

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):	<p>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.</p>
Server(s):	<p>Purpose: Web App Environment: Physical Servers Operating System: Windows</p>

	<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. List of resources: <ul style="list-style-type: none">- 10 E32-16as v5 (16 vCPUs, 256 GB RAM)- 3 DC8s v3 (8 vCPUs, 64 GB RAM)- Block Blob Storage, General Purpose V2, Flat Namespace, LRS Redundancy, Hot Access Tier, 1 TB Capacity- Internet egress, 200 GB outbound data transfer <p>⇒ Try to create resources as same as current on-prem</p>

Screenshot 1

Submit the screenshot for each of the above configurations from Azure TCO.
VM and Web Apps Server screenshot should be submitted here.

Servers

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

The screenshot shows the 'Servers' configuration page. It has two main sections: 'Windows/Linux Server' and 'Web App'. Both sections include fields for Workload, Environment, Operating system, Operating System License, VMs, and Virtualization. Under 'Windows/Linux Server', the 'Core(s)' field is set to 16 and the 'RAM (GB)' field is set to 256. Under 'Web App', the 'Core(s)' field is set to 8 and the 'RAM (GB)' field is set to 64. Both sections have an 'Optimize by' dropdown set to 'CPU' and a radio button for 'Windows Server 2008/2008 R2' selected.

Screenshot 2

Submit the screenshot for each of the above configurations from Azure TCO.
Database screenshot should be submitted here.

Database Server

Source

The screenshot shows the 'Database Server' configuration page under the 'Source' tab. It includes fields for Database (Microsoft SQL Server), License (Enterprise), Environment (Virtual Machines), Operating system (Windows), Operating System License (Datacenter), and VMs (3). The 'Virtualization' section shows Hyper-V selected. The 'Core(s)' field is set to 16 and the 'RAM (GB)' field is set to 64. The 'Optimize by' dropdown is set to 'CPU' and the radio button for 'SQL Server 2008/2008 R2' is selected.

Destination

The screenshot shows the 'Database Server' configuration page under the 'Destination' tab. It includes fields for Service (SQL Database), Purchase Model (vCore), Service Tier (Business Critical), Instance cores (2), SQL Server storage (5 GB), and SQL Server backup (0 GB). The 'Optimize by' dropdown is set to 'CPU' and the radio button for 'SQL Server 2008/2008 R2' is selected.

Screenshot 3

Submit the screenshot for each of the above configurations from Azure TCO.
Storage configuration screenshot should be submitted here.

Storage

The screenshot shows the 'Storage' configuration page. It includes fields for Storage type (Local Disk/SAN), Disk type (HDD), Capacity (1 TB), Backup (0 TB), and Archive (0 TB). The 'Capacity' dropdown is set to 'TB' and the range is '(1 - 5000)'. The 'Backup' and 'Archive' dropdowns are also set to 'TB' with ranges '(0 - 5000)'.

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)

Destination Region

East US

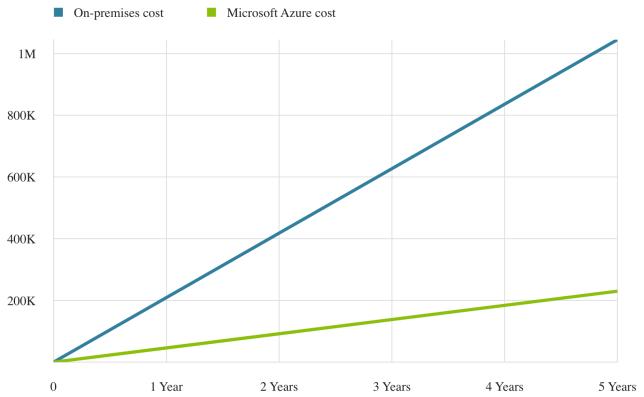
Screenshot 5

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

Over 5 year(s) with Microsoft Azure, your estimated cost savings could be as much as **\$814,991**

Total on-premises vs. Azure cost over time

Savings from running workloads in Azure accrue over time. The following shows how those savings add up over years.

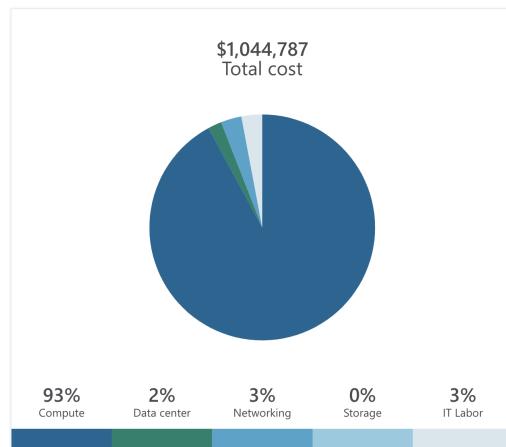


Screenshot 6

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

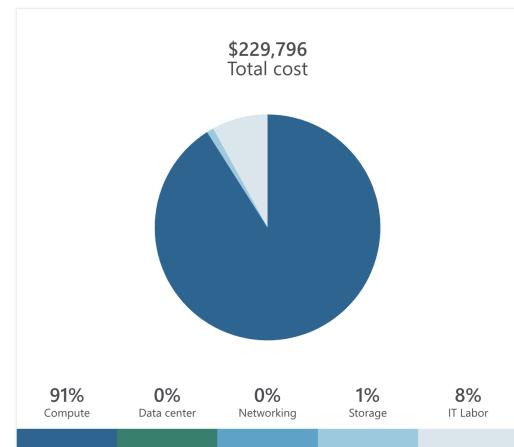
Total on-premises over 5 year(s)

TCO of on-premises environments tends to be driven by compute and data center costs.



Total Azure cost over 5 year(s)

In Azure, certain cost categories decrease or go away completely.

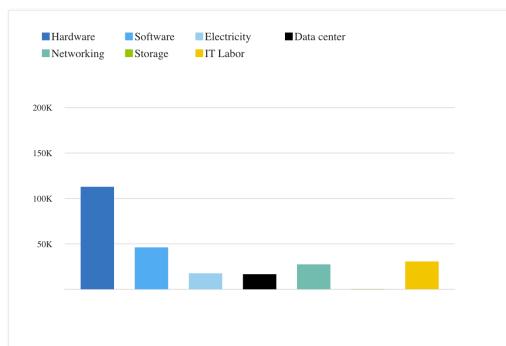


Screenshot 7

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.

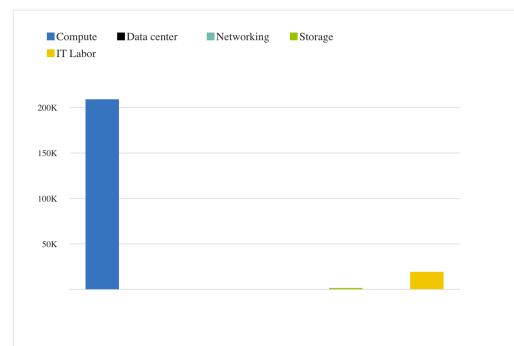


\$1,044,787

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.



\$229,796

Cost over 5 year(s)

On-premises cost breakdown summary

Category	Cost
Compute	\$969,745.70
Hardware	\$112,868.00
Software	\$46,162.50
Electricity	\$17,592.00
Virtualization	\$25,459.20
Database	\$767,664.00
Data Center	\$16,624.85
Networking	\$27,441.77
Storage	\$307.20
IT Labor	\$30,667.05
Total	\$1,044,787.00

Azure cost breakdown summary

Category	Cost
Compute	\$209,202.00
Data Center	\$0.00
Networking	\$0.00
Storage	\$1,427.40
IT Labor	\$19,167.05
Total	\$229,796.00

Explanation 1

We can see that using Azure save a huge amount of cost compared to the on-prem
 1. Compute Cost

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

	On-prem	Azure
	<p>Pay for the physical servers which need to be replaced and maintained from time to time with the needs of the organization.</p> <p>Company is stuck with the purchased hardware. If they want to upgrade, they must sell with lower price or reuse the outdated hardware and buy additional resources for the data center.</p>	<p>No cost for hardware. Maintenance and support cost are included, eliminating annual contracts, and Azure owns up the responsibility of providing the up-to-date hardware to clients. Client don't have to pay for the maintenance. There are also various payment types such as pay as you go, reservation ...</p>
	<p>Have to pay for the license such as OS, software...</p>	<p>Azure Hybrid Benefit is a licensing benefit that helps you do more with less, reducing the costs of running your workloads. It works by letting you use Software Assurance-enabled Windows Server and SQL Server licenses, and RedHat and SUSE Linux subscriptions on virtual machines in Azure.</p>

2. Data Center Costs

	On-prem	Azure
	<p>Cost to place data center, for maintenance, cooling, operation, ...</p>	<p>No Datacenter cost or can say that the cost is included in the bill.</p>
	<p>Electricity costs should be considered since the machine is running 24/24, cooling system, ...</p> <p>The price base on the geo location</p>	<p>Electricity costs on azure are lower than on-prem and Azure also use green energy</p>

3. Networking Cost

On-prem	Azure
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Cost for ISP, VPN,... Price depends on the provider	Free 100 GB bandwidth per month, a very small amount will be charged for each GB (over 100 GB, price base on geo location), which is cheaper than on-prem.
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4. Storage Cost

On-prem	Azure
Hardware cost, need data center, hard to scale, cost to upgrade, operate, maintain...	Cost base on capacity and transactions, easy to scale up or down, up-to-date hardware. Provide a lot of services with reasonable prices (backup, geo-redundancy) for HA, DR... Only pay for what you use

5. IT Labor Cost

On-prem	Azure
A lot of things have to be taken care of, need a large number of operators, maintainers... based on the size of the data center	A small number of cloud engineers can operate the cloud infra which help reduce the cost

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.

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

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.
- Choose the instance you want to create in both the regions from the possible VM sizes mentioned in the classroom.
- 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.

The screenshot shows the Azure Pricing Calculator interface. At the top, it displays "Virtual Machines" with a note: "5 B16ms (16 vCPUs, 64 GB RAM) x 730 Hours (Pay a...)" and "Upfront: \$0.00 Monthly: \$2,664.50". Below this is a search bar labeled "Virtual Machines". A promotional message says "Get \$200 credit plus free monthly amounts of popular services for 12 months—including Virtual Machines. See free amounts". The configuration details are as follows:

- Region: East US 2
- Operating system: Windows
- Type: (OS Only)
- Tier: Standard
- Category: All
- Instance Series: All
- INSTANCE: B16ms: 16 Cores, 64 GB RAM, 128 GB Temporary storage, \$0.730/hour
- Virtual machines: 5
- Hours: 730

Savings Options: Explore pricing models to help optimize your Azure costs. Buttons include "Learn more" and "Compute (B16ms)" and "OS (Windows)".

Compute (B16ms)	OS (Windows)	Total
<input checked="" type="radio"/> Pay as you go	<input checked="" type="radio"/> License included	\$2,664.50
<input type="radio"/> 1 year savings plan (~21% discount)	<input type="radio"/> Azure Hybrid Benefit	Average per month (\$0.00 charged upfront)
<input type="radio"/> 3 year savings plan (~47% discount)		
<input type="radio"/> 1 year reserved (~42% discount)		
<input type="radio"/> 3 year reserved (~62% discount)		
\$2,430.90	\$233.60	
Average per month (\$0.00 charged upfront)	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.

