

DEVOPS with MULTI-CLOUD

Practice Tasks

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Course : DevOps with Multi-Cloud
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TASK-6 : 3-Tier Architecture (Basic).

Date : 28/01/26

Objective :-

To design and implement a three-tier architecture in Azure that separates the web, application, and database layers, improving security, scalability, and availability by controlling traffic flow between each tier.

3 - Tier Architecture :-

- In the 3-tier Architecture we will have front end server ,backend server and business & logic server.
- A 3-tier Architecture divides the application into web server, app and database servers.each has its own role and this improves the security and maintenance.

Implementation of Three-Tier Architecture :-

- Create the virtual machines VM-WEB and VM-APP under the resource group RG01 and virtual network VN01 with two subnets SN-WEB & SN-APP.
- also create the virtual machine VM-DB under the resource group RG02 and virtual network VN02 with subnet SN-DB. (since we created db in different regions due to less cpu's, now we need to add vnet peering between both the virtual networks vn01 and vn02.)

The screenshot shows the Microsoft Azure portal interface. The left sidebar is titled "Compute infrastructure" and includes sections for Overview, All resources, Favorites (with "Virtual machines" selected), Infrastructure, and more. The main content area is titled "Virtual machines" and shows a table of three existing VMs:

Name	Subscription	Resource Group	Location	Status	Operating system	Size
VM-APP	Azure subscription	RG01	Central India	Running	Linux	Standard_D2s...
VM-DB	Azure subscription	RG02	South India	Running	Linux	Standard_D2s...
VM01-webserver	Azure subscription	RG01	Central India	Running	Linux	Standard_D2s...

fig(1) the three virtual machines are created.

→ Now login to the machine Vm-web and install nginx.
And browse the vm web ip address for validation.

The screenshot shows a web browser window with the URL "http://20.197.24.142". The page content is as follows:

Welcome to nginx!

If you see this page, the nginx web server is successfully installed and working. Further configuration is required.

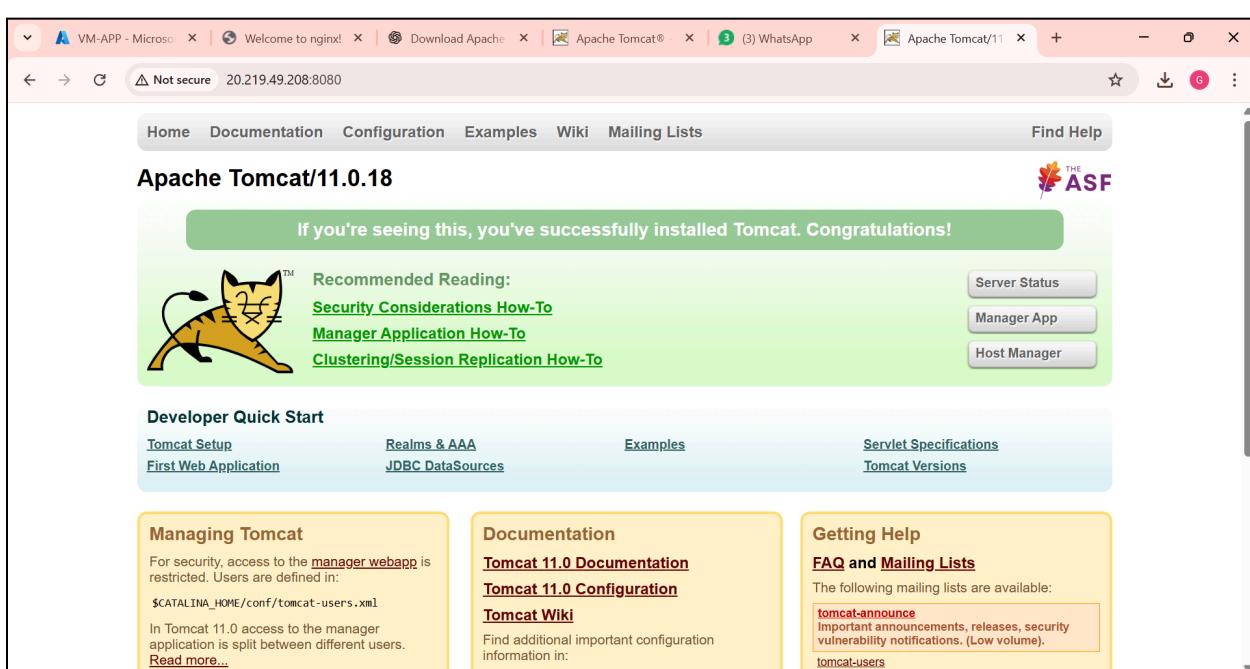
For online documentation and support please refer to nginx.org.
Commercial support is available at nginx.com.

