options

Save up to 72% on pay-as-you-go prices with 1-year or 3-year Reserved Virtual Machine Instances. Reserved Instances are great for applications with steady-state usage and applications that require reserved capacity. [Learn more about Reserved VM Instances pricing.](#)

Compute (B16ms)

☒ Pay as you go

☐ 1 year reserved (~42% discount)

☐ 3 year reserved (~62% discount)

\$2,430.90

Average per month (\$0.00 charged upfront)

OS (Windows)

☒ License included

☐ Azure Hybrid Benefit

\$233.60

Average per month (\$0.00 charged upfront)

\$2,664.50

Average per month (\$0.00 charged upfront)

Screenshot 2

Submit the screenshot for each of the above configurations from the Azure Pricing

Calculator.
Submit the US
West Coast
monthly costs
here.

Virtual Machines

5 B16ms (16 vCPUs, 64 GB RAM) x 730 Hours (Pay a...Upfront: \$0.00Monthly: \$2,664.55

Virtual Machines

REGION:West US 2OPERATING SYSTEM:WindowsTYPE:(OS Only)TIER:Standard

CATEGORY:AllINSTANCE SERIES:Bs-seriesINSTANCE:B16ms: 16 Cores, 64 GB RAM, 128 GB Temporary storage, \$0.730/hour

Virtual machines5x730Hours

Savings Options

Save up to 72% on pay-as-you-go prices with 1-year or 3-year Reserved Virtual Machine Instances. Reserved Instances are great for applications with steady-state usage and applications that require reserved capacity. [Learn more about Reserved VM Instances pricing.](#)

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Average per month

(\$0.00 charged upfront)

OS (Windows)

☒ License included

☐ Azure Hybrid Benefit

\$233.60

Average per month

(\$0.00 charged upfront)

= \$2,664.50

Average per month

(\$0.00 charged upfront)

Screenshot 3

Submit the
screenshot for
total cost per
month for both
US East and
West Coasts.

Virtual Machines

5 B16ms (16 vCPUs, 64 GB RAM) x 730 Hours (Pay a...Upfront: \$0.00Monthly: \$2,664.55

Virtual Machines

5 B16ms (16 vCPUs, 64 GB RAM) x 730 Hours (Pay a...Upfront: \$0.00Monthly: \$2,664.55

Support

SUPPORT:Included\$0.00

Select your programme/offer

LICENSING PROGRAMME:Microsoft Customer Agreement (MCA)

☒ SHOW DEV/TEST PRICING

Estimated upfront cost\$0.00

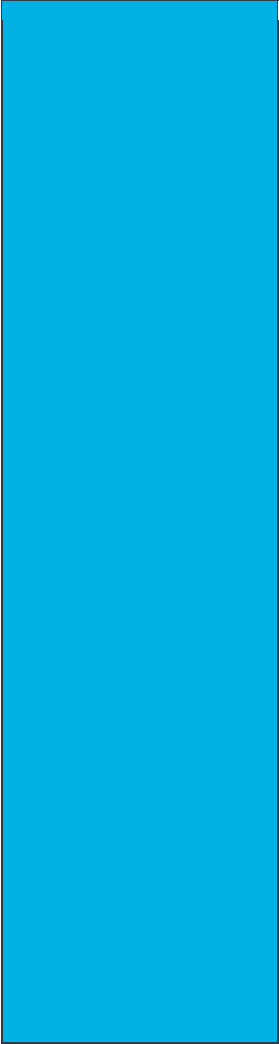
Estimated monthly cost\$5,329.10

Explanation 1

Explain how
resilience is
built in by
moving to
Azure

- We get Built in resiliency as 5 VMs are in East Coast while 5 are in West Coast this makes our workload highly available.

Resiliency is a system's ability to recover from failures and continue to function. It's not only about avoiding failures but also involves responding to failures in a way that minimizes downtime or data loss. Because failures can occur at various levels, it's important to have protection for all types based on your service availability requirements. Resiliency in Azure supports and advances capabilities that respond to outages in real time to



ensure continuous service and data protection assurance for mission-critical applications that require near-zero downtime and high customer confidence.

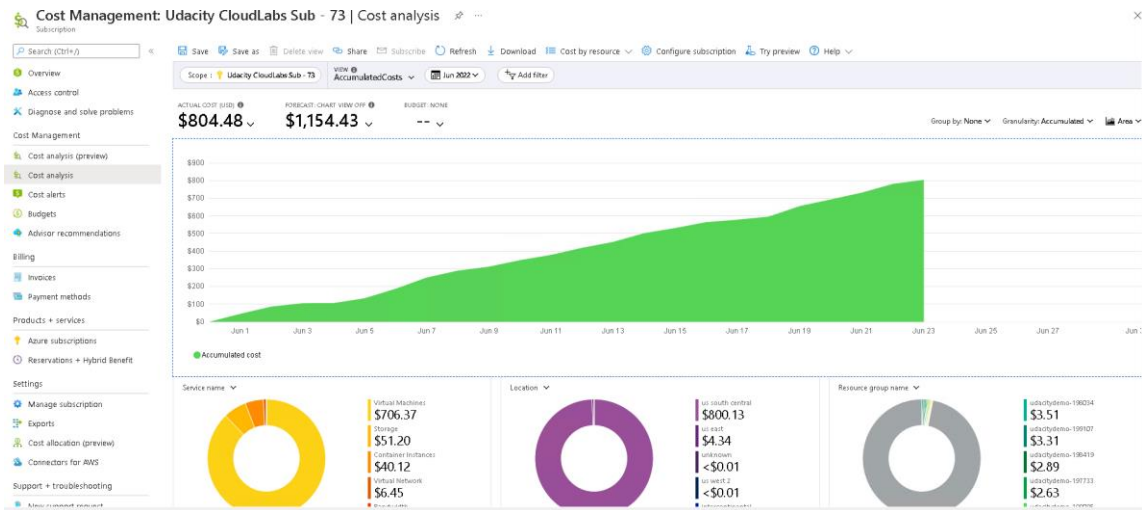
Azure includes built-in resiliency services that you can leverage and manage based on your business needs. Whether it's a single hardware node failure, a rack level failure, a datacenter outage, or a large-scale regional outage, Azure provides solutions that improve resiliency. For example, availability sets ensure that the virtual machines deployed on Azure are distributed across multiple isolated hardware nodes in a cluster. Availability zones protect customers' applications and data from datacenter failures across multiple physical locations within a region.

Building resilient systems on Azure is a shared responsibility. Microsoft is responsible for the reliability of the cloud platform, which includes its global network and datacenters. Azure customers and partners are responsible for the resilience of their cloud applications, using architectural best practices based on the requirements of each workload.

STEP 3: Azure Cost Management + Billing

Background	You have now configured your Azure Production Workload environment and been using Azure for a few days. You have now been tasked by your CIO to present some metrics on how the costs are being billed within Azure and also what other functionalities Azure has in regards to cost management, which were not previously available.
Question 1 Submit the explanation	What is the purpose of Azure Cost Mgmt + billing Dashboard?
Explanation 1	<ol style="list-style-type: none">1) To create and maintain a cost-efficient solution:<ul style="list-style-type: none">• Checking and understanding if service tier / SKU is right sized, its properly scaled up/down vertically/horizontally, keep checking for changes needed.2) Understanding Costs:<ul style="list-style-type: none">• Basically, what is contributing to costs, analysis of data to estimate/determine actual costs, understanding the base of costs, example: Compute/Networking in step1, identifying costs that may be unexpected, like an unexpected hike in compute costs, (some dev VM was left on during night) or in rare cases unexpected hike in CPU due to traffic on web servers causing autoscaling due to a (DDOS/DOS Attacks).3) Having a good idea of costs (avoiding surprises when one sees his bill):<ul style="list-style-type: none">• Setting alerts when "X" % of Budget is over, leading us to fix problems from increasing from 1% to 100%, basically stopping it at 10-15% or some other desired threshold.
Screenshot 2 Submit the screenshot for	Hint: Navigate to the Cost Management Section on the left and then click "Cost Analysis" to reach this dashboard. Students need to submit the main screenshot of the Billing dashboard

main Cost Mgmt + Billing Dashboard.



Explanation 2

Explain the key components of the screenshot submitted. An explanation to be provided for Scope and Area dropdown from the screenshot submitted.

Hint: Make sure the right time period is selected to see the data.

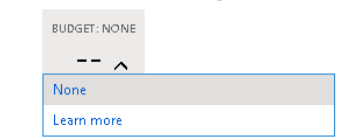
Top part of the graph shows an area chart for the appropriate date selected (top dropdown June 2022) and for the right scope.

Graph Shows:

- Accumulated cost - the shaded green part indicates what the total cost for the Azure account as there is just 1 Subscription, otherwise it would depend on the scope selected.

Subscription name ↑↓	Subscription ID ↑↓	My role ↑↓	Current cost	Secure Score ↑↓	Parent management group ↑↓	Status
Udacity CloudLabs Sub - 73	c9f3ddc6-8cec-407e-977f-00022f967a0f	Specified access	\$804.48	-	Tenant Root Group	Active

(There is no budget line shown here due to some issue in the lab environment)



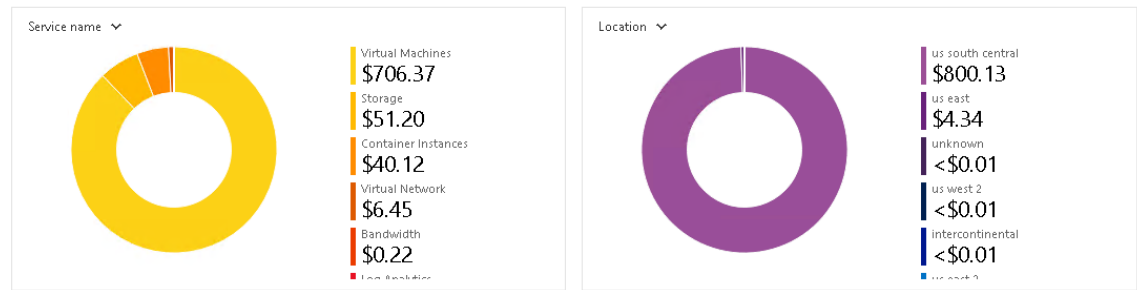
Scope: They are levels in the resource hierarchy, where one can manage and control access to one or more resources. Starts from Root management group to sub-groups, so one can track various teams.

Screenshot 3

Submit the screenshot for breakdown of costs by

Hint: Navigate to Cost Management Section on the left, and then click “Cost Analysis” to reach this dashboard. These pie charts are under the above graph submitted.

Service Name and Location.



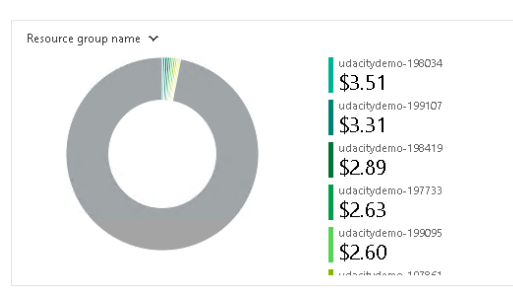
Explanation 3

Explain the key components of the screenshot submitted.

