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.

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

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| **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. | * Virtual Machines: For VM’s and Web Apps. The operating system license is always Standard and Virtualization is always Hyper-V. So we can use this service for them. * SQL Database service for Database servers. 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.  VM and Web Apps Server 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. |  |
| **Screenshot 3**  Submit the screenshot for each of the above configurations from Azure TCO.  Storage configuration screenshot should be submitted here. |  |
| **Screenshot 4**  Submit the screenshot for each of the above configurations from Azure TCO.  Networking configuration screenshot should be submitted here. |  |
| **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. |  |
| **Explanation 1**  Explain the breakdown of the costs and show your understanding of how on-prem costs versus Azure compare | The costs includes compute cost, data center cost, networking cost, storage cost and IT labor cost.  When using Azure, the compute cost, storage cost and IT labor cost decreases drastically and data center cost, networking cost is zero. So Azure saves a lot of money. |

# **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](https://portal.azure.com/#create/Microsoft.VirtualMachine) *link to see all possible VM sizes and go through the classroom instructions for more details.*

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| **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. |  |
| **Screenshot 2**  Submit the screenshot for each of the above configurations from the Azure Pricing Calculator. Submit the US **West Coast** monthly costs here. |  |
| **Screenshot 3**  Submit the screenshot for total cost per month for both US East and West Coasts. |  |
| **Explanation 1**  Explain how resilience is built in by moving to Azure | We have 10 severs across 2 regions. It means system is more resilience, HR and DR are available. We also can scale in and scale out when needed. |

# **STEP 3: Azure Cost Management + Billing**

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| **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** | Azure Cost Management + Billing is a suite of tools provided by Microsoft that helps us analyze, manage, and optimize the costs of our workloads. These tools help to ensure the benefits of the cloud are utilized. |
| **Screenshot 2**  Submit the screenshot for 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. | The key parts of the demo are broken down by 2 sections on the page:   * The top part of the graph shows an area chart for the appropriate date selected (top dropdown) and for the right scope. * The graph itself shows the following:   + Accumulated cost - shown by the shaded green part and indicates what the total cost for the Azure plant   + Monthly budget: Is the amount set by the Azure architect for which you want to be alerted once the amount is exceeded   + Overage: Is the amount which shows the amount you have exceeded by   + Forecast: Your total expected expense for the month   We also are able to see how the graph visually indicates when a budget target is met and the monthly costs continue to stack up. It also helps you forecast the costs for any particular month.   * The bottom donut charges show the charges by the following options:   + Service Name: Costs broken down by service name   + Location: Costs broken by region where your Azure infrastructure is stood up   + Subscription: Costs broken down by subscription.   Scopes are levels in the resource hierarchy where you manage and control access to one or more resources. Select a scope to see a filtered roll-up of all resources, products, and services. |
| **Screenshot 3**  Submit the screenshot for breakdown of costs by Service Name and Location. |  |
| **Explanation 3**  Explain the key components of the screenshot submitted. | * + Service Name: Costs broken down by service name   + Location: Costs broken by region where your Azure infrastructure is stood up |
| **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. | We have budget details, the period of the budget and the creation and expiration date, budget amount. |
| **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). |
| **Explanation 5**  Explain the key components of the screenshot submitted. | We have alert condition which can be forecasted or actual thresholds. When event happens, an alert will be sent to the recipients. |
| **Screenshot 6**  Submit the screenshot for breakdown of costs by Service Name and Location. | Same as screenshot 3. |
| **Explanation 6**  Explain the key components of the screenshot submitted. | Same as screenshot 3. |
| **Explanation 7**  Explain the summarized highlights of this part of the project, Azure Cost Mgmt + Billing | * Azure Cost Management + Billing provides visibility into daily cloud costs and helps you analyze, manage, and optimize the costs of your workloads. * It also displays how current, accrued costs are tracking versus the budget set. * The Accumulated Cost Report visualizes your monthly costs and overage costs, if a certain budget limit is exceeded. It also visualizes forecasted costs for the month. * The Service name donut chart visualizes the Azure service and the costs associated with each of those service. * The Location donut chart helps indicates different Azure locations and how much each location has cost. * The Subscription donut chart shows costs based on the scope of subscription. |

