

# Saltstack - Week 4

## Assignment Report

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# Chapter 1

## Setup Salt Master and Minion

### 1.1 Master - Minion setup

```
1 # On Master VM
2 sudo apt update
3 sudo apt install salt-master -y
4
5 # On Minion VM
6 sudo apt update
7 sudo apt install salt-minion -y
8 sudo vim /etc/salt/minion
9     master: 192.168.64.X    #replace with salt-master-vm IP
10 sudo systemctl restart salt-minion
11
12 #On Master VM
13 sudo salt-key -L
14 sudo salt-key -A
```

Listing 1.1: Installing Salt Master and Minion

#### Explanation

- Lines 2–3: Update package lists and install the Salt master on the master VM.
- Lines 6–7: Update package lists and install the Salt minion on the minion VM.
- Lines 8–9: Edit the minion configuration file to point it to the master’s IP address.
- Line 10: Restart the Salt minion service so it connects to the master.
- Lines 13–14: On the master, list pending minion keys and accept them so the master–minion trust is established.

## 1.2 Screenshots

```
ubuntu@salt-master-vm:/srv/pillar$ sudo salt-key -L
Accepted Keys:
api1-vm
api2-vm
db-vm
frontend-vm
nginx-vm
Denied Keys:
Unaccepted Keys:
Rejected Keys:
ubuntu@salt-master-vm:/srv/pillar$ sudo salt '*' test.ping
frontend-vm:
    True
nginx-vm:
    True
api2-vm:
    True
db-vm:
    True
api1-vm:
    True
ubuntu@salt-master-vm:/srv/pillar$ █
```

Figure 1.1: Master Accepted our minions keys

# Chapter 2

## Salt States and Pillars

### 2.1 Salt State for Config File

#### 2.1.1 State File - /srv/salt/top.sls

```
1 base:  
2   'nginx-vm':  
3     - nginx
```

Listing 2.1: Top.sls

#### Explanation

- Line 1: Defines the ‘base‘ environment in the Salt top file.
- Line 2: Targets the minion with ID ‘nginx-vm‘.
- Line 3: Applies the ‘nginx‘ state to that minion, ensuring the defined configuration is enforced.

## 2.1.2 State File -/srv/salt/nginx/init.sls

```
1 nginx:
2     pkg.installed:
3         - name: nginx
4
5 service.running:
6     - name: nginx
7     - enable: True
8     - reload: True
9
10 /etc/nginx/sites-available/bookstore:
11     file.managed:
12         - source: salt://nginx/bookstore.jinja
13         - template: jinja
14         - context:
15     backend_servers: {{ salt['mine.get']('api*', 'network.ip_addrs') }}
16     frontend_server: {{ pillar['nginx']['frontend_server'] }}
17     server_name: {{ pillar['nginx']['server_name'] }}
18         - require:
19             - pkg: nginx
20
21
22 /etc/nginx/sites-enabled/bookstore:
23     file.symlink:
24         - target: /etc/nginx/sites-available/bookstore
25         - require:
26             - file: /etc/nginx/sites-available/bookstore
```

Listing 2.2: init.sls

### Explanation

- Lines 1–3: The ‘nginx‘ package is installed using the ‘pkg.installed‘ state. This ensures that the nginx software is present on the minion before attempting to start the service or manage configuration files.

- Lines 5–8:

The ‘service.running‘ state ensures that the nginx service is:

- Running (‘service.running‘).
- Enabled to start automatically on boot (‘enable: True‘).
- Reloaded whenever there are configuration changes (‘reload: True‘).

- Lines 10–19:

The ‘/etc/nginx/sites-available/bookstore‘ file is managed using ‘file.managed‘ with a Jinja template:

- ‘source: salt://nginx/bookstore.jinja‘ points to the template in the Salt file server.
  - ‘template: jinja‘ tells Salt to render it as a Jinja template.
  - ‘context:‘ defines variables used in the template:
  - ‘backend\_servers‘ is dynamically fetched from minions whose IDs match ‘api\*‘ using the Salt Mine.
  - ‘frontend\_server‘ and ‘server\_name‘ are pulled from pillar data for flexible configuration.
  - ‘require:‘ ensures that the nginx package is installed before attempting to manage the config file.
- Lines 22–26:  
The ‘/etc/nginx/sites-enabled/bookstore‘ symlink is created with ‘file.symlink‘:
- ‘target‘ points to the managed config file in ‘sites-available‘.
  - ‘require:‘ ensures that the source config file exists before creating the symlink.
  - This is a standard nginx pattern to enable sites while keeping the original configuration in ‘sites-available‘.
- Overall: This state file ensures a fully configured nginx server: package installed, service running, site configuration deployed with dynamic values, and site enabled via symlink.