Area Dropdown: It has many options Area, Line, Column(stacked), Column(grouped) and Table these are different types of charts or visual representation types to better visualize our costs. (They can give greater insights with group by and granularity dropdown)

The bottom donut charts show the charges by the certain options:

- Service Name: Costs broken down by service name
- Location: Costs broken by region where your Azure infrastructure is stood up

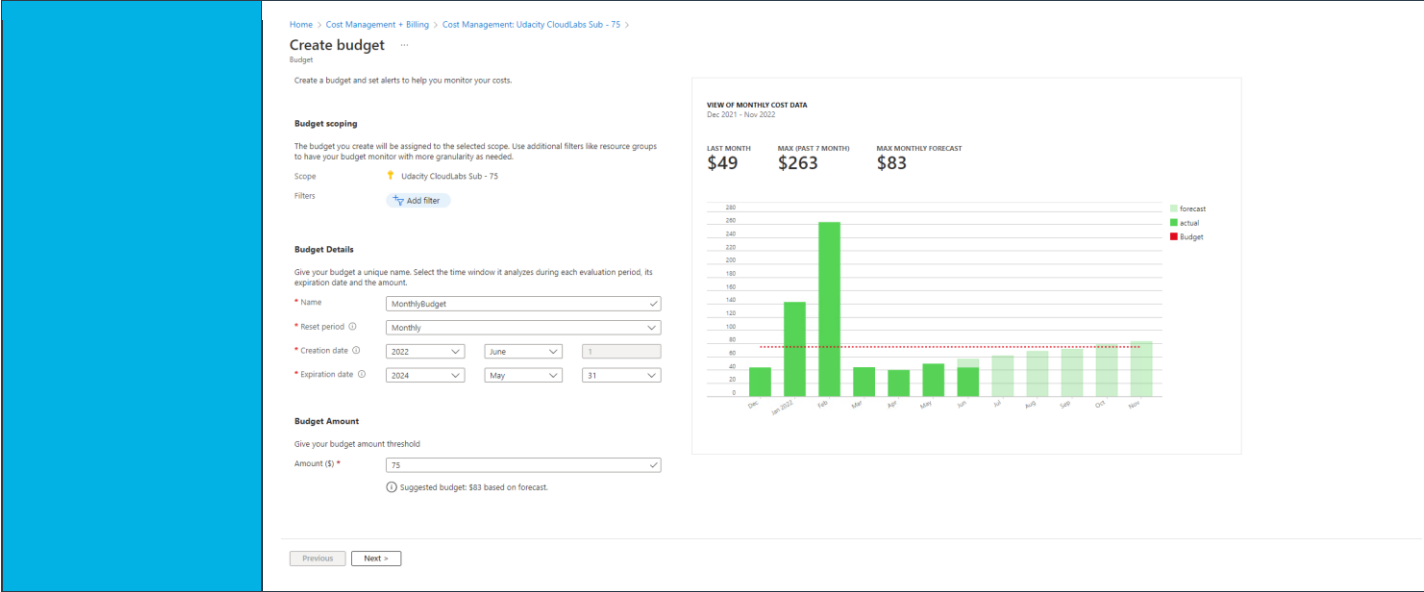


- Resource Group Name: Costs broken down by subscription.

Screenshot 4

Submit the screenshot for breakdown of costs by Service Name and Location.

Hint: Navigate to Cost Management Section on the left and then click "Cost Alert" to reach this wizard. Next, click on "Add button" on top left under this tab. This is Part 1 of the wizard (of the 2-part process).



Explanation 4

Explain the key components of the screenshot submitted.

Budgets are commonly used as part of cost control. Budgets can be scoped in Azure. For instance, one could narrow one's budget view based on subscription, resource groups, or a collection of resources.

In addition to using the budgets API to notify one via email when a budget threshold is reached, one can use Azure Monitor action groups to trigger an orchestrated set of actions resulting from a budget event.

Hence, we set a budget to for better visualization and analysis.

One can create a monthly, quarterly, annual budget and set the maximum threshold for their organization.

Screenshot 5

Submit the screenshot for breakdown of costs by Service Name and Location

Hint: This is Part 2 of the wizard (of the 2-part process).

Create budget

Budget

✓ Create a budget **Set alerts**

Configure alert conditions and send email notifications based on your spend.

Alert conditions

Type	% of budget	Amount	Action group
Actual	70	\$2.50	None
Select type	Enter %	-	None

Manage action group

Alert recipients (email)

Alert recipients (email)

od_user_199316@vdaotyfabr.commicrosoft.com ✓
example@email.com

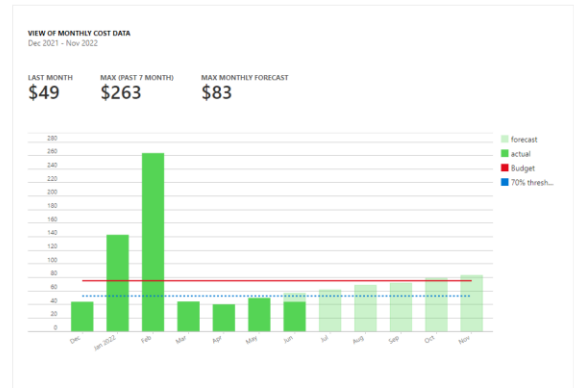
It is recommended to add azure-noreply@microsoft.com to your email white list to ensure alert mails do not go to your spam folder.

Language preference

Select your preferred language for receiving the alert email for all recipients provided above. Default is the language associated to your enrollment.

Languages * Default

Previous Create

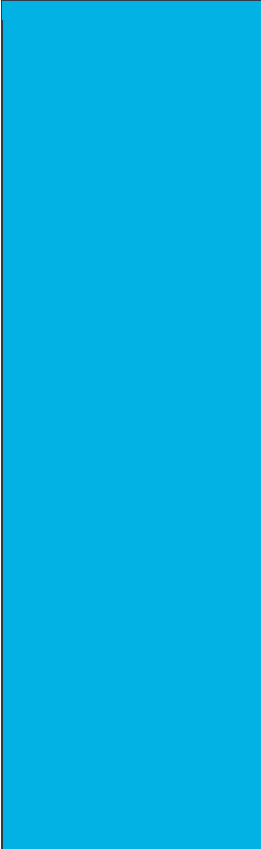


Cannot create budget

The client does not have authorization to perform action. Request ID: f263bed2-6b22-4674-8c97-721968198a83

Hence cannot provide screenshot of Cost Analysis Page with Budget line and Alert line.

Also since there was no Logic app/Azure Function created and added to an action group, hence action group says none, one could create one to check for unused instances or shutdown all instances, I mean to say anything that is to be done to make sure costs don't go above certain thresholds. (any desired task can be done in azure via functions and logic apps)



[Home](#) > [Cost Management + Billing](#) > [Cost Management: Udacity CloudLabs Sub - 75](#) > [Create budget](#) > [Action groups](#) >

Create an action group ...

[Basics](#) [Notifications](#) [Actions](#) [Tags](#) [Review + create](#)

An action group invokes a defined set of notifications and actions when an alert is triggered. [Learn more](#)

Project details

Select a subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription * ⓘ

Udacity CloudLabs Sub - 75

Resource group * ⓘ

[Create new](#)

Instance details

Action group name * ⓘ

Display name * ⓘ

This display name is limited to 12 characters

[Review + create](#) [Previous](#) [Next: Notifications >](#)

Explanation 5

Explain the key components of the screenshot submitted.

Here we are setting an alert, and putting 70% as the threshold of the alert. On hitting this alert threshold, the specified email would receive an email mentioning 70% of the budget has been used.

This also has an option of Action Group, one can use this action group to execute a task for eg an Azure function or a Logic App (for eg we check for unused VMs or shutdown lower priority infrastructure etc based on requirement.)

Budget alerts support both cost-based and usage-based budgets. Budget alerts are generated automatically whenever the budget alert conditions are met. You can view all cost alerts in the Azure portal. Whenever an alert is generated, it's shown in cost alerts.

Screenshot 6

Submit the screenshot for breakdown of costs by

Service Name and Location.

The screenshot displays the Azure Cost Management + Billing interface. At the top, there's a navigation bar with options like 'Add', 'Manage', 'Refresh', 'Dismiss', 'Re-Activate', and 'Help'. Below this, a filter bar shows 'Scope: Udacity CloudLabs Sub - 75', a 'Filter by name...' input, and filters for 'Last 30 days', 'Group by: None', and 'Status: Active'. The main area shows a green dollar sign icon and the text 'No results' and 'No alerts match the given filter.' Below this, a description states 'The cost is greater than \$6 and exceeds monthly-budget threshold of 100%.' and provides a link to 'Analyze in cost analysis'. On the right, it shows 'Current cost 614% | \$36.89' and 'Last Updated: April 29, 2022 at 7:09 AM'. At the bottom, there's a table with columns for Name, Date, and Scope. The table contains one row with 'Actual > 100%', '4/7/2022, 7:07:58 AM', and 'Udacity CloudLabs Sub - 75 (subscription)'. Below the table, it shows 'Budget monthly-budget' and 'Email sent to: fasal.zaman@spektrasystems.com'.

Explanation 6

Explain the key components of the screenshot submitted.

Here Alerts are shown when an Alert is fired. Since the alert threshold was not met as the budget itself could not be created, hence no alerts are shown.

Scopes can be used for different subscriptions or hierarchy. Other metrics such as Last X days/months, Group by, Status can be used for more specific searches.

Explanation 7

Explain the summarized highlights of this part of the project, Azure Cost Mgmt + Billing

Azure Cost Management + Billing is a suite of tools provided by Microsoft that helps you analyze, manage, and optimize the costs of your workloads. These tools help to ensure the benefits of the cloud are utilized.

Azure Cost Management + Billing Dashboard has the following features which help with monitoring cost efficiency:

- Data analysis of costs
- Identify opportunities that optimize spending
- Set spending thresholds (policies)
- Pay bill from here
- Download cost and usage data

STEP 4: Azure Policy to create and enforce policies

Background	<p>You have now configured your Azure Production Workload environment and been using Azure for a few days. You realize that many infrastructure administrators are creating VM sizes without doing proper due diligence, thus having a direct impact on cost.</p> <p>You now decide to leverage Azure Policy features to ensure that appropriate controls are put in place.</p>
Screenshots 1 through 5 Submit the screenshots for Azure Policy steps.	<p>Hint: Navigate to and select the built-in Azure policy “Allowed virtual machine size SKUs,” then follow the wizard steps. Submit a screenshot for every single step of the wizard so that any mistakes in the final step can be caught by your reviewer.</p> <p><u>Very important note:</u></p> <ol style="list-style-type: none">1. Due to lab restrictions, while you go through the wizard, you will not be allowed to create the policy in the final step. Please submit all screenshots though2. So for the Part 2 of this project to be submitted, a successful policy has already been created in the lab for you, which can be used to test the VM creation scenario. Please ensure to double check which VM series is allowed to be created in the lab and ensure that you do not use the same series for passing this part of the project

Step 1:

[Home](#) > [Policy](#) > [Allowed virtual machine size SKUs](#) >

Allowed virtual machine size SKUs

Assign policy

[Basics](#) [Parameters](#) [Remediation](#) [Non-compliance messages](#) [Review + create](#)

Scope

Scope [Learn more about setting the scope](#) *

Udacity CloudLabs Sub - 73 ✓ ...

Exclusions

Optionally select resources to exclude from the policy assignment. ...

Basics

Policy definition

Allowed virtual machine size SKUs

Assignment name * ⓘ

Allowed virtual machine size SKUs

Description

Policy enforcement ⓘ

Enabled Disabled

Assigned by

ODL_User 199299

[Review + create](#) [Cancel](#) [Previous](#) [Next](#)

Step 2:

[Home](#) > [Policy](#) > [Allowed virtual machine size SKUs](#) >

Allowed virtual machine size SKUs ...

Assign policy

Basics

Parameters

Remediation

Non-compliance messages

Review + create

Search by parameter name

☒ Only show parameters that need input or review

Allowed Size SKUs * ⓘ

Standard_B1s



Review + create

Cancel

Previous

Next

Step 3

[Home](#) > [Policy](#) > [Allowed virtual machine size SKUs](#) >

Allowed virtual machine size SKUs

Assign policy

Basics Parameters **Remediation** Non-compliance messages Review + create


By default, this assignment will only take effect on newly created resources. Existing resources can be updated via a remediation task after the policy is assigned. For deployIfNotExists policies, the remediation task will deploy the specified template. For modify policies, the remediation task will edit tags on the existing resources.