Thank you for using nginx.

Fig (2) successfully installed nginx in vm-web.

→ Now login to the vm-app and install Apache Tomcat.

- To run Tomcat we need java, so first download java:-
 - apt install default-jdk -y
 - java -version
 - To install Tomcat :-
 - Go to the Apache Tomcat official website and get the latest version.
 - wget
- <https://dlcdn.apache.org/tomcat/tomcat-10/v10.1.18/bin/apache-tomcat-10.1.18.tar.gz>
- tar -xvzf [apache-tomcat-10.1.18.tar.gz](https://dlcdn.apache.org/tomcat/tomcat-10/v10.1.18/bin/apache-tomcat-10.1.18.tar.gz)
 - mv apache-tomcat-10.1.18 tomcat
 - cd tomcat/bin
 - ./startup.sh



fig(3) successfully Tomcat installed in vm-app.

→ Now login to the vm-db and install MYSQL.

- apt install mysql-server –y
- mysql_secure_installation
- nano /etc/mysql/mysql.conf.d/mysqld.cnf
- bind-address = 0.0.0.0
- Save and exit (CTRL + X, then Y, then Enter).
- systemctl restart mysql
- systemctl status mysql

→ Now we have installed and configured in all the 3 tiers, since we have already created nsg for login to vm's.

→ Now we will add some new rules.

The screenshot shows the Microsoft Azure portal interface. The left sidebar has a 'Network settings' section highlighted. The main content area is titled 'VM01-webserver | Network settings'. It shows a network security group named 'VM01-webserver-nsg' attached to 'vm01-webserver233'. There are 5 inbound port rules and 3 outbound port rules listed. The inbound rules include SSH (port 22), allowhttp (port 80), and several rules for Azure services. The outbound rules include DenyAllInbound and AllowVnetInbound.

Prio...	Name	Port	Protocol	Source	Destination	Action
300	SSH	22	TCP	Any	Any	Allowed
310	allowhttp	80	Any	Any	Any	Allowed
65000	AllowVnetInbound	Any	Any	VirtualNetwork	VirtualNetwork	Allowed
65001	AllowAzureLoadBalancerInB...	Any	Any	AzureLoadBalancer	Any	Allowed
65500	DenyAllInbound	Any	Any	Any	Any	Denied

Fig (4) nsg rules for vm-web.

VM-APP | Network settings

Network security group VM-APP-nsg (attached to networkInterface: vm-app268)
Impacts 0 subnets, 1 network interfaces

Inbound port rules (5)

Prio...	Name	Port	Protocol	Source	Destination	Action
290	allow-web	8080	Any	172.16.0.4	172.16.1.4	Allow
300	SSH	22	TCP	Any	Any	Allow
65000	AllowVnetInBound	Any	Any	VirtualNetwork	VirtualNetwork	Allow
65001	AllowAzureLoadBalancerInB...	Any	Any	AzureLoadBalancer	Any	Allow
65500	DenyAllInbound	Any	Any	Any	Any	Deny

Outbound port rules (3)

Fig (5) nsg rules for vm-app.

VM-DB | Network settings

Network security group VM-DB-nsg (attached to networkInterface: vm-db948)
Impacts 0 subnets, 1 network interfaces

Inbound port rules (6)

Prio...	Name	Port	Protocol	Source	Destination	Action
300	SSH	22	TCP	Any	Any	Allow
310	app-db.nsg	3306	Any	172.16.1.4	172.17.0.4	Allow
320	DENY-WEB	Any	Any	172.16.0.4	172.17.0.4	Deny
65000	AllowVnetInBound	Any	Any	VirtualNetwork	VirtualNetwork	Allow
65001	AllowAzureLoadBalancerInB...	Any	Any	AzureLoadBalancer	Any	Allow
65500	DenyAllInbound	Any	Any	Any	Any	Deny

Outbound port rules (3)

