

.NET CORE AZURE VM DEPLOY GUIDE

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ABSTRACT. Simple and easy way to deploy your .NET Core web application to the Azure Ubuntu-based virtual machine.

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1. VIRTUAL MACHINE CREATION

Firstly, it is necessary to create a virtual machine (unexpectedly) where deployment to be hosted on. In this guide is considered free virtual machine of type **Standard B1ms** (1 vcpu, 2 GiB memory) with Ubuntu 20.04 operating system. Definitely it won't be considered step by step creation in this document, however required VM parameter are as follows:

- Size: **Standard B1ms** (1 vcpu, 2 GiB memory)
- OS: **Ubuntu Server 20.04 LTS - Gen2**
- Availability options: **No infrastructure required**
- Authentication type: **SSH public key**
- SSH public key source: **Use existing public key (create it before you created VM)**

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2010 Mathematics Subject Classification. 26E70, 05A30.

Key words and phrases. Azure, DevOps, Virtual machine, Deploy, Nginx, SSH, CI/CD, Azure pipelines, Github actions .

- Public inbound ports: HTTP(80), HTTPS(443), SSH(22)
- OS disk type: Standard SSD
- Encryption type: Default
- Public IP: Basic SKU, Static (be sure to create static IP)
- Select inbound ports: HTTP(80), HTTPS(443), SSH(22)
- Boot diagnostics: Disabled

Chosen parameters of the virtual machine are collected in order to minimize vm's cost. If you are not sure, refer to the screenshots via the [link](#).

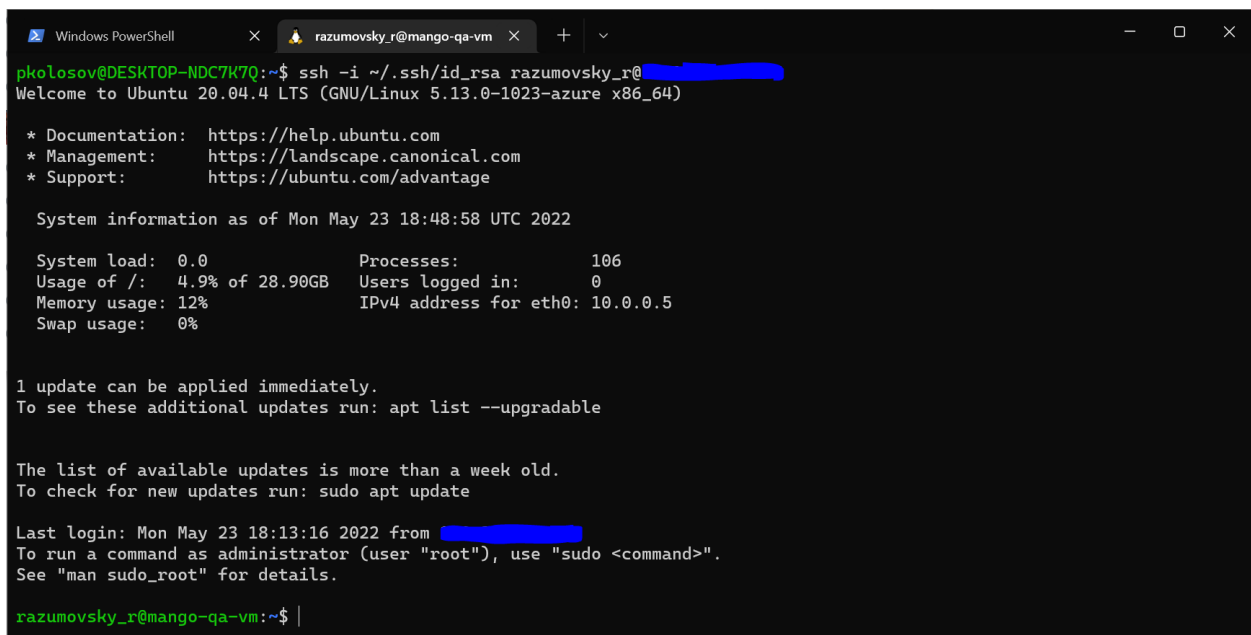
2. CONNECT TO VM VIA SSH

It is assumed that programmer uses WSL 2 under Windows 10 in order to work with VM via the SSH. By default, SSH keys are stored under the path `c/Users/username/.ssh`. Assume that RSA key-pair is stored there and have the names `id_rsa` and `id_rsa.pub` for private and public keys respectively. In order to interact the VM via SSH it is necessary to copy RSA keypair to the WSL `username/.ssh` folder, we use the commands under WSL