Managed Identity

Policies with the deployIfNotExists and modify effect types need the ability to deploy resources and edit tags on existing resources respectively. To do this, choose between an existing user assigned managed identity or creating a system assigned managed identity. [Learn more about Managed Identity.](#)

☐ Create a Managed Identity ⓘ

Permissions

 This policy does not contain any role definitions. deployIfNotExists and modify policies must specify role definitions in order to create the correct role assignments for the managed identity.

[Review + create](#) [Cancel](#) [Previous](#) [Next](#)

Step 4:

[Home](#) > [Policy](#) > [Allowed virtual machine size SKUs](#) >

Allowed virtual machine size SKUs

Assign policy

Basics Parameters Remediation Non-compliance messages Review + create

Non-compliance messages help users understand why a resource is not compliant with the policy. The message will be displayed when a resource is denied and in the evaluation details of any non-compliant resource.

Non-compliance message

Only B1's are allowed

[Review + create](#) [Cancel](#) [Previous](#) [Next](#)

Step 5:

	<div><div>Home > Policy > Allowed virtual machine size SKUs ></div><div><div>Allowed virtual machine size SKUs</div><div>Assign policy</div></div><div><div>Basics</div><div>Parameters</div><div>Remediation</div><div>Non-compliance messages</div><div>Review + create</div></div><div><div>Basics</div><div>Scope</div><div>Exclusions</div><div>Policy definition</div><div>Assignment name</div><div>Description</div><div>Policy enforcement</div><div>Assigned by</div><div>Parameters</div><div>listOfAllowedSKUs</div><div>Remediation</div><div>No managed identity associated with this assignment.</div><div>Non-compliance messages</div><div>Default non-compliance message</div></div><div><div>Create</div><div>Cancel</div><div>Previous</div><div>Next</div></div></div>
<div><div>Screenshot 6</div><div>Explain through screenshots what happens when you create a VM which is in violation with the policy</div></div>	<div><div>Once the Azure policy creation is complete, try to create a VM which is of a "NOT ALLOWED" size.</div><div><div>Hint:</div><div>pick any size; it doesn't matter as long as it's not in the allowed list in Azure policy you just created.</div></div><div>Once you go through the wizard, in the final step you will see the following screenshot, which needs to be submitted.</div></div>

you just
created.

Home > Virtual machines > Create a virtual machine >

Select a VM size

Search by VM size... Display cost: Monthly vCPUs: All RAM (GiB): All Add filter

Showing 610 VM sizes | Subscription: UdayCloudLabs Sub - 73 | Region: South Central US | Current size: Standard_DS2_v2 | Image: Ubuntu Server 20.04 LTS | [Learn more about VM sizes](#) | Group by series

VM Size	Type	vCPUs	RAM (GiB)	Data disks	Max IOPS	Temp storage (GiB)	Premium disk	Cost/month
Most used by Azure users								
The most used sizes by users in Azure								
D-Series v2								
The 2nd generation D family sizes for your general purpose needs								
DS2_v2	General purpose	2	7	0	6400	14	Supported	\$92.71
Blocked by Policy								
Your organization has Azure Policies in place that restrict these sizes.								
DS1_v2	General purpose	1	3.5	4	3200	7	Supported	\$46.43
DS1_v2	General purpose	1	3.5	4	3200	7	Supported	\$46.43
DS1_v3	General purpose	2	8	4	3200	16	Supported	\$80.30
DS1_v3	General purpose	2	8	4	3200	16	Supported	\$80.30
DS1_v4	General purpose	2	8	4	3200	16	Supported	\$83.95
DS1_v4	General purpose	2	8	4	3200	16	Supported	\$83.95
B2s	General purpose	2	4	4	1280	9	Supported	\$36.43
B2s	General purpose	2	4	4	1280	9	Supported	\$36.43
B1s	General purpose	1	1	2	320	4	Supported	\$9.13
B1s	General purpose	1	1	2	320	4	Supported	\$9.13
B2ms	General purpose	2	8	4	1920	16	Supported	\$72.85
B2ms	General purpose	2	8	4	1920	16	Supported	\$72.85
B1ms	General purpose	1	0.5	2	160	4	Supported	\$4.56
B1ms	General purpose	1	0.5	2	160	4	Supported	\$4.56
B4ms	General purpose	4	16	9	2880	32	Supported	\$146.00

Select Prices presented are estimates in your local currency that include only Azure infrastructure costs and any discounts for the subscription and location. The prices don't include any applicable software costs. Final charges will appear in your local currency in cost analysis and billing views. [View Azure pricing calculator](#)

Since all are already blocked by the policy, I don't even get to select it.

Normally if a policy is violated then at the end tab (review + create) validation error will be seen saying SKU disallowed by policy.

Like this:

✖ Validation failed.

✖ Basics Disks

[See all sizes](#)

i Item(s) availability based on policy assignment(s) for the selected scope.
Allowed virtual machine size SKUs ([Policy details](#))

✖ The value must not be empty.

Blocks all recommended SKUs by default due to policy.

Standard_DS2_v2 - 2 vcpus, 7 GiB memory (\$92.71/month)

[See all sizes](#)

i Item(s) availability based on policy assignment(s) for the selected scope.
Allowed virtual machine size SKUs ([Policy details](#))

Only this SKU is allowed.

<p>Explanation 1</p> <p>Explain the summarized highlights of this part of the project, Azure Policy.</p>	<p>Azure Policy helps to enforce organizational standards and to assess compliance at scale (in our case we get to restrict admins who are creating VM sizes without considering costs). It provides an aggregated view with the ability to drill down to the per-resource, per-policy granularity.</p> <p>Policies can be applied at multiple levels and are inherited from top to bottom starting from the root management group up to resource groups. They also help assign policies at the appropriate level to have the right controls for resources. Azure Policy starts with a policy definition with conditions for enforcement. If certain conditions are met, we can Deny, Remediate, or Audit. (In our case we used a Deny Policy)</p>
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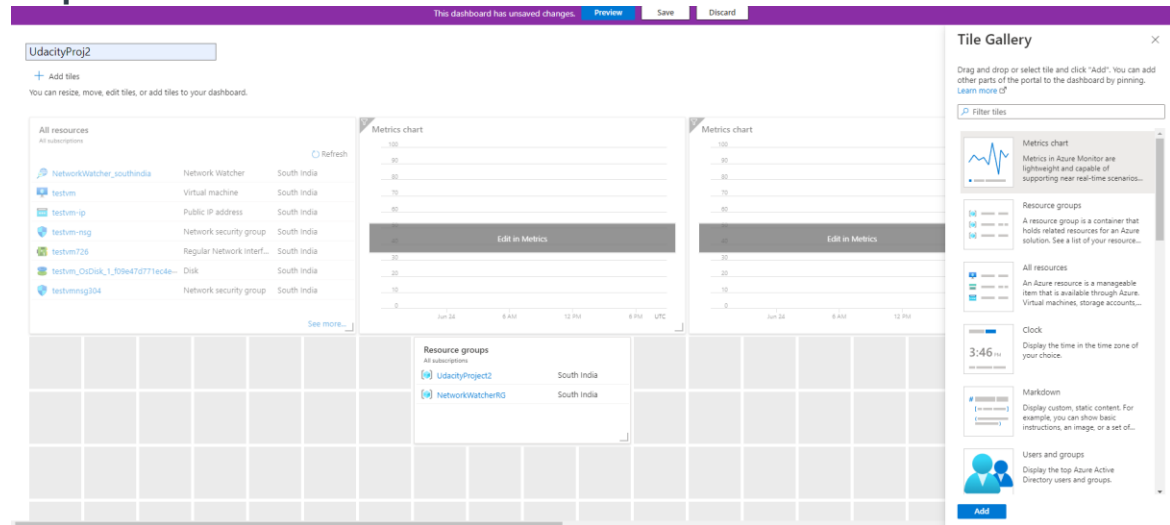
STEP 5: Azure Dashboards

<p>Background</p>	<p>Azure Dashboards are a one stop shop to monitor</p> <ul style="list-style-type: none"> • Your logs • Your infrastructure • Your applications
<p>Task 1</p>	<p>You need to create an Azure dashboard that will pull in a few widgets: Percentage CPU, All Resources, Resource Groups & Avg CPU Credits Consumed. Submit the screenshots and explain the key components of the Dashboard. Be sure to include a screenshot of the final Dashboard.</p>

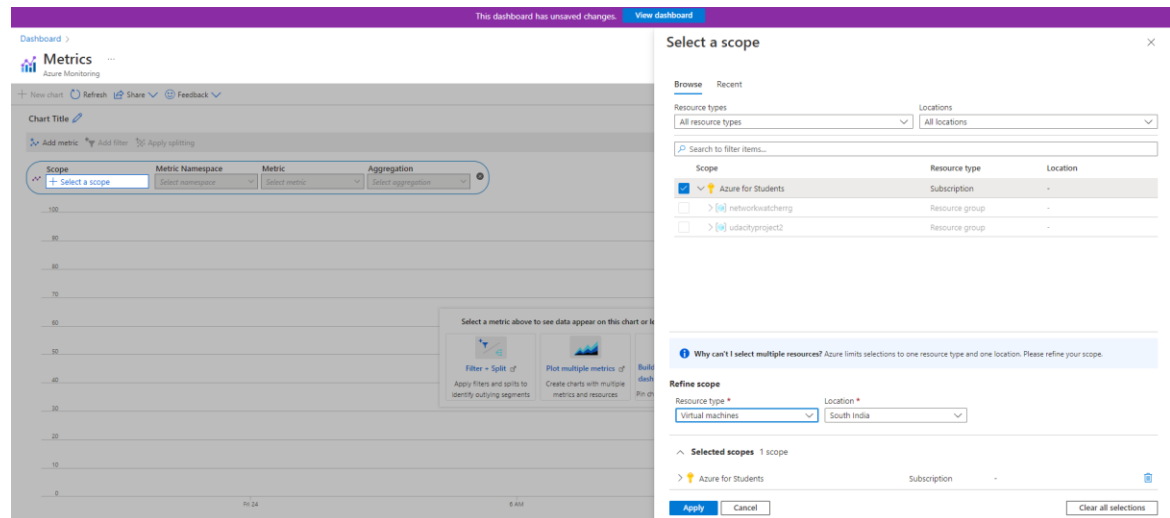
Screenshots 1 through 3

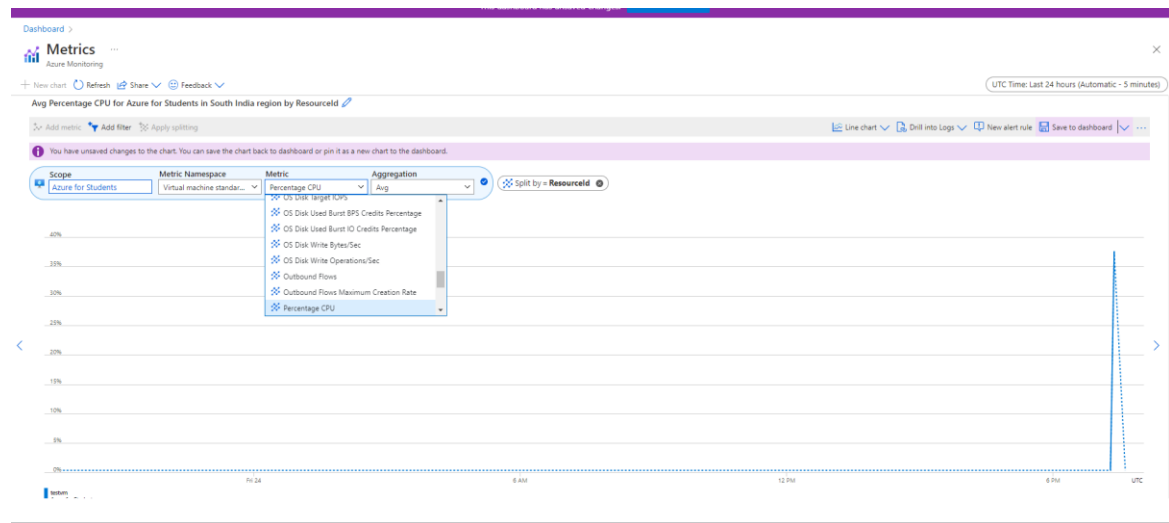
You will submit the screenshots for Overview tab.

