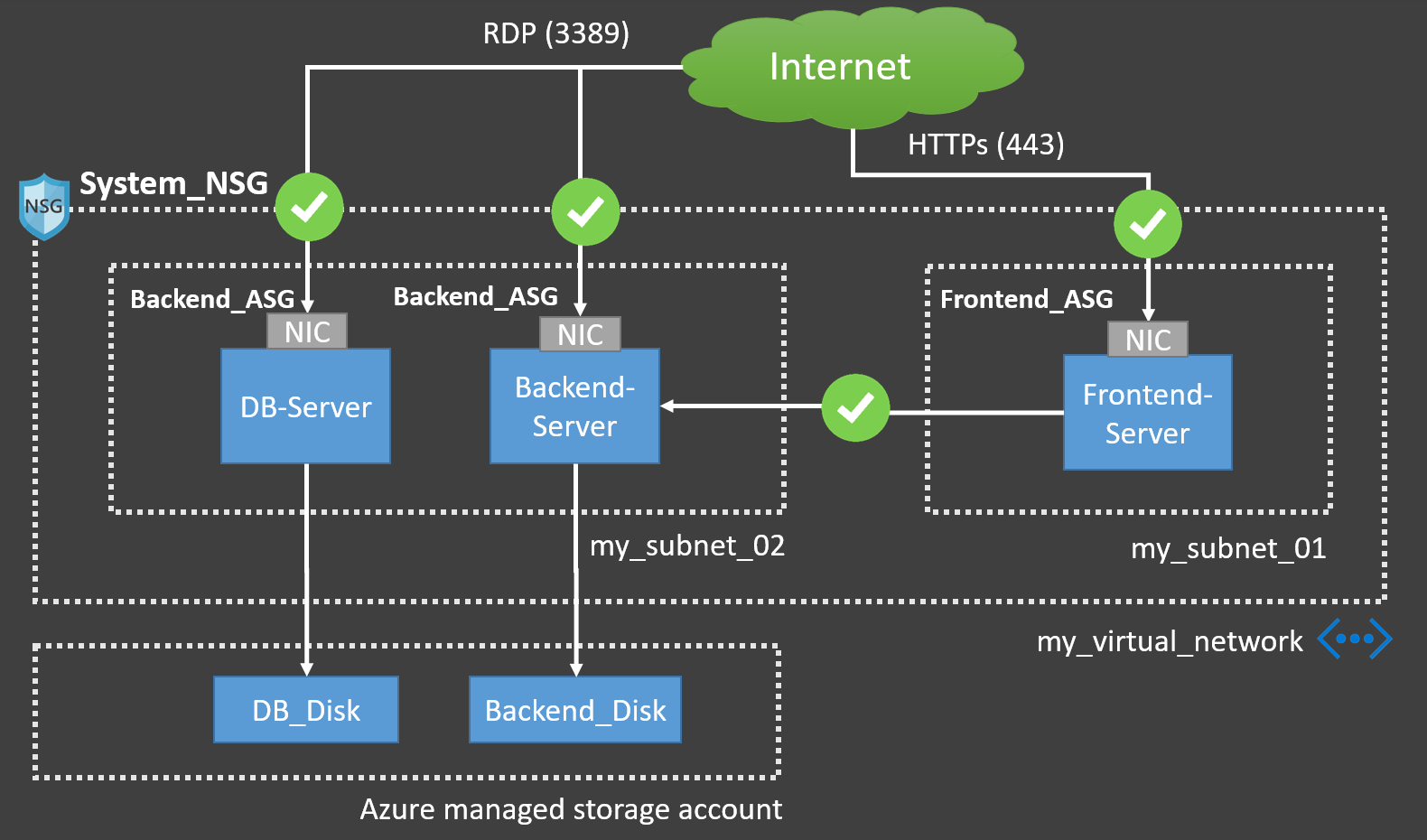
**Mission is Possible! - Your Project Assignment**

**Introduction**

Hi, and welcome! After learning so many features and configuration options in Azure, it is a great time to practice and building your first cloud IaaS system. Your mission, if you are willing to accept it :-), will be to create an end-to-end cloud-based solution using Microsoft Azure while using the services and resource types we covered in this course.

At the end of the project, it will be great if you can share inside the course dashboard the following sentence: “[Full Name] - Mission Accomplished!”

**Target System Architecture**



**Ok, How?**

The project is divided into several steps, presented in the following table. Right after this high-level table, you will find a detailed description per each step.

