# Learning Ansible with Rocky (English version)

## A book from the Documentation Team

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*Rocky Documentation Team*

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# 2. Learning Ansible with Rocky

Ansible is a simple, yet powerful, automation engine for Linux. This tutorial will guide you through the concepts of using Ansible to automate your IT tasks in a way that is (hopefully) fun and informative. Using the exercises throughout these chapters, will help you gain a comfort level with Ansible in real-world applications.

# 3. Ansible Basics

In this chapter you will learn how to work with Ansible.

---

**Objectives**: In this chapter you will learn how to:

✔ Implement Ansible;
✔ Apply configuration changes on a server;
✔ Create first Ansible playbooks;

🏁 **ansible**, **module**, **playbook** .

**Knowledge**: ⭐⭐⭐
**Complexity**: ⭐⭐

**Reading time**: 30 minutes

---

Ansible centralizes and automates administration tasks. It is:

- **agentless** (it does not require specific deployments on clients),
- **idempotent** (same effect each time it is run).

It uses the **SSH** protocol to remotely configure Linux clients or the **WinRM** protocol to work with Windows clients. If none of these protocols is available, it is always possible for Ansible to use an API, which makes Ansible a real Swiss army knife for the configuration of servers, workstations, docker services, network equipment, etc. (almost everything in fact).

> ⚠ **Warning**
>
> The opening of SSH or WinRM flows to all clients from the Ansible server, makes it a critical element of the architecture that must be carefully monitored.

As Ansible is mainly push-based, it will not keep the state of its targeted servers between each of its executions. On the contrary, it will perform new state checks each time it is executed. It is said to be stateless.

It will help you with:

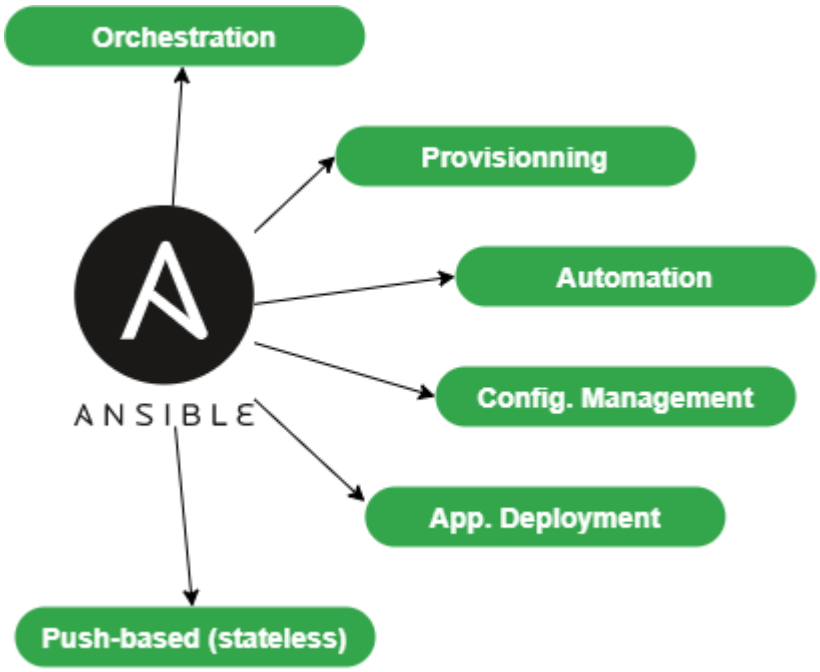
- provisioning (deploying a new VM),
- application deployments,
- configuration management,
- automation,
- orchestration (when more than 1 target is in use).

**Note**

Ansible was originally written by Michael DeHaan, the founder of other tools such as Cobbler.

The earliest first version was 0.0.1, released on March 9, 2012.

On October 17, 2015, AnsibleWorks (the company behind Ansible) was acquired by Red Hat for $150 million.




To offer a graphical interface to your daily use of Ansible, you can install some tools like Ansible Tower (RedHat), which is not free, its opensource counterpart Awx, or other projects like Jenkins and the excellent Rundeck can also be used.

**Abstract**

To follow this training, you will need at least 2 servers under Rocky8:

- the first one will be the **management machine**, Ansible will be installed on it.
- the second one will be the server to configure and manage (another Linux than Rocky Linux will do just as well).

In the examples below, the administration station has the IP address 172.16.1.10, the managed station 172.16.1.11. It is up to you to adapt the examples according to your IP addressing plan.