Step 1:



Step 2: Percentage CPU:





Avg CPU Credits consumed:

Microsoft Azure Search resources, services, and docs (v1.1)

Dashboard > Metrics Azure Monitoring

Chart Title

Scope: + Select a scope Metric Namespace: Select namespace Metric: Select metric Aggregation: Select aggregation

Select a metric above to see data appear on this chart or to

Filter = Split of Apply filters and cards to identify outlying segments Plot multiple metrics of Create charts with multiple metrics and resources Bulk dashboards Pin chart

Select a scope

Browse Recent

Resource types: All resource types Locations: All locations

Search to filter items...

Scope	Resource type	Location
<input checked="" type="checkbox"/> Azure for Students	Subscription	-
<input type="checkbox"/> > networkwatcher	Resource group	-
<input type="checkbox"/> > udacityproject2	Resource group	-

Why can't I select multiple resources? Azure limits selections to one resource type and one location. Please refine your scope.

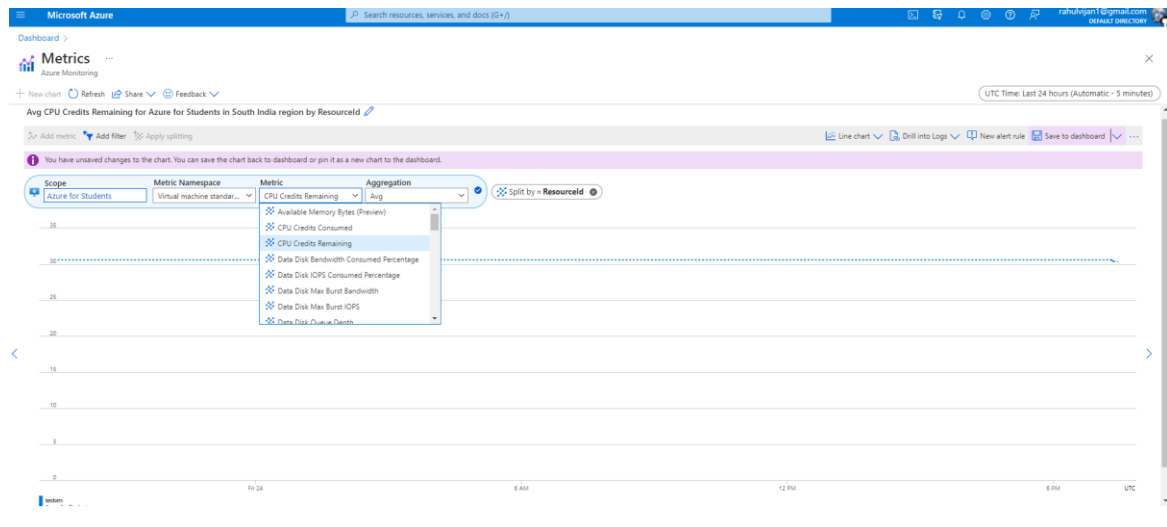
Refine scope

Resource type: Virtual machines Location: South India

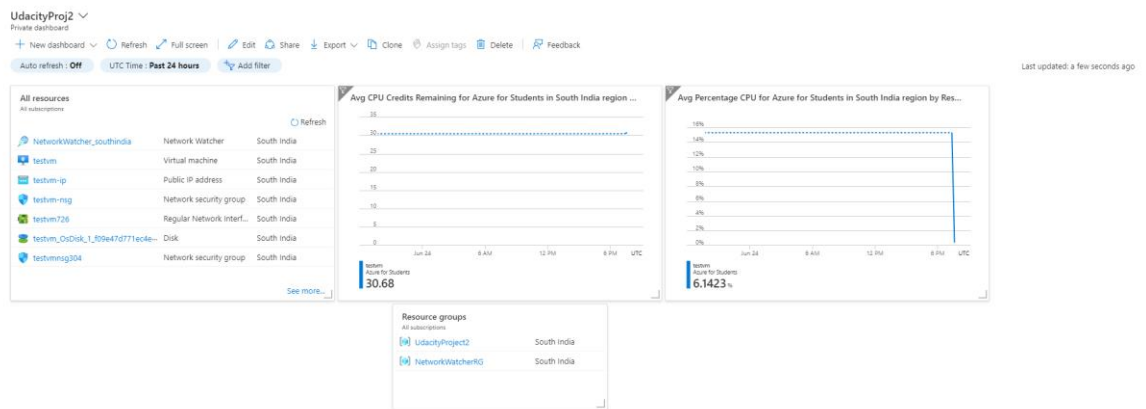
Selected scopes: 1 scope

Azure for Students Subscription

Apply Cancel Clear all selections



Step 3 (Final Output):



STEP 6: Azure Monitor – Metrics

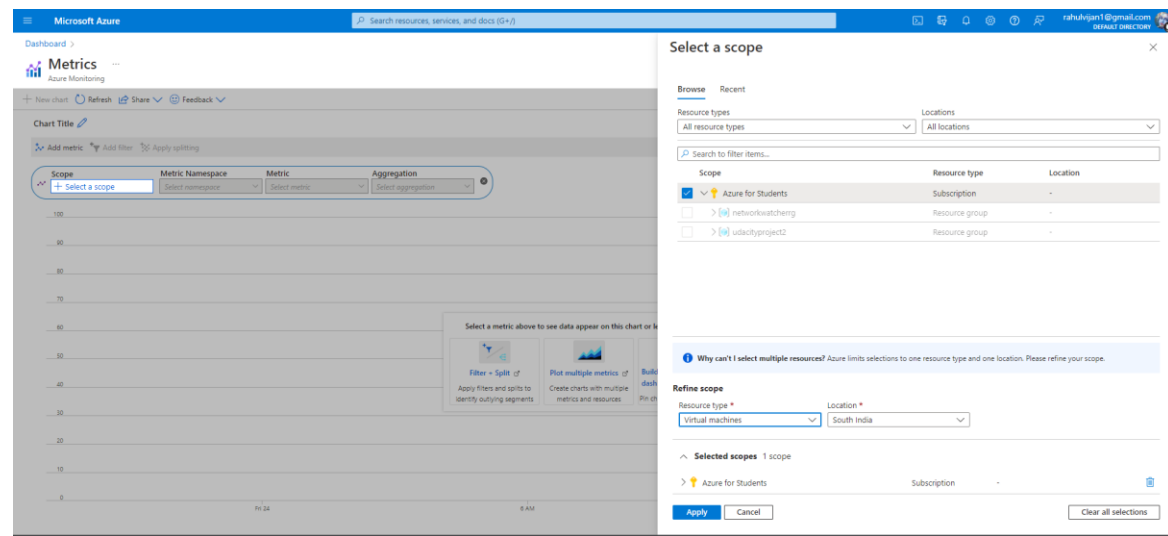
Task 1

You need to navigate to Azure Monitor > Metrics screen and create a Percentage CPU as a metric and submit screenshot of the graph generated and pin to dashboard.

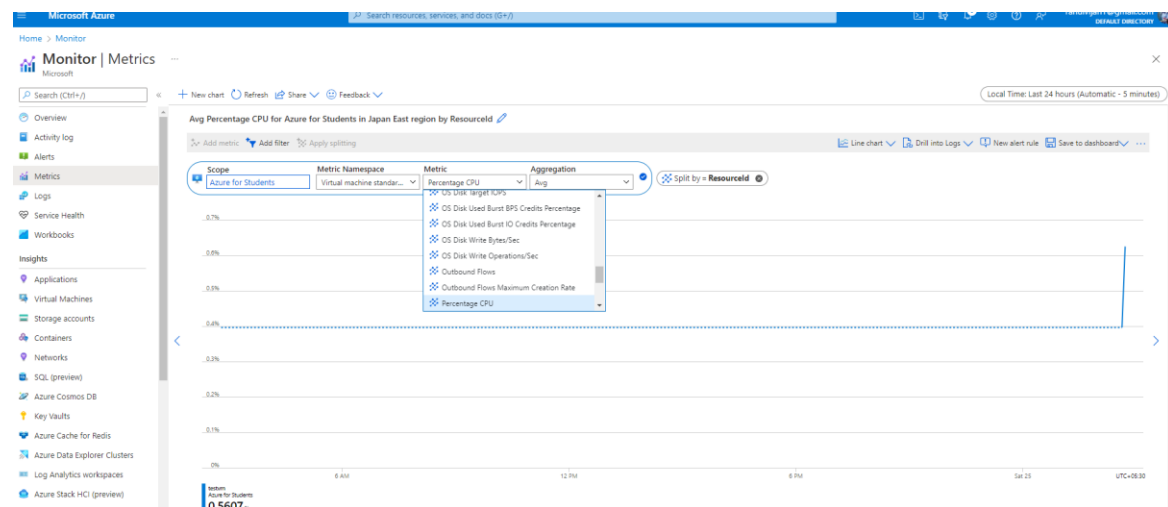
Screenshots 1 through 3

You will submit the screenshots for Monitor | Metrics screen as you are setting up

Step 1:



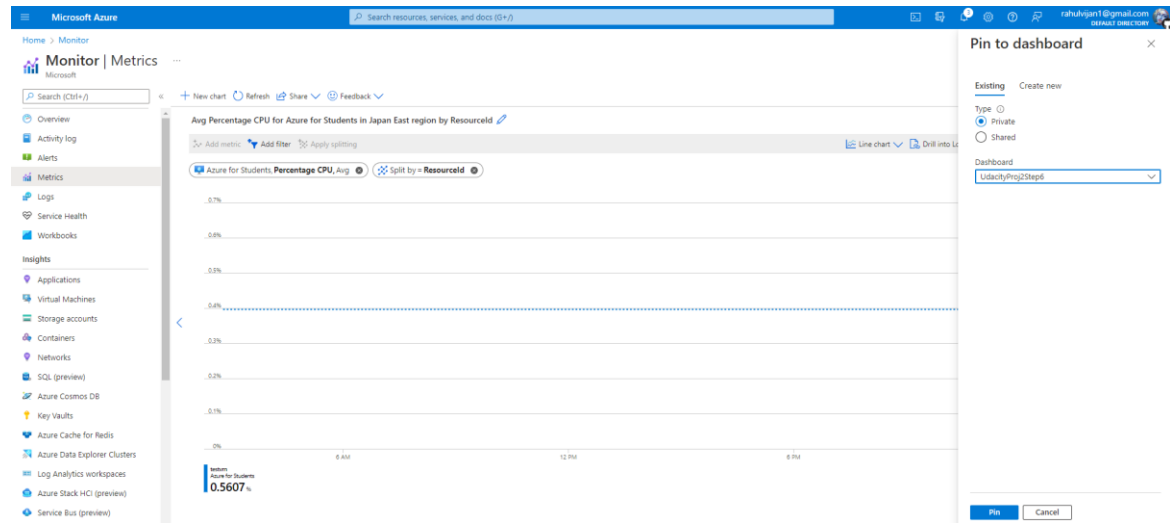
Step 2:



Step 3:

Screenshot 4

Now that Azure Metrics Monitor is configured, please set an alert for that metric. The alert is whenever the Avg % CPU is greater than 0.3; then the alert will be triggered.