The screenshot shows the Azure Pricing Calculator interface. At the top, it displays a summary: **Virtual Machines**, **5 B16ms (16 vCPUs, 64 GB RAM) x 730 Hours (Pay a...)**, **Upfront: \$0.00**, and **Monthly: \$2,664.50**. Below this is a section titled "Virtual Machines" with a promotional message: "Get \$200 credit plus free monthly amounts of popular services for 12 months—including Virtual Machines. See free amounts". The configuration details are as follows:

- Region:** West US 2
- Operating system:** Windows
- Type:** (OS Only)
- Tier:** Standard
- Category:** All
- Instance Series:** All
- INSTANCE:** B16ms: 16 Cores, 64 GB RAM, 128 GB Temporary storage, \$0.730/hour
- Virtual machines:** 5
- Hours:** 730

Savings Options: Explore pricing models to help optimize your Azure costs. [Learn more](#)

Compute (B16ms)	OS (Windows)	Total
<input checked="" type="radio"/> Pay as you go	<input checked="" type="radio"/> License included	\$2,664.50
<input type="radio"/> 1 year savings plan (~13% discount)	<input type="radio"/> Azure Hybrid Benefit	
<input type="radio"/> 3 year savings plan (~32% discount)		
<input type="radio"/> 1 year reserved (~42% discount)		
<input type="radio"/> 3 year reserved (~62% discount)		
\$2,430.90	\$233.60	= \$2,664.50
Average per month (\$0.00 charged upfront)	Average per month (\$0.00 charged upfront)	Average per month (\$0.00 charged upfront)

Screenshot 3

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

The screenshot shows the Azure Pricing Calculator interface with two configurations listed under "Your Estimate":

- Virtual Machines**: 5 B16ms (16 vCPUs, 64 GB RAM) x 730 Hours (Pay a...), Upfront: \$0.00, Monthly: \$2,664.50
- Virtual Machines**: 5 B16ms (16 vCPUs, 64 GB RAM) x 730 Hours (Pay a...), Upfront: \$0.00, Monthly: \$2,664.50

Support:

- SUPPORT:** Included
- LICENSING PROGRAM:** Microsoft Customer Agreement (MCA)
- SHOW DEV/TEST PRICING

Estimated upfront cost: \$0.00

Estimated monthly cost: \$5,329.00

Explanation 1

Resiliency is the ability of a system to recover from failures and continue to function. Every technology has its own particular failure modes, which you

Explain how resilience is built in by moving to Azure

must consider when designing and implementing your application. Use this checklist to review the resiliency considerations for specific Azure services.

Azure includes built-in reliability services that you can use 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 reliability. 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. Regions and availability zones are central to your application design and resiliency strategy.

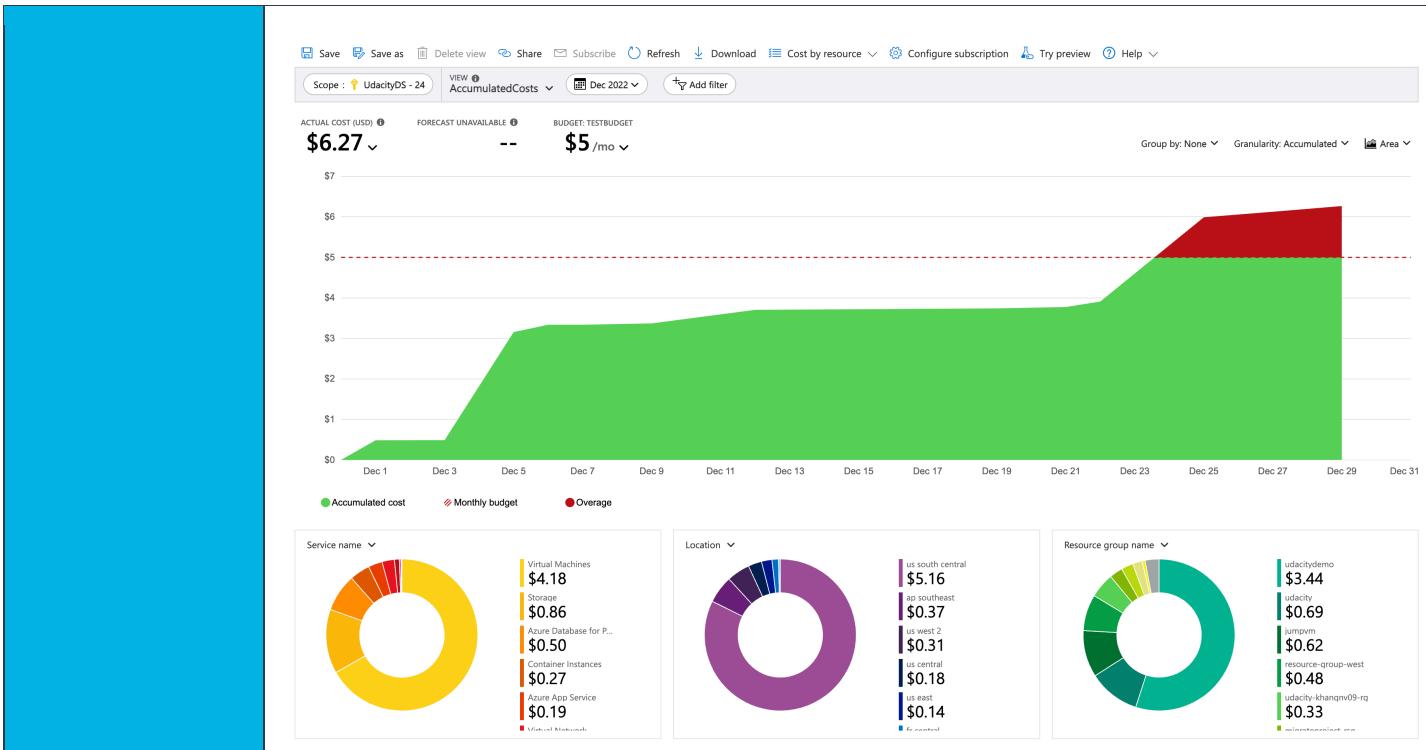
Since Azure already provided built-in reliability, Azure's users also have responsibility for the reliability of the platform. Building reliable systems on Azure is a shared responsibility. Microsoft is responsible for the reliability of the cloud platform, which includes its global network and datacenters. Azure customers and partners are responsible for the reliability of their cloud applications, using architectural best practices based on the requirements of each workload.

In this case, by moving to Azure, we created VMs in multiple AZs in different (in this case 2 regions US East and US West Coasts), which makes our services highly available and resilient. For example, if there is an issue which makes all VMs in the US East Coast region down, there're VMs running in US West Coast, and we can archive zero downtime even an issue happens.

More about Azure reliability: [Azure reliability documentation | Microsoft Learn](#)

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	The cost management and billing dashboard is a centralized portal for all cost-optimization insights. You can use these insights to make data-driven decisions on optimizing cloud costs. Azure Advisor also recommends changes in configuration and workloads that could optimize your cloud spend.
Screenshot 2 Submit the screenshot for main Cost Mgmt + Billing Dashboard.	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



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.

- The area chart shows the cost trending in the appropriately selected date range (Dec 2022) and for the selected scope. This chart can be change to other type of data visualization (line, column, table) by click the Area dropdown. The green is the amount of costs that under the budget threshold, the red color is the amount that exceeded the threshold.
- Scope: 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.
- Area dropdown: change visualization type of the main chart. Available options: Area chart, Line chart, Grouped or Stacked Column, Table.

Screenshot 3

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.

<p>Submit the screenshot for breakdown of costs by Service Name and Location.</p>	<p>The image contains three donut charts side-by-side, each showing a breakdown of costs:</p> <ul style="list-style-type: none"> Service name: Breakdown by service type. The largest segment is Virtual Machines at \$4.18. Location: Breakdown by region. The largest segment is us south central at \$5.16. Resource group name: Breakdown by resource group. The largest segment is udacitydemo at \$3.44. 																																							
<p>Explanation 3 Explain the key components of the screenshot submitted.</p>	<p>The bottom donut charts show the charges by the certain options:</p> <ul style="list-style-type: none"> - Service Name: Costs broken down by service name - Location: Costs broken down by region where your Azure infrastructure is stood up - Resource Group Name: Costs broken down by resource group 																																							
<p>Screenshot 4 Submit the screenshot for breakdown of costs by Service Name and Location.</p>	<p>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).</p> <p>Create budget ...</p> <p>Budget</p> <p>Create a budget Add filter Set alerts</p> <p>Create a budget and set alerts to help you monitor your costs.</p> <p>Budget scoping</p> <p>The budget you create will be assigned to the selected scope. Use additional filters like resource groups to have your budget monitor with more granularity as needed.</p> <p>Scope: UdacityDS - 24</p> <p>Filters: Add filter</p> <p>Budget Details</p> <p>Give your budget a unique name. Select the time window it analyzes during each evaluation period, its expiration date and the amount.</p> <p>Name: <input type="text" value="Enter a unique name"/></p> <p>Reset period: <input checked="" type="radio"/> Monthly</p> <p>Creation date: <input type="text" value="2023 January 1"/></p> <p>Expiration date: <input type="text" value="2024 December 31"/></p> <p>Budget Amount</p> <p>Give your budget amount threshold</p> <p>Amount: <input type="text" value="0"/></p> <p>VIEW OF MONTHLY COST DATA</p> <p>LAST MONTH: \$6 MAX (PAST 6 MONTHS): \$18</p> <table border="1"> <thead> <tr> <th>Month</th> <th>Actual</th> <th>Budget</th> </tr> </thead> <tbody> <tr><td>Jan</td><td>~6</td><td>~6</td></tr> <tr><td>Feb</td><td>~7</td><td>~6</td></tr> <tr><td>Mar</td><td>~7</td><td>~6</td></tr> <tr><td>Apr</td><td>~7</td><td>~6</td></tr> <tr><td>May</td><td>~7</td><td>~6</td></tr> <tr><td>Jun</td><td>~7</td><td>~6</td></tr> <tr><td>Jul</td><td>~7</td><td>~6</td></tr> <tr><td>Aug</td><td>~7</td><td>~6</td></tr> <tr><td>Sep</td><td>~7</td><td>~6</td></tr> <tr><td>Oct</td><td>~7</td><td>~6</td></tr> <tr><td>Nov</td><td>~7</td><td>~6</td></tr> <tr><td>Dec</td><td>~7</td><td>~6</td></tr> </tbody> </table>	Month	Actual	Budget	Jan	~6	~6	Feb	~7	~6	Mar	~7	~6	Apr	~7	~6	May	~7	~6	Jun	~7	~6	Jul	~7	~6	Aug	~7	~6	Sep	~7	~6	Oct	~7	~6	Nov	~7	~6	Dec	~7	~6
Month	Actual	Budget																																						
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Feb	~7	~6																																						
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<p>Explanation 4 Explain the key</p>	<p>Budgets can be scoped in Azure, we can narrow a budget view based on subscription, resource groups, or a collection of resources, etc. We can also filter the resources that will be analyzed by the budget using tags, resource type, resource id, etc.</p>																																							

components of the screenshot submitted.

Reset period is the time window analyzed by the budget. At the beginning of each new period the cost evaluated will start at zero. We can create a monthly, quarterly, annual budget and set the maximum threshold for their organization.

Creation date is the first day of the first budget evaluation period. Subsequent evaluation periods will begin on the same day of the month moving forward.

Expiration date is the day the budget stops evaluating and/or alerting and becomes expired.