## 3.1 The Ansible vocabulary

- The **management machine**: the machine on which Ansible is installed. Since Ansible is **agentless**, no software is deployed on the managed servers.
- The **managed nodes**: the target devices that Ansible manages are also referred to as "hosts." These can be servers, network appliances, or any other computer.
- The **inventory**: a file containing information about the managed servers.
- The **tasks**: a task is a block defining a procedure to be executed (e.g., create a user or a group, install a software package, etc.).

- A **module**: a module abstracts a task. There are many modules provided by Ansible.
- The **playbooks**: a simple file in yaml format defining the target servers and the tasks to be performed.
- A **role**: a role allows you to organize the playbooks and all the other necessary files (templates, scripts, etc.) to facilitate the sharing and reuse of code.
- A **collection**: a collection includes a logical set of playbooks, roles, modules, and plugins.
- The **facts**: these are global variables containing information about the system (machine name, system version, network interface and configuration, etc.).
- The **handlers**: these are used to cause a service to be stopped or restarted in the event of a change.

## 3.2 Installation on the management server

Ansible is available in the *EPEL* repository, but may sometimes be too old for the current version, and you'll want to work with a more recent version.

We will therefore consider two types of installation:

- the one based on EPEL repositories
- one based on the `pip` python package manager

The *EPEL* is required for both versions, so you can go ahead and install that now:

- EPEL installation:

```
sudo dnf install epel-release
```

### 3.2.1 Installation from EPEL

If we install Ansible from the *EPEL*, we can do the following:

```
sudo dnf install ansible
```

And then verify the installation:

```
$ ansible --version
ansible [core 2.14.2]
  config file = /etc/ansible/ansible.cfg
  configured module search path = ['/home/rocky/.ansible/plugins/modules', '/
usr/share/ansible/plugins/modules']
  ansible python module location = /usr/lib/python3.11/site-packages/ansible
ansible collection location = /home/rocky/.ansible/collections:/usr/share/
ansible/collections
  executable location = /usr/bin/ansible
  python version = 3.11.2 (main, Jun 22 2023, 04:35:24) [GCC 8.5.0 20210514
(Red Hat 8.5.0-18)] (/usr/bin/python3.11)
  jinja version = 3.1.2
  libyaml = True

$ python3 --version
Python 3.6.8
```

Please note that ansible comes with its own version of python, different from the system version of python (here 3.11.2 vs 3.6.8). You'll need to take this into account when pip-installing the python modules required for your installation (e.g. `pip3.11 install PyVMomi`).

## 3.2.2 Installation from python pip

As we want to use a newer version of Ansible, we will install it from `python3-pip`:

**Note**

Remove Ansible if you have installed it previously from *EPEL*.

At this stage, we can choose to install ansible with the version of python we want.

```
sudo dnf install python38 python38-pip python38-wheel python3-argcomplete rust
cargo curl
```

**Note**

`python3-argcomplete` is provided by *EPEL*. Please install epel-release if not done yet. This package will help you complete Ansible commands.

We can now install Ansible:

```
pip3.8 install --user ansible
activate-global-python-argcomplete --user
```

Check your Ansible version:

```
$ ansible --version
ansible [core 2.13.11]
  config file = None
  configured module search path = ['/home/rocky/.ansible/plugins/modules', '/
usr/share/ansible/plugins/modules']
  ansible python module location = /home/rocky/.local/lib/python3.8/site-
packages/ansible
  ansible collection location = /home/rocky/.ansible/collections:/usr/share/
ansible/collections
  executable location = /home/rocky/.local/bin/ansible
  python version = 3.8.16 (default, Jun 25 2023, 05:53:51) [GCC 8.5.0 20210514
(Red Hat 8.5.0-18)]
  jinja version = 3.1.2
  libyaml = True
```

**Note**

The manually installed version in our case is older than the version packaged by RPM because we used an older version of python. This observation will vary with time and the age of the distribution and the python version of course.

## 3.3 Configuration files

The server configuration is located under `/etc/ansible`.

There are two main configuration files:

- The main configuration file `ansible.cfg` where the commands, modules, plugins, and ssh configuration reside;
- The client machine management inventory file `hosts` where the clients, and groups of clients are declared.