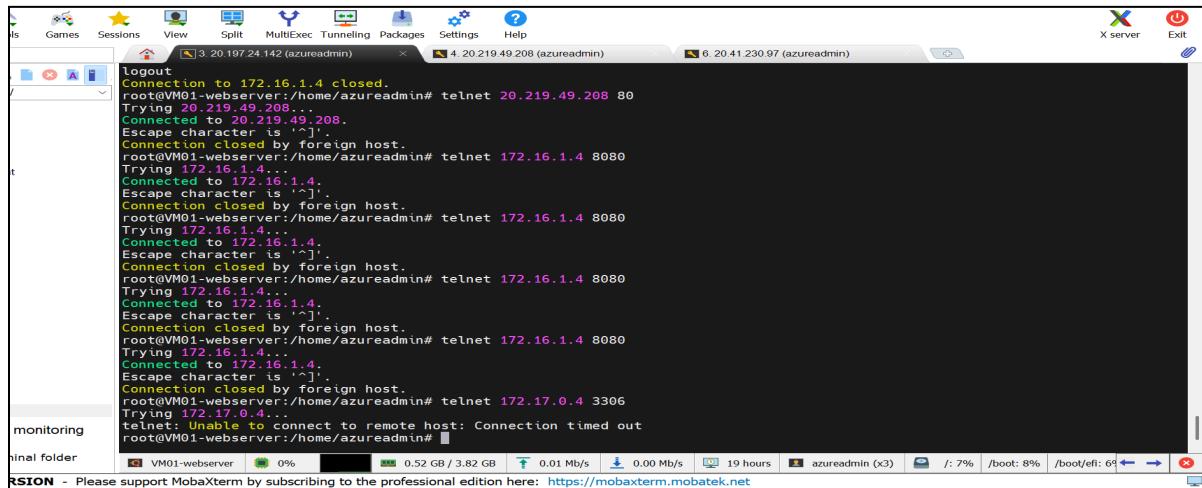
Fig (6) nsg rules for vm-db.

→ now we have configured and installed everything, we need to just connect the 3 tiers.

→ To connect them all first we need to add peering in the virtual network vn01 and vn02, since they are in different regions.

→ Finally to connect them all from one tier to another we will use the telnet command.

- Telnet<pvt-ip address>d port no. (for pvt connection).
- Telnet<pub-ip address>d port no. (for pub connection)



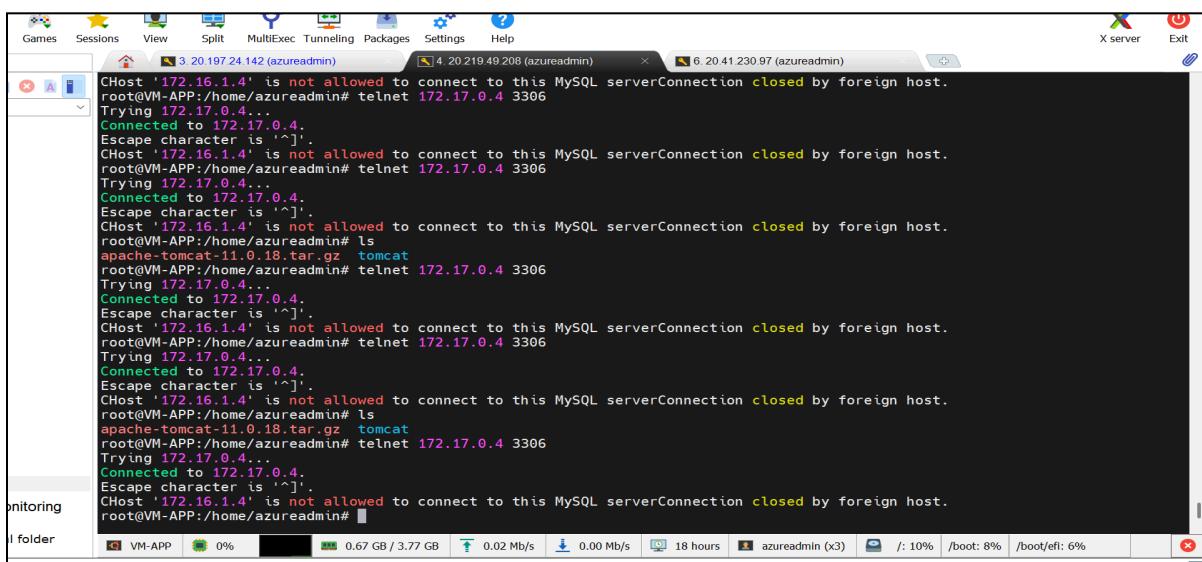
```

logout
Connection to 172.16.1.4 closed.
root@VM01-websrvr:/home/azureadmin# telnet 20.219.49.208 80
Trying 20.219.49.208...
Connected to 20.219.49.208.
Escape character is '^'.
Connection closed by foreign host.
root@VM01-websrvr:/home/azureadmin# telnet 172.16.1.4 8080
Trying 172.16.1.4...
Connected to 172.16.1.4.
Escape character is '^'.
Connection closed by foreign host.
root@VM01-websrvr:/home/azureadmin# telnet 172.16.1.4 8080
Trying 172.16.1.4...
Connected to 172.16.1.4.
Escape character is '^'.
Connection closed by foreign host.
root@VM01-websrvr:/home/azureadmin# telnet 172.16.1.4 8080
Trying 172.16.1.4...
Connected to 172.16.1.4.
Escape character is '^'.
Connection closed by foreign host.
root@VM01-websrvr:/home/azureadmin# telnet 172.17.0.4 3306
Trying 172.17.0.4...
Connected to 172.17.0.4.
Escape character is '^'.
Connection closed by foreign host.
root@VM01-websrvr:/home/azureadmin# telnet 172.17.0.4 3306
telnet: Unable to connect to remote host: Connection timed out
root@VM01-websrvr:/home/azureadmin#

