docs.saltproject.io /salt/user-guide/en/latest/topics/states.html

Salt states - Salt user guide

14-18 minutes

Overview of Salt states¶

Salt states are used to deploy and manage infrastructure and to allow automation of recursive and predictable tasks.

Salt states can contain:

- Multi-language renderers
- Derivative state options
- Multiple data types for variable manipulation

State structure vs. terminal commands¶

Every Salt state can be created with terminal commands from Salt execution modules. However, this method has several limitations, such as the lack of conditional statements. Salt state files are essentially batch files of terminal commands that can work around these limitations.

For example, this script installs a system as a working DNS server:

```
#!/bin/bash

# Install latest dns package
salt \* pkg.latest bind

# Lay down a new configuration file
salt \* cp.get_file salt://dns/files/dns.conf /etc/named.conf

# Start dns service
salt \* service.start named
```

Salt state modules provide conditional statements that can answer such questions as:

- What if the package is already installed or needs to be upgraded?
- What if the service is already started? Does it need to be restarted?
- When setting permissions and ownership on the file, or copying the file from the Salt master to the target location, is it required to make additional calls to restart a service?

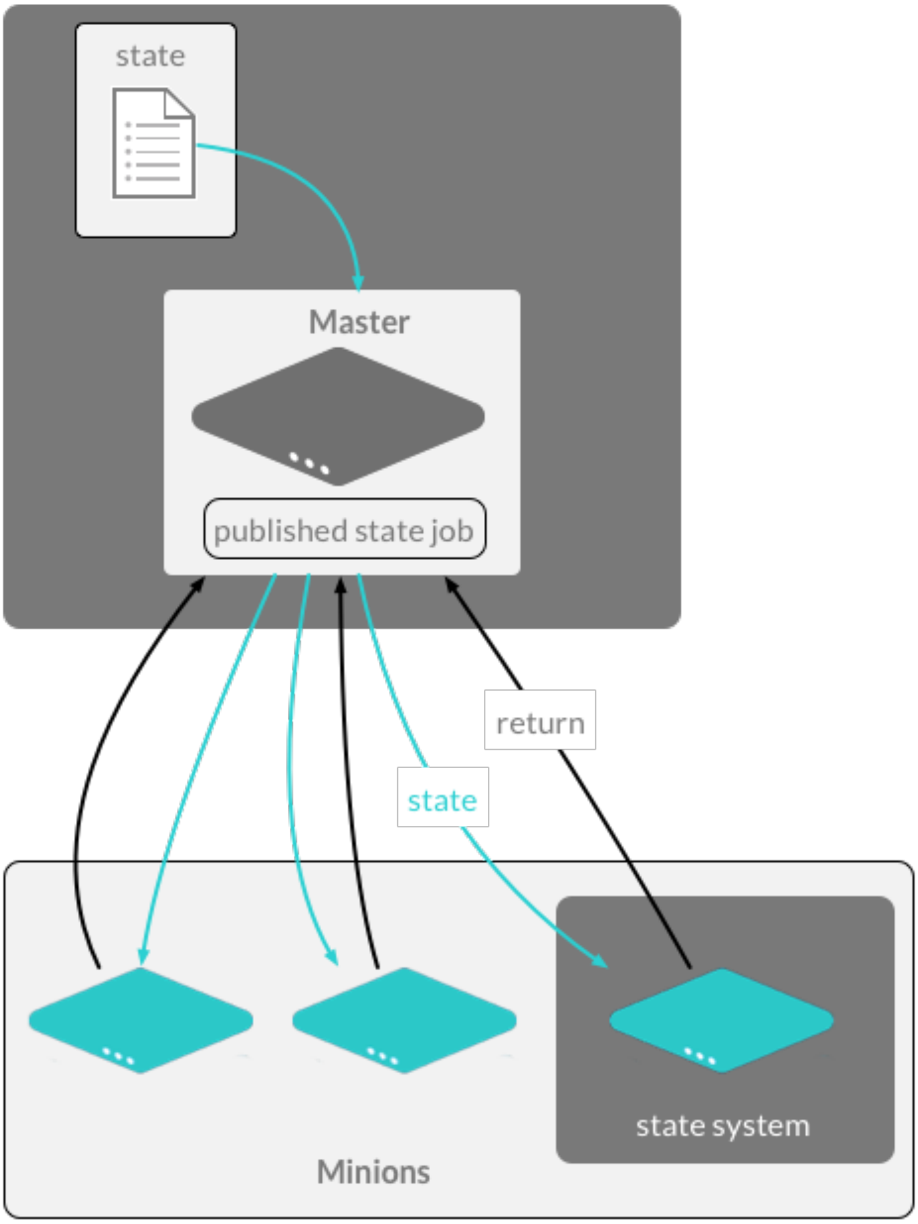
State language variations¶

YAML is the default language for creating Salt states. In additon, `jinja2` is used as a templating language to remove redundancy in states and state files.