- `cp /mnt/c/Users/pkolosov/.ssh/id_rsa /.ssh/`
- `cp /mnt/c/Users/pkolosov/.ssh/id_rsa.pub /.ssh/`

Then connection is available now using the command

- `ssh -i /.ssh/id_rsa razumovsky_r@MachineStaticIP`



```
Windows PowerShell x razumovsky_r@mango-qa-vm x + v
pkolosov@DESKTOP-NDC7K7Q:~$ ssh -i ~/.ssh/id_rsa razumovsky_r@[REDACTED]
Welcome to Ubuntu 20.04.4 LTS (GNU/Linux 5.13.0-1023-azure x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/advantage

System information as of Mon May 23 18:48:58 UTC 2022

System load:  0.0      Processes:      106
Usage of /:   4.9% of 28.90GB   Users logged in:  0
Memory usage: 12%      IPv4 address for eth0: 10.0.0.5
Swap usage:   0%

1 update can be applied immediately.
To see these additional updates run: apt list --upgradable

The list of available updates is more than a week old.
To check for new updates run: sudo apt update

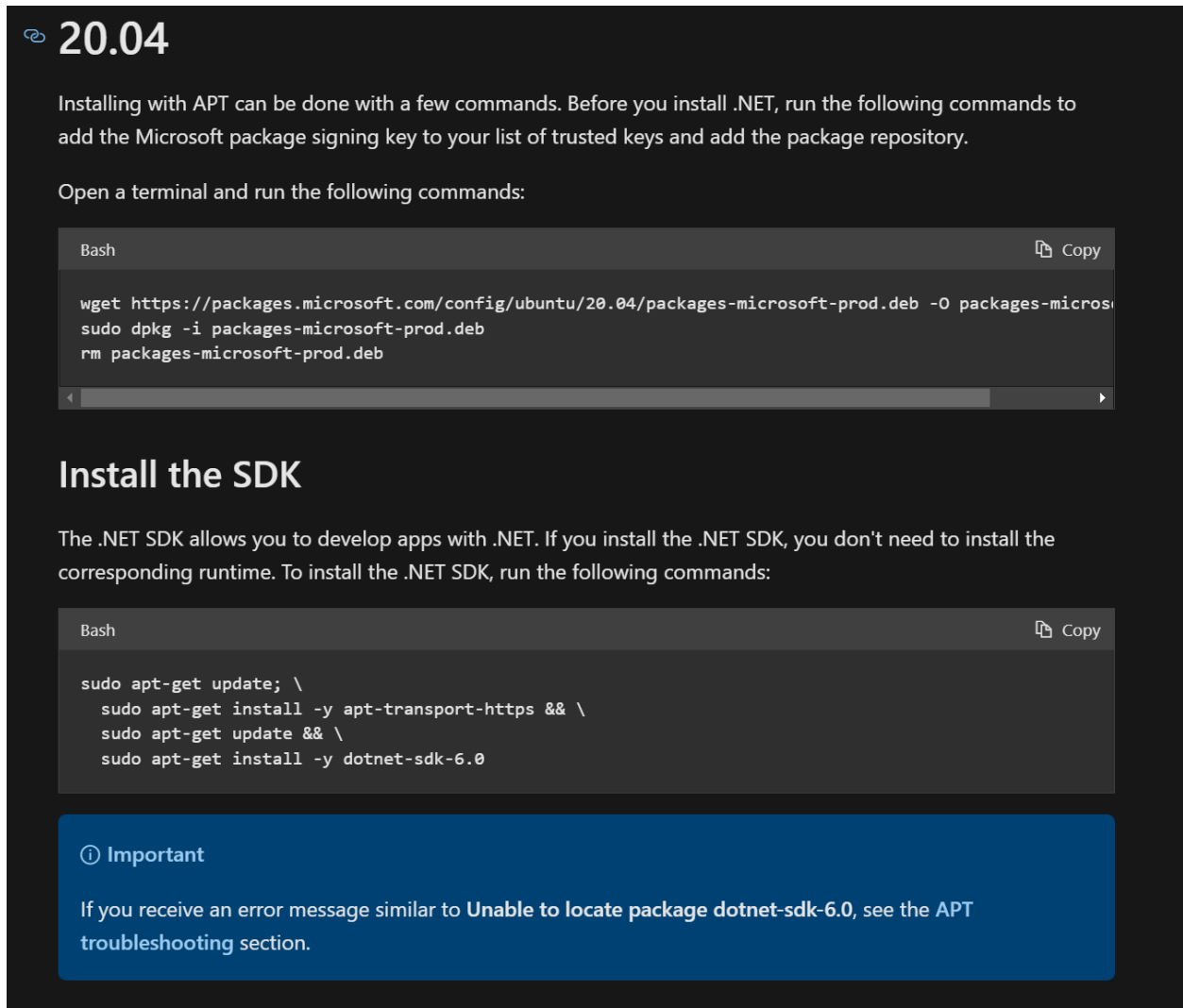
Last login: Mon May 23 18:13:16 2022 from [REDACTED]
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

razumovsky_r@mango-qa-vm:~$ |
```