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# **STEP 4: Azure Policy to create and enforce policies**

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| **Background** | 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.  You now decide to leverage Azure Policy features to ensure that appropriate controls are put in place. |
| **Screenshots 1 through 5**  Submit the screenshots for Azure Policy steps. | **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.  **Very important note:**   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 though 2. 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:**  **Step 2:**    **Step 3**    **Step 4:**    **Step 5:** |
| **Screenshot 6**  Explain through screenshots what happens when you create a VM which is in violation with the policy you just created. | 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. |
| **Explanation 1**  Explain the summarized highlights of this part of the project, Azure Policy. | The sizes which is not in the allowed list will be grey out with a message: Cannot create this VM size which I assigned above. |

**STEP 5: Azure Dashboards**

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| **Background** | Azure Dashboards are a one stop shop to monitor   * 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. |
| **Screenshots1 through 3**  You will submit the screenshots for Overview tab. | **Step 1:**  **Step 2:**  **Step 3 (Final Output):** |

# **STEP 6: Azure Monitor – Metrics**

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| **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. |  |

# **STEP 7: Azure Monitor – Log Analytics**

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| **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:**    **Step 2:**    **Step 3:**  **Step 4:** |

# **STEP 8: Azure Insights**

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| **Background** | Azure Insights can only be created once you have the Log Analytics workspace completed. |
| **Screenshots1 through 6**  You will submit the screenshots for the Monitor | Metrics screen as you are setting up. | **Hint 1:** Navigate to Insights > Applications and then click Add button  **Hint 2:** The Log Analytics workspace you created before will be used here  **Step 1:**  **Step 2:**  **Step 3:**  **Step 4:**  **Step 5:**  **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:**  **Step 9:**  **Step 10:**  **Step 11:**  **Step 12:** |

# **STEP 9: Azure Monitor – Smart Alerts**

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| **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:**    **Step 4:**  **Step 5:**    **Step 6 (Summary after above steps):**  **Step 7 (Screenshot post-creation of the alert):**  **Step 8 (If you had any alerts, they would be submitted here):** |
| **Explanation 1**  Explain the purpose of Azure Dashboards, Azure Monitor and alerts | 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 adding the appropriate widgets. * Azure Dashboard provides a unified place to monitor resources quickly. * Building a custom Dashboard can enable you to quickly consume relevant information, identify issues.   Azure Monitor is a service for collecting, analyzing, and acting on telemetry from your cloud and on-premises environments. IT Operations, DevOps, and developer teams use Azure Monitor to maximize the availability and performance of applications and services.  Alerts proactively notify you when issues are found within your infrastructure or application using your monitoring data in Azure Monitor. They also allow you to identify and address issues before the users of your system notice them. |

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

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| **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”):**  **Step 3 (Create the scale rule. They key part on this screen is that Percentage CPU metric is selected):**    **Step 4 (Once scale rule is created, submit the summary screenshot):**  **Step 5 (Screenshot for “Autoscale Enabled”):** |
| **Explanation 1**  Explain the key details of autoscale screenshots you have submitted. | Autoscaling has 2 different options:   * Manual Scale * Custom Autoscale   + Within this Scale mode - Scale based on metric is selected   + Add a rule option is selected which lets you add the add a rule for that metric     - Another wizard opens up wherein all the defaults are selected       * Time Aggregation as Average is selected - so the scale is applied to the average metric       * Metric Name : Percentage CPU is selected       * Operator such as Greater than is selected       * Most importantly metric threshold to trigger scale action is then entered which in the demo is 70       * Other defaults such as duration and cool down period are set as per suggested by Azure   + Instance details are defaulted which essentially define what happens when the autoscale triggers. |