Budget amount is the threshold that if total cost (scoped and filtered) exceeds its condition (step 2), the budget will send an alert to the configured emails or trigger the action groups.

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	80	12.00	None
Forecasted	100	15.00	None
Select type	Enter %	-	None

Manage action group

* Alert recipients (email)

Alert recipients (email)

longpv10@fsoft.com.vn

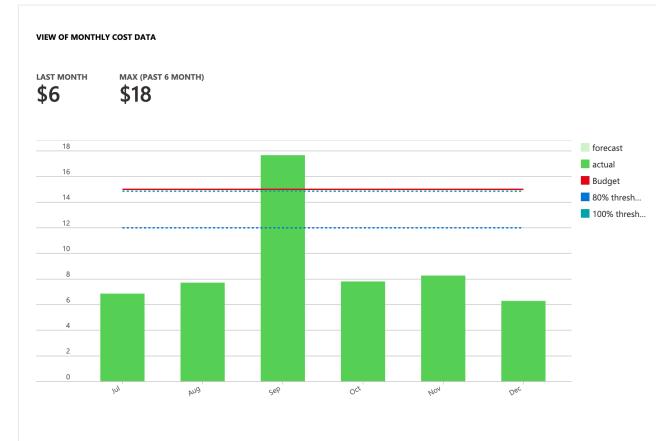
example@email.com

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 *



Explanation 5

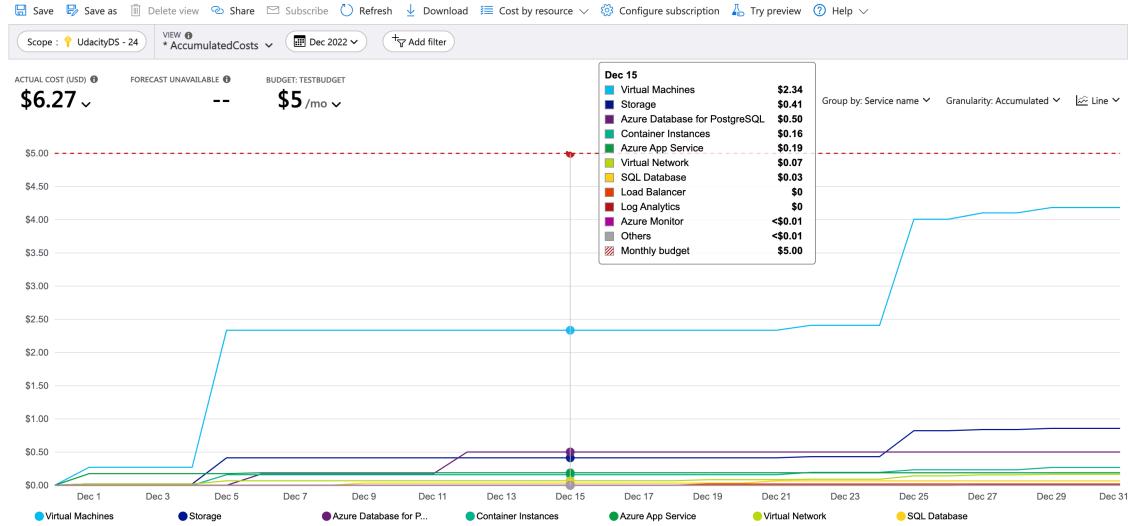
Explain the key components of the screenshot submitted.

Azure provides budgets API to notify one via email (send to the **Alert recipients email**) when a budget **Alert condition** (the **actual/ forecasted** cost exceeds the **% of budget * budget amount**) is satisfied. We can use Azure Monitor **action groups** to trigger an orchestrated set of actions resulting from a budget event along with sending email.

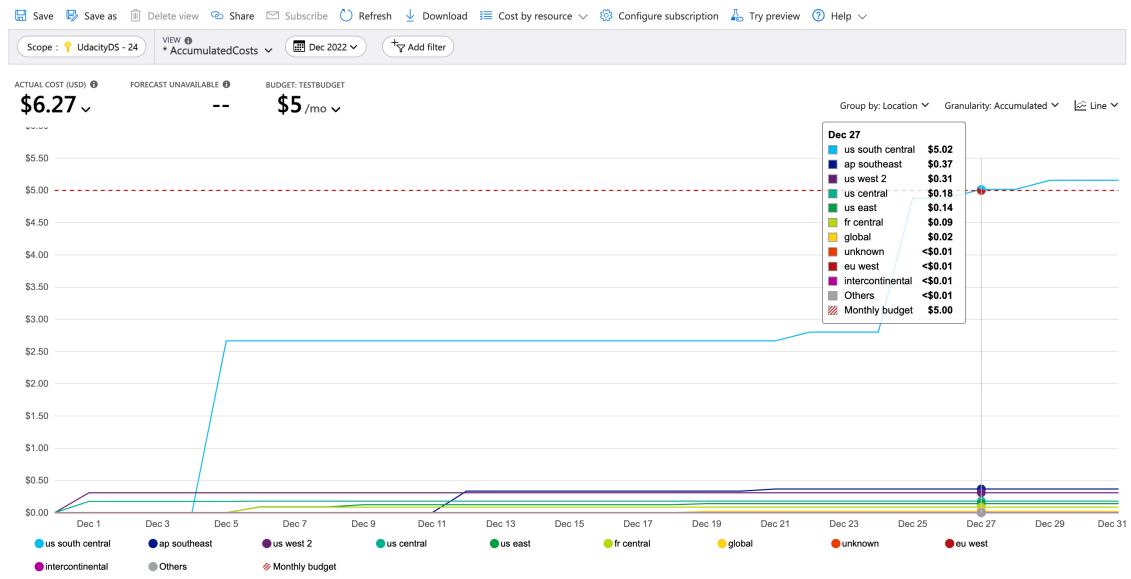
Screenshot 6

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

Group by Service Name



Group by Location



Explanation 6

Explain the key components of the

Pic 1: Grouped the costs by Service name, there is no single service that exceed the threshold in Dec 2022

Pic 2: Grouped the costs by Location, the US South Central region has the cost exceeded the threshold (5\$) from Dec 27 (\$5.02) and beyond

Screenshot submitted.	
<p>Explanation 7</p> <p>Explain the summarized highlights of this part of the project, Azure Cost Mgmt + Billing</p>	<p>Azure Cost Management and Billing is a suite tools that helps users analyze, manage, and optimize the costs. These tools help to ensure the benefits of the cloud are utilized. Azure Cost Management and Billing Dashboard has the following features which help with monitoring cost efficiency:</p> <ul style="list-style-type: none">- Data analysis of costs- Identify opportunities that optimize spending- Alert or trigger actions by setting spending thresholds- Pay bill- 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 | Compliance >

Assign policy

Basics Advanced Parameters Remediation Non-compliance messages Review + create

Scope

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

UdacityDS - 24



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 221034

[Review + create](#)

[Cancel](#)

[Previous](#)

[Next](#)

Step 2:

Home > Policy | Compliance >

Assign policy

Home

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

Search by parameter name Only show parameters that need input or review

Allowed Size SKUs * ⓘ

5 selected

Select all

Basic_A0

Basic_A1

Basic_A2

Basic_A3

Basic_A4

Standard_A0

Standard_A1

Standard_A1_v2

Standard_A2

Standard_A2_v2

Standard_A2m_v2

Standard_A3

Standard_A4

Standard_A4_v2

Standard_A4m_v2

Standard_A5

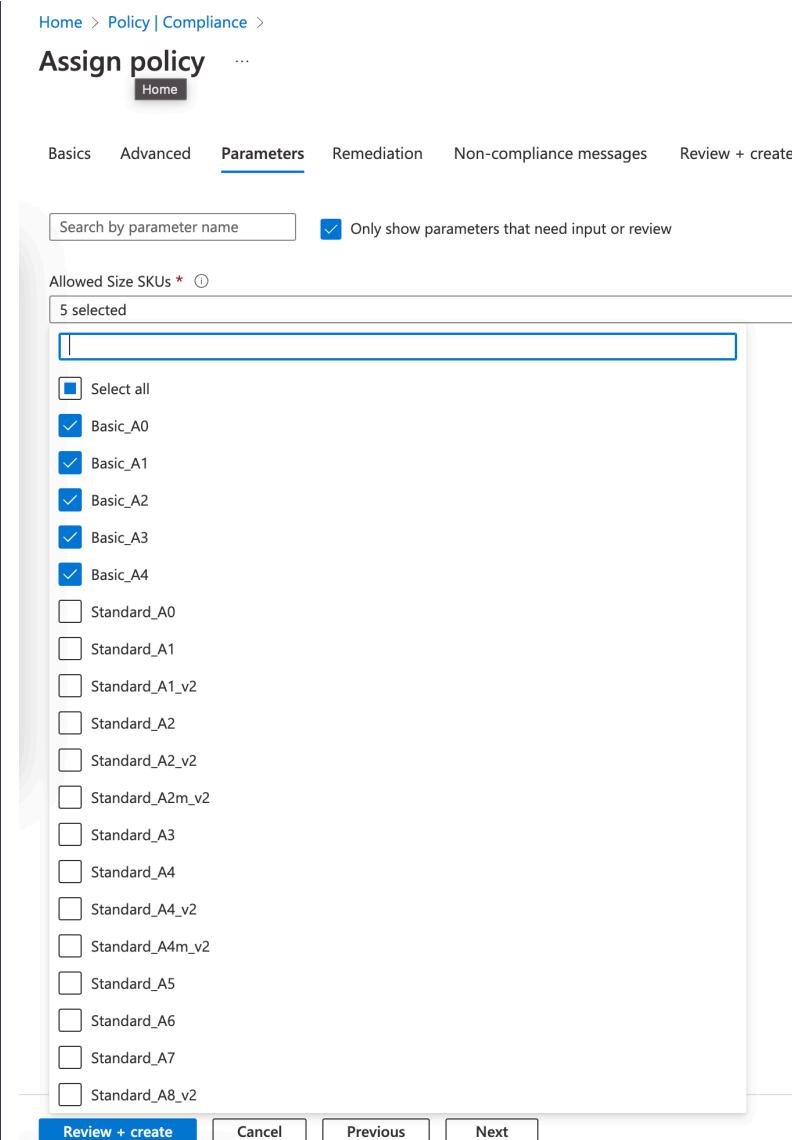
Standard_A6

Standard_A7

Standard_A8_v2

<https://portal.azure.com/#home>

Step 3



Assign policy

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

Search by parameter name

Only show parameters that need input or review

Allowed Size SKUs * ⓘ

Standard_E104i_v5

Review + create

Cancel

Previous

Next

Step 4:

Assign policy

...

Basics Advanced 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 5:

Home > Policy | Compliance >

Assign policy ...

Basics Advanced 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 A-Series is allowed



Review + create

Cancel

Previous

Next

Home > Policy | Compliance >
Assign policy ...

Basics Advanced Parameters Remediation Non-compliance messages Review + create

Basics

Scope	UdacityDS - 24
Exclusions	--
Policy definition	Allowed virtual machine size SKUs
Assignment name	Allowed virtual machine size SKUs
Description	--
Policy enforcement	Enabled
Assigned by	ODL_User 221034

Advanced

Resource selectors

Info No selectors associated with this assignment.

Overrides

Info No overrides associated with this assignment.

Parameters

listOfAllowedSKUs	basic_a0;basic_a1;basic_a2;basic_a3;basic_a4
-------------------	--

Remediation

Info No managed identity associated with this assignment.