In addition, other languages can be helpful for some scenarios:

- Python states allow complicated logic that otherwise cannot be created in YAML.
- JSON states are faster than YAML for computers to translate, but are less human-readable.

Salt State files are rendered on the `salt-minion` in a decentralized computational model. This removes possible bottlenecks when rendering and executing modules on the `salt-master`.



For more information, see the list of Renderer Modules.

State modules¶

When creating individual states, a `module.function` is specified from the state modules. These state modules call their execution module counterparts, and either add or restrict options from the execution module for stateful operations.

Be aware that conficts may arise between state modules and execution modules. For example, state modules do not have “status check” options for logs, so you must call the Salt action that determines the status.

For example, using the terminal to check and install the `tree` package:

```
# command output

Command 'tree' not found, but can be installed with:
sudo apt install tree
```

```
# command output
```

```
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  tree
[installed successfully]...
```

However, doing the same with a Salt state requires no check state, since the install state implicitly checks for the package in the system's package manager.

/srv/salt/tree.sls¶

```
install_tree_now:
  pkg.installed:
    - pkgs:
        - tree
```

```
salt rebel_01 state.sls tree
```

```
# command output

rebel_01:
----------
          ID: install_tree_now
    Function: pkg.installed
      Result: True
     Comment: The following packages were installed/updated: tree
     Started: 18:44:21.733166
    Duration: 7498.878 ms
     Changes:
              ----------
              tree:
                  ----------
                  new:
                      1.7.0-5
                  old:

Summary for rebel_01
------------
Succeeded: 1 (changed=1)
Failed:    0
------------
Total states run:     1
Total run time:   7.499 s
```

The state SLS data structure¶

A state definition in a state file will have the following components:

- **Identifier** is the identifier declaration for the state section.
- **State** is the name of the `state` module containing the function, such as pkg.
- **Function** is the function to call in the named module, such as `installed`.
- **Name** is the name of the state call, which is usually the name of the file to be managed or the name of the package to be installed.

- **Arguments** are the arguments that the state function will accept.

Requisites and **Declarations** are discussed in State requisites and declarations.

An example of a single state layout in YAML, using the names of the high data components:

/srv/salt/example.sls¶

```
identifier:
  module.function:
    - name: name_value
    - function_arg: arg_value
    - function_arg: arg_value
    - function_arg: arg_value
```

Layers of data abstraction¶

Another important feature of Salt is for that many packages, differences between platforms have been abstracted away and normalized. This reduces the amount of code that developers must write, and makes it easier to write code that is compatible over different platforms. Salt will automatically evaluate the states using the correct package manager for the current platform.

Organizing states¶

Salt states for a state tree should be written so that another developer can quickly ascertain the purpose of the Salt state and to see the workflow of the entire state tree.

A good practice is to reduce the complexity of the state tree by only using a few levels of nesting. This will make the tree easier to navigate and lead to fewer problems down the line as a project matures:

```
/srv/salt
├── core.sls
├── httpd
│   ├── files
│   │   ├── apache2.conf
│   │   └── httpd.conf
│   └── init.sls
├── dns
│   ├── files
│   │   ├── bind.conf
│   │   └── named.conf
│   └── init.sls
├── ntp
│   ├── files
│   │   └── ntp.conf
│   ├── init.sls
│   ├── ntp-client.sls
│   └── ntp-server.sls
├── redis
│   ├── files
│   │   └── redis.conf
│   ├── init.sls
│   └── map.jinja
├── ssh
│   ├── files
│   │   ├── ssh_config
│   │   └── sshd_config
│   ├── init.sls
│   └── map.jinja
│
```

```
└── top.sls
```

The Salt state tree `file roots`¶

On the `salt-master`, the `file_roots` option for determines where the state tree starts. By default this is `/srv/salt` directory. The state tree directory is where all state files are found, along with any files related to the Salt states, such as application configuration files.