Figure 1. SSH connected successfully.

3. INSTALL .NET SDK AND RUNTIME TO THE UBUNTU 20.04

Next, we should install the .NET SDK (unexpectedly again) in order to run our application. Proceeding, we refer to the Microsoft documentation article named [Install the .NET SDK or the .NET Runtime on Ubuntu](#), precisely the version is 20.04. As per documentation, consider the following commands to install .NET 6.0 SDK to your Ubuntu VM



The screenshot shows the '20.04' section of the Microsoft documentation for installing the .NET SDK on Ubuntu. It includes a terminal window with the following commands:

```
Bash
wget https://packages.microsoft.com/config/ubuntu/20.04/packages-microsoft-prod.deb -O packages-microsoft-prod.deb
sudo dpkg -i packages-microsoft-prod.deb
rm packages-microsoft-prod.deb
```

Below the terminal window, it says 'Install the SDK'. The text explains that the .NET SDK allows developing apps with .NET and that installing the SDK also installs the runtime. It provides another terminal window with the following commands:

```
Bash
sudo apt-get update; \
sudo apt-get install -y apt-transport-https && \
sudo apt-get update && \
sudo apt-get install -y dotnet-sdk-6.0
```

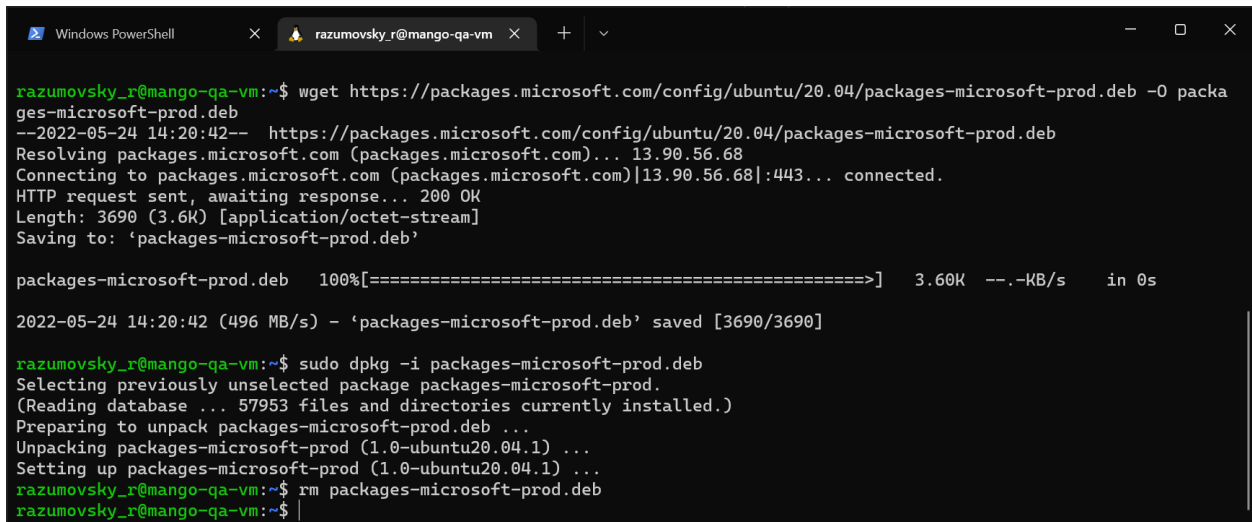
At the bottom, there is an 'Important' note in a blue box: 'If you receive an error message similar to Unable to locate package dotnet-sdk-6.0, see the APT troubleshooting section.'