Non-compliance messages

Default non-compliance message	Only A-Series is allowed
--------------------------------	--------------------------

Create **Cancel** **Previous** **Next**

Screenshot 6

Explain through screenshots what happens when you create a VM which is in

Once the Azure policy creation is complete, try to create a VM which is of a "NOT ALLOWED" size.

Hint: pick any size; it doesn't matter as long as it's not in the allowed list in Azure policy you just created.

Once you go through the wizard, in the final step you will see the following screenshot, which needs to be submitted.

violation with
the policy
you just
created.

Home > Create a resource > Create a virtual machine >

Select a VM size ...

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

Showing 691 VM sizes. | Subscription: UdacityDS - 24 | Region: East US | Current size: Standard_D2s_v3 | Image: Ubuntu Server 20.04 LTS | Learn more about VM sizes

VM Size ↑↓	Type ↑↓	vCPUs ↑↓	RAM (GB) ↑↓	Data disks ↑↓	Max IOPS ↑↓	Temp storage (GiB) ↑↓	Premium disk ↑↓	Cost/month ↑↓
> Most used by Azure users ↗								
> B-Series								
> D-Series v3								
> D-Series v2								
> Size not available								
> Unsupported generation								
▽ Blocked by Policy								
D2as_v4	General purpose	2	8	4	3200	16	Supported	US\$70.08
D2as_v4	General purpose	2	8	4	3200	16	Supported	US\$70.08
B1ls	General purpose	1	0.5	2	320	4	Supported	US\$3.80
B1ls	General purpose	1	0.5	2	320	4	Supported	US\$3.80
D8s_v3	General purpose	8	32	16	12800	64	Supported	US\$280.32
D8s_v3	General purpose	8	32	16	12800	64	Supported	US\$280.32
A0 ⚡ Retiring Soon	General purpose	1	0.75	1	1x500	20	Not supported	US\$14.60
A0 Basic ⚡ Retiring Soon	General purpose	1	0.75	1	1x500	20	Not supported	US\$13.14
A1 ⚡ Retiring Soon	General purpose	1	1.75	2	2x500	70	Not supported	US\$43.80
A1_Basic ⚡ Retiring Soon	General purpose	1	1.75	2	2x500	40	Not supported	US\$16.79
A1_v2 ⚡	General purpose	1	2	2	1600	10	Not supported	US\$31.39
A2 ⚡ Retiring Soon	General purpose	2	3.5	4	3200	135	Not supported	US\$87.60
A2_Basic ⚡ Retiring Soon	General purpose	2	3.5	4	4x500	60	Not supported	US\$57.67
A2_v2 ⚡	General purpose	2	4	4	3200	20	Not supported	US\$66.43
A7m_v2 ⚡	General purpose	7	16	4	32000	70	Not supported	US\$66.43

Select Prices presented are estimates in USD 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. Give feedback

Since the D2as_v4 size is restricted by policy, the Select button is gray and I cannot select that size, so I cannot continue the next step to create the VM.

If I choose an allowed size, I can create the VM

Home > Create a resource >

Create a virtual machine

 Changing Basic options may reset selections you have made. Review all options prior to creating the virtual machine.

Basics Disks Networking Management Monitoring Advanced Tags Review + create

Create a virtual machine that runs Linux or Windows. Select an image from Azure marketplace or use your own customized image. Complete the Basics tab then Review + create to provision a virtual machine with default parameters or review each tab for full customization. [Learn more](#)

Project details

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

Subscription * 

UdacityDS - 24 

Resource group * 

Udacity 

[Create new](#)

Instance details

Virtual machine name * 

vm-policy-test 

Region * 

(US) South Central US 

Availability options 

No infrastructure redundancy required 

Security type 

Standard 

Image * 

 Ubuntu Server 20.04 LTS - x64 Gen2 

[See all images](#) | [Configure VM generation](#)

VM architecture 

Arm64

x64

Run with Azure Spot discount 

Size * 

Standard_D2s_v3 - 2 vcpus, 8 GiB memory (US\$80.30/month) 

[See all sizes](#)

 Item(s) availability based on policy assignment(s) for the selected scope.

arch798-221034-PolicyDefinition ([Policy details](#))

cloud-demo513-PolicyDefinition ([Policy details](#))

udacitydedicatedsubscriptionGroup1/Microsoft.Authorization/891f056473974f7289c7b312

[Review + create](#)

< Previous

Next : Disks >

Home > Create a resource >

Create a virtual machine

...

Validation passed

Basics Disks Networking Management Monitoring Advanced Tags **Review + create**

Cost given below is an estimate and not the final price. Please use [Pricing calculator](#) for all your pricing needs.

PRODUCT DETAILS

1 X Standard D2s v3

by Microsoft

[Terms of use](#) | [Privacy policy](#)

Subscription credits apply

0.1100 USD/hr

[Pricing for other VM sizes](#)

TERMS

By clicking "Create", I (a) agree to the legal terms and privacy statement(s) associated with the Marketplace offering(s) listed above; (b) authorize Microsoft to bill my current payment method for the fees associated with the offering(s), with the same billing frequency as my Azure subscription; and (c) agree that Microsoft may share my contact, usage and transactional information with the provider(s) of the offering(s) for support, billing and other transactional activities. Microsoft does not provide rights for third-party offerings. See the [Azure Marketplace Terms](#) for additional details.

Name

ODL_User 221034

Preferred e-mail address

(Redacted)

Preferred phone number

4253580297

You have set SSH port(s) open to the internet. This is only recommended for testing. If you want to change this setting, go back to Basics tab.

Basics

Subscription UdacityDS - 24

Resource group Udacity

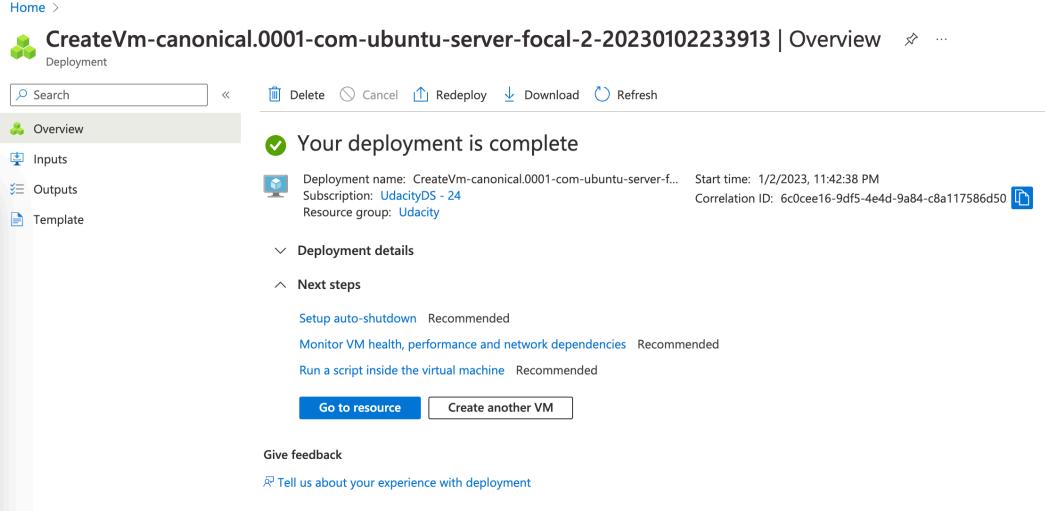
Virtual machine name vm-policy-test

Create

< Previous

Next >

[Download a template for automation](#)

	 <p>The screenshot shows the Azure Deployment Overview page for a deployment named 'CreateVm-canonical.0001-com-ubuntu-server-focal-2-20230102233913'. The status is 'Your deployment is complete' with a green checkmark. Deployment details include a start time of 1/2/2023, 11:42:38 PM, and a correlation ID of 6c0cee16-9df5-4e4d-9a84-c8a117586d50. There are sections for 'Deployment details' (Setup auto-shutdown, Monitor VM health, Run a script inside the virtual machine) and 'Next steps'. Buttons for 'Go to resource' and 'Create another VM' are at the bottom.</p>
Explanation 1 Explain the summarized highlights of this part of the project, Azure Policy.	<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. 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>

STEP 5: Azure Dashboards

Background	Azure Dashboards are a one stop shop to monitor <ul style="list-style-type: none"> ● Your logs ● Your infrastructure ● Your applications
-------------------	---

Task 1

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.

Screenshots 1 through 3

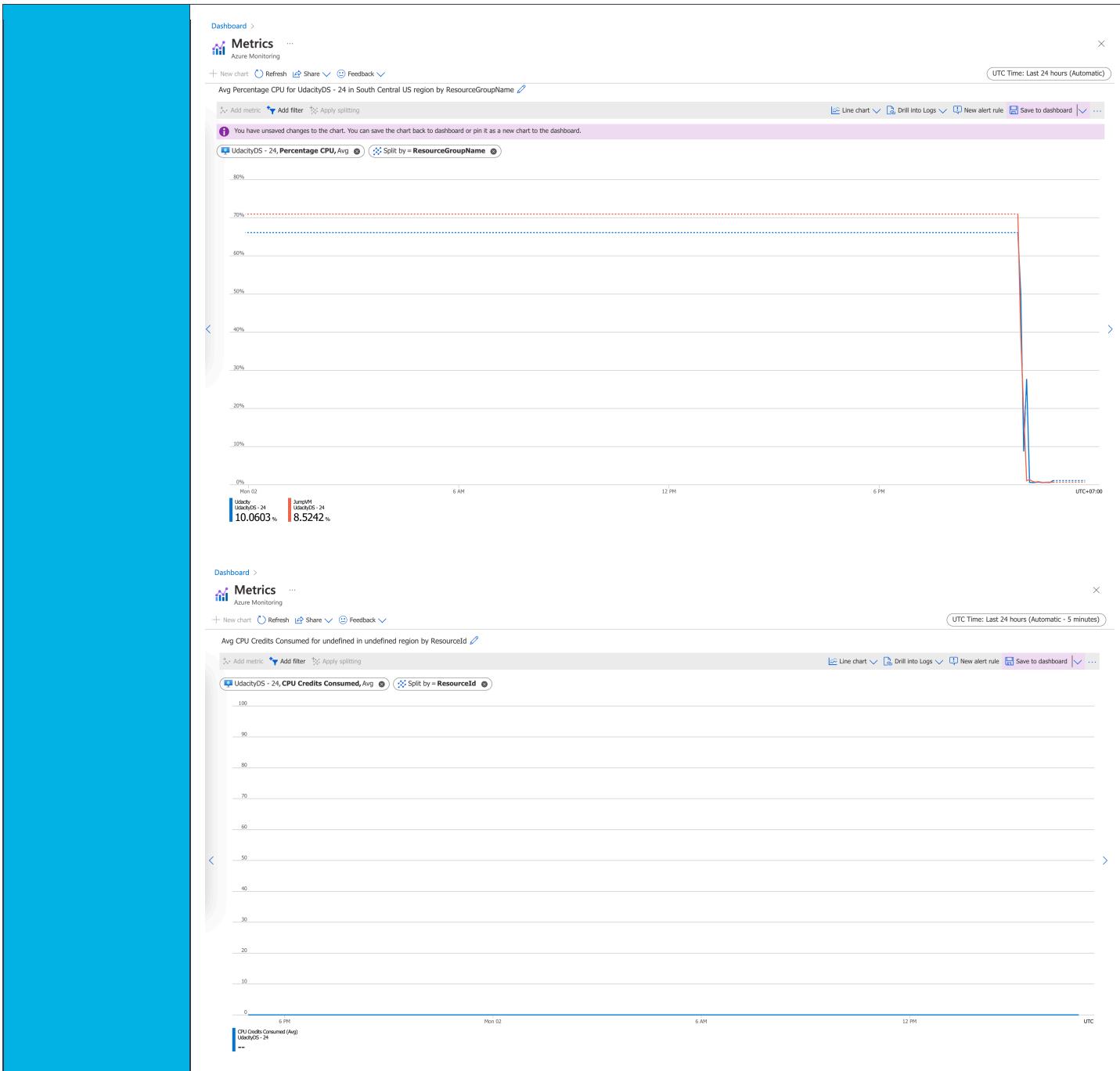
You will submit the screenshots for Overview tab.

