

# Automating a Multi-Tier Application on VMware with Ansible

## **Objective:**

Using Ansible to fully automate the deployment, configuration, and orchestration of a multi-tier application (e.g., LAMP stack) across multiple CentOS VMs (master node, node1, and node2) in a VMware environment.

## **Steps:**

### **1. Provisioning VMs:**

- Use Ansible to deploy and configure two nodes (node1 and node2) on VMware.
- Automate the installation of necessary dependencies like Apache on one node and MySQL on the other.

### **2. Role-based Deployment:**

- Use **Ansible roles** to separate the tasks:
  - **Web server role** (for node1 to host Apache/PHP).
  - **Database server role** (for node2 to host MySQL).
- Deploy a simple PHP application on the web server node and configure it to communicate with the database on node2.

### **3. Network Configuration & Load Balancing:**

- Automate firewall rules, IP tables, and networking configurations between the nodes.

### **4. Backup and Recovery Automation:**

- Automate backups of the database on node2 using Ansible scheduled jobs.
- Automate web content backup on node1.

### **5. Security:**

- Implement Ansible Vault to manage secrets such as database credentials.
- Use Ansible to apply security updates and harden the systems.

## **Outcome:**

- A fully automated infrastructure with multiple VMs on VMware, deploying a multi-tier application.
- Centralized monitoring and logging for system health and performance.

- Secure and efficient infrastructure with automated backups and firewall configurations.

### Project Structure

```
[mohamed@master ~]$ tree Ansible_Final_Project/
Ansible_Final_Project/
├── ansible.cfg
├── group_vars
│   └── all.yml
├── inventory
│   └── hosts
├── playbook.yml
├── README.md
├── roles
│   ├── apache
│   │   ├── files
│   │   │   └── main.yml
│   │   ├── handlers
│   │   ├── tasks
│   │   │   └── main.yml
│   │   └── templates
│   │       └── index.php.j2
│   ├── backup
│   │   └── tasks
│   │       ├── backup_db.yml
│   │       ├── backup_web.yml
│   │       └── main.yml
│   ├── firewall
│   │   └── tasks
│   │       └── main.yml
│   └── mysql
│       ├── handlers
│       └── tasks
│           └── main.yml
```

### Define the Inventory, Setup and Provisioning VMs



```
[mohamed@master lab2]$ ansible all -m ping
192.168.250.141 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/bin/python3"
    },
    "changed": false,
    "ping": "pong"
}
192.168.250.128 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/bin/python3"
    },
    "changed": false,
    "ping": "pong"
}
```

## Set Global Variables and use Ansible Vault

```
mohamed@master:~/lab2/inventory/group_vars — vim all.yaml
mysql_root_password: rootpassword
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
2,0-1 All
```

```
mohamed@master:~/Ansible_Final_Project/group_vars — vim all.yml
$ANSIBLE_VAULT;1.1;AES256
36363136393836356463623966383031316666633338626334646332313966326664303637313465
6638383266373435363131383064386261326538656232610a386565616435626237323836633032
38383663663561376464346163393833383737326262343638313435366662396463373433343662
3439386566626437640a383564363838333730646136623965356461663966643665353134383636
33353632306262663434616565363738323235636664336464646530323666663735616630623063
3938636661303661303731346634643861643634666562656338
~
~
~
~
~
~
~
~
~
~
```

## Create Roles

### Apache Role (Web Server)

```
mohamed@master:~/lab2/roles/apache/tasks — vim main.yml
---
- name: Install Apache
  yum:
    name: httpd
    state: present

- name: Install PHP
  yum:
    name: php
    state: present

- name: Copy index.php template
  template:
    src: index.php.j2
    dest: /var/www/html/index.php
    mode: 0644

- name: Start and enable Apache
  systemd:
    name: httpd
    state: started
    enabled: yes

:wq
```

### PHP application template



## MySQL Role (Database Server)

```
mohamed@master:~/lab2/roles/mysql/tasks — vim main.yml
---
- name: Install Python 3 and PyMySQL
  yum:
    name:
      - python3
      - python3-PyMySQL
    state: present

- name: Install MySQL
  yum:
    name: mysql-server
    state: present

- name: Start and enable MySQL
  systemd:
    name: mysqld
    state: started
    enabled: yes

- name: Set MySQL root password
  mysql_user:
    name: root
    password: "{{ mysql_root_password }}"
    login_unix_socket: /var/lib/mysql/mysql.sock
    state: present
~
```