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| Step # | Description | High-level steps |
| 1 | Getting Started with Azure | * Open a new account in Microsoft Azure * Organize your favorites navigator * Create a personal dashboard |
| 2 | Users, Resource Groups and Access Control | * Create new users * Create new resources groups and configure roles * Create a storage account |
| 3 | Network and Security | * Create a virtual network and subnets * Configure security rules |
| 4 | Virtual Data Disks | * Create managed virtual disks |
| 5 | Virtual Machines Initial Setup | * Create a frontend server * Create a backend server * Create a database server * Associate VMs to ASGs * Testing remote connection to VMs and setting data disks * Creating a backup policy |
| 6 | Ongoing VMs Monitoring and Optimization | * Metrics and alerts * Vertical scaling |

* For any question, suggestion or some request, please use the course dashboard.
* If you can’t remember how to perform a specific step, just locate the relevant demo lecture and review the video. All lectures with demonstrations are starting with the word “Demo” and then the main topic for the demo.

**Good Luck!**

Idan Gabrieli

**Mission Steps - Detailed Description**

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| **Step 1 - Getting Started with Azure** | |
| Open a new account in Microsoft Azure | 1. Go to <https://azure.microsoft.com/en-us/> and click “start free”. 2. Create a new Microsoft account (unless you already have an account with Microsoft for other applications). 3. Follow the prompts to verify your account. Keep in mind that you need to supply a valid credit card number to verify your identity. There is no charge involved with the setting up of a free account. 4. Within a minute, the new account will be ready. Click “My Account” or go directly to the [Microsoft Azure Portal](https://portal.azure.com). |
| Organize your favorites navigator | 1. We want to re-organize the default favorite navigator on the left side, so it will be more useful for the project we are planning to create. 2. Inside the Azure portal, click on “All Services” (left side) and in search of the following items. Use the “Star” checkmark to insert/remove an item from the favorite. 3. If you can’t find an item while scrolling down for the long list of options, search it in the filter. 4. The following items should be inside the favorite:    * Subscriptions    * All resources    * Resource Groups    * Virtual machines    * Disks    * Virtual networks    * Network security groups    * Application security groups    * Network Interfaces    * Storage Accounts    * Azure Active Directory (under “Identity”)    * Free services   Important Note – don’t use any item with the word “classic”. |
| Create a personal dashboard | 1. On the upper side above the existing dashboard locate the menu for adjusting the dashboard setting. 2. Click on “new dashboard” and call with your full name, like “Idan Gabrieli Dashboard”. 3. Still, inside the dashboard customization mode, search for the following items and click “Add”:    1. Clock    2. Users and Groups    3. All resources 4. Click “Done customization” |

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| **Step 2 - Users, Resource Groups and Access Control** | |
| Creating new users | 1. We would like to practice how to create new users and assign roles to those users. 2. Select “Azure Active Directory” from the left side favorite’s navigator. Under the “Overview” option copy the name of **your default directory**      1. Select the “Users” option under the “Manage” category. We will get the list of existing users. Right now there is only one user (you…) as a global administrator. 2. Select “New User” and create the following two users:   User-1   * **Name:** Bob Marley * **Username:** bobm@[**your default directory]** * **Profile:** Job title🡪Network and Security Expert, Department🡪IT * **Properties:** Default * **Group:** 0 groups selected * **Directory role:** User   User-2   * **Name:** Chris Martin * **Username:** chrism@[**your default directory]** * **Profile:** Job title🡪VMs Expert, Department🡪IT * **Properties:** Default * **Group:** 0 groups selected * **Directory role:** User |