Figure 2. Ubuntu 20.04 install .NET 6.0 SDK MSDN.

Prepare your virtual machine applying the commands

- `wget https://packages.microsoft.com/config/ubuntu/20.04/packages-microsoft-prod.deb -O packages-microsoft-prod.deb`
- `sudo dpkg -i packages-microsoft-prod.deb`
- `rm packages-microsoft-prod.deb`

The terminal output is as follows



```

razumovsky_r@mango-qa-vm:~$ wget https://packages.microsoft.com/config/ubuntu/20.04/packages-microsoft-prod.deb -O packages-microsoft-prod.deb
--2022-05-24 14:20:42-- https://packages.microsoft.com/config/ubuntu/20.04/packages-microsoft-prod.deb
Resolving packages.microsoft.com (packages.microsoft.com)... 13.90.56.68
Connecting to packages.microsoft.com (packages.microsoft.com)|13.90.56.68|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 3690 (3.6K) [application/octet-stream]
Saving to: 'packages-microsoft-prod.deb'

packages-microsoft-prod.deb  100%[=====]  3.60K  --.-KB/s  in 0s

2022-05-24 14:20:42 (496 MB/s) - 'packages-microsoft-prod.deb' saved [3690/3690]

razumovsky_r@mango-qa-vm:~$ sudo dpkg -i packages-microsoft-prod.deb
Selecting previously unselected package packages-microsoft-prod.
(Reading database ... 57953 files and directories currently installed.)
Preparing to unpack packages-microsoft-prod.deb ...
Unpacking packages-microsoft-prod (1.0-ubuntu20.04.1) ...
Setting up packages-microsoft-prod (1.0-ubuntu20.04.1) ...
razumovsky_r@mango-qa-vm:~$ rm packages-microsoft-prod.deb
razumovsky_r@mango-qa-vm:~$

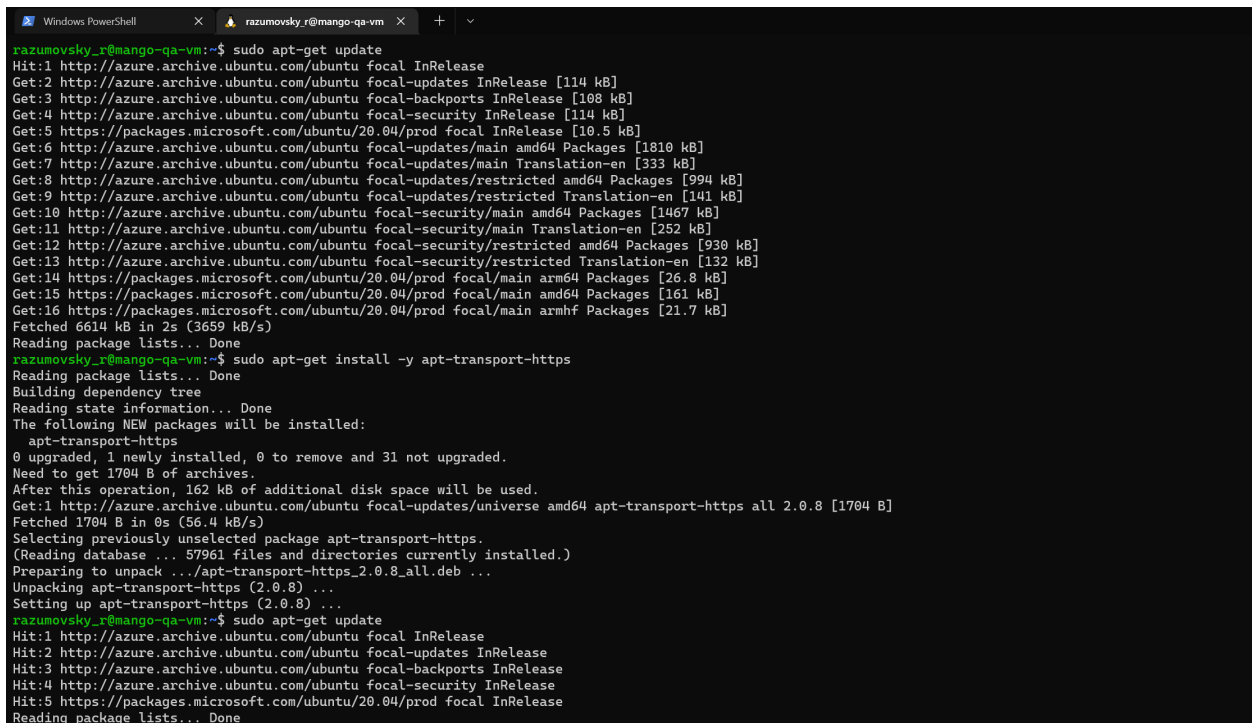
```