The `top.sls` file¶

Since some environments have hundreds of state files targeting thousands of minions, it is not practical to run each state individually and then target the applicable minions each time.

Salt offers two features to help with this scaling problem:

- The `top.sls` file, to map Salt states to the authorized minion
- `highstate` execution, to run all Salt states outlined in `top.sls` in a single Salt job

The `top.sls` file creates some general abstractions:

- Maps what nodes should pull from which environments
- Defines which states should be run from those environments

The contents and layout of the files are intended to be as simple as possible, while still allowing for maximum flexibility:

/srv/salt/top.sls¶

```
base:
  '*':
    - core
  '^(app|web).(qa|prod).loc
:
    - match: pcre
    - httpd
    - nagios.web
  'os:Ubuntu':
    - match: grain
    - repos.ubuntu
  'os_family:RedHat':
    - match: grain
    - repos.epel
  'nagios* or G@role:monitoring':
    - match: compound
    - nagios.server
```

- base is the default environment to use as the `file_roots`.
- Targeting parameter is defined next.
- If a match type is anything other than minion ID globbing, then a **match** type must be defined.

- One or more state files are added as list items under the target.

Top file targeting types¶

Targeting in the top file can use the same matching types as the salt command-line by declaring the match option.

The default match type is a compound matcher. A single glob, when passed through the compound matcher, acts the same way as matching by `glob`, so in most cases the two are indistinguishable.

Type	??	Description
glob	n/a	A glob match on minion ID
pcre	E	A minion ID match using PCRE
grain	?	A match on grain data
grain_pcre	P	A grain match using PCRE
list	?	A list of minion ID's (must be complete minion ID's)
pillar	I	A match on pillar data
pillar_pcre	?	A pillar match using PCRE
compound	n/a	A compound match of multiple match types
ipcidr	?	A match for expression in CIDR notation
nodegroup	N	A match for pre-defined compound expressions

Running highstate using top files¶

When managing from the master, it is good practice to either manually run the command when the state tree is updated, or to execute from the master with a `cron` job.

Use the `salt` command to execute the `state.highstate` function:

The entire highstate high data can be viewed by running:

```
salt \* state.show_highstate
```

The output is similar to using `state.show_sls` for individual states.

Batching large jobs¶

While Salt can easily handle thousands of simultaneous state runs, for large clusters it may be desirable to have the master throttle the output in batches.

In this example, 10% of all the minions will be running `state.highstate`:

```
salt \* state.highstate --batch 10%
```

In this example, 10 minions will be running `state.highstate`:

```
salt \* state.highstate --batch 10
```

Note

If the minion population being targeted is larger than the percentage or count being batched, the currently targeted minions will constitute a sliding window with the batched amount.

Managing multiple environments¶

Multiple state trees can be created by defining multiple environments, which are declared by:

- Defining multiple environments in the master configuration
- Creating a top file configuration for each environment, or a common top file accessible to all environments which contain sections defining each environment
- Configuring minions to make requests from the Salt master to a single environment, or to override requests on the command line

Multiple environments structure on the Salt master¶

Multiple State Trees are defined by declaring more environments within the Salt Master configuration. Each State Tree may have multiple paths defined. This allows for a different State Tree for Production, Development, and QA.

If multiple environments are needed, separate `file_roots` can be created to serve more than just one State Tree:

/etc/salt/master.d/file_roots.conf¶

```
file_roots:
  base:
    - /srv/salt/base
  dev:
    - /srv/salt/dev1
    - /srv/salt/dev2
  qa:
    - /srv/salt/qa1
    - /srv/salt/qa2
  prod:
    - /srv/salt/prod
```

Multiple environments top file structure¶

The top file maps states from multiple environments to applicable minions in the salt cluster. Each state tree environment may have a top.sls file.