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| Creating new resource groups | 1. We learned that resources must be created in logical containers called resource groups. In our project, we will create two resource groups, one will be used for holding any resource related to the underline network, and the second resource group will be used for holding any other resources (e.g. VMs, Disks). 2. Select “Resource groups” from the left side favorite’s navigator. Click “Add” and add the following resource groups:   Resource Group-1   * **Resource group name:** Network\_RG * **Subscription:** your free subscription or pay-as-you-go * **Resource group location:** East US   Resource Group-2   * **Resource group name:** VMs\_RG * **Subscription:** your free subscription or pay-as-you-go * **Resource group location:** East US  1. Click “Refresh” – two new items      1. Click on “Network\_RG” and the left side, select “Access control (IAM). Click “Add” to add a new role assignment:   Role: Contributor  Assign access to Azure AD user, group, or service principal  Select: Bob Marley (as he is our network expert)     1. Back to the list of resource groups. Click on “VMs\_RG” and on the left side, select “Access control (IAM). Click “Add” to add a new role assignment:   Role: Contributor  Assign access to Azure AD user, group, or service principal  Select: Chris Martin (as he is our VMs expert) |
| Creating a new storage account | 1. Any storage resource must be created inside a storage account. A storage account is created and managed by us or directly by Azure, depending on the use case. 2. Let’s practice how to create and manage a storage account. 3. Select “Storage accounts” from the left side favorite’s navigator. Click “Add” to add a new storage account with the following properties:   PROJECT DETAILS:   * **Subscription:** your free subscription * **Resource group:** VMs\_RG   INSTANCE DETAILS:   * **Storage account name:** [your name]storage4321   + E.g. “idanstorage4321” but with your name * **Location:** East US * **Performance:** Standard * **Account kind:** general purpose V2 * **Replication:** LRS * **Access tier:** Hot   Click on “Review + Create”, check out your setting in this summary list. If the validation passed, then click “Create”.   1. Under the Notifications in the upper right side menu, check if the creation process finished with success. Go back to the “Storage accounts” option.     At this point, the storage account is empty. We will get back to it later.  Under the main dashboard, we will now see a single new resource under “all resource” and three users under “Users and groups”. |

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| **Step 3 - Network and Security** | |
| Create a new virtual network | 1. Select “Virtual networks” from the left side favorite’s navigator. Click “Add” to add a new virtual network (VNET) with the following properties:   **Name:** my\_virtual\_network  **Address space:** 10.0.0.0/23 (512 addresses)  **Subscription:** your free subscription or pay-as-you-go  **Resource group:** Network\_RG  **Location:** East US  **Subnet name:** my\_subnet\_01  **Subnet address range:** 10.0.0.0/25 (128 addresses)  **DDoS protection:** Basic  **Service endpoints:** Disabled  **Firewall:** Disabled     1. Click the new virtual network, and on the left side menu select “Subnets”. Click on “Subnet” to add the additional subnet.   **Subnet name:** my\_subnet\_02  **Subnet address range:** 10.0.1.0/25 (123 + 5 Azure reserved addresses)  NSG: None  Route table: None  Service endpoints: 0 Selected  Subnet delegation: None |

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| Create ASGs and an NSG | 1. Select “Application security groups” from the left side favorite’s navigator. Click “Add” to add two new ASPs with the following properties:   ASP-01  **Subscription:** your free subscription or pay-as-you-go  **Resource group:** Network\_RG  **Name:** Frontend\_ASG  **Location:** East US  ASP-02  **Subscription:** your free subscription or pay-as-you-go  **Resource group:** Network\_RG  **Name:** Backend\_ASG  **Location:** East US     1. Select “Network security groups” from the left side favorite’s navigator. Click “Add” to add a new NSG with the following properties:   **Name:** System\_NSG  **Subscription:** your free subscription or pay-as-you-go  **Resource group:** Network\_RG  **Location:** East US     1. Click on the new network security group “System\_NSG”. On the left side menu, select “Subnets”. Select “Associate” and then select the virtual network “my\_virtual\_network” and “my\_subnet\_01”. Click again on “Associate” and repeated to the process to “my\_subnet\_02”.      1. Still under the “System\_NSG” network security group, looking at the “Overview”, the network security group is now associated with two subnets. |

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| Configure security rules | 1. Select “Network security groups” from the left side favorite’s navigator. Click on “System\_NSG” security group. 2. On the left side, select “Inbound security rules”. We would like to add a security rule that will enable incoming HTTPs requests only into our Frontend servers and also incoming RDP connection to our backend servers. 3. Click “Add” and add two new inbound security rules with the following properties:   Rule-1  **Source:** Any  **Source port ranges:** \* (any port)  **Destination:** Application security group 🡪 Frontend\_ASG  **Destination port ranges:** 443 (HTTPs)  **Protocol:** TCP  **Action:** Allow  **Priority:** 100  **Name:** HTTPs\_Requests  Rule-2  **Source:** Any  **Source port ranges:** \* (any port)  **Destination:** Application security group 🡪 Backend\_ASG  **Destination port ranges:** 3389 (RDP)  **Protocol:** TCP  **Action:** Allow  **Priority:** 110  **Name:** RDP |