The configuration file would automatically be created if Ansible was installed with its RPM package. With a `pip` installation, this file does not exist. We'll have to create it by hand thanks to the `ansible-config` command:

```
$ ansible-config -h
usage: ansible-config [-h] [--version] [-v] {list,dump,view,init} ...

View ansible configuration.

positional arguments:
  {list,dump,view,init}
    list                Print all config options
    dump                Dump configuration
    view                View configuration file
    init                Create initial configuration
```

Example:

```
ansible-config init --disabled > /etc/ansible/ansible.cfg
```

The `--disabled` option allows you to comment out the set of options by prefixing them with a `;`.

**Note**

You can also choose to embed the ansible configuration in your code repository, with Ansible loading the configuration files it finds in the following order (processing the first file it encounters and ignoring the rest):

- if the environment variable `$ANSIBLE_CONFIG` is set, load the specified file.
- `ansible.cfg` if exists in the current directory.
- `~/.ansible.cfg` if exists (in the user's home directory).

The default file is loaded if none of these three files are found.

## 3.3.1 The inventory file `/etc/ansible/hosts`

As Ansible will have to work with all your equipment to be configured, providing it with one (or more) well-structured inventory file(s) that perfectly matches your organization is essential.

It is sometimes necessary to think carefully about how to build this file.

Go to the default inventory file, which is located under `/etc/ansible/hosts`. Some examples are provided and commented:

```
# This is the default ansible 'hosts' file.
#
# It should live in /etc/ansible/hosts
```

```
#
#   - Comments begin with the '#' character
#   - Blank lines are ignored
#   - Groups of hosts are delimited by [header] elements
#   - You can enter hostnames or ip addresses
#   - A hostname/ip can be a member of multiple groups

# Ex 1: Ungrouped hosts, specify before any group headers:

## green.example.com
## blue.example.com
## 192.168.100.1
## 192.168.100.10

# Ex 2: A collection of hosts belonging to the 'webservers' group:

## [webservers]
## alpha.example.org
## beta.example.org
## 192.168.1.100
## 192.168.1.110

# If you have multiple hosts following a pattern, you can specify
# them like this:

## www[001:006].example.com

# Ex 3: A collection of database servers in the 'dbservers' group:

## [dbservers]
##
## db01.intranet.mydomain.net
## db02.intranet.mydomain.net
## 10.25.1.56
## 10.25.1.57

# Here's another example of host ranges, this time there are no
# leading 0s:

## db-[99:101]-node.example.com
```

As you can see, the file provided as an example uses the INI format, which is well known to system administrators. Please note that you can choose another file format (like yaml for example), but for the first tests, the INI format is well adapted to our future examples.

The inventory can be generated automatically in production, especially if you have a virtualization environment like VMware VSphere or a cloud environment (Aws, OpenStack, or another).

- Creating a hostgroup in `/etc/ansible/hosts`:

As you may have noticed, the groups are declared in square brackets. Then come the elements belonging to the groups. You can create, for example, a `rocky8` group by inserting the following block into this file:

```
[rocky8]
172.16.1.10
172.16.1.11
```

Groups can be used within other groups. In this case, it must be specified that the parent group is composed of subgroups with the `:children` attribute like this:

```
[linux:children]
rocky8
debian9

[ansible:children]
ansible_management
ansible_clients

[ansible_management]
172.16.1.10

[ansible_clients]
172.16.1.10
```

We won't go any further on inventory, but if you are interested, consider checking this link.

Now that our management server is installed and our inventory is ready, it's time to run our first `ansible` commands.

## 3.4 `ansible` command line usage

The `ansible` command launches a task on one or more target hosts.

```
ansible <host-pattern> [-m module_name] [-a args] [options]
```

Examples:

> **Warning**
>
> Since we have not yet configured authentication on our 2 test servers, not all the following examples will work. They are given as examples to facilitate understanding, and will be fully functional later in this chapter.

- List the hosts belonging to the rocky8 group:

```
ansible rocky8 --list-hosts
```

- Ping a host group with the `ping` module:

```
ansible rocky8 -m ping
```

- Display facts from a host group with the `setup` module:

```
ansible rocky8 -m setup
```

- Run a command on a host group by invoking the `command` module with arguments:

```
ansible rocky8 -m command -a 'uptime'
```

- Run a command with administrator privileges:

```
ansible ansible_clients --become -m command -a 'reboot'
```

- Run a command using a custom inventory file:

```
ansible rocky8 -i ./local-inventory -m command -a 'date'
```

**Note**

As in this example, it is sometimes simpler to separate the declaration of managed devices into several files (by cloud project for example) and provide Ansible with the path to these files, rather than to maintain a long inventory file.