Home > Monitor >

Create an alert rule

Scope Condition Actions **Details** Tags Review + create

Create an alert rule to identify and address issues when important conditions are found in your monitoring data. [Learn more](#)

+ Select scope

Resource	Hierarchy
All virtual machines (Japan East)	Azure for Students

Microsoft Azure

Search resources, services, and docs (5+)

Home > Monitor >

Create an alert rule

Scope Condition Actions Details Tags Review + create

Configure when the alert rule should trigger by selecting a signal and defining its logic.

+ Add condition

Review + create Previous Next: Actions >

Select a signal

Choose a signal below and configure the logic on the next screen to define the alert condition.

Signal type Metrics Monitor service All

Displaying 1 - 3 signals out of total 3 search results

Signal name	Signal type	Monitor service
CPU Credits Consumed	Metrics	Platform
CPU Credits Remaining	Metrics	Platform
Percentage CPU	Metrics	Platform

Done

Microsoft Azure

Search resources, services, and docs (5+)

Home > Monitor >

Create an alert rule

Scope Condition Actions Details Tags Review + create

Configure when the alert rule should trigger by selecting a signal and defining its logic.

+ Add condition

Review + create Previous Next: Actions >

Configure signal logic

Percentage CPU (Avg)
0.54%

Alert logic

Threshold State Dynamic

Operator Greater than Aggregation type Average Threshold value 0.3 %

Condition preview

Whenever the average percentage cpu is greater than 0.3%

Evaluated based on

Aggregation granularity (Period) 1 minute Frequency of evaluation Every 1 Minute

Done

Create an alert rule ...

Scope Condition Actions Details Tags Review + create

An action group is a set of actions that can be applied to an alert rule. [Learn more](#)

+ Select action groups + Create action group

Action group name Contains actions

No action group selected yet

Create an alert rule ...

Scope Condition Actions Details Tags Review + create

Project details

Select the subscription and resource group in which to save the alert rule.

Subscription * ⓘ Azure for Students

Resource group * ⓘ testvm_group

[Create new](#)

Alert rule details

Severity * ⓘ 3 - Informational

Alert rule name * ⓘ CpuincreaseAlert

Alert rule description ⓘ

Enable upon creation ⓘ ☒

Automatically resolve alerts ⓘ ☒

Create an alert rule ...

Scope Condition Actions Details Tags Review + create

Tags are name and value pairs that enable you to categorize resources and view consolidated billing by applying the same tag to multiple resources and resource groups. [Learn more about using tags](#)

Note that if you later change resource settings on other tabs, your tags will be automatically updated.

Name ⓘ Value ⓘ

:

Scope	Condition	Actions
-------	-----------	---------

1 Condition

Total pricing
0.10 USD/month
Pricing

Scope

Resource

[Azure for Students](#) > [All virtual machines \(Japan East\)](#)

Condition

Operator

Greater than

Aggregat

Average

Threshold value

0.3

Aggregation gra

1 minute

Frequency of evaluation

Every 1 Minute

Details

Project details

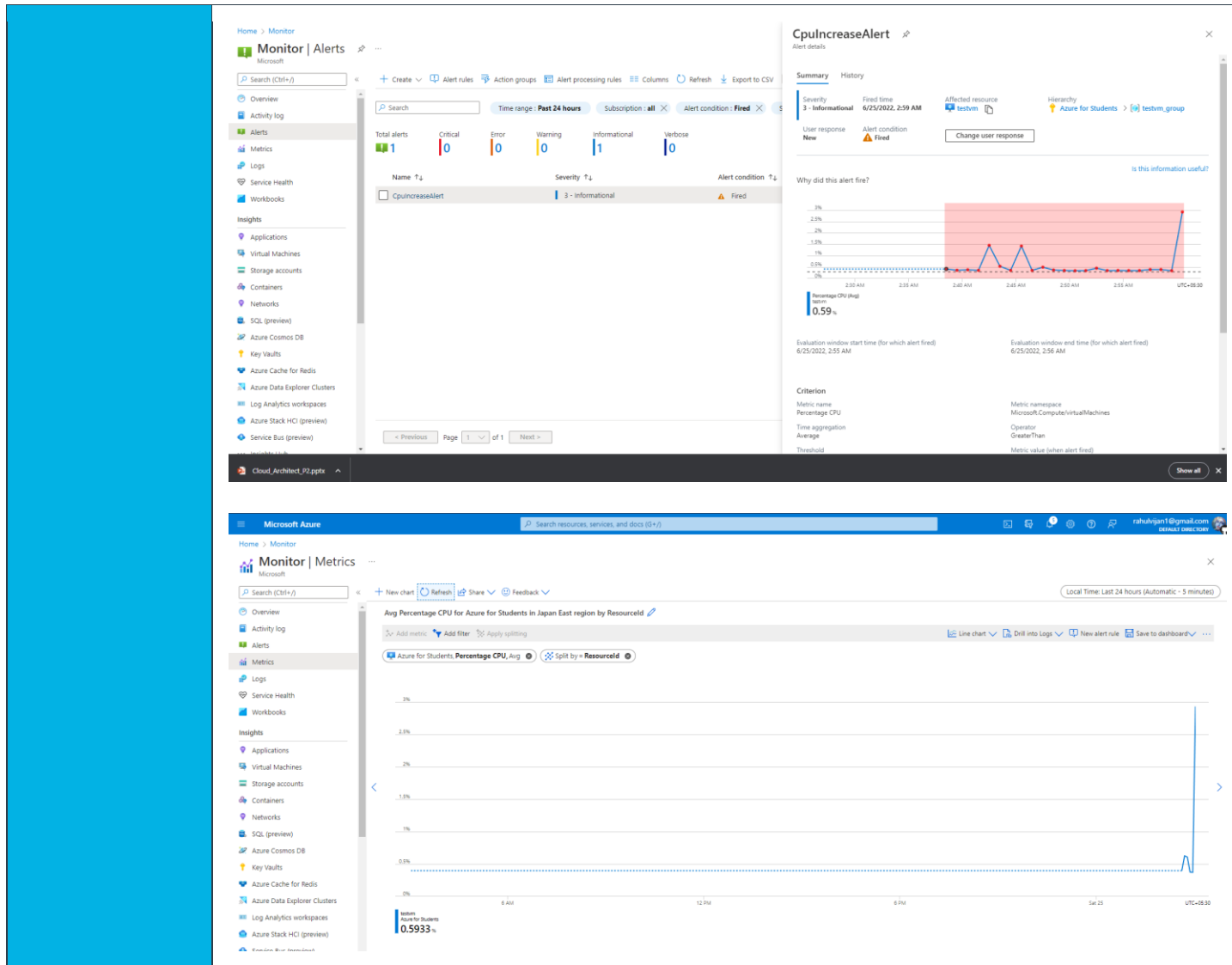
Resource gro

testvm_group

Alert rule details

Create

[Previous](#)[illegible]



STEP 7: Azure Monitor – Log Analytics

Task 1	You need to create a Log Analytics workspace and submit step-by-step screenshots.
Screenshots 1 through 4	Step 1:
You will submit the screenshots	

for Log
Analytics
workspace
creation
screens.

[Home](#) > [Log Analytics workspaces](#) >

Create Log Analytics workspace ...

Basics Tags Review + Create

i A Log Analytics workspace is the basic management unit of Azure Monitor Logs. There are specific considerations you should take when creating a new Log Analytics workspace. [Learn more](#)

With Azure Monitor Logs you can easily store, retain, and query data collected from your monitored resources in Azure and other environments for valuable insights. A Log Analytics workspace is the logical storage unit where your log data is collected and stored.

Project details

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription *
Resource group *
[Create new](#)

Instance details

Name *
Region *

[Review + Create](#) [Previous](#) [Next: Tags >](#)

Step 2:

Create Log Analytics workspace ...

Basics **Tags** Review + Create

Tags are name/value pairs that enable you to categorize resources and view consolidated billing by applying the same tag to multiple resources and resource groups. [Learn more](#)

Name ^① Value ^①
 :

Step 3:

Home > Log Analytics workspaces >

Create Log Analytics workspace

Validation passed

Basics Tags Review + Create

Log Analytics workspace
by Microsoft

Basics

Subscription Azure for Students
Resource group testvm_group
Name MyLogWorkspace
Region East US

Pricing

Pricing tier Pay-as-you-go (Per GB 2018)

The cost of your workspace depends on the volume of data ingested and how long it is retained. Regional pricing details are available on the [Azure Monitor pricing page](#). You can change to a different pricing tier after the workspace is created. [Learn more about Log Analytics pricing models](#).

Tags

(none)

Create

Previous

Download a template for automation

Step 4:

Home >

Microsoft.LogAnalyticsOMS | Overview

Deployment

Search (Ctrl+F)

Delete Cancel Redeploy Refresh

Overview

Inputs

Outputs

Template

Deployment is in progress

Deployment name: Microsoft.LogAnalyticsOMS
Subscription: Azure for Students
Resource group: testvm_group

Start time: 6/25/2022, 3:13:07 AM
Correlation ID: 71645eb9-c722-4a21-a56a-948de9da9f11

Deployment details (Download)

Resource	Type	Status	Operation details
No results.			

https://portal.azure.com/#@rahulgan1@gmail.commicrosoft.com/resource/subscriptions/9f888028-4205-4602-a0f9-233ca23d30ea

Home > Microsoft.LogAnalyticsOMS >

MyLogWorkspace
Log Analytics workspace

Search (Ctrl+F)

Delete

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Settings

Locks

Agents management

Agents configuration

Custom logs

Computer Groups

Data Export

Linked storage accounts

Network isolation

Tables (preview)

General

Workspace summary

Workbooks

Logs

Solutions

Usage and estimated costs

Essentials

Resource group (new) : testvm_group
Status : Active
Location : East US
Subscription (new) : Azure for Students
Subscription ID : 9f888028-4205-4602-a0f9-233ca23d30ea
Tags (edit) : [Click here to add tags](#)

Workspace Name : MyLogWorkspace
Workspace ID : f6b6d542-7653-48f9-b111-9566f552b129
Pricing tier : Pay-as-you-go
Access control mode : Use resource or workspace permissions
Operational issues : [OK](#)

Get started with Log Analytics

Log Analytics collects data from a variety of sources and uses a powerful query language to give you insights into the operation of your applications and resources. Use Azure Monitor to access the complete set of tools for monitoring all of your Azure resources.