Figure 3. Virtual machine preparation..

Apply the following commands in order to install the SDK

- `sudo apt-get update`
- `sudo apt-get install -y apt-transport-https`
- `sudo apt-get update`
- `sudo apt-get install -y dotnet-sdk-6.0`

The terminal output after .NET 6.0 SDK installation is as follows



```

razumovsky_r@mango-qa-vm:~$ sudo apt-get update
Hit:1 http://azure.archive.ubuntu.com/ubuntu focal InRelease
Get:2 http://azure.archive.ubuntu.com/ubuntu focal-updates InRelease [114 kB]
Get:3 http://azure.archive.ubuntu.com/ubuntu focal-backports InRelease [108 kB]
Get:4 http://azure.archive.ubuntu.com/ubuntu focal-security InRelease [114 kB]
Get:5 https://packages.microsoft.com/ubuntu/20.04/prod focal InRelease [10.5 kB]
Get:6 http://azure.archive.ubuntu.com/ubuntu focal-updates/main amd64 Packages [1810 kB]
Get:7 http://azure.archive.ubuntu.com/ubuntu focal-updates/main Translation-en [333 kB]
Get:8 http://azure.archive.ubuntu.com/ubuntu focal-updates/restricted amd64 Packages [994 kB]
Get:9 http://azure.archive.ubuntu.com/ubuntu focal-updates/restricted Translation-en [141 kB]
Get:10 http://azure.archive.ubuntu.com/ubuntu focal-security/main amd64 Packages [1467 kB]
Get:11 http://azure.archive.ubuntu.com/ubuntu focal-security/main Translation-en [252 kB]
Get:12 http://azure.archive.ubuntu.com/ubuntu focal-security/restricted amd64 Packages [930 kB]
Get:13 http://azure.archive.ubuntu.com/ubuntu focal-security/restricted Translation-en [132 kB]
Get:14 https://packages.microsoft.com/ubuntu/20.04/prod focal/main arm64 Packages [26.8 kB]
Get:15 https://packages.microsoft.com/ubuntu/20.04/prod focal/main amd64 Packages [161 kB]
Get:16 https://packages.microsoft.com/ubuntu/20.04/prod focal/main armhf Packages [21.7 kB]
Fetched 6614 kB in 2s (3659 kB/s)
Reading package lists... Done
razumovsky_r@mango-qa-vm:~$ sudo apt-get install -y apt-transport-https
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  apt-transport-https
0 upgraded, 1 newly installed, 0 to remove and 31 not upgraded.
Need to get 1704 B of archives.
After this operation, 162 kB of additional disk space will be used.
Get:1 http://azure.archive.ubuntu.com/ubuntu focal-updates/universe amd64 apt-transport-https all 2.0.8 [1704 B]
Fetched 1704 B in 0s (56.4 kB/s)
Selecting previously unselected package apt-transport-https.
(Reading database ... 57961 files and directories currently installed.)
Preparing to unpack .../apt-transport-https.2.0.8_all.deb ...
Unpacking apt-transport-https (2.0.8) ...
Setting up apt-transport-https (2.0.8) ...
razumovsky_r@mango-qa-vm:~$ sudo apt-get update
Hit:1 http://azure.archive.ubuntu.com/ubuntu focal InRelease
Hit:2 http://azure.archive.ubuntu.com/ubuntu focal-updates InRelease
Hit:3 http://azure.archive.ubuntu.com/ubuntu focal-backports InRelease
Hit:4 http://azure.archive.ubuntu.com/ubuntu focal-security InRelease
Hit:5 https://packages.microsoft.com/ubuntu/20.04/prod focal InRelease
Reading package lists... Done