| Option | Information |
|---|---|
| `-a 'arguments'` | The arguments to pass to the module. |
| `-b -K` | Requests a password and runs the command with higher privileges. |
| `--user=username` | Uses this user to connect to the target host instead of the current user. |
| `--become-user=username` | Executes the operation as this user (default: `root`). |
| `-C` | Simulation. Does not make any changes to the target but tests it to see what should be changed. |
| `-m module` | Runs the module called |

## 3.4.1 Preparing the client

On both management machine and clients, we will create an `ansible` user dedicated to the operations performed by Ansible. This user will have to use sudo rights, so it will have to be added to the `wheel` group.

This user will be used:

- On the administration station side: to run `ansible` commands and SSH to managed clients.
- On the managed stations (here the server that serves as your administration station also serves as a client, so it is managed by itself) to execute the commands launched from the administration station: it must therefore have sudo rights.

On both machines, create an `ansible` user, dedicated to ansible:

```
sudo useradd ansible
sudo usermod -aG wheel ansible
```

Set a password for this user:

```
sudo passwd ansible
```

Modify the sudoers config to allow members of the `wheel` group to sudo without password:

```
sudo visudo
```

Our goal here is to comment out the default, and uncomment the NOPASSWD option so that these lines look like this when we are done:

```
## Allows people in group wheel to run all commands
# %wheel  ALL=(ALL)       ALL

## Same thing without a password
%wheel        ALL=(ALL)       NOPASSWD: ALL
```

**Warning**

If you receive the following error message when entering Ansible commands, it probably means that you forgot this step on one of your clients: `"msg": "Missing sudo password`

When using management from this point on, start working with this new user:

```
sudo su - ansible
```

## 3.4.2 Test with the ping module

By default, password login is not allowed by Ansible.

Uncomment the following line from the `[defaults]` section in the `/etc/ansible/ansible.cfg` configuration file and set it to True:

```
ask_pass      = True
```

Run a `ping` on each server of the rocky8 group:

```
# ansible rocky8 -m ping
SSH password:
172.16.1.10 | SUCCESS => {
    "changed": false,
    "ping": "pong"
}
172.16.1.11 | SUCCESS => {
    "changed": false,
    "ping": "pong"
}
```

**Note**

You are asked for the `ansible` password of the remote servers, which is a security problem...

**Tip**

If you get this error `"msg": "to use the 'ssh' connection type with passwords, you must install the sshpass program"`, you can just install `sshpass` on the management station:

```
$ sudo dnf install sshpass
```

**Abstract**

You can now test the commands that didn't work previously in this chapter.

## 3.5 Key authentication

Password authentication will be replaced by a much more secure private/public key authentication.

### 3.5.1 Creating an SSH key

The dual-key will be generated with the command `ssh-keygen` on the management station by the `ansible` user:

```
[ansible]$ ssh-keygen
Generating public/private rsa key pair.
Enter file in which to save the key (/home/ansible/.ssh/id_rsa):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/ansible/.ssh/id_rsa.
Your public key has been saved in /home/ansible/.ssh/id_rsa.pub.
The key fingerprint is:
SHA256:Oa1d2hYzzdO0e/K10XPad25TA1nrSVRPIuS4fnmKr9g
ansible@localhost.localdomain
The key's randomart image is:
+---[RSA 3072]----+
|           .o . +|
|           o . =.|
|          . . + +|
|         o . = =.|
|        S o = B.o|
|         = + = =+|
|        . + = o+B|
```

```
|         o + o *@|
|        . Eoo .+B|
+----[SHA256]-----+
```

The public key can be copied to the servers:

```
# ssh-copy-id ansible@172.16.1.10
# ssh-copy-id ansible@172.16.1.11
```

Re-comment the following line from the `[defaults]` section in the `/etc/ansible/ansible.cfg` configuration file to prevent password authentication:

```
#ask_pass      = True
```

### 3.5.2 Private key authentication test

For the next test, the `shell` module, allowing remote command execution, is used:

```
# ansible rocky8 -m shell -a "uptime"
172.16.1.10 | SUCCESS | rc=0 >>
 12:36:18 up 57 min,  1 user,  load average: 0.00, 0.00, 0.00

172.16.1.11 | SUCCESS | rc=0 >>
 12:37:07 up 57 min,  1 user,  load average: 0.00, 0.00, 0.00
```

No password is required, private/public key authentication works!