1 Connect a data source

Select one or more data sources to connect to the workspace
Azure virtual machines (VMs)
Windows and Linux Agents management
Azure Activity logs
Storage account log
System Center Operations Manager

2 Configure monitoring solutions

Add monitoring solutions that provide insights for applications and services in your environment
[View solutions](#)

3 Monitor workspace health

Create alerts to proactively detect any issue that arise in your workspace
[Learn more about monitor workspace health](#)

Useful links

[Documentation site](#)
[Community](#)

Maximize your Log Analytics experience

Search and analyze logs

Use Log Analytics rich query language to analyze logs
[View logs](#)

Manage alert rules

Notify or take action in response to important information in your data

Manage usage and costs

Understand your usage of Log Analytics and estimate your costs for each month

Create and Share Workbooks

Use Workbooks to create rich interactive reports with your data
[Create Workbook](#)

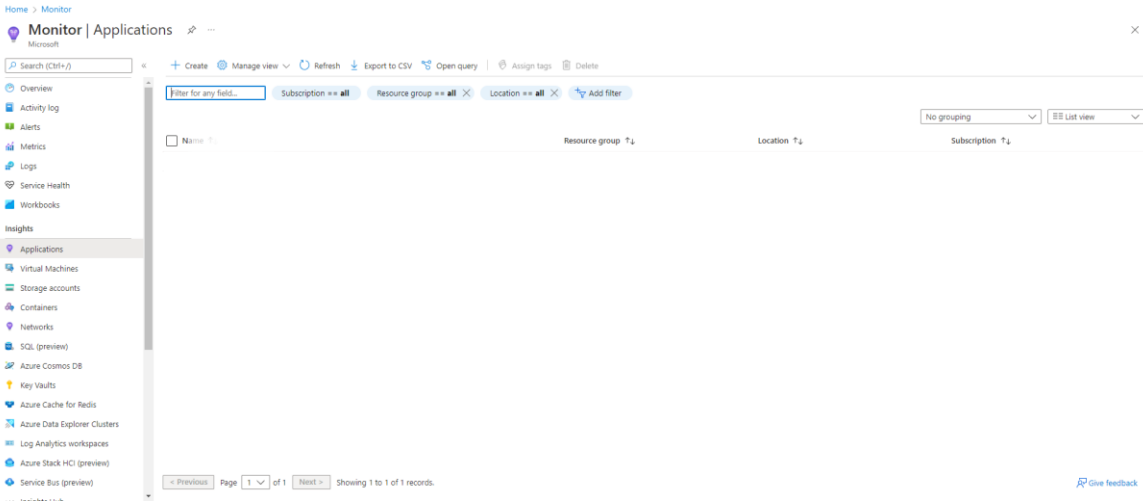
Deployment succeeded
Deployment 'Microsoft.LogAnalyticsOMS' to resource group 'testvm_group' was successful.

[Go to resource](#)

[Pin to dashboard](#)

JSON View

STEP 8: Azure Insights

Background	Azure Insights can only be created once you have the Log Analytics workspace completed.
Screenshots 1 through 6 You will submit the screenshots for the Monitor Metrics screen as you are setting up.	<p>Hint 1: Navigate to Insights > Applications and then click Add button</p> <p>Hint 2: The Log Analytics workspace you created before will be used here</p> <p>Step 1:</p>  <p>Step 2:</p>

Home > Monitor >

Application Insights

Monitor web app performance and usage

Basics Tags Review + create

Create an Application Insights resource to monitor your live web application. With Application Insights, you have full observability into your application across all components and dependencies of your complex distributed architecture. It includes powerful analytics tools to help you diagnose issues and to understand what users actually do with your app. It's designed to help you continuously improve performance and usability. It works for apps on a wide variety of platforms including .NET, Node.js and Java EE, hosted on-premises, hybrid, or any public cloud. [Learn More](#)

PROJECT DETAILS

Select a subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription *

Resource Group * [Create new](#)

INSTANCE DETAILS

Name *

Region *

Resource Mode *

WORKSPACE DETAILS

Subscription *

*Log Analytics Workspace

[Review + create](#)

[Previous](#)

[Next: Tags >](#)

Step 3:

Application Insights

Monitor web app performance and usage

Basics Tags Review + create

Tags are name/value pairs that enable you to categorize resources and view consolidated billing by applying the same tag to multiple resources and resource groups. [Learn More](#)

Name ⓘ

Value ⓘ

:

Step 4:

Home > Monitor >

Application Insights

Monitor web app performance and usage

Validation passed

Basics Tags Review + create

SUMMARY

Application Insights by Microsoft

Subscription	Azure for Students
Resource Group	testm_group
Name	MyApplicationInsights
Region	East US
Workspace	MyLogWorkspace [testu]

Create Previous Download a template for automation

Step 5:

Home >

Microsoft.AppInsights | Overview

Deployment

Search (Ctrl+V) Delete Cancel Redeploy Refresh

Overview Inputs Outputs Template

Deployment is in progress

Deployment name: Microsoft.AppInsights
Subscription: Azure for Students
Resource group: testm_group

Start time: 6/25/2022, 3:20:11 AM
Correlation ID: 48596656-8d91-40c2-8926-120ee077e011

Deployment details (Download)

Resource	Type	Status	Operation details
No results.			

Deployment in progress... Deployment to resource group 'testm_group' is in progress.

Step 6: Click "Go to resource"

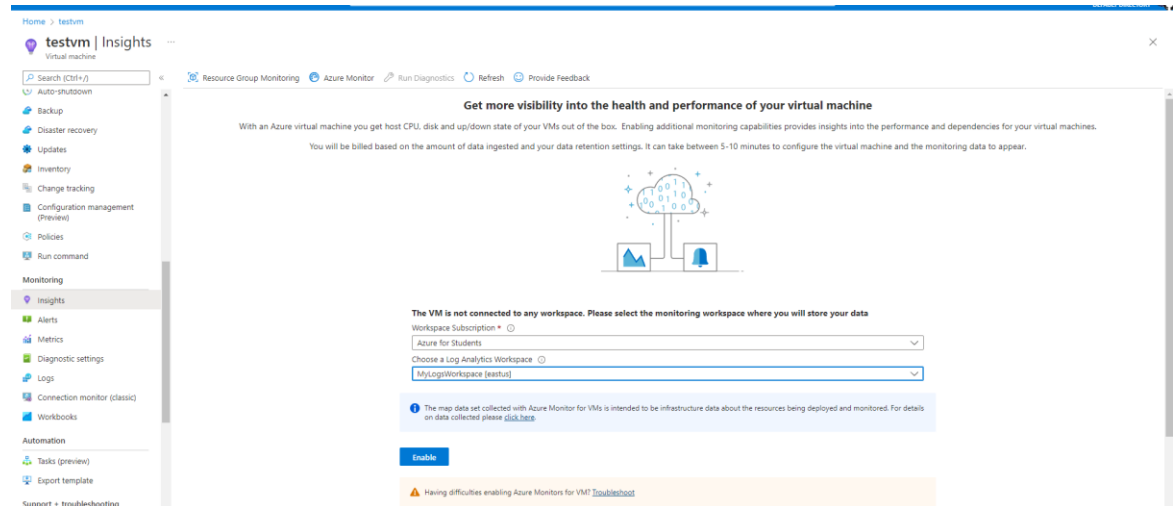
Screenshots 7 through 12

You will submit screenshots of you enabling the VM.

Hint 1: So now that you have created Azure Insights for the Resource group, you need to go to Virtual Machines tab and actually enable it for the VM itself.

Hint 2: The key is to select the Log Analytics workspace which you created above in STEP 7: Azure Monitor – Log Analytics.

Step 7:



Step 8:

Microsoft Azure

Home > testvm

testvm | Insights

Virtual machine

Search (Ctrl+F)

Auto-shutdown

Backup

Disaster recovery

Updates

Inventory

Change tracking

Configuration management (Preview)

Policies

Run command

Monitoring

Insights

Alerts

Metrics

Diagnostic settings

Logs

Connection monitor (classic)

Workbooks

Automation

Tasks (preview)

Export template

Resource Group Monitoring

Azure Monitor

Run Diagnostics

Refresh

Provide Feedback

Insights deployment is in progress... Please wait.

Get more visibility into the health and performance of your virtual machine

Hang tight while we get your virtual machine setup with monitoring. It can take between 5-10 minutes for the setup to complete.

Having difficulties enabling Azure Monitor for VM? [Troubleshoot](#)

Notifications

More events in the activity log →

Dismiss all

- Initializing deployment... Running X
Initializing template deployment to resource group 'testvm_group'.
a few seconds ago
- Deployment succeeded X
Deployment 'Microsoft.AppInsights' to resource group 'testvm_group' was successful.
Go to resource Pin to dashboard
14 minutes ago
- Deployment succeeded X
Deployment 'Microsoft.LogAnalyticsOMS' to resource group 'testvm_group' was successful.
Go to resource Pin to dashboard
21 minutes ago
- Successfully stopped virtual machine X
Successfully stopped the virtual machine 'testvm'.
29 minutes ago
- Delete alert rule X
Alert rule deleted successfully.
29 minutes ago
- Alert rule created X
Alert rule CpuIncreaseAlert successfully created. It might take a few minutes for changes to be shown.
37 minutes ago

Step 9:

Microsoft Azure

Home > testvm

testvm | Insights

Virtual machine

Search (Ctrl+F)

Auto-shutdown

Backup

Disaster recovery

Updates

Inventory

Change tracking

Configuration management (Preview)

Policies

Run command

Monitoring

Insights

Alerts

Metrics

Diagnostic settings

Logs

Connection monitor (classic)

Workbooks

Automation

Tasks (preview)

Export template

Support + troubleshooting

Resource Group Monitoring

Azure Monitor

Run Diagnostics

Refresh

Provide Feedback

Get started

Performance

Map

Health (preview)

Monitor the health and performance of virtual machines

VM insights monitors the performance and health of your virtual machines and virtual machine scale sets, including their running processes and dependencies on other resources. It can help deliver predictable performance and availability of vital applications by identifying performance bottlenecks and network issues. [Learn more](#)

Analyze data

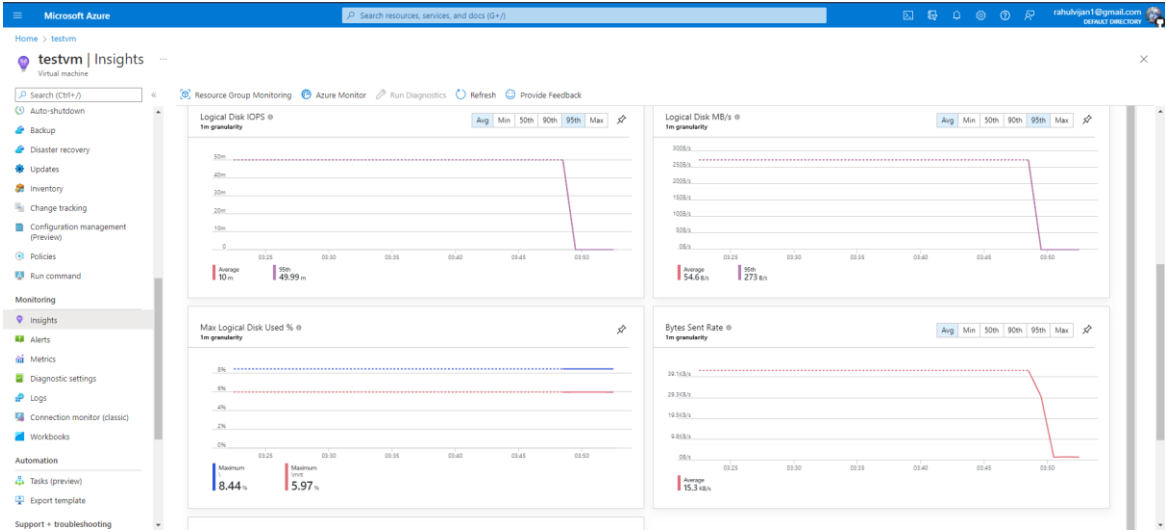
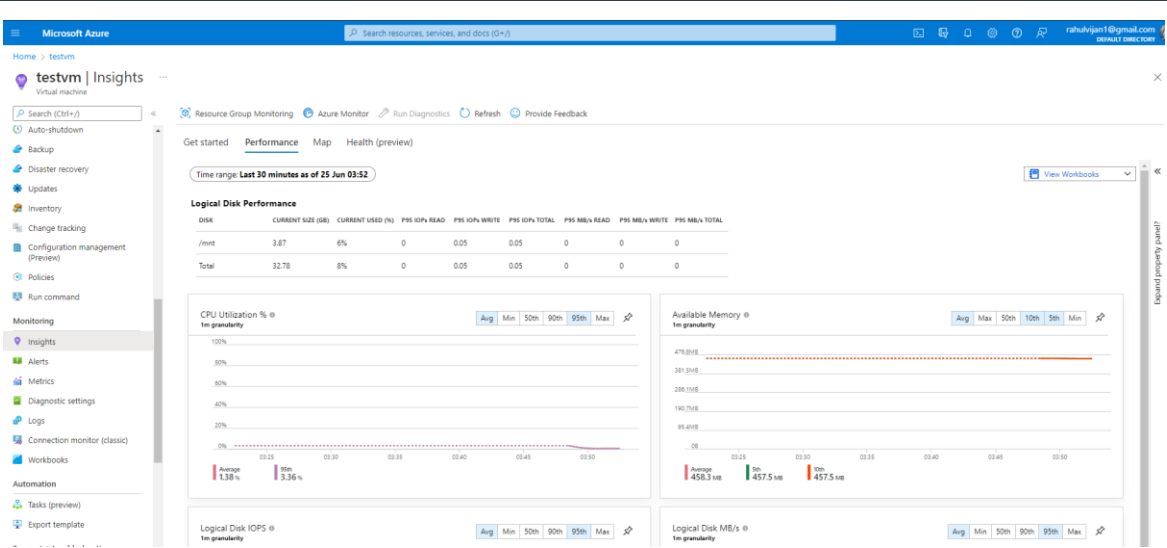
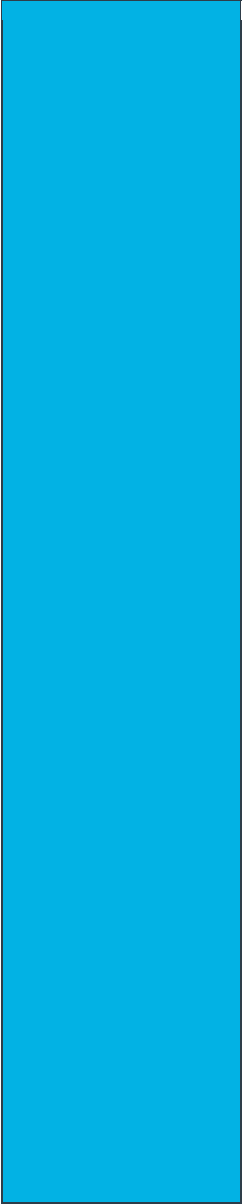
Analyze the health and performance for a single machine or multiple machines and drill into logs for troubleshooting. [Learn more](#)