### 2.1.3 State File -/srv/salt/nginx/bookstore.jinja

```
1 # Upstream backend APIs
2 upstream backend_api {
3     {% for backend, ips in backend_servers.items() %}
4         {% for ip in ips %}
5             server {{ ip }}:5000;
6             {% endfor %}
7         {% endfor %}
8     }
9
10 server {
11     listen 80;
12     server_name {{ server_name }};
13
14     # Frontend React Dev Server Proxy
15     location / {
16         proxy_pass http://{{ frontend_server }};
17         proxy_set_header Host $host;
18     }
19
20     # API Proxy
21     location /api/ {
22         proxy_pass http://backend_api/;
23     }
24 }
```

Listing 2.3: bookstore.jinja

#### Explanation

This Jinja template generates the nginx configuration for the bookstore application. It combines backend API servers and a frontend server into one configuration.

- Lines 1-8:

Define the upstream block ‘backend\_api‘. - It loops through all backends and their IPs from ‘backend\_servers‘.

- Each IP is added as a server on port 5000.

- This way, nginx can load balance between multiple backend API servers automatically.

- Lines 10-12:

Start the main ‘server‘ block.

- The server listens on port 80 (HTTP).

- The ‘server\_name‘ is dynamically injected from pillar data, allowing flexible use for different domains.

- Lines 14-18:

Configure the frontend React server proxy.

- The ‘location /‘ block proxies all root requests to the ‘frontend\_server‘ defined in pillar.

- Lines 20-24:

Configure the API proxy.

- The ‘location /api/‘ block forwards requests to the ‘backend\_api‘ upstream group defined earlier.
- This ensures all API calls are distributed among the backend servers.

Overall, this template makes nginx act as a reverse proxy: sending front-end requests to the React server and API requests to a pool of backend services.

## 2.1.4 Screenshots

```
ubuntu@salt-master-vm:~$ sudo salt 'nginx-vm' state.apply nginx
nginx-vm:
-----
          ID: nginx
        Function: pkg.installed
          Result: True
        Comment: All specified packages are already installed
      Started: 07:37:57.959028
     Duration: 18.734 ms
    Changes:
-----
          ID: nginx
        Function: service.running
          Result: True
        Comment: The service nginx is already running
      Started: 07:37:57.978599
     Duration: 15.047 ms
    Changes:
-----
          ID: /etc/nginx/sites-available/bookstore
        Function: file.managed
          Result: True
        Comment: File /etc/nginx/sites-available/bookstore updated
      Started: 07:37:57.994971
     Duration: 15.275 ms
    Changes:
-----
          diff:
          ---
          ++++
          @@ -1,5 +1,13 @@
          # Upstream backend APIs
          upstream backend_api {
          +
          +
          +    server 192.168.64.30:5000;
          +
          +
          +    server 192.168.64.31:5000;
          +
          }

          -----
          ID: /etc/nginx/sites-enabled/bookstore
        Function: file.symlink
          Result: True
        Comment: Symlink /etc/nginx/sites-enabled/bookstore is present and owned by root:root
      Started: 07:37:58.010446
     Duration: 0.817 ms
    Changes:
Summary for nginx-vm
-----
Succeeded: 4 (changed=1)
Failed:   0
-----
Total states run:    4
Total run time:  49.873 ms
```

Figure 2.1: State applied from Minion

## 2.2 Pillar File and Using Values

### 2.2.1 Pillar - /srv/pillar/top.sls

```
1 base:
2   'nginx-vm':    # only apply to nginx server
3     - nginx
```

Listing 2.4: Top.sls

#### Explanation

- Line 1: Defines the ‘base‘ environment in the Salt top file.
- Line 2: Targets the minion with ID ‘nginx-vm‘.
- Line 3: Applies the ‘nginx‘ pillar file to that minion, ensuring the defined configuration is enforced.

### 2.2.2 Pillar - /srv/pillar/nginx.sls

```
1 nginx:
2   backend_servers:
3     - 192.168.64.30:5000
4     - 192.168.64.31:5000
5   frontend_server: 192.168.64.32:3000
6   server_name: bookstore.local
```

Listing 2.5: nginx.sls

#### Explanation

This pillar file defines reusable configuration values for nginx. Using a pillar allows central management and easy updates without modifying state files.