> **Note**
>
> In production environment, you should now remove the `ansible` passwords previously set to enforce your security (as now an authentication password is not necessary).

## 3.6 Using Ansible

Ansible can be used from the shell or via playbooks.

### 3.6.1 The modules

The list of modules classified by category can be found here. Ansible offers more than 750!

The modules are now grouped into module collections, a list of which can be found here.

Collections are a distribution format for Ansible content that can include playbooks, roles, modules, and plugins.

A module is invoked with the `-m` option of the `ansible` command:

```
ansible <host-pattern> [-m module_name] [-a args] [options]
```

There is a module for almost every need! It is thus advised, instead of using the shell module, to look for a module adapted to the need.

Each category of need has its own module. Here is a non-exhaustive list:

| Type | Examples |
|---|---|
| System Management | `user` (users management), `group` (groups management), etc. |
| Software management | `dnf`, `yum`, `apt`, `pip`, `npm` |
| File management | `copy`, `fetch`, `lineinfile`, `template`, `archive` |
| Database management | `mysql`, `postgresql`, `redis` |
| Cloud management | `amazon S3`, `cloudstack`, `openstack` |
| Cluster management | `consul`, `zookeeper` |
| Send commands | `shell`, `script`, `expect` |
| Downloads | `get_url` |
| Source management | `git`, `gitlab` |

## Example of software installation

The `dnf` module allows for the installation of software on the target clients:

```
# ansible rocky8 --become -m dnf -a name="httpd"
172.16.1.10 | SUCCESS => {
    "changed": true,
    "msg": "",
    "rc": 0,
    "results": [
      ...
      \n\nComplete!\n"
    ]
}
```

```
172.16.1.11 | SUCCESS => {
    "changed": true,
    "msg": "",
    "rc": 0,
    "results": [
      ...
    \n\nComplete!\n"
    ]
}
```

The installed software being a service, it is now necessary to start it with the module `systemd`:

```
# ansible rocky8 --become  -m systemd -a "name=httpd state=started"
172.16.1.10 | SUCCESS => {
    "changed": true,
    "name": "httpd",
    "state": "started"
}
172.16.1.11 | SUCCESS => {
    "changed": true,
    "name": "httpd",
    "state": "started"
}
```

**Tip**

Try to launch those last 2 commands twice. You will observe that the first time Ansible will take actions to reach the state set by the command. The second time, it will do nothing because it will have detected that the state is already reached!

## 3.6.2 Exercises

To help discover more about Ansible and to get used to searching the Ansible documentation, here are some exercises you can do before going on:

- Create the groups Paris, Tokio, NewYork
- Create the user `supervisor`
- Change the user to have a uid of 10000
- Change the user so that it belongs to the Paris group
- Install the tree software
- Stop the crond service
- Create an empty file with `644` rights
- Update your client distribution
- Restart your client

> **Warning**
>
> Do not use the shell module. Look in the documentation for the appropriate modules!

### `setup` module: introduction to facts

The system facts are variables retrieved by Ansible via its `setup` module.

Take a look at the different facts of your clients to get an idea of the amount of information that can be easily retrieved via a simple command.

We'll see later how to use facts in our playbooks and how to create our own facts.

```
# ansible ansible_clients -m setup | less
192.168.1.11 | SUCCESS => {
    "ansible_facts": {
        "ansible_all_ipv4_addresses": [
            "192.168.1.11"
        ],
        "ansible_all_ipv6_addresses": [
            "2001:861:3dc3:fcf0:a00:27ff:fef7:28be",
            "fe80::a00:27ff:fef7:28be"
        ],
        "ansible_apparmor": {
```

```
            "status": "disabled"
        },
        "ansible_architecture": "x86_64",
        "ansible_bios_date": "12/01/2006",
        "ansible_bios_vendor": "innotek GmbH",
        "ansible_bios_version": "VirtualBox",
        "ansible_board_asset_tag": "NA",
        "ansible_board_name": "VirtualBox",
        "ansible_board_serial": "NA",
        "ansible_board_vendor": "Oracle Corporation",
        ...
```

Now that we have seen how to configure a remote server with Ansible on the command line, we will be able to introduce the notion of playbook. Playbooks are another way to use Ansible, which is not much more complex, but which will make it easier to reuse your code.

## 3.7 Playbooks

Ansible's playbooks describe a policy to be applied to remote systems, to force their configuration. Playbooks are written in an easily understandable text format that groups together a set of tasks: the `yaml` format.