Create alerts

Alerts in Azure Monitor proactively notify you of interesting data and patterns in your monitoring data and potentially take automated actions based on triggers. [Learn more](#)

Analyze data

Step 10:



STEP 9: Azure Monitor – Smart Alerts

Task 1

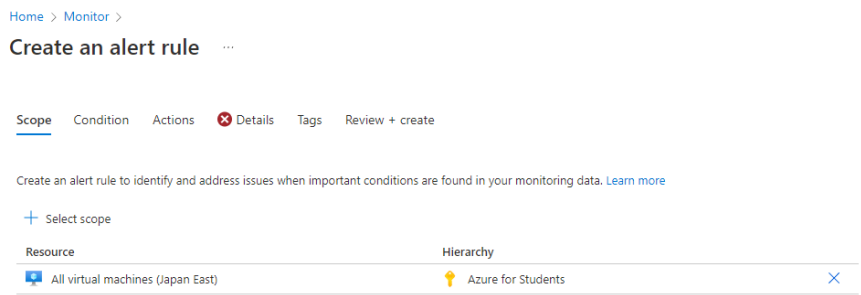
Navigate to Setup Alert & Actions under Azure Monitor >Overview.

The condition name should be CPU units consumed and its value should be greater than 0.3.

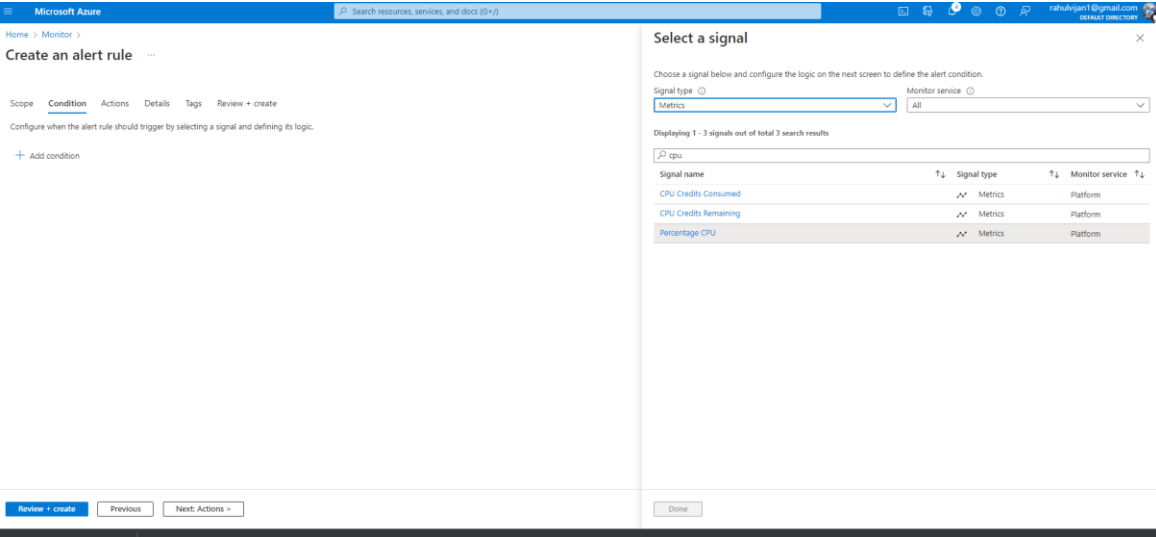
Screenshots 1 through 8

You will submit step-by-step screenshots for creating a Setup Alert & Actions.

Step 1:



Step 2:



Step 3:

The screenshot shows the Microsoft Azure portal interface for creating an alert rule. The main heading is "Create an alert rule" with a three-dot menu. Below it are tabs for "Scope", "Condition", "Actions", "Details", "Tags", and "Review + create". The "Condition" tab is active, showing a message: "Configure when the alert rule should trigger by selecting a signal and defining its logic." Below this is a "+ Add condition" button. On the right, the "Configure signal logic" panel is open, displaying a line chart for "Resource CPU (avg)" with a current value of 0.54%. The "Alert logic" section shows a "Threshold" set to "Static", an "Operator" of "Greater than", an "Aggregation type" of "Average", and a "Threshold value" of 0.3. The "Condition preview" states: "Whenever the average percentage cpu is greater than 0.3%". The "Evaluated based on" section shows "Aggregation granularity (Period)" set to "1 minute" and "Frequency of evaluation" set to "Every 1 Minute". At the bottom of the panel is a "Done" button. At the bottom of the main page are buttons for "Review + create", "Previous", and "Next: Actions >".

Step 4:

The screenshot shows the "Create an alert rule" page in the Microsoft Azure portal, with the "Actions" tab selected. The breadcrumb navigation is "Home > Monitor >". The main heading is "Create an alert rule" with a three-dot menu. Below it are tabs for "Scope", "Condition", "Actions", "Details", "Tags", and "Review + create". The "Actions" tab is active, showing a message: "An action group is a set of actions that can be applied to an alert rule. [Learn more](#)". Below this are two buttons: "+ Select action groups" and "+ Create action group". A section titled "Action group name" contains a text input field with the placeholder "No action group selected yet". To the right of this input field is a label "Contains actions".

Step 5:

Create an alert rule ...

Scope Condition Actions Details Tags Review + create

Project details

Select the subscription and resource group in which to save the alert rule.

Subscription * ⓘ	<div>Azure for Students</div>
Resource group * ⓘ	<div>testvm_group</div> <div>Create new</div>

Alert rule details

Severity * ⓘ	<div>3 - Informational</div>
Alert rule name * ⓘ	<div>CpuIncreaseAlert</div>
Alert rule description ⓘ	<div></div>
Enable upon creation ⓘ	<input checked="" type="checkbox"/>
Automatically resolve alerts ⓘ	<input checked="" type="checkbox"/>

Create an alert rule ...

Scope Condition Actions Details Tags Review + create

Tags are name and value pairs that enable you to categorize resources and view consolidated billing by applying the same tag to multiple resources and resource groups. [Learn more about using tags](#)

Note that if you later change resource settings on other tabs, your tags will be automatically updated.

Name ⓘ	Value ⓘ
<div></div>	<div></div>

...

Create Previous

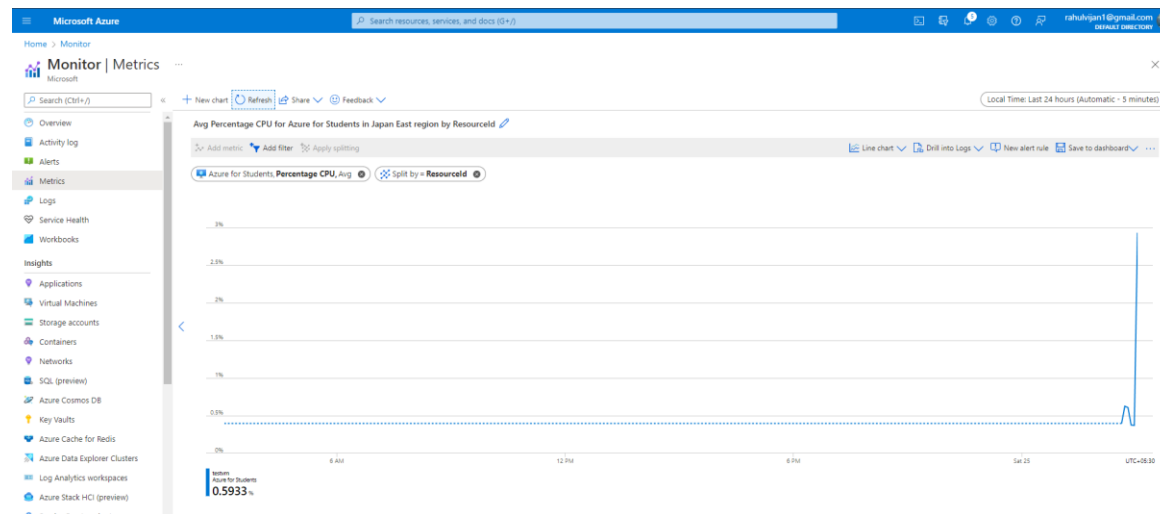
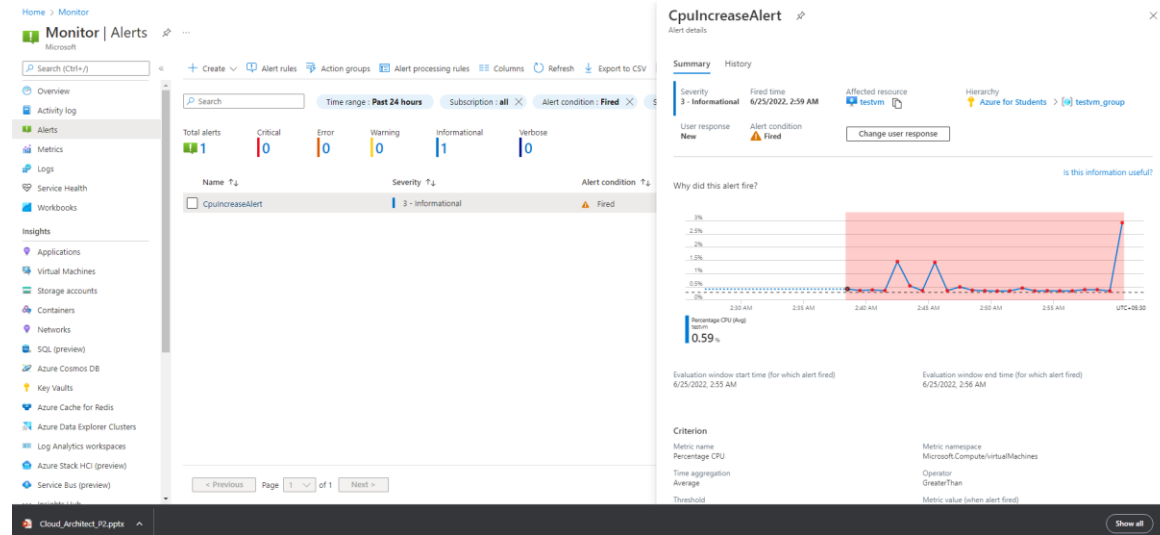
Step 3 (Summary after above steps):