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| **Step 4 - Virtual Data Disks** | |
| Create managed virtual disks | 1. Select “Disks” from the left side favorite’s navigator. Click “Add” to create a newly managed disks. Add two new disks with the following properties:   Disk-01  **Name:** DB\_Disk  **Subscription:** your free subscription or pay-as-you-go  **Resource group:** VMs\_RG  **Location:** East US  **Account type:** Standard HDD  **Source type:** None (empty disk)  **Size:** 1 GiB  Disk-02  **Name:** Backend\_Disk  **Subscription:** your free subscription or pay-as-you-go  **Resource group:** VMs\_RG  **Location:** East US  **Account type:** Standard HDD  **Source type:** None (empty disk)  **Size:** 1 GiB     1. Looking on your dashboard under “All resources” this is what is expected: |

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| **Step 5 - Virtual Machines Initial Setup** | |
| Create a Frontend Server | 1. Select “Virtual machines” from the left side favorite’s navigator. Click “Add” to create a new virtual machine. 2. Creating a Frontend Server:   Project Details:   * **Subscription:** your free subscription * **Resource group:** VMs\_RG   Instance Details:   * **Virtual machine name:** Frontend-Server * **Region:** East US * **Availability option:** No infrastructure redundancy required * **Image:** Windows 10 Pro (latest version) * **Size:** change size 🡪 B1s (1 vcpu, 1 GB memory)   Administrator Account:   * **Username:** Your First Name * **Password:** CloudExpert007   Inbound Port Rules:   * **Public inbound ports:** None   Disk Options:   * **OS Disk type:** Standard HDD * **Advanced:** Use managed disks 🡪 Yes   Network Interfaces:   * **Virtual network:** my\_virtual\_network * **Subnet:** my\_subnet\_01 * **Public IP:** (new) Frontend-Server-ip * **Network security group:** Advanced 🡪 None * **Accelerate networking:** Off   Monitoring   * **Boot diagnostics:** On * **OS guest diagnostics:** On * **Diagnostics storage account:** [your name]storage431   Identity   * **System assigned managed identity:** Off   Auto-Shutdown   * **Enable auto-shutdown:** Off |

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| Create a Backend Server | * **Subscription:** your free subscription * **Resource group:** VMs\_RG * **Virtual machine name:** Backend-Server * **Region:** East US * **Availability option:** No infrastructure redundancy required * **Image:** Windows 10 Pro (latest version) * **Size:** change size 🡪 B1s (1 vcpu, 1 GB memory) * **Username:** Your First Name * **Password:** CloudExpert007   + This user and password will be used to perform remote connection * **Public inbound ports:** None * **OS Disk type:** Standard HDD * **Data Disks** 🡪 Attach an existing disk 🡪 Backend\_Disk * **Advanced:** Use managed disks 🡪 Yes * **Virtual network:** my\_virtual\_network * **Subnet:** my\_subnet\_02 * **Public IP:** (new) Backend-Server-ip * **Network security group:** Advanced 🡪 None * **Accelerate networking:** Off * **Boot diagnostics:** On * **OS guest diagnostics:** On * **Diagnostics storage account:** [your name]storage431 * **System assigned managed identity:** Off * **Enable auto-shutdown:** Off |
| Create a Database Server | * **Subscription:** your free subscription * **Resource group:** VMs\_RG * **Virtual machine name:** DB-Server * **Region:** East US * **Availability option:** No infrastructure redundancy required * **Image:** Windows 10 Pro (latest version) * **Size:** change size 🡪 B1s (1 vcpu, 1 GB memory) * **Username:** Your First Name * **Password:** CloudExpert007 * **Public inbound ports:** None * **OS Disk type:** Standard HDD * **Data Disks** 🡪 Attach an existing disk 🡪 DB\_Disk * **Advanced:** Use managed disks 🡪 Yes * **Virtual network:** my\_virtual\_network * **Subnet:** my\_subnet\_02 * **Public IP:** (new) DB-Server-ip * **Network security group:** Advanced 🡪 None * **Accelerate networking:** Off * **Boot diagnostics:** On * **OS guest diagnostics:** On * **Diagnostics storage account:** [your name]storage431 * **System assigned managed identity:** Off * **Enable auto-shutdown:** Off   After creating the three VMs: |
| Associate VMs to ASGs | 1. Select “Virtual machines” from the left side favorite’s navigator. Click on the “Backend-Server”. On the left side menu, select “Networking”. 2. Click on “Configure the application security groups”. Select the “Backend\_ASG” and “Save”.      1. Go back to the list of VMs and click on “DB-Server”. Networking🡪 Configure the application security groups🡪Backend\_ASG. 2. Go back to the list of VMs and click on “Fronted-Server”. Networking🡪 Configure the application security groups🡪Frontend\_ASG. |
| Testing remote connection to VMs and setting data disks | 1. Open RDP client in your computer (assuming Win7/10) by searching for “mstsc” in the start menu 2. Go back to the Azure portal. Select “Virtual machines” to get the list of VMs and then on “Frontend-Server”. In the “Overview” screen locate the specific public IP address that was allocated dynamically by Azure.      1. Copy and paste the public IP inside the RDP client. Try to connect…. 2. The expected result is that we can’t connect to this VM as the security rules are configured to allow incoming RDP requests only to the Backend application security group. 3. Now, select the Backend-Server and copy-paste the public IP into the RDP client. You should be able to connect to the remote Win10 VM. Type the username and password that you configured when creating the VM.  * User: [your name] * Password: CloudExpert007  1. Setup the data disk associated with the VM:    1. Inside the remote VM, start menu enters: “diskmgmt.msc”    2. Disk Management recognizes that you have a new, uninitialized disk and the Initialize Disk window appears    3. Verify the new disk is selected and then select OK to initialize it    4. The new disk appears as unallocated.      * 1. Right-click anywhere on the disk and select New simple volume. The New Simple Volume Wizard window opens.   2. Proceed through the wizard, keeping all of the defaults, and when you're done select Finish.      * 1. Open file explorer and locate the new disk drive      1. Close the Win10 VM remote connection. |
| Creating a backup policy | 1. We would like to back up the data in our database server once a day. 2. Select “Virtual machines” from the left side favorite’s navigator. Click on “DB-Server”, scroll below and find “Backup” under the “Operations” category. 3. Enable Backup:   **Recovery Service vault:** Create new  **Resource group:** VMs\_RG  **Choose backup policy:** (new) Daily policy   1. After the deployment is completed, go back again the “Backup” option and click on “Backup now” to create the first backup now.      1. Click on “View all jobs” to present the progress of the backup jobs: |