> **Note**
>
> Learn more about yaml here

```
ansible-playbook <file.yml> ... [options]
```

The options are identical to the `ansible` command.

The command returns the following error codes:

| Code | Error |
|---|---|
| `0` | OK or no matching host |
| `1` | Error |
| `2` | One or more hosts are failing |
| `3` | One or more hosts are unreachable |
| `4` | Analyze error |
| `5` | Bad or incomplete options |
| `99` | Run interrupted by user |
| `250` | Unexpected error |

**Note**

Please note that `ansible` will return Ok when no host matches your target, which might mislead you!

## 3.7.1 Example of Apache and MySQL playbook

The following playbook allows us to install Apache and MariaDB on our target servers.

Create a `test.yml` file with the following content:

```
---
- hosts: rocky8 <1>
  become: true <2>
  become_user: root

  tasks:

    - name: ensure apache is at the latest version
      dnf: name=httpd,php,php-mysqli state=latest

    - name: ensure httpd is started
      systemd: name=httpd state=started

    - name: ensure mariadb is at the latest version
      dnf: name=mariadb-server state=latest

    - name: ensure mariadb is started
```

```
      systemd: name=mariadb state=started
...
```

- <1> The targeted group or the targeted server must exist in the inventory
- <2> Once connected, the user becomes `root` (via `sudo` by default)

The execution of the playbook is done with the command `ansible-playbook`:

```
$ ansible-playbook test.yml

PLAY [rocky8] ******************************************************************

TASK [setup] *******************************************************************
ok: [172.16.1.10]
ok: [172.16.1.11]

TASK [ensure apache is at the latest version] **********************************
ok: [172.16.1.10]
ok: [172.16.1.11]

TASK [ensure httpd is started] *************************************************
changed: [172.16.1.10]
changed: [172.16.1.11]

TASK [ensure mariadb is at the latest version]
*********************************
changed: [172.16.1.10]
changed: [172.16.1.11]

TASK [ensure mariadb is started]
*******************************************
changed: [172.16.1.10]
changed: [172.16.1.11]

PLAY RECAP
*********************************************************************
172.16.1.10            : ok=5    changed=3    unreachable=0    failed=0
172.16.1.11            : ok=5    changed=3    unreachable=0    failed=0
```

For more readability, it is recommended to write your playbooks in full yaml format. In the previous example, the arguments are given on the same line as the module, the value of the argument following its name separated by an `=`. Look at the same playbook in full yaml:

```
---
- hosts: rocky8
  become: true
  become_user: root

  tasks:

    - name: ensure apache is at the latest version
      dnf:
        name: httpd,php,php-mysqli
        state: latest

    - name: ensure httpd is started
      systemd:
        name: httpd
        state: started

    - name: ensure mariadb is at the latest version
      dnf:
        name: mariadb-server
        state: latest

    - name: ensure mariadb is started
      systemd:
        name: mariadb
        state: started
...
```

**Tip**

`dnf` is one of the modules that allow you to give it a list as argument.

Note about collections: Ansible now provides modules in the form of collections. Some modules are provided by default within the `ansible.builtin` collection, others must be installed manually via the:

```
ansible-galaxy collection install [collectionname]
```

where [collectionname] is the name of the collection (the square brackets here are used to highlight the need to replace this with an actual collection name, and are NOT part of the command).

The previous example should be written like this:

```
---
- hosts: rocky8
  become: true
  become_user: root

  tasks:

    - name: ensure apache is at the latest version
      ansible.builtin.dnf:
        name: httpd,php,php-mysqli
        state: latest

    - name: ensure httpd is started
      ansible.builtin.systemd:
        name: httpd
        state: started

    - name: ensure mariadb is at the latest version
      ansible.builtin.dnf:
        name: mariadb-server
        state: latest

    - name: ensure mariadb is started
      ansible.builtin.systemd:
        name: mariadb
        state: started
...
```

A playbook is not limited to one target:

```
---
- hosts: webservers
  become: true
  become_user: root

  tasks:

    - name: ensure apache is at the latest version
      ansible.builtin.dnf:
        name: httpd,php,php-mysqli
        state: latest

    - name: ensure httpd is started
      ansible.builtin.systemd:
        name: httpd
        state: started
```

```
- hosts: databases
  become: true
  become_user: root

    - name: ensure mariadb is at the latest version
      ansible.builtin.dnf:
        name: mariadb-server
        state: latest

    - name: ensure mariadb is started
      ansible.builtin.systemd:
        name: mariadb
        state: started
...
```