Step 1:

The screenshot shows the Microsoft Azure portal interface for creating a new dashboard named 'p2 dashboard'. The dashboard currently contains two 'Metrics chart' tiles. To the right, there is a 'Tile Gallery' where you can drag and drop or select tiles to add them to the dashboard. A tooltip for the 'Metrics chart' tile explains that metrics in Azure Monitor are lightweight and capable of supporting near real-time scenarios. Another tile, 'Security metric', displays summarized security metrics from Azure Security Center with a value of 685.

Step 2:

The screenshot shows the Azure Metrics blade. A new chart is being created with the following settings: Scope is set to 'Select a scope', Resource type is set to 'Virtual machines', and Location is set to 'South Central US'. The 'Selected scopes' section shows that 'UdacityDS - 24' has been selected. The main area displays a blank chart area with a placeholder message: 'Select a metric above to see data appear here'.



Step 3 (Final Output):

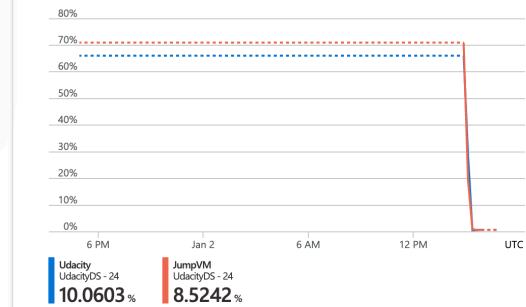
p2 dashboard Save Cancel
Private dashboard
+ Create Upload Refresh Full screen | Edit Share Export Clone Assign tags Delete | Feedback
Auto refresh : Off UTC Time : Past 24 hours Add filter

All resources		
All subscriptions		
c221034aqbdiaeixfihm	Container instances	South Central US
default-NSG	Network security group	South Central US
JumpVM-221034	Virtual machine	South Central US
JumpVM-221034-osdisk	Disk	South Central US
jumpvm-nic	Network Interface	South Central US
jumpvm-nsg	Network security group	South Central US
jumpvm-pip	Public IP address	South Central US

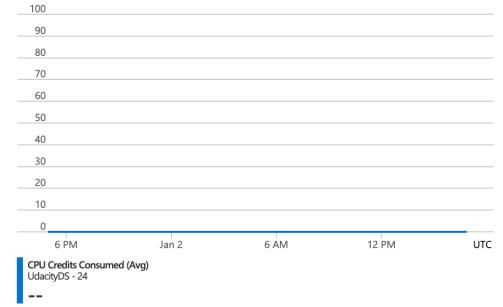
See more...

Resource groups		
All subscriptions		
Cloudlabs-ACI-221034-JumpVM-221034-cs5af249		South Central US
JumpVM		South Central US
NetworkWatcherRG		South Central US
Udacity		South Central US
UdacityDemo		South Central US

Avg Percentage CPU for UdacityDS - 24 in South Central US region by Re...



Avg CPU Credits Consumed for undefined in undefined region by Resour...



STEP 6: Azure Monitor – Metrics

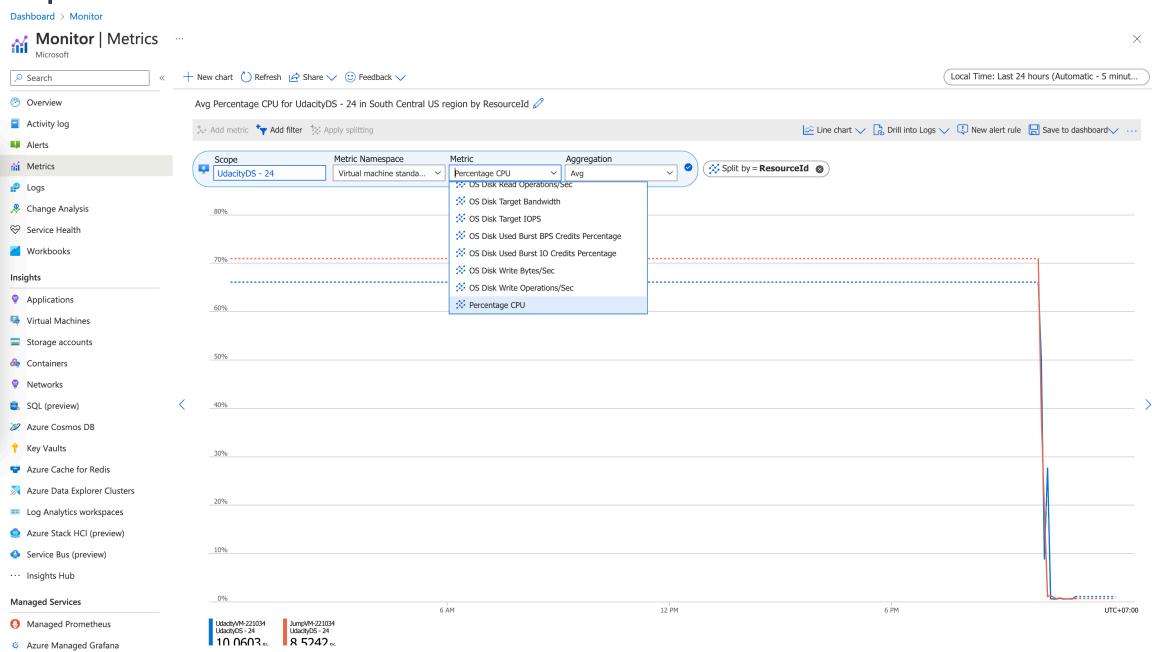
Task 1

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:

The screenshot shows the Azure Monitor Metrics interface. On the left, a sidebar lists various monitoring categories like Overview, Activity log, Alerts, Metrics (which is selected), Logs, Change Analysis, Service Health, Workbooks, Insights, Applications, Virtual Machines, Storage accounts, Containers, Networks, SQL (preview), Azure Cosmos DB, Key Vaults, Azure Cache for Redis, Azure Data Explorer Clusters, Log Analytics workspaces, Azure Stack HCI (preview), Service Bus (preview), and Insights Hub. Below this is a section for Managed Services with options for Managed Prometheus and Azure Managed Grafana.

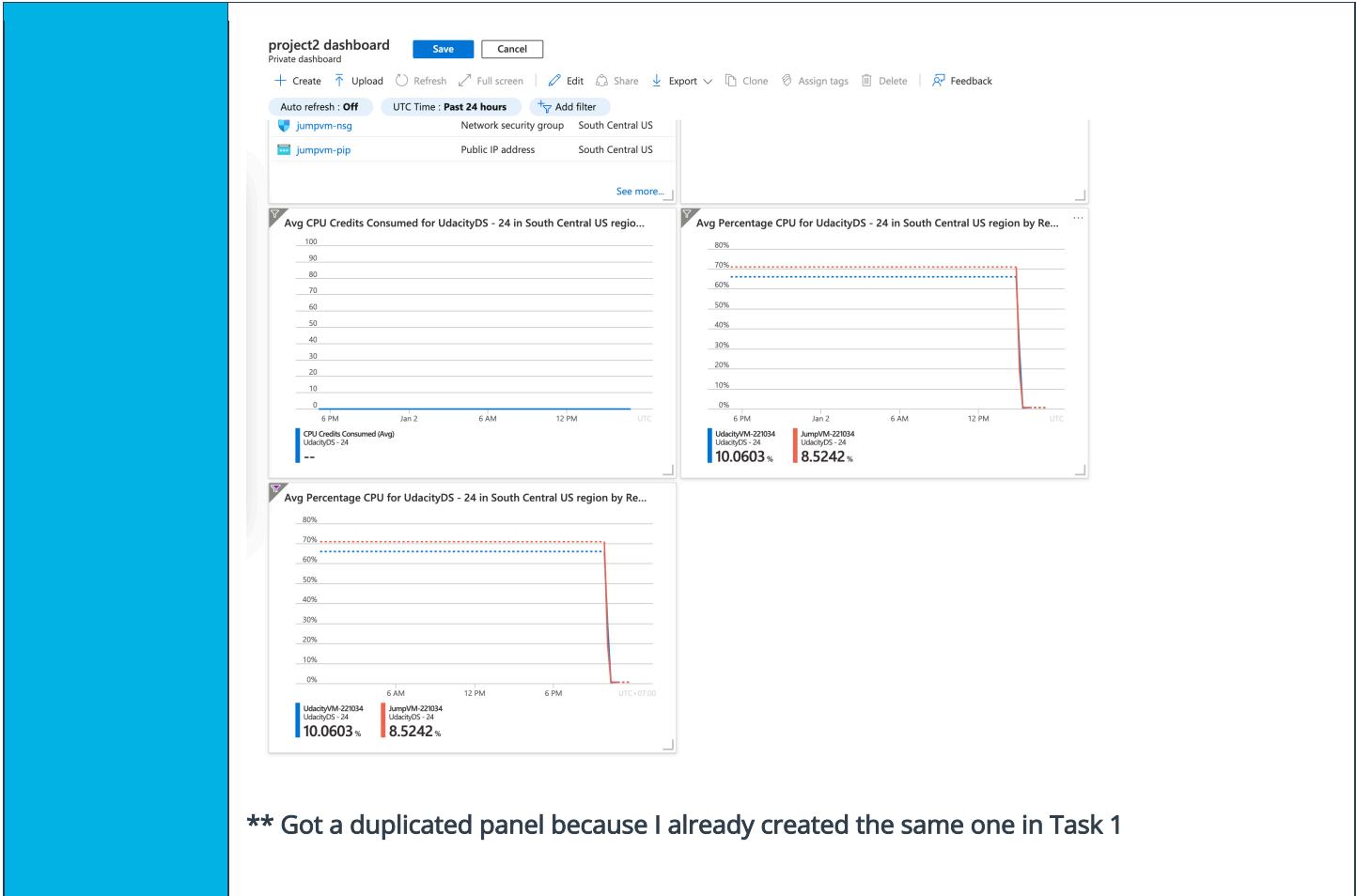
The main area displays a chart titled "Avg Percentage CPU for UdacityDS - 24 in South Central US region by ResourceId". The chart shows two data series: "UdacityVM221034" (blue bar) at 10.0603% and "JumpVM221034" (orange bar) at 8.5242%. The chart has a time range from 6 AM to 6 PM. Above the chart, there are buttons for "New chart", "Refresh", "Share", "Feedback", "Add metric", "Add filter", "Apply splitting", "Line chart", and "Drill into".

To the right, a "Pin to dashboard" dialog is open. It includes tabs for "Existing" and "Create new", a "Type" section with "Private" (radio button selected) and "Shared" options, and a dropdown menu for "Dashboard" set to "project2 dashboard". At the bottom of the dialog are "Pin" and "Cancel" buttons.