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| **Step 6 - Ongoing VMs Monitoring and Optimization** | |
| Metrics and alerts | 1. Select “Virtual machines” from the left side favorite’s navigator. Click on “Frontend-Server”, scroll below and find “Metrics” under the “Monitoring” category. 2. On the new graph, select the metric “Percentage CPU” from the drop-down list of metrics with average aggregation. On the upper side, change the timescale to the “last hour”.        1. Click on “Add metric”. Select the resource “Backend-Server” and then the “Percentage CPU”. Now the graph presents the two servers. Click on “Pin to Dashboard”. |
| Setting thresholds policy rules | 1. Select “Virtual machines” from the left side favorite’s navigator. Click on “Frontend-Server”, scroll below and find “Alerts” under the “Monitoring” category. 2. Click on “New alert rule”:   Define alert condition:  Alert target: Frontend-Server  Alert criteria:   * Add criteria🡪Percentage CPU 🡪 Greater than 90 (average) * Over the last 🡪 15 mins, Frequency 🡪 Every 5min   Define alert details:   * Alert rule name: High Load on Frontend Server * Description: Over the last 15min, the VM CPU reached 90% and it is recommended to scale up the VM size. * Severity: 4   Define action group:  New action group:   * Group name: Scale Up VM * Resource group: VMs\_RG * Action name: Recommend scale up * Action type: Email/SMS * Email: [support@mycompany.com](mailto:support@mycompany.com)  1. Finally, select the new action group under the define action group step and click “Create an alert rule”. 2. If the rule condition will be true then a new alert will be created by Azure and under the “Alert” menu you will be able to see the list of alerts and manage the alerts rules. |

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| Vertical scaling | 1. Vertical scaling is adding/reducing resources to a specific VM. Let’s say that while monitoring the VMs, you discover that the workload of the Frontend server is reaching the maximum available computing power of the VM as a growing amount of users are connecting to the system. One option will be to add another Frontend server (horizontal scaling) and we will learn how to do it in the next levels. The second option will be to scale up the VM size. 2. Select “Virtual machines” from the left side favorite’s navigator. Click on “Frontend-Server”, scroll below and find “Size” under the “Setting” category. 3. Find a VM template with:  * vCPU=2 * RAM=4 GB  1. Select “Resize”. This process will take a while (few minutes). 2. Validate the new size. Click on “Overview” and then “Refresh”. |

**Congratulation! You made it :-)**

I will be happy to hear your feedback about the project.

Thanks

Idan Gabrieli