You can check the syntax of your playbook:

```
ansible-playbook --syntax-check play.yml
```

You can also use a "linter" for yaml:

```
dnf install -y yamllint
```

then check the yaml syntax of your playbooks:

```
$ yamllint test.yml
test.yml
  8:1       error    syntax error: could not find expected ':' (syntax)
```

## 3.8 Exercises results

- Create the groups Paris, Tokio, NewYork
- Create the user `supervisor`
- Change the user to have a uid of 10000
- Change the user so that it belongs to the Paris group
- Install the tree software
- Stop the crond service
- Create an empty file with `0644` rights

- Update your client distribution
- Restart your client

```
ansible ansible_clients --become -m group -a "name=Paris"
ansible ansible_clients --become -m group -a "name=Tokio"
ansible ansible_clients --become -m group -a "name=NewYork"
ansible ansible_clients --become -m user -a "name=Supervisor"
ansible ansible_clients --become -m user -a "name=Supervisor uid=10000"
ansible ansible_clients --become -m user -a "name=Supervisor uid=10000
groups=Paris"
ansible ansible_clients --become -m dnf -a "name=tree"
ansible ansible_clients --become -m systemd -a "name=crond state=stopped"
ansible ansible_clients --become -m copy -a
"content='' dest=/tmp/test force=no mode=0644"
ansible ansible_clients --become -m dnf -a "name=* state=latest"
ansible ansible_clients --become -m reboot
```

# 4. Ansible Intermediate

In this chapter, you will continue to learn how to work with Ansible.

---

**Objectives**: In this chapter, you will learn how to:

✔ work with variables;
✔ use loops;
✔ manage state changes and react to them;
✔ manage asynchronous tasks.

🏁 **ansible**, **module**, **playbook**

**Knowledge**: ★ ★ ★
**Complexity**: ★ ★

**Reading time**: 30 minutes

---

In the previous chapter, you learned how to install Ansible, use it on the command line, and write playbooks to promote the re-usability of your code.

In this chapter, we can start to discover more advanced notions of how to use Ansible and some interesting tasks that you will use regularly.

## 4.1 The variables

> **Note**
>
> More information can be found here.

Under Ansible, there are different types of primitive variables:

- strings,
- integers,
- booleans.

These variables can be organized as:

- dictionaries,
- lists.

A variable can be defined in different places, such as a playbook, a role, or the command line.

For example, from a playbook:

```
---
- hosts: apache1
  vars:
    port_http: 80
    service:
      debian: apache2
      rhel: httpd
```

or from the command line:

```
ansible-playbook deploy-http.yml --extra-vars "service=httpd"
```

Once defined, a variable can be used by calling it between double braces:

- `{{ port_http }}` for a simple value,
- `{{ service['rhel'] }}` or `{{ service.rhel }}` for a dictionary.

For example:

```
- name: make sure apache is started
  ansible.builtin.systemd:
    name: "{{ service['rhel'] }}"
    state: started
```

Of course, it is also possible to access the global variables (the **facts**) of Ansible (OS type, IP addresses, VM name, etc.).

### 4.1.1 Outsourcing variables

Variables can be included in a file external to the playbook, in which case this file must be defined in the playbook with the `vars_files` directive:

```
---
- hosts: apache1
  vars_files:
    - myvariables.yml
```

The `myvariables.yml` file:

```
---
port_http: 80
ansible.builtin.systemd::
  debian: apache2
  rhel: httpd
```

It can also be added dynamically with the use of the module `include_vars`:

```
- name: Include secrets.
  ansible.builtin.include_vars:
    file: vault.yml
```

### 4.1.2 Display a variable

To display a variable, you have to activate the `debug` module as follows:

```
- ansible.builtin.debug:
    var: service['debian']
```

You can also use the variable inside a text:

```
- ansible.builtin.debug:
    msg: "Print a variable in a message : {{ service['debian'] }}"
```

### 4.1.3 Save the return of a task

To save the return of a task and to be able to access it later, you have to use the keyword `register` inside the task itself.

Use of a stored variable:

```
- name: /home content
  shell: ls /home
  register: homes

- name: Print the first directory name
  ansible.builtin.debug:
    var: homes.stdout_lines[0]

- name: Print the first directory name
  ansible.builtin.debug:
    var: homes.stdout_lines[1]
```

**Note**

The variable `homes.stdout_lines` is a list of variables of type string, a way to organize variables we had not yet encountered.