```

Figure 4. Ubuntu 20.04 install .NET 6.0 SDK terminal output.

```

Windows PowerShell
razumovsky_r@mango-qa-vm:~$ sudo apt-get install -y dotnet-sdk-6.0
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  aspnetcore-runtime-6.0 aspnetcore-targeting-pack-6.0 dotnet-apphost-pack-6.0 dotnet-host dotnet-hostfxr-6.0 dotnet-runtime-6.0 dotnet-runtime-deps-6.0
  dotnet-targeting-pack-6.0 netstandard-targeting-pack-2.1
The following NEW packages will be installed:
  aspnetcore-runtime-6.0 aspnetcore-targeting-pack-6.0 dotnet-apphost-pack-6.0 dotnet-host dotnet-hostfxr-6.0 dotnet-runtime-6.0 dotnet-runtime-deps-6.0 dotnet-sdk-6.0
  dotnet-targeting-pack-6.0 netstandard-targeting-pack-2.1
0 upgraded, 10 newly installed, 0 to remove and 31 not upgraded.
Need to get 123 MB of archives.
After this operation, 501 MB of additional disk space will be used.
Get:1 https://packages.microsoft.com/ubuntu/20.04/prod focal/main amd64 dotnet-host amd64 6.0.5-1 [55.7 kB]
Get:2 https://packages.microsoft.com/ubuntu/20.04/prod focal/main amd64 dotnet-hostfxr-6.0 amd64 6.0.5-1 [142 kB]
Get:3 https://packages.microsoft.com/ubuntu/20.04/prod focal/main amd64 dotnet-runtime-deps-6.0 amd64 6.0.5-1 [2806 B]
Get:4 https://packages.microsoft.com/ubuntu/20.04/prod focal/main amd64 dotnet-runtime-6.0 amd64 6.0.5-1 [22.6 MB]
Get:5 https://packages.microsoft.com/ubuntu/20.04/prod focal/main amd64 aspnetcore-runtime-6.0 amd64 6.0.5-1 [6604 kB]
Get:6 https://packages.microsoft.com/ubuntu/20.04/prod focal/main amd64 dotnet-targeting-pack-6.0 amd64 6.0.5-1 [2125 kB]
Get:7 https://packages.microsoft.com/ubuntu/20.04/prod focal/main amd64 aspnetcore-targeting-pack-6.0 amd64 6.0.5-1 [1307 kB]
Get:8 https://packages.microsoft.com/ubuntu/20.04/prod focal/main amd64 dotnet-apphost-pack-6.0 amd64 6.0.5-1 [3509 kB]
Get:9 https://packages.microsoft.com/ubuntu/20.04/prod focal/main amd64 netstandard-targeting-pack-2.1 amd64 2.1.0-1 [1476 kB]
Get:10 https://packages.microsoft.com/ubuntu/20.04/prod focal/main amd64 dotnet-sdk-6.0 amd64 6.0.300-1 [84.9 MB]
Fetched 123 MB in 4s (31.9 MB/s)
Selecting previously unselected package dotnet-host.
(Reading database ... 57965 files and directories currently installed.)
Preparing to unpack .../0-dotnet-host-6.0.5-1_amd64.deb ...
Unpacking dotnet-host (6.0.5-1) ...
Selecting previously unselected package dotnet-hostfxr-6.0.
Preparing to unpack .../1-dotnet-hostfxr-6.0.5-1_amd64.deb ...
Unpacking dotnet-hostfxr-6.0 (6.0.5-1) ...
Selecting previously unselected package dotnet-runtime-deps-6.0.
Preparing to unpack .../2-dotnet-runtime-deps-6.0.5-1_amd64.deb ...
Unpacking dotnet-runtime-deps-6.0 (6.0.5-1) ...
Selecting previously unselected package dotnet-runtime-6.0.
Preparing to unpack .../3-dotnet-runtime-6.0.5-1_amd64.deb ...
Unpacking dotnet-runtime-6.0 (6.0.5-1) ...
Selecting previously unselected package aspnetcore-runtime-6.0.
Preparing to unpack .../4-aspnetcore-runtime-6.0.5-1_amd64.deb ...
Unpacking aspnetcore-runtime-6.0 (6.0.5-1) ...
Selecting previously unselected package dotnet-targeting-pack-6.0.
Preparing to unpack .../5-dotnet-targeting-pack-6.0.5-1_amd64.deb ...
Unpacking dotnet-targeting-pack-6.0 (6.0.5-1) ...
Selecting previously unselected package aspnetcore-targeting-pack-6.0.
Preparing to unpack .../6-aspnetcore-targeting-pack-6.0.5-1_amd64.deb ...
Unpacking aspnetcore-targeting-pack-6.0 (6.0.5-1) ...
Selecting previously unselected package dotnet-apphost-pack-6.0.
Preparing to unpack .../7-dotnet-apphost-pack-6.0.5-1_amd64.deb ...
Unpacking dotnet-apphost-pack-6.0 (6.0.5-1) ...
Selecting previously unselected package netstandard-targeting-pack-2.1.

