### Research Document: Multi-Tier Network Architecture with VMs

#### 1. \*\*Architecture Overview\*\*

- \*\*Web Tier\*\*: Hosts the web servers with Apache on Linux and IIS on Windows. Limited to internet access and communication with the App tier.

- \*\*App Tier\*\*: Hosts application logic with Apache on Linux and IIS on Windows. Can communicate with both the Web and DB tiers.

- \*\*DB Tier\*\*: Hosts the database servers with MySQL/PostgreSQL on Linux and SQL Server on Windows. Isolated from the Web and App tiers; no direct internet access.

#### 2. \*\*Subnet Configuration\*\*

\*\*1. Web Tier\*\*

- \*\*Subnet Name\*\*: WebSubnet

- \*\*CIDR Block\*\*: 10.0.1.0/24

\*\*2. App Tier\*\*

- \*\*Subnet Name\*\*: AppSubnet

- \*\*CIDR Block\*\*: 10.0.2.0/24

\*\*3. DB Tier\*\*

- \*\*Subnet Name\*\*: DBSubnet

- \*\*CIDR Block\*\*: 10.0.3.0/24

#### 3. \*\*Network Security Groups (NSGs) Configuration\*\*

\*\*Web Tier NSG\*\*:

- \*\*Inbound Rules\*\*:

- Allow HTTP (port 80) and HTTPS (port 443) from the internet.

- Allow RDP (port 3389) and SSH (port 22) from a specific IP range (e.g., your office IP).

- Allow communication from AppSubnet.

\*\*App Tier NSG\*\*:

- \*\*Inbound Rules\*\*:

- Allow communication from WebSubnet.

- Allow communication from DBSubnet.

- Allow RDP (port 3389) and SSH (port 22) from a specific IP range.

\*\*DB Tier NSG\*\*:

- \*\*Inbound Rules\*\*:

- Allow communication from AppSubnet.

- Allow RDP (port 3389) and SSH (port 22) from a specific IP range.

#### 4. \*\*Virtual Machine Deployment\*\*

\*\*Web Tier\*\*

- \*\*Linux VM\*\*: Install Apache

- Configuration:

```bash

sudo apt update

sudo apt install apache2 -y

```

- \*\*Windows VM\*\*: Install IIS

- Configuration:

- Use the Server Manager to add the Web Server (IIS) role.

\*\*App Tier\*\*

- \*\*Linux VM\*\*: Install Apache

- Configuration:

```bash

sudo apt update

sudo apt install apache2 -y

```

- \*\*Windows VM\*\*: Install IIS

- Configuration:

- Use the Server Manager to add the Web Server (IIS) role.

\*\*DB Tier\*\*

- \*\*Linux VM\*\*: Install MySQL or PostgreSQL

- Configuration:

- For MySQL:

```bash

sudo apt update

sudo apt install mysql-server -y

```

- For PostgreSQL:

```bash

sudo apt update

sudo apt install postgresql postgresql-contrib -y

```

- \*\*Windows VM\*\*: Install SQL Server

- Configuration:

- Use the SQL Server Installation Center to install a new SQL Server stand-alone installation.

#### 5. \*\*NSG Rules for Communication\*\*

\*\*Web Tier to App Tier\*\*:

- \*\*AppSubnet NSG\*\*:

- Allow HTTP (port 80) and HTTPS (port 443) from WebSubnet.

\*\*App Tier to DB Tier\*\*:

- \*\*DBSubnet NSG\*\*:

- Allow database ports (e.g., 3306 for MySQL, 5432 for PostgreSQL, or 1433 for SQL Server) from AppSubnet.

#### 6. \*\*Internet Access Configuration\*\*

\*\*Web Tier NSG\*\*:

- \*\*Outbound Rules\*\*:

- Allow internet access.

\*\*App Tier and DB Tier NSGs\*\*:

- \*\*Outbound Rules\*\*:

- Deny internet access.

### Step-by-Step Implementation

#### 1. Create Virtual Networks and Subnets

1. \*\*Create Virtual Networks (VNet)\*\*:

- Create a VNet for each tier.

2. \*\*Create Subnets\*\*:

- Add WebSubnet to Web VNet.

- Add AppSubnet to App VNet.

- Add DBSubnet to DB VNet.

#### 2. Configure NSGs

1. \*\*Create NSGs\*\*:

- Create an NSG for each subnet.

2. \*\*Add NSG Rules\*\*:

- Apply rules as specified above.

#### 3. Deploy Virtual Machines

1. \*\*Deploy VMs\*\*:

- Create VMs in each subnet.

2. \*\*Configure VMs\*\*:

- Install required software on each VM.

### Final Checks

1. \*\*Validate NSG Rules\*\*:

- Test communication between tiers to ensure rules are correctly implemented.

2. \*\*Validate Internet Access\*\*:

- Ensure only Web tier has internet access.

3. \*\*Check VM Configuration\*\*:

- Verify Apache and IIS installations on respective VMs.