- Line 2:  
Defines the root key ‘nginx‘, grouping all related settings.
- Lines 3-5:  
‘backend\_servers‘ lists the backend API servers by their IP and port (here two servers on port 5000).
- Line 6:  
‘frontend\_server‘ specifies the React frontend server running on port 3000.
- Line 7:  
‘server\_name‘ sets the domain (here `bookstore.local`) that nginx should respond to.

In short, this pillar makes it easy to inject environment-specific values (IPs, ports, domains) into the Jinja template, keeping states clean and flexible.

### 2.2.3 Screenshots



```
ubuntu@salt-master-vm:/srv/salt$ sudo salt 'nginx-vm' pillar.items
nginx-vm:
-----
nginx:
-----
backend_servers:
  - 192.168.64.30:5000
  - 192.168.64.31:5000
frontend_server:
  192.168.64.32:3000
server_name:
  bookstore.local
```

Figure 2.2: Pillar values applied

# Chapter 3

## Running Salts without Master

### 3.1 Explanation

1. Setup multi-master for minions. if one down then it can connect to different master.
2. Don't keep files like states and pillars on master. use gitfs fileserver backend to connect to git and use state and files from there.
3. If somehow all masters are down. Then, we can pull states and pillar on mininons from git and run Salt states locally on the minion using --local mode, without requiring a master connection.

### 3.2 Minion config - /etc/salt/minon

```
1 master:  
2   - 192.168.64.34    # salt-master-vm  
3   - 192.168.64.35    # salt-master-vm1  
4 master_type: failover  
5 master_alive_interval: 30
```

Listing 3.1: Multi-master setup on nginx-vm(Minion)

#### Explanation

This configuration defines how a Salt minion connects to multiple masters and manages failover.

- Line 1 :  
‘master’: Lists the available master servers by their IPs. In this case, 192.168.64.34 and 192.168.64.35.
- Line 4 :

‘master\_type: failover’: Ensures the minion connects to the first master in the list and only switches to the next if the current master becomes unavailable.

- Line 5 :

‘master\_alive\_interval: 30’: Configures the interval (in seconds) at which the minion checks if the master is alive.

This setup provides **“high availability”**: if one master fails, the minion can continue functioning by connecting to the backup master.

### 3.3 Master config - /etc/salt/master

```
1 fileserver_backend:
2   - gitfs
3
4 gitfs_remotes:
5   - https://github.com/siddharth5intern-collab/salt.git:
6     - base: main
7     - root: states      # states/ folder inside repo
8
9 ext_pillar:
10  - git:
11    - main https://github.com/siddharth5intern-collab/salt.git:
12    - root: pillar      # use pillar/ folder
```

Listing 3.2: Connecting file server to github

Explanation

This configuration integrates Salt with a Git repository for both states and pillar data. It allows managing infrastructure as code directly from version control.

- Line 1:

‘fileserver\_backend’ specifies which backend Salt should use for serving state files. Here, it is set to ‘gitfs’.

- Line 4: ‘gitfs\_remotes’ lists Git repositories that contain Salt states.

- Lines 5-7: The repository <https://github.com/siddharth5intern-collab/salt.git> is used.

- ‘base: main’ tells Salt to use the **main** branch as the **base environment**.

- ‘root: states’ restricts Salt to use only the **states/** directory inside the repo.

- Line 9: ‘ext\_pillar’ defines external pillar sources.

- Lines 10-12: Pillar data is also pulled from the same Git repo.

- ‘main’ refers to the branch used.
- ‘root: pillar’ restricts Salt to load pillar files only from the `pillar/` directory.

With this setup, both **states** and **pillars** are version-controlled in Git, enabling collaborative development and consistent configuration management.

### 3.4 Salt call locally

```
1 # Running state locally on Minion
2 sudo salt-call --local state.apply nginx
```

Listing 3.3: Running Salt Locally

## 3.5 Screenshots

```
local:
-----
      ID: nginx
      Function: pkg.installed
      Result: True
      Comment: All specified packages are already installed
      Started: 07:50:54.683829
      Duration: 12.814 ms
      Changes:

-----
      ID: nginx
      Function: service.running
      Result: True
      Comment: The service nginx is already running
      Started: 07:50:54.697156
      Duration: 11.323 ms
      Changes:

-----
      ID: /etc/nginx/sites-available/bookstore
      Function: file.managed
      Result: True
      Comment: File /etc/nginx/sites-available/bookstore is in the correct state
      Started: 07:50:54.709596
      Duration: 12.635 ms
      Changes:

-----
      ID: /etc/nginx/sites-enabled/bookstore
      Function: file.symlink
      Result: True
      Comment: Symlink /etc/nginx/sites-enabled/bookstore is present and owned by root:root
      Started: 07:50:54.722411
      Duration: 0.727 ms
      Changes:

Summary for local
-----
Succeeded: 4
Failed:   0
-----
Total states run:    4
Total run time:  37.499 ms
ubuntu@nginx-vm:/etc/salt$
```