```

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Fig (7) successfully connected from web to app.



```

Games Sessions View Split MultiExec Tunneling Packages Settings Help
3.20.197.24.142 (azureadmin) 4.20.219.49.208 (azureadmin) 6.20.41.230.97 (azureadmin)
Chost '172.16.1.4' is not allowed to connect to this MySQL serverConnection closed by foreign host.
root@VM-APP:/home/azureadmin# telnet 172.17.0.4 3306
Trying 172.17.0.4...
Connected to 172.17.0.4.
Escape character is ']'.
Chost '172.16.1.4' is not allowed to connect to this MySQL serverConnection closed by foreign host.
root@VM-APP:/home/azureadmin# telnet 172.17.0.4 3306
Trying 172.17.0.4...
Connected to 172.17.0.4.
Escape character is ']'.
Chost '172.16.1.4' is not allowed to connect to this MySQL serverConnection closed by foreign host.
root@VM-APP:/home/azureadmin# ls
apache-tomcat-11.0.18.tar.gz tomcat
root@VM-APP:/home/azureadmin# telnet 172.17.0.4 3306
Trying 172.17.0.4...
Connected to 172.17.0.4.
Escape character is ']'.
Chost '172.16.1.4' is not allowed to connect to this MySQL serverConnection closed by foreign host.
root@VM-APP:/home/azureadmin# telnet 172.17.0.4 3306
Trying 172.17.0.4...
Connected to 172.17.0.4.
Escape character is ']'.
Chost '172.16.1.4' is not allowed to connect to this MySQL serverConnection closed by foreign host.
root@VM-APP:/home/azureadmin# ls
apache-tomcat-11.0.18.tar.gz tomcat
root@VM-APP:/home/azureadmin# telnet 172.17.0.4 3306
Trying 172.17.0.4...
Connected to 172.17.0.4.
Escape character is '^'.
Chost '172.16.1.4' is not allowed to connect to this MySQL serverConnection closed by foreign host.
root@VM-APP:/home/azureadmin#

```

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Fig (8) successfully connected from app to db.

```

20.41.230.97 (azureadmin)
Terminal Sessions View X server Tools Games Settings Macros Help
Session Servers Tools Games Sessions View Split MultiExec Tunneling Packages Settings Help
Quick connect...
/home/azureadmin/
Name
.. cache ssh .bash_logout .bashrc .profile .Xauthority
64 bytes from 172.16.1.4: icmp_seq=22 ttl=64 time=16.2 ms
64 bytes from 172.16.1.4: icmp_seq=23 ttl=64 time=18.1 ms
64 bytes from 172.16.1.4: icmp_seq=24 ttl=64 time=16.3 ms
^C
--- 172.16.1.4 ping statistics ---
24 packets transmitted, 24 received, 0% packet loss, time 23031ms
rtt min/avg/max/mdev = 15.990/17.085/19.957/1.400 ms
root@VM-DB:/home/azureadmin# apt install mysql-server
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
mysql-server is already the newest version (8.0.44-0ubuntu0.24.04.2).
0 upgraded, 0 newly installed, 0 to remove and 5 not upgraded.
root@VM-DB:/home/azureadmin# nano /etc/mysql/mysql.conf.d/mysqld.cnf
root@VM-DB:/home/azureadmin# systemctl restart mysql
root@VM-DB:/home/azureadmin# systemctl status mysql
● mysql.service - MySQL Community Server
   Loaded: loaded (/usr/lib/systemd/system/mysql.service; enabled; preset: enabled)
   Active: active (running) since Wed 2026-01-28 07:29:01 UTC; 25s ago
     Process: 33427 ExecStartPre=/usr/share/mysql/mysql-systemd-start pre (code=exited, status=0/SUCCESS)
      Main PID: 33437 (mysqld)
        Status: "Server is operational"
       Tasks: 38 (limit: 4675)
      Memory: 365.5M (peak: 380.8M)
         CPU: 610ms
        CGroup: /system.slice/mysql.service
                  └─33437 /usr/sbin/mysqld
Jan 28 07:29:00 VM-DB systemd[1]: Starting mysql.service - MySQL Community Server...
Jan 28 07:29:01 VM-DB systemd[1]: Started mysql.service - MySQL Community Server.
root@VM-DB:/home/azureadmin# 

```

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Fig (9) successfully installed mysql.

→ Therefore the 3-Tier Architecture is successfully implemented.