```

Figure 5. Ubuntu 20.04 install .NET 6.0 SDK terminal output.

```

Selecting previously unselected package netstandard-targeting-pack-2.1.
Preparing to unpack .../8-netstandard-targeting-pack-2.1.2.1.0-1_amd64.deb ...
Unpacking netstandard-targeting-pack-2.1 (2.1.0-1) ...
Selecting previously unselected package dotnet-sdk-6.0.
Preparing to unpack .../9-dotnet-sdk-6.0.6.0.300-1_amd64.deb ...
Unpacking dotnet-sdk-6.0 (6.0.300-1) ...
Setting up dotnet-host (6.0.5-1) ...
Setting up dotnet-apphost-pack-6.0 (6.0.5-1) ...
Setting up netstandard-targeting-pack-2.1 (2.1.0-1) ...
Setting up dotnet-targeting-pack-6.0 (6.0.5-1) ...
Setting up dotnet-runtime-deps-6.0 (6.0.5-1) ...
Setting up aspnetcore-targeting-pack-6.0 (6.0.5-1) ...
Setting up dotnet-hostfxr-6.0 (6.0.5-1) ...
Setting up dotnet-runtime-6.0 (6.0.5-1) ...
Setting up aspnetcore-runtime-6.0 (6.0.5-1) ...
Setting up dotnet-sdk-6.0 (6.0.300-1) ...
This software may collect information about you and your use of the software, and send that to Microsoft.
Please visit http://aka.ms/dotnet-cli-eula for more information.
Welcome to .NET!
-----
Learn more about .NET: https://aka.ms/dotnet-docs
Use 'dotnet --help' to see available commands or visit: https://aka.ms/dotnet-cli-docs

Telemetry
-----
The .NET tools collect usage data in order to help us improve your experience. It is collected by Microsoft and shared with the community. You can opt-out of telemetry by setting
the DOTNET_CLI_TELEMETRY_OPTOUT environment variable to '1' or 'true' using your favorite shell.

Read more about .NET CLI Tools telemetry: https://aka.ms/dotnet-cli-telemetry

Configuring...
-----
A command is running to populate your local package cache to improve restore speed and enable offline access. This command takes up to one minute to complete and only runs once.
Processing triggers for man-db (2.9.1-1) ...