Figure 3.1: Salt state applied without Master

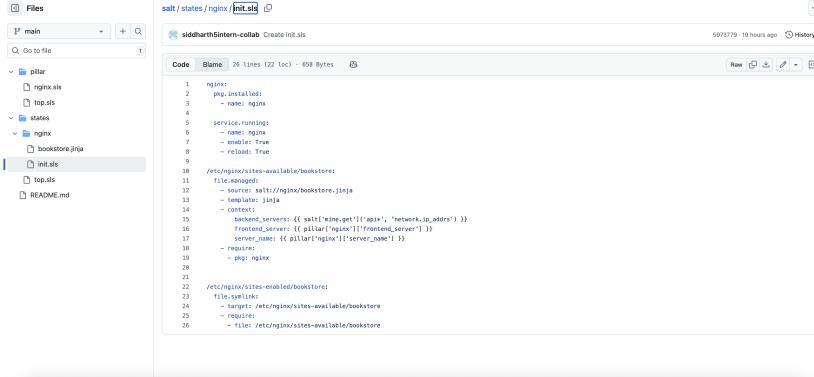


Figure 3.2: Salt and pillar files on github

```

Total run time: 43.045 ms
minion@salt-master-vm:/etc/salt$ sudo salt-run fileserver.update
[...]
minion@salt-master-vm:/etc/salt$ sudo salt 'nginx-vm' state.apply
[...]
salt://nginx/init.sls
[...]
ID: nginx
Function: pkg.installed
Result: True
Comment: No previously specified packages are already installed
Started: 11:39:58.967717
Duration: 12.028 ms
Changes:
[...]
ID: nginx
Function: service.running
Result: True
Comment: The service nginx is already running
Started: 11:39:58.970516
Duration: 11.288 ms
Changes:
[...]
ID: /etc/nginx/sites-available/bookstore
Function: file.managed
Result: True
Comment: File /etc/nginx/sites-available/bookstore updated
Started: 11:39:58.980756
Duration: 18.401 ms
Changes:
[...]
diff:
[...]
@@ -10,7 +10,7 @@
[...]
    #!/usr/bin/python
    #!/usr/bin/python
    server {
        listen 80;
        server_name bookstore.local;
    }
[...]
ID: /etc/nginx/sites-enabled/bookstore
Function: file.symlink
Result: True
Comment: Symlink /etc/nginx/sites-enabled/bookstore is present and owned by root:root
Started: 11:39:58.980789
Duration: 8.795 ms
Changes:
Summary for nginx-vm
[...]
Success: 4 (changes=4)
[...]
Total states run: 4
Total run time: 43.353 ms

```

Figure 3.3: Running salt and pillar from git

```

Aug 25 10:26:35 nginx-vm system[1]: Starting the Salt Minion...
Aug 25 10:26:35 nginx-vm system[1]: Started The Salt Minion
Aug 25 10:26:41 nginx-vm salt-minion[17777]: [WARNING] Master_type 'set to 'failover'' but 'retry_dns' is not 0. Setting 'retry_dns' to 0 to failover to the next master on DNS errors.
Aug 25 10:26:41 nginx-vm salt-minion[17777]: [WARNING] Master ip address changed from 192.168.64.34 to 192.168.64.35
Aug 25 10:30:42 nginx-vm salt-minion[17777]: [WARNING] Master ip address changed from 192.168.64.35 to 192.168.64.34
Aug 25 10:30:42 nginx-vm salt-minion[17777]: [WARNING] Master ip address changed from 192.168.64.34 to 192.168.64.35
Aug 25 10:44:43 nginx-vm salt-minion[17777]: [WARNING] Master ip address changed from 192.168.64.34 to 192.168.64.35
Aug 25 10:46:44 nginx-vm salt-minion[17777]: [WARNING] Master ip address changed from 192.168.64.35 to 192.168.64.34
Aug 25 10:46:44 nginx-vm salt-minion[17777]: [WARNING] Master ip address changed from 192.168.64.35 to 192.168.64.34

```

Figure 3.4: Minion connecting to another available master