Step 3:

Pinned to dashboard X

Successfully pinned to dashboard 'project2 dashboard'



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.

Dashboard > Metrics >
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.

Percentage CPU

Alert logic

Threshold Static Dynamic

Aggregation type Average

Operator Greater than

Threshold value * 30 %

When to evaluate

Check every 5 minutes

Lookback period 5 minutes

+ Add condition

Review + create Previous Next: Actions >

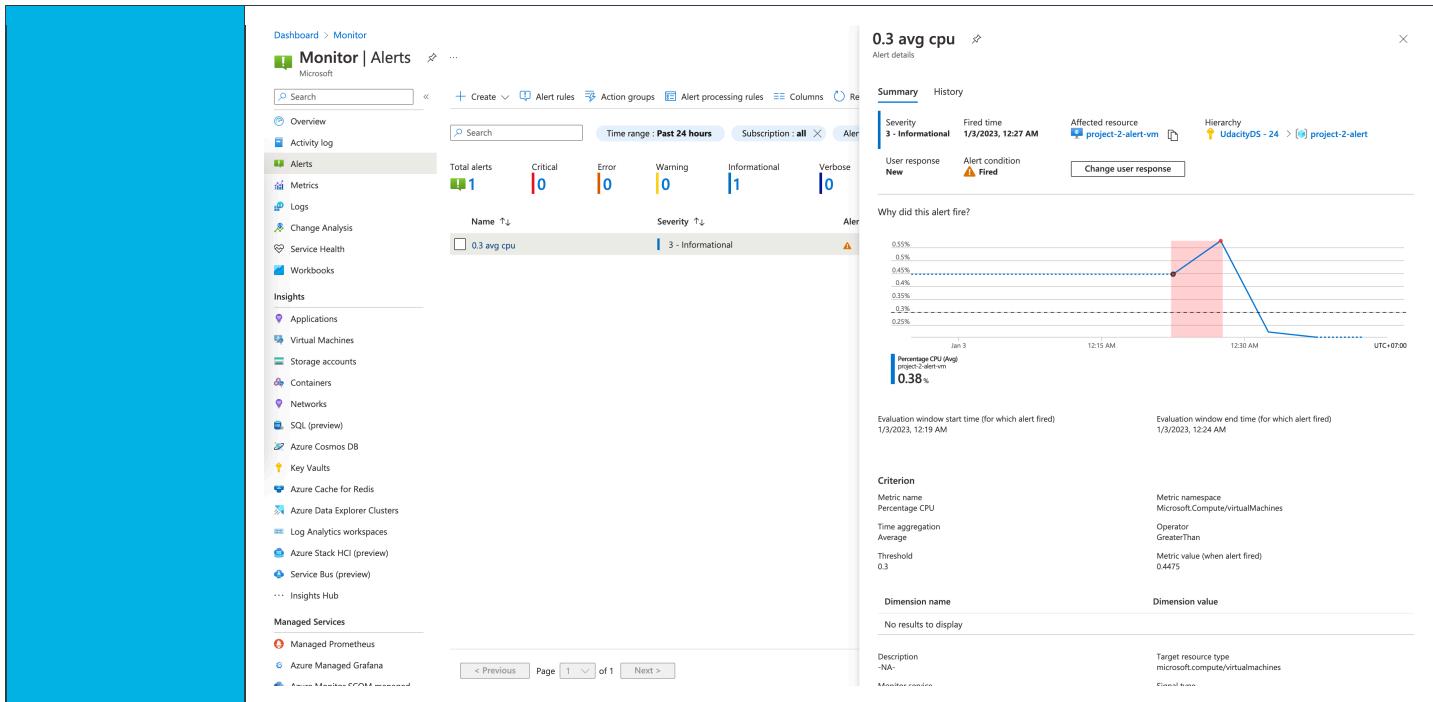
Preview \$0.20 USD/month
Whenever the average Percentage CPU is greater than 30%
Time range : Over the last 6 hours Time series : JumpVM-221034; Aggregate

70%
60%
50%
40%
30%
20%
10%
7 PM 8 PM 9 PM 10 PM 11 PM UTC+07:00
Percentage CPU (Avg)
Jumpvm-221034
8.52 %

✓ Alert rule created

Alert rule project 2 - cpu avg 03 successfully created. It might take a few minutes for changes to be shown.

a few seconds ago



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 You will submit the screenshots for Log Analytics workspace creation screens.	Step 1:

Create Log Analytics workspace

Basics Tags Review + Create

! 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](#) X

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 * ⓘ

UdacityDS - 24

Resource group * ⓘ

Udacity

[Create new](#)

Instance details

Name * ⓘ

p2-log-analytics

Region * ⓘ

South Central US

[Review + Create](#)

[« Previous](#)

[Next : Tags >](#)

Step 2:

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

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 ⓘ	Value ⓘ	
<input type="text"/>	:	<input type="text"/>

[Review + Create](#)

[« Previous](#)

[Next : Review + Create >](#)

Step 3:

Dashboard > Log Analytics workspaces >

Create Log Analytics workspace

 Validation passed

Basics Tags Review + Create



Basics

Subscription UdacityDS - 24
Resource group Udacity
Name p2-log-analytics
Region South Central 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:

Dashboard > Microsoft.LogAnalyticsOMS | Overview >

 project-2-log-analytics Log Analytics workspace

[Search](#) [Delete](#)

[Overview](#)

[Activity log](#)

[Access control \(IAM\)](#)

[Tags](#)

[Diagnose and solve problems](#)

[Settings](#)

[Locks](#)

[Agents management](#)

[Legacy agents management](#)

[Custom logs](#)

[Computer Groups](#)

[Data Export](#)

[Linked storage accounts](#)

[Network Isolation](#)

[Tables](#)

[General](#)

[Workspace summary](#)

[Workbooks](#)

[Logs](#)

[Solutions](#)

[Usage and estimated costs](#)

[Properties](#)

[Service Map](#)

[Workspace Data Sources](#)

[Virtual machines](#)

[Essentials](#)

Resource group (move) : [udacity](#)

Status : Active

Location : South Central US

Subscription (move) : [UdacityDS - 24](#)

Subscription ID : 37ddac16-67cc-43e8-a92f-62164ea50288

Tags (edit) : [Click here to add tags](#)

[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](#)
[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](#)

1 Search and analyze logs

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

2 Manage alert rules

Notify or take action in response to important information in your data
[Set alerts](#)

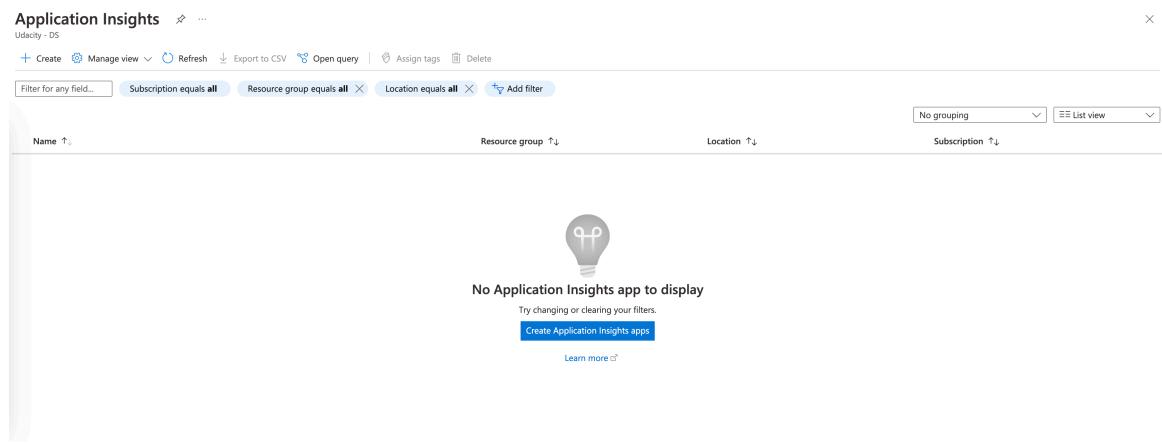
3 Manage usage and costs

Understand your usage of Log Analytics and estimate your costs for each month
[Manage costs](#)

4 Create and Share Workbooks

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

STEP 8: Azure Insights

Background	Azure Insights can only be created once you have the Log Analytics workspace completed.
Screenshots 1 through 6	<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>
You will submit the screenshots for the Monitor Metrics screen as you are setting up.	<p>Step 1:</p>  <p>The screenshot shows the 'Application Insights' blade in the Azure portal. At the top, there are navigation links: 'Dashboard' (highlighted in blue), 'Create', 'Manage view', 'Refresh', 'Export to CSV', 'Open query', 'Assign tags', and 'Delete'. Below these are filter buttons for 'Subscription equals all', 'Resource group equals all', and 'Location equals all'. A 'Add filter' button is also present. The main area has columns for 'Name', 'Resource group', 'Location', and 'Subscription'. A lightbulb icon is centered in the middle of the page, and the text 'No Application Insights app to display' is displayed below it. There is a link 'Create Application Insights apps' and a 'Learn more' link.</p>

Step 2:

Dashboard > Application Insights >

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 * ?

UdacityDS - 24

Resource Group * ?

Udacity

[Create new](#)

INSTANCE DETAILS

Name * ?

project-2-app-insight

Region * ?

(US) South Central US

Resource Mode * ?

Classic Workspace-based

WORKSPACE DETAILS

Subscription * ?

UdacityDS - 24

Log Analytics Workspace * ?

(new) DefaultWorkspace-37ddca16-67cc-43e8-a92f-62164ea50288-5CUS...

[Review + create](#)

[« Previous](#)

[Next : Tags >](#)

Step 3:

Dashboard > Application Insights >

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 ⓘ	
<input type="text"/>	:	<input type="text"/>

[Review + create](#)

[« Previous](#)

[Next : Review + create >](#)

Step 4:

Dashboard > Application Insights >

Application Insights

Monitor web app performance and usage

✓ Validation passed

Basics Tags Review + create

SUMMARY

Application Insights by Microsoft

Subscription	UdacityDS - 24
Resource Group	Udacity
Name	project-2-app-insight
Region	South Central US
Workspace	DefaultWorkspace-37ddca16-67cc-43e8-a92f-62164ea50288-SCUS [southcentralus]

Create

« Previous

Download a template for automation

Step 5:

Dashboard >

Microsoft.AppInsights | Overview

Deployment

Search

Delete

Cancel

Redeploy

Download

Refresh

Overview

✓ Your deployment is complete

Deployment name: Microsoft.AppInsights
Subscription: UdacityDS - 24
Resource group: Udacity

Start time: 1/3/2023, 1:00:00 AM

Correlation ID: ea776c6d-a98f-4b5e-8428-2e671702a098

Inputs

Outputs

Template

Deployment details

Next steps

Go to resource

Give feedback

Tell us about your experience with deployment

**Screenshots
7 through 12**

You will submit screenshots of you enabling the VM.