```

Figure 6. Ubuntu 20.04 install .NET 6.0 SDK terminal output.

In order to install the .NET Runtime we refer again to the Microsoft documentation, that is

Install the runtime

The ASP.NET Core Runtime allows you to run apps that were made with .NET that didn't provide the runtime. The following commands install the ASP.NET Core Runtime, which is the most compatible runtime for .NET. In your terminal, run the following commands:

Bash

Copy

```
sudo apt-get update; \  
  sudo apt-get install -y apt-transport-https && \  
  sudo apt-get update && \  
  sudo apt-get install -y aspnetcore-runtime-6.0
```

Important

If you receive an error message similar to **Unable to locate package aspnetcore-runtime-6.0**, see the [APT troubleshooting](#) section.

As an alternative to the ASP.NET Core Runtime, you can install the .NET Runtime, which doesn't include ASP.NET Core support: replace `aspnetcore-runtime-6.0` in the previous command with `dotnet-runtime-6.0`:

Bash

Copy

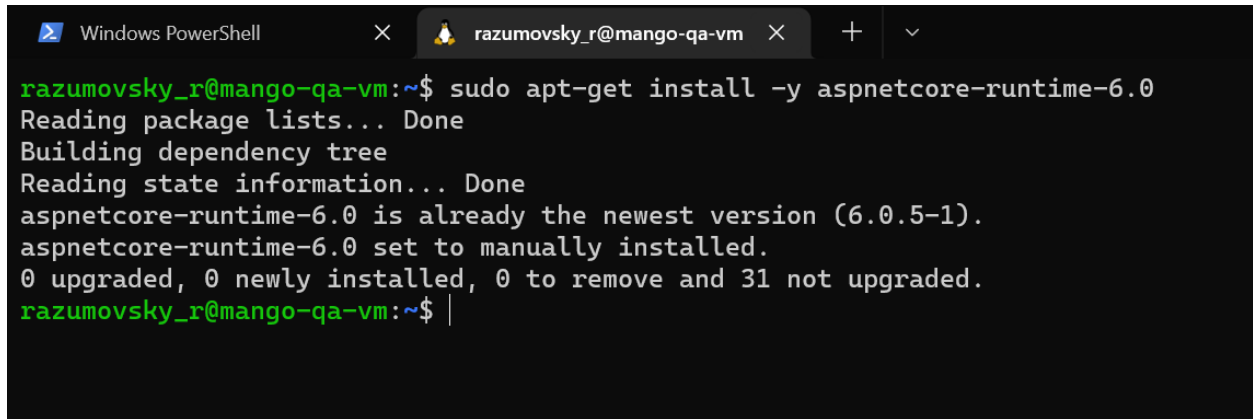
```
sudo apt-get install -y dotnet-runtime-6.0
```

Figure 7. Ubuntu 20.04 install .NET 6.0 SDK terminal output.

We install .NET runtime using the commands

- `sudo apt-get update`
- `sudo apt-get install -y apt-transport-https`
- `sudo apt-get update`
- `sudo apt-get install -y aspnetcore-runtime-6.0`

Terminal output as follows



```

Windows PowerShell
razumovsky_r@mango-qa-vm
razumovsky_r@mango-qa-vm:~$ sudo apt-get install -y aspnetcore-runtime-6.0
Reading package lists... Done
Building dependency tree
Reading state information... Done
aspnetcore-runtime-6.0 is already the newest version (6.0.5-1).
aspnetcore-runtime-6.0 set to manually installed.
0 upgraded, 0 newly installed, 0 to remove and 31 not upgraded.
razumovsky_r@mango-qa-vm:~$

```

Figure 8. Ubuntu 20.04 install .NET 6.0 Runtime terminal output.

4. COPY BUILD FILES TO THE VM VIA SSH
5. CONFIGURE UBUNTU SERVICE
6. INSTALL AND CONFIGURE NGINX SERVER
7. CONFIGURE DOMAIN NAME AND SSL
8. DEPLOY FRONTEND PROJECT
9. CONCLUSIONS

Conclusions of your manuscript.

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