## Firewall Role (For Both Nodes)

```
mohamed@master:~/lab2/roles/firewall/tasks — vim main.yml
---
- name: Open HTTP port for Apache
  firewallld:
    port: 80/tcp
    permanent: yes
    state: enabled

- name: Open MySQL port
  firewallld:
    port: 3306/tcp
    permanent: yes
    state: enabled

- name: Reload firewall
  firewallld:
    state: reloaded

~
~
~
~
~
~
17,0-1 All
```

## Backup Role

- **For MySQL Database**

```

---
name: Create .my.cnf file for MySQL root user
copy:
  dest: /root/.my.cnf
  content: |
    [client]
    user=root
    password={{ mysql_root_password }}
  owner: root
  group: root
  mode: '0600'

name: Backup MySQL database
command: mysqldump --all-databases > /root/db_backup.sql

```

- **For Apache Web Content**





## Create the Playbook

```
mohamed@master:~/lab2 — vim playbook.yml
---
- hosts: web
  become: yes
  roles:
    - apache
    - firewall
    - backup

- hosts: db
  become: yes
  roles:
    - mysql
    - firewall
    - backup

"playbook.yml" 15L, 158B                                     15,0-1                                     All
```

## Use Ansible Vault

```
[mohamed@master lab2]$ ansible-vault encrypt group_vars/all.yml
New Vault password:
Confirm New Vault password:
Encryption successful
```

## Apply The Playbook

```
[mohamed@master lab2]$ ansible-playbook -i inventory/hosts playbook.yml --ask-vault-pass
Vault password:

PLAY [web] *****

TASK [Gathering Facts] *****
ok: [192.168.250.128]

TASK [apache : Install Apache] *****
ok: [192.168.250.128]

TASK [apache : Install PHP] *****
ok: [192.168.250.128]

TASK [apache : Copy index.php template] *****
ok: [192.168.250.128]

TASK [apache : Start and enable Apache] *****
ok: [192.168.250.128]

TASK [firewall : Open HTTP port for Apache] *****
ok: [192.168.250.128]

TASK [firewall : Open MySQL port] *****
ok: [192.168.250.128]

TASK [firewall : Reload firewalld service] *****
changed: [192.168.250.128]

TASK [backup : include_tasks] *****
skipping: [192.168.250.128]

TASK [backup : include_tasks] *****
included: /home/mohamed/lab2/roles/backup/tasks/backup_web.yml for 192.168.250.128

TASK [backup : Backup web content] *****
changed: [192.168.250.128]
```

```
TASK [backup : Backup web content] *****
changed: [192.168.250.128]

PLAY [db] *****

TASK [Gathering Facts] *****
ok: [192.168.250.141]

TASK [mysql : Install Python 3 and PyMySQL] *****
ok: [192.168.250.141]

TASK [mysql : Install MySQL] *****
ok: [192.168.250.141]

TASK [mysql : Start and enable MySQL] *****
ok: [192.168.250.141]

TASK [mysql : Set MySQL root password] *****
ok: [192.168.250.141]

TASK [firewall : Open HTTP port for Apache] *****
ok: [192.168.250.141]

TASK [firewall : Open MySQL port] *****
ok: [192.168.250.141]

TASK [firewall : Reload firewalld service] *****
changed: [192.168.250.141]

TASK [backup : include_tasks] *****
included: /home/mohamed/lab2/roles/backup/tasks/backup_db.yml for 192.168.250.141

TASK [backup : Create .my.cnf file for MySQL root user] *****
ok: [192.168.250.141]

TASK [backup : Backup MySQL database] *****
changed: [192.168.250.141]

TASK [backup : include_tasks] *****
skipping: [192.168.250.141]

PLAY RECAP *****
192.168.250.128      : ok=10  changed=2  unreachable=0  failed=0  skipped=1  rescued=0  ignored=0
192.168.250.141     : ok=11  changed=2  unreachable=0  failed=0  skipped=1  rescued=0  ignored=0
```