Step 6: Click "Go to resource"

Dashboard > Microsoft.AppInsights | Overview >

project-2-app-insight

Application Insights

Search

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Investigate

Application map

Smart detection

Live metrics

Transaction search

Availability

Failures

Performance

Troubleshooting guides (preview)

Monitoring

Alerts

Metrics

Diagnostic settings

Logs

Workbooks

Usage

Users

Sessions

Events

Funnels

Essentials

Resource group (move) : Udacity

Location : South Central US

Subscription (move) : UdacityDS - 24

Subscription ID : 37ddca16-67cc-43e8-a92f-62164ea50288

Tags (edit) : Click here to add tags

Show data for last: 30 minutes, 1 hour, 6 hours, 12 hours, 1 day, 3 days, 7 days, 30 days

Failed requests

Server response time

Server requests

Availability

Instrumentation Key : 16c8d28c-a1bf-4669-bb83-f2a7168b24d0

Connection String : InstrumentationKey=16c8d28c-a1bf-4669-bb83-f2a7168b24d0;IngestionEndpoint=https://so...

Workspace : DefaultWorkspace-37ddca16-67cc-43e8-a92f-62164ea50288-SCUS

JSON View

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:

The screenshot shows the Azure portal interface for managing resources. On the left, there's a sidebar with navigation links like Home, All resources, and a search bar. The main area displays a list of resources under categories such as project-2-alert, udacity, and udacitydemo. A specific resource, project-2-alert-vm, is selected. A modal window titled "Monitoring configuration" is open over the main content. This modal has sections for "Enable insights using" (with options for "Azure Monitor agent (Recommended)" and "Log Analytics agent"), "Subscription" (set to "UdacityOS - 24"), and "Log Analytics workspaces" (set to "project-2-alert-log-analytics"). At the bottom of the modal are "Configure" and "Cancel" buttons.

Monitoring configuration

Virtual machine Insights now supports data collection using the Azure Monitor agent. Configuring using the Azure Monitor Agent is currently in preview mode.

Enable insights using

Azure Monitor agent (Recommended)

Log Analytics agent

Subscription *

UdacityOS - 24

Log Analytics workspaces

project-2-alert-log-analytics

Configure **Cancel**

project-2-alert-vm | Insights

Virtual machine

Get more

With an Azure virtual machine you get host-based monitoring, built-in automation, and built-in diagnostic tools.

Monitoring

- Insights
- Alerts
- Metrics
- Diagnostic settings
- Logs
- Connection monitor (classic)
- Workbooks

Automation

- Tasks (preview)
- Export template

Help

- Resource health
- Boot diagnostics
- Performance diagnostics
- VM Inspector (Preview)
- Reset password
- Redeploy + reapply
- Ubuntu Advantage support plan
- Serial console
- Connection troubleshoot
- Support + Troubleshooting

Get started **Performance** **Map**

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 9:

The screenshot shows the Azure Monitor Insights blade for the virtual machine 'project-2-alert-vm'. The left sidebar includes sections for Bastion, Auto-shutdown, Backup, Disaster recovery, Updates, Inventory, Change tracking, Automate, Configuration management (Preview), Policies, Run command, Monitoring (with Insights selected), Alerts, Metrics, Diagnostic settings, Logs, Connection monitor (classic), Workbooks, Automation (Tasks (preview)), Export template, Help, Resource health, Boot diagnostics, and Performance diagnostics.

The main content area displays several performance metrics:

- Logical Disk Performance**: Shows disk usage statistics for /mnt and Total. For /mnt, Current Size is 15.64 GB, Current Used is 5%, and Throughput metrics (P95 IOPS Read, P95 IOPS Write, P95 JOPS Total, P95 MB/s Read, P95 MB/s Write) are all 0. For Total, Current Size is 44.54 GB, Current Used is 8%, and Throughput metrics are all 0.
- CPU Utilization %**: A line chart showing CPU utilization over a 1m granularity. The Y-axis ranges from 0% to 100%. The X-axis shows time from 12:30 to 01:15. Average utilization is 0.36%, and the 95th percentile is also 0.36%.
- Available Memory**: A line chart showing available memory in GB over a 1m granularity. The Y-axis ranges from 0GB to 7.5GB. The X-axis shows time from 12:30 to 01:15. Available memory starts at approximately 6.5GB and decreases to about 1.9GB by 01:15.
- Logical Disk IOPS**: A line chart showing logical disk IOPS over a 1m granularity. The Y-axis ranges from 0 to 100. The X-axis shows time from 12:30 to 01:15. Average IOPS is 30, and the 95th percentile is 36.
- Logical Disk MB/s**: A line chart showing logical disk throughput in MB/s over a 1m granularity. The Y-axis ranges from 0 to 1000B/s. The X-axis shows time from 12:30 to 01:15. Throughput starts at 100B/s and drops to 20B/s by 01:15.

Step 10:

The screenshot shows the Azure Monitor Performance blade for the virtual machine 'project-2-alert-vm'. The top navigation bar includes Home, project-2-alert-vm | Insights, Performance (selected), and three other tabs. The toolbar includes Workbooks, Edit, Refresh, Help, and Auto-refresh: Off.

The main content area displays four performance charts:

- CPU Utilization %**: A line chart showing CPU utilization over time. The Y-axis ranges from 0.42 to 0.62. The X-axis shows time from 1:15 AM to 1:25 AM. Average utilization is 0.445, and the 95th percentile is 0.55.
- Available Memory MB**: A line chart showing available memory in MB over time. The Y-axis ranges from 7.31K to 7.31K. The X-axis shows time from 1:15 AM to 1:25 AM. Available memory starts at 7.31K and remains constant until 1:25 AM.
- Logical Disk IOPS**: A line chart showing logical disk IOPS over time. The Y-axis ranges from 80 to 100. The X-axis shows time from 1:15 AM to 1:25 AM. Average IOPS is 7.31k, and the 95th percentile is 7.31k.
- Logical Disk MB/s**: A line chart showing logical disk throughput in MB/s over time. The Y-axis ranges from 80 to 100. The X-axis shows time from 1:15 AM to 1:25 AM. Throughput starts at 7.31k and remains constant until 1:25 AM.

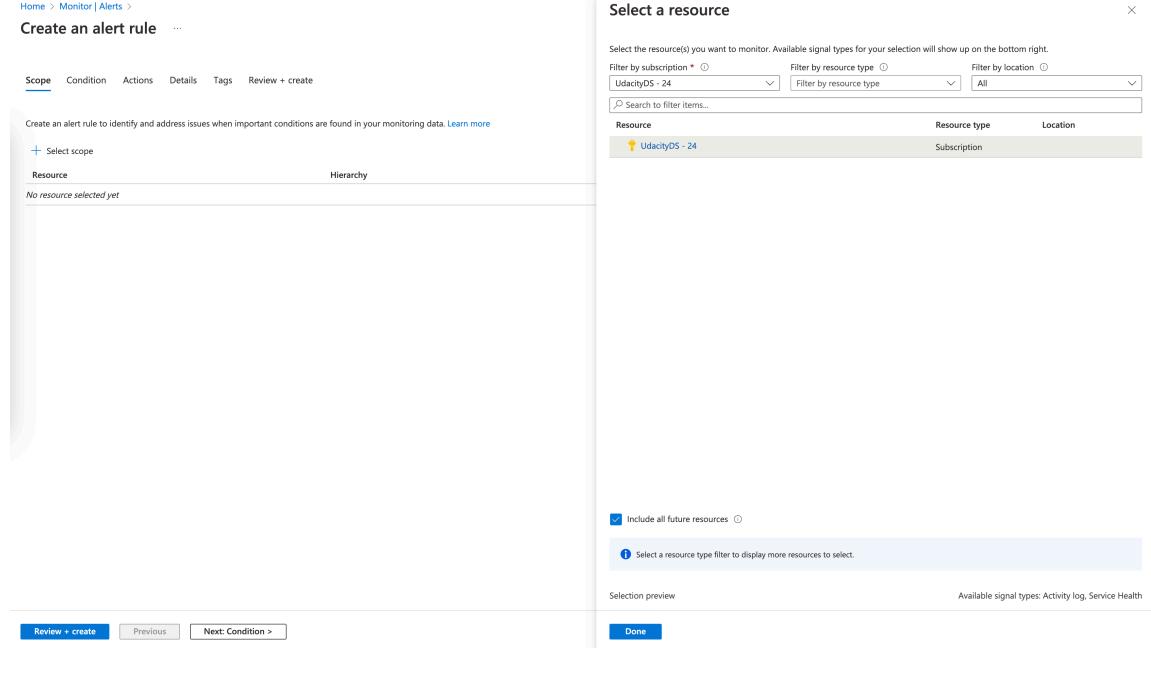
Step 11:

The screenshot shows the 'Activity Logs Insights' workspace for the 'project-2-alert-vm' resource. The top navigation bar includes 'Workbooks', 'Edit', 'Run Diagnostics', 'Refresh', 'Help', and 'Auto refresh: Off'. The current resource is 'project-2-alert-vm' and the time range is 'Last 7 days'. A note at the top states: 'It is required to enable Log Analytics in Diagnostic Settings for this workbook to work.' Below this are four tabs: 'General', 'Operations', 'Failures', 'Administrative', and 'Autoscale'. The 'General' tab is selected. Under 'AZURE ACTIVITY LOG ENTRIES', it says 'There are no Activity Log for the selected time range'. The other three sections ('ACTIVITY LOGS BY STATUS', 'ACTIVITY LOGS BY RESOURCE', and 'ACTIVITY LOGS BY RESOURCE PROVIDER') also show 'There are no Activity Log for the selected time range'.

Step 12:

The screenshot shows the 'project-2-alert-vm | Insights' blade. The left sidebar lists various monitoring and diagnostic options: Bastion, Auto-shutdown, Backup, Disaster recovery, Updates, Inventory, Change tracking, Automange, Configuration management (Preview), Policies, Run command, Monitoring, Insights (selected), Alerts, Metrics, Diagnostic settings, Logs, Connection monitor (classic), Workbooks, Automation, Tasks (preview), Export template, Help, Resource health, Boot diagnostics, and Performance diagnostics. The main area displays the 'Machine Summary' for 'project-2-alert-vm'. It includes a penguin icon, a summary table with 4 Processes (less), and details about the operating system (Linux 5.15.0-1029-azure, Ubuntu 20.04.5 LTS). It also lists IP addresses (10.1.0.4/24) and provides links for Properties, Log Events, Alerts, Connections, and Changes. On the right, there are 'Quick links' for Connection details, 'Health' status (green), and 'Machine properties' including Default IPv4 Gateway (10.1.0.1), IPv6 Addresses (fe80::20d:3aff:fe75:28b), Mac Addresses (00:0D:3A:75:02:8B), DNS Names (project-2-alert-vm), and Last Boot Time (2023-01-02T17:02:11Z).

STEP 9: Azure Monitor – Smart Alerts

Task 1	<p>Navigate to Setup Alert & Actions under Azure Monitor >Overview.</p> <p>The condition name should be CPU units consumed and its value should be greater than 0.3.</p>						
Screenshots 1 through 8 You will submit step-by-step screenshots for creating a Setup Alert & Actions.	<p>Step 1:</p> <p>Home > Monitor Alerts > Create an alert rule ...</p> <p>Scope Condition Actions Details Tags Review + create</p> <p>Create an alert rule to identify and address issues when important conditions are found in your monitoring data. Learn more</p> <p>+ Select scope</p> <p>Resource Hierarchy</p> <p>No resource selected yet</p> <p>Select a resource</p> <p>Select the resource(s) you want to monitor. Available signal types for your selection will show up on the bottom right.</p> <p>Filter by subscription * <input type="button" value="UdacityDS - 24"/> Filter by resource type <input type="button" value="All"/> Filter by location <input type="button" value="All"/></p> <p>Search to filter items...</p> <table border="1"><thead><tr><th>Resource</th><th>Resource type</th><th>Location</th></tr></thead><tbody><tr><td>UdacityDS - 24</td><td>Subscription</td><td></td></tr></tbody></table> <p><input checked="" type="checkbox"/> Include all future resources <input type="radio"/></p> <p><input type="checkbox"/> Select a resource type filter to display more resources to select.</p> <p>Selection preview Available signal types: Activity log, Service Health</p> <p>Review + create Previous Next: Condition > Done</p> 	Resource	Resource type	Location	UdacityDS - 24	Subscription	
Resource	Resource type	Location					
UdacityDS - 24	Subscription						

Step 2:

Home > Monitor | Alerts >

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.