- Each state tree environment may have a `top.sls` file:
    - The file must contain a reference to the environment being served.
    - The file may span multiple environments, however, this is not common

A file that spans multiple environments and is accessible to each environment might look like:

```
base:
  '*':
    - core
dev:
  'webserver*dev*':
    - webserver
  'db*dev*':
    - db
qa:
  'webserver*qa*':
    - webserver
  'db*qa*':
    - db
prod:
  'webserver*prod*':
    - webserver
  'db*prod*':
    - db
```

The `top.sls` file in this example would either need to be made available to each environment's `file_roots` as defined in the Salt master configuration. This example could also be broken into four separate `top.sls` files, one in each environment's `file_roots`.

Minion environment configuration¶

A minion can be configured to only pull states from a specific environment using the following Salt minion configuration:

/etc/salt/minion.d/environment.conf¶

With this setting, the Salt minion would be limited to only viewing the `file_roots` path defined by the Salt master for the `prod` environment.

Multiple environment example¶

This example shows how all state tree components collectively generate a highstate:

The steps include:

1. Defining the `file_roots`
    1. Use a `base` environment as the default - not used in this scenario
    2. Create a `prod` environment for production states
    3. Create a `dev` environment for further state development
2. Creating the Salt states
    1. Disable USB storage on all systems from `prod`
    2. Provide an SSH configuration files for both `prod` and `dev`

    3. Provide an Apache configuration for `dev` and *prod* with a different name

3. Add resources for state runs
4. Create top file

Defining the file_roots¶

The `file_roots` configuration:

/etc/salt/master.d/file_roots.conf¶

```
file_roots:
  base: # Not used in this example, but must be defined
    - /srv/salt/base
  dev:  # Not used in this example
    - /srv/salt/dev
  prod:
    - /srv/salt/prod
```

Create a disable USB storage state¶

The Disable USB Storage State in the `base` environment will look like:

/srv/salt/prod/security/disable-usb.sls¶

```
disable_usb:
  file.managed:
    - name: /etc/modprobe.d/blacklist-usbstorage
    - contents: |
        # Blacklist USB storage
        blacklist usb-storage
```

Create the SSH state¶

The SSH State file will look like:

```
install_openssh:
  pkg.installed:
    - name: openssh

push_ssh_conf:
  file.managed:
    - name: /etc/ssh/ssh_config
    - source: salt://ssh/ssh_config

push_sshd_conf:
  file.managed:
    - name: /etc/ssh/sshd_config
    - source: salt://ssh/sshd_config

start_sshd:
  service.running:
    - name: sshd
    - enable: True
```

Create the Apache state¶

The Apache State file will look like:

/srv/salt/dev/apache/init.sls¶

```
implement_httpd:
  pkg.installed:
    - name: httpd

http_conf:
  file.managed:
    - name: /etc/httpd/conf/httpd.conf
    - source: salt://apache/httpd.conf

start_httpd:
  service.running:
    - name: httpd
    - enable: True
```

Create a `firewalld` state¶

/srv/salt/dev/firewalld/init.sls¶

```
install_firewalld:
  pkg.installed:
      - name: firewalld

firewalld_open_web:
  firewalld.present:
      - name: public
      - masquerade: False
      - ports:
          - 80/tcp
          - 443/tcp
```

Production build-out¶

All states in the Development State Tree `/srv/salt/dev` can be copied to the Production State Tree in `/srv/salt/prod`.

In this example, to show that we have two environments, the `apache/init.sls` state is renamed to `apache-prod/init.sls`.

Create the default top file¶

The state `top.sls` will target all systems for `ssh` and only web servers will get the `apache` state. The state will be copied by to both dev and prod State Tree paths.

/etc/salt/master.d/file_roots.conf¶

```
dev:
  '*':
    - ssh
  'G@role:web':
    - match: grain
    - apache
    - firewalld

prod:
  '*':
    - ssh
    - security.disable-usb
  'G@role:web':
    - match: grain
    - apache-prod
    - firewalld
```

Test setup¶

We can see the different state trees using the `saltenv` kwarg to override the minion’s configured environment.

Note

All web minions have a `role` grain.

This example is in the `dev` environment:

```
salt \* cp.list_states saltenv=dev
```

```
# command output

ns01:
  - ssh
  - top
web01:
  - apache
  - firewalld
  - ssh
  - top
```

The example is in the `prod` environment.

```
salt \* cp.list_states saltenv=prod
```

```
# command output

ns01:
  - security.disable-usb
  - ssh
  - top
web01:
  - apache-prod
  - firewalld
  - security.disable-usb
  - ssh
  - top
```