X

Step 7 (Screenshot post-creation of the alert):

```
demouser@ubuntu:~$  
Reading package lists... Done  
debconf-getty-tty-5  
Homebrew/gremlins:~$ sudo apt-get upgrade  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
Calculating upgrade... Done  
The following packages will be upgraded:  
libnss-libidn libnss-myhostname libnss-proxy libnss-syslinux linux-cloud-tools-common  
linux-tools-common nvidia-openvm-tools-openssl  
1 standard security updates.  
0 regular updates.  
Need to get 4688 kB of archives.  
After this operation, 1636 kB of additional disk space will be used.  
Do you want to continue? [Y/n] y  
Get:1 http://azure.archive.ubuntu.com/ubuntu focal-updates/main amd64 libnss-libidn 1.1.1f-ubuntu2.15 [131k]  
Get:2 http://azure.archive.ubuntu.com/ubuntu focal-updates/universe amd64 open-vm-tools 1.2.11.3.0-SubUbuntu-ubuntu20-  
04.2 [167kB]  
Get:3 http://azure.archive.ubuntu.com/ubuntu focal-updates/main amd64 openssl amd64 1.1.1f-ubuntu15 [192kB]  
Get:4 http://azure.archive.ubuntu.com/ubuntu focal-updates/main amd64 libnss-proxy amd64 1.20.7-sububuntu0.48.1 [5912 B]
```

Step 8 (If you had any alerts, they would be submitted here):



Explanation 1

Explain the purpose of Azure Dashboards,

Azure Dashboards are a key tool for Solution Architects to monitor operational efficiency. Dashboards are a focused and customized view of your cloud resources and metrics in the Azure portal.

- Azure Dashboard provides a customized view of your cloud metrics by use of appropriate widgets.

Azure Monitor and alerts

- Azure Dashboard provides a unified place to monitor resources quickly.
- Building a custom Dashboard can enable one to quickly consume relevant information, identify issues.

Dashboards are a focused and organized view of your cloud resources in the Azure portal.

Use dashboards as a workspace where you can monitor resources and quickly launch tasks for day-to-day operations and can build custom dashboards based on projects, tasks, or user roles etc.

The Azure portal provides a default dashboard as a starting point, we can also edit the default dashboard and create and customize additional dashboards.

Azure Monitor

Azure Monitor helps you maximize the availability and performance of your applications and services.

It delivers a comprehensive solution for collecting, analyzing, and acting on telemetry from your cloud and on-premises environments.

This information helps you understand how your applications are performing and proactively identify issues that affect them and the resources they depend on.

Azure Monitor Alerts

Alerts help you detect and address issues before users notice them by proactively notifying you when Azure Monitor data indicates that there may be a problem with your infrastructure or application.

You can alert on any metric or log data source in the Azure Monitor data platform.

STEP 10: Autoscale In-Out Based on Number of Users per CPU Core

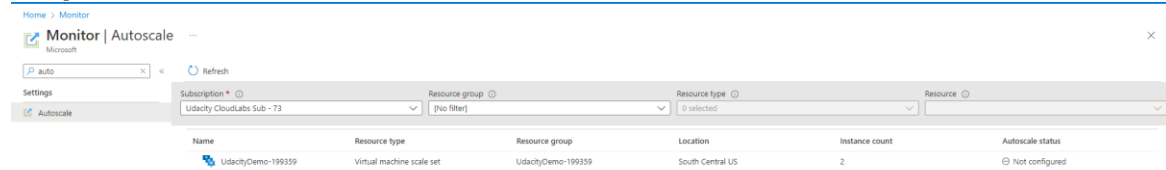
Task 1

The lab will have a Virtual Machine Scale set already created. Navigate to Azure Monitor > Settings > Autoscale. You will create an Autoscale rule as part of this project.

Screenshots 1-5

You will submit step-by-step screenshots for creating an autoscale rule under Azure Monitor.

Step 1 (Browse to Monitor > Autoscale):



Step 2 (Select the option for Custom autoscale and within that Scale based on metric and then click "Add Rule"):

Home > Monitor >

Autoscale setting

UdacityDemo-199359 (Virtual machine scale set)


Save Discard Refresh Logs Feedback

i Predictive autoscale (public preview) is currently supported in the following regions: Australia East, Australia Southeast, Canada Central, Canada East, East Asia, Southeast Asia


Configure Scale-In Policy Predictive charts Run history JSON Notify Diagnostic settings

Autoscale is a built-in feature that helps applications perform their best when demand changes. You can choose to scale your resource manually to a specific instance count, or via a custom Autoscale policy that scales based on metric(s) thresholds, or schedule instance count which scales during designated time windows. Autoscale enables your resource to be performant and cost effective by adding and removing instances based on demand. [Learn more about Azure Autoscale](#) or [view the how-to video](#).

Choose how to scale your resource

**Manual scale**
Maintain a fixed instance count

☐

**Custom autoscale**
Scale on any schedule, based on any metrics

☒

Custom autoscale

Autoscale setting name *

UdacityDemo-199359-Autoscale-30

Resource group

UdacityDemo-199359

Predictive autoscale (public preview)

Mode Disabled

Pre-launch setup of instances (minutes) 0

i Enable Forecast only or Predictive autoscale. [Learn more about Predictive autoscale](#).

Default * Auto created scale condition

Delete warning

i The very last or default recurrence rule cannot be deleted. Instead, you can disable autoscale to turn off autoscale.

Scale mode

☒ Scale based on a metric ☐ Scale to a specific instance count

Rules

w Scale is based on metric trigger rules but no rule(s) is defined: click [Add a rule](#) to create a rule. For example: 'Add a rule that increases instance count by 1 when CPU percentage is above 70%'. If no rules is defined, the resource will be set to default instance count.

Instance limits

Minimum	Maximum	Default
2	2	2

Schedule

This scale condition is executed when none of the other scale condition(s) match

+ Add a scale condition

Step 3 (Create the scale rule. The key part on this screen is that Percentage CPU metric is selected):

Scale rule



Metric source

Current resource (UdacityDemo-199359)

Resource type

Virtual machine scale sets

Resource

UdacityDemo-199359

Criteria

Time aggregation *

Average

Metric namespace *

Virtual Machine Host

Metric name

Percentage CPU

1 minute time grain

Dimension Name

Operator

Dimension Values

Add

VMName

=

All values



If you select multiple values for a dimension, autoscale will aggregate the metric across the selected values, not evaluate the metric for each values individually.



Percentage CPU (Average)

0.24 %

☐ Enable metric divide by instance count

Operator *

Greater than

Metric threshold to trigger scale action *

5

%

Duration (minutes) *

10

Time grain (minutes)

1

Time grain statistic *

Average

Action

Operation *

Increase count by

Cool down (minutes) *

5

Instance count *

1

Add

Scale mode

Rules

☒ Scale based on a metric

☐ Scale to a specific instance count

It is recommended to have at least one scale in rule. To create new rules, click [Add a rule](#).

Scale out

When	UdacityDemo-199359	(Average) Percentage CPU > 5	Increase count by 1
------	--------------------	------------------------------	---------------------

+

Add a rule

Step 4 (Once scale rule is created, submit the summary screenshot):

[Home](#) > [Monitor](#) >

Autoscale setting

UdacityDemo-199359 (Virtual machine scale set)

[Save](#) [Discard](#) [Refresh](#) [Logs](#) [Feedback](#)

[Configure](#) [Scale-In Policy](#) [Predictive charts](#) [Run history](#) [JSON](#) [Notify](#) [Diagnostic settings](#)

Autoscale is a built-in feature that helps applications perform their best when demand changes. You can choose to scale your resource manually to a specific instance count, or via a custom Autoscale policy that scales based on metric(s) thresholds, or schedule instance count which scales during designated time windows. Autoscale enables your resource to be performant and cost effective by adding and removing instances based on demand. [Learn more about Azure Autoscale](#) or [view the how-to video](#).

Choose how to scale your resource

☐ **Manual scale**
Maintain a fixed instance count

☒ **Custom autoscale**
Scale on any schedule, based on any metrics

Custom autoscale

Autoscale setting name *

UdacityDemo-199359-Autoscale-424

Resource group

UdacityDemo-199359

Predictive autoscale (public preview)

Mode Disabled

Pre-launch setup of instances (minutes) 1

☒ Enable Forecast only or Predictive autoscale. [Learn more about Predictive autoscale.](#)

Default * Auto created scale condition

Delete warning

The very last or default recurrence rule cannot be deleted. Instead, you can disable autoscale to turn off autoscale.

Scale mode

☒ Scale based on a metric ☐ Scale to a specific instance count

Rules

It is recommended to have at least one scale in rule. To create new rules, click [Add a rule](#).

Scale out

When

UdacityDemo-199359

(Average) Percentage CPU > 5

Increase count by 1

+ Add a rule

Instance limits

Minimum 1

2

Maximum 1

2

Default 1

2

Schedule

This scale condition is executed when none of the other scale condition(s) match

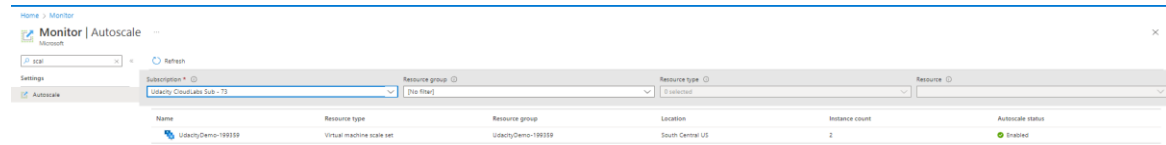
[+ Add a scale condition](#)

[More events in the activity log](#) →

[Dismiss all](#) ▾

✓ Resource 'UdacityDemo-199359' updated ✕
Successfully updated configuration for 'UdacityDemo-199359'
a few seconds ago

Step 5 (Screenshot for “Autoscale Enabled”):



Explanation 1

Explain the key details of autoscale screenshots you have submitted.

AutoScale can be done Manually (would become just scaling rather than auto scaling) or via customization.

We have 2 choices

- Scale based on metric
- Scale to specific instance count - Autoscale based on a schedule

We choose scale based on metric count,

- Leverage metrics such as % CPU to scale out or scale in

We Add a rule for metric based scale in/out.

- Time Aggregation as Average is selected - so the scale is applied to the average metric instead of min/max.
- Metric Name : Percentage CPU is selected
- Operator such as Greater than is selected can be other operators as well based on requirement.
- Most importantly metric threshold to trigger scale action is then entered which in this case is 5%.

Other defaults such as duration and cool down period are set as per suggested by Azure

(Cool down means once one this custom scale has triggered wait for atleast 5 mins in our case to trigger another custom scale rule trigger is detected)

Min, Max, default are instance parameters (provided by default by azure but customizable):

- Can go to Min no of 2 VMs in case of scale in
- Can go to Max no of 2 VMs in case of scale out (since we already have 2 VMs we wont scale up even if rule is triggered)
- Default is 2