Percentage CPU 

Alert logic

Threshold Static Dynamic

Aggregation type Average

Greater than

Operator

Less than

Threshold value * 30

%

When to evaluate

Check every 1 minute

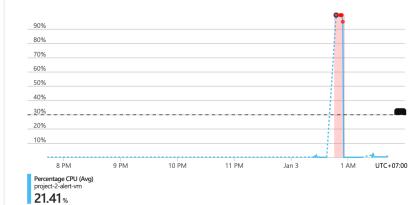
Lookback period 1 minute

+ Add condition

Preview

Whenever the average Percentage CPU is greater than 30%

Time range: Over the last 6 hours Time series: Aggregate



Review + create

Previous

Next: Actions >

Step 3:

Home > Monitor | Alerts >

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

Review + create

Previous

Next: Details >

Step 4:

Home > Monitor | Alerts >

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 * ⓘ

UdacityDS - 24

Resource group * ⓘ

project-2-alert

[Create new](#)

Alert rule details

Severity * ⓘ

3 - informational

Alert rule name * ⓘ

cpu-30-alert

Alert rule description ⓘ

(Empty)

▼ Advanced options

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

Step 5:

Home > Monitor | 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

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

Step 6 (Summary after above steps):

Home > Monitor | Alerts >

Create an alert rule ...

Scope Condition Actions Details Tags Review + create

Metric alert rule Total pricing
1 Condition Variable
[Terms of use](#) | [Privacy statement](#) [Pricing](#)

Scope
Resource project-2-alert > project-2-alert-vm

Condition

Signal name	Percentage CPU
Operator	Greater than
Aggregation type	Average
Threshold value	30
Lookback period	1 minute
Check every	1 minute

Details

Project details

Subscription	UdacityDS - 24
Resource group	project-2-alert
Region	global

Alert rule details

Alert rule name	cpu-30-alert
Alert rule description	
Severity	3 - Informational
Enable upon creation	<input checked="" type="checkbox"/>
Automatically resolve alerts	<input checked="" type="checkbox"/>

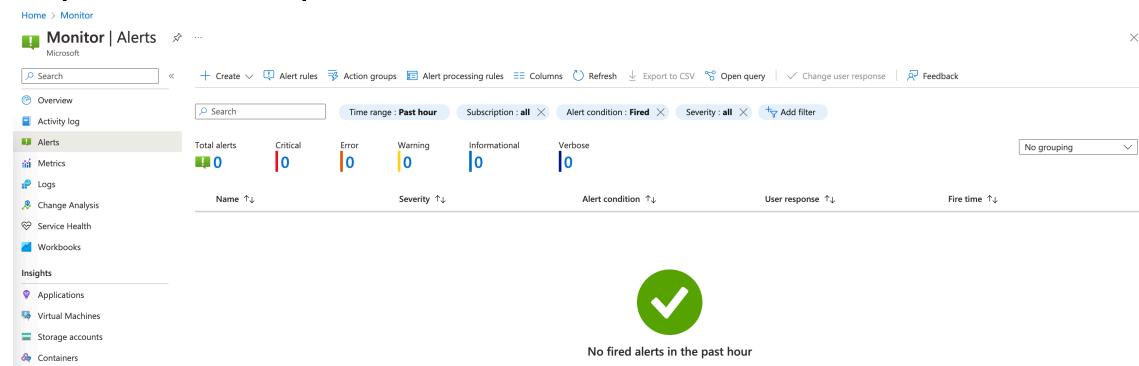
[Create](#) [Previous](#)

Alert rule created

Alert rule cpu-30-alert successfully created. It might take a few minutes for changes to be shown.

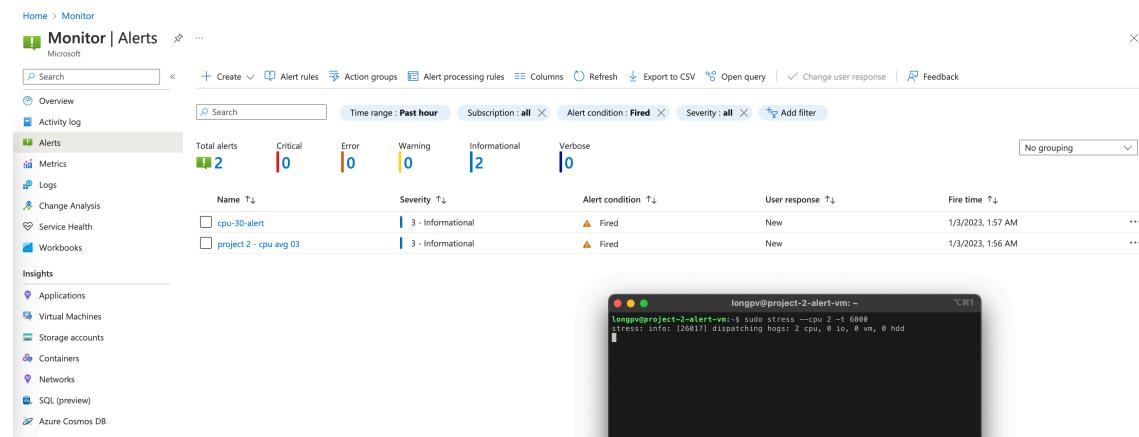
a few seconds ago

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



The screenshot shows the Azure Monitor Alerts interface. The left sidebar includes links for Overview, Activity log, Metrics, Logs, Change Analysis, Service Health, Workbooks, and Insights. Under Insights, there are sections for Applications, Virtual Machines, Storage accounts, and Containers. The main area displays alert statistics: Total alerts (1), Critical (0), Error (0), Warning (0), Informational (1), and Verbose (0). Below this is a table with columns for Name, Severity, Alert condition, User response, and Fire time. A large green checkmark icon is overlaid on the right side of the table, and a message below it states "No fired alerts in the past hour".

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



The screenshot shows the Azure Monitor Alerts interface with two alerts listed: "cpu-30-alert" and "project 2 - cpu avg 03". Both alerts are informational and have fired. A terminal window at the bottom shows the command "sudo stress --cpu 2 -t 6000" being run, with output indicating stress is dispatching 2 CPU cores, 0 I/O, 0 VM, and 0 HDD.

Explanation 1

Explain the purpose of

Azure Dashboards

- 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 Dashboards, Azure Monitor and alerts

- Provides a customized view of your cloud metrics by use of appropriate widgets, a unified place to monitor resources quickly.
- Building a custom Dashboard can enable one to quickly consume relevant information, identify issues.
- 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

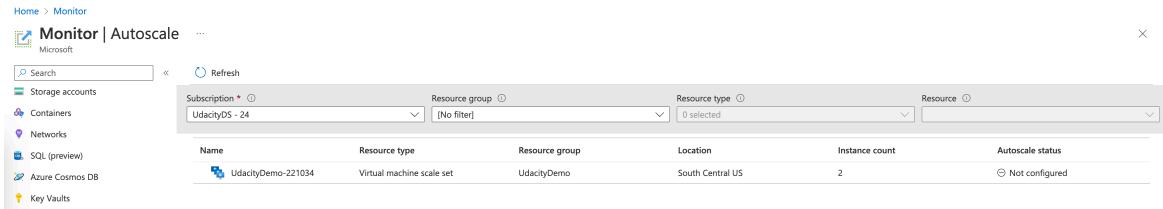
Task 1

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):



The screenshot shows the Azure Monitor | Autoscale interface. On the left, there's a sidebar with links for Storage accounts, Containers, Networks, SQL (preview), Azure Cosmos DB, and Key Vaults. The main area has a search bar and a refresh button. It displays a table with the following data:

Name	Resource type	Resource group	Location	Instance count	Autoscale status
UdacityDemo-221034	Virtual machine scale set	UdacityDemo	South Central US	2	<input checked="" type="checkbox"/> Not configured

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

Home > Monitor | Autoscale >

Autoscale setting ...

UdacityDemo-221034 (Virtual machine scale set)

Save Discard Refresh Logs Feedback

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-221034-Autoscale-979
Resource group	UdacityDemo
Predictive autoscale	Mode: <input type="button" value="Disabled"/> Pre-launch setup of instances (minutes) <input type="button" value=""/>
<input checked="" type="checkbox"/> Enable Forecast only or Predictive autoscale. Learn more about Predictive autoscale .	

Default* Auto created default 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

Rules 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

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. They key part on this screen is that Percentage CPU metric is selected):

Scale rule

X

Metric source

Current resource (UdacityDemo-221034)

Resource type

Virtual machine scale sets

Resource

UdacityDemo-221034

Criteria

Metric namespace *

Virtual Machine Host

Metric name

Percentage CPU

1 minute time grain

Dimension Name

Operator

Dimension Values

Add

VMName

=

All values

v



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)

0.33 %

Enable metric divide by instance count ⓘ

Operator *

Greater than

Metric threshold to trigger scale action * ⓘ

70

%

Duration (minutes) * ⓘ

Time grain (minutes) ⓘ

10

1

Time grain statistic * ⓘ

Time aggregation * ⓘ

Average

Average

Action

Operation *

Decrease count by

Cool down (minutes) * ⓘ

5

instance count *

1



Add

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

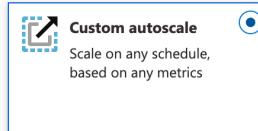
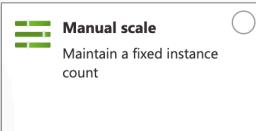
Home > Monitor | Autoscale >

Autoscale setting ...

UdacityDemo-221034 (Virtual machine scale set)

Save Discard Refresh Logs Feedback

CHOOSE HOW TO SCALE YOUR RESOURCE



Custom autoscale

Autoscale setting name UdacityDemo-221034-Autoscale-979

Resource group UdacityDemo

Instance count 2

Predictive autoscale Mode Disabled Pre-launch setup of instances (minutes) 0

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

Default* Auto created default 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-221034 (Average) Percentage CPU > 70 Increase count by 1

+ Add a rule

Instance limits

Minimum 2 Maximum 2 Default 2

Schedule

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

+ Add a scale condition

Step 5 (Screenshot for "Autoscale Enabled"):

Home > Monitor

Monitor | Autoscale ...

Microsoft

Search Refresh

Overview

Activity log

Alerts

Metrics

Logs

Change Analysis

Subscription

[No filter]

Resource group

[No filter]

Resource type

[No selected]

Resource

[No selected]

Name

UdacityDemo-221034

Resource type

Virtual machine scale set

Resource group

UdacityDemo

Location

South Central US

Instance count

2

Autoscale status

Enabled

Explanation

1

Explain the key details of autoscale screenshots you have submitted.

AutoScale can be done manually or via customization.

There're 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
- 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 at least 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