The strings that make up the stored variable can be accessed via the `stdout` value (which allows you to do things like `homes.stdout.find("core") != -1`), to exploit them using a loop (see `loop`), or simply by their indices as seen in the previous example.

### 4.1.4 Exercises:

- Write a playbook, `play-vars.yml,` using global variables that print the target's distribution name and major version.
- Write a playbook using the following dictionary to display the services that will be installed:

```
service:
  web:
    name: apache
    rpm: httpd
  db:
```

```
    name: mariadb
    rpm: mariadb-server
```

The default type should be "web".

- Override the `type` variable using the command line
- Externalize variables in a `vars.yml` file

## 4.2 Loop management

A loop allows you to iterate a task over a list, a hash, or a dictionary, for example.

> **Note**
>
> More information can be found here.

A simple example of use, creation of 4 users:

```
- name: add users
  user:
    name: "{{ item }}"
    state: present
    groups: "users"
  loop:
     - antoine
     - patrick
     - steven
     - xavier
```

At each iteration of the loop, the value of the list used is stored in the `item` variable, accessible in the loop code.

Of course, a list can be defined in an external file:

```
users:
  - antoine
  - patrick
  - steven
  - xavier
```

and be used inside the task like this (after having included the vars file):

```
- name: add users
  user:
    name: "{{ item }}"
    state: present
    groups: "users"
  loop: "{{ users }}"
```

We can use the example seen while studying stored variables to improve it. Use of a stored variable:

```
- name: /home content
  shell: ls /home
  register: homes

- name: Print the directories name
  ansible.builtin.debug:
    msg: "Directory => {{ item }}"
  loop: "{{ homes.stdout_lines }}"
```

A dictionary can also be used in a loop.

In this case, you must transform the dictionary into an item with a **jinja filter** (jinja is the templating engine used by Ansible): `| dict2items`.

In the loop, it becomes possible to use `item.key`, which corresponds to the dictionary key, and `item.value`, which corresponds to the key's values.

Let's see this through a concrete example, showing the management of the system users:

```
---
- hosts: rocky8
  become: true
  become_user: root
  vars:
    users:
      antoine:
        group: users
        state: present
      steven:
        group: users
        state: absent

  tasks:
```

```
- name: Manage users
  user:
    name: "{{ item.key }}"
    group: "{{ item.value.group }}"
    state: "{{ item.value.state }}"
  loop: "{{ users | dict2items }}"
```

**Note**

Loops can be used for many things. When your use of Ansible pushes you to use them more complexly, you will discover the possibilities they offer.

## 4.2.1 Exercises:

- Display the content of the `service` variable from the previous exercise using a loop.

**Note**

You will have to transform your `service` variable, which is a dictionary, to a list with the help of the jinja filter `list` as this:

```
{{ service.values() | list }}
```

## 4.3 Conditionals

**Note**

More information can be found here.

The `when` statement is very useful in many cases, such as not performing certain actions on certain types of servers, if a file or a user does not exist, etc.

**Note**

Behind the `when` statement, the variables do not need double braces (they are, in fact, Jinja2 expressions...).

```
- name: "Reboot only Debian servers"
  reboot:
  when: ansible_os_family == "Debian"
```

Conditions can be grouped with parentheses:

```
- name: "Reboot only CentOS version 6 and Debian version 7"
  reboot:
  when: (ansible_distribution == "CentOS" and
ansible_distribution_major_version == "6") or
        (ansible_distribution == "Debian" and
ansible_distribution_major_version == "7")
```

The conditions corresponding to a logical AND can be provided as a list:

```
- name: "Reboot only CentOS version 6"
  reboot:
  when:
    - ansible_distribution == "CentOS"
    - ansible_distribution_major_version == "6"
```

You can test the value of a boolean and verify that it is true:

```
- name: check if directory exists
  stat:
    path: /home/ansible
  register: directory

- ansible.builtin.debug:
    var: directory

- ansible.builtin.debug:
    msg: The directory exists
  when:
    - directory.stat.exists
    - directory.stat.isdir
```

You can also test that it is not true:

```
when:
  - file.stat.exists
  - not file.stat.isdir
```

You will probably have to test that a variable exists to avoid execution errors:

```
when: myboolean is defined and myboolean
```

### 4.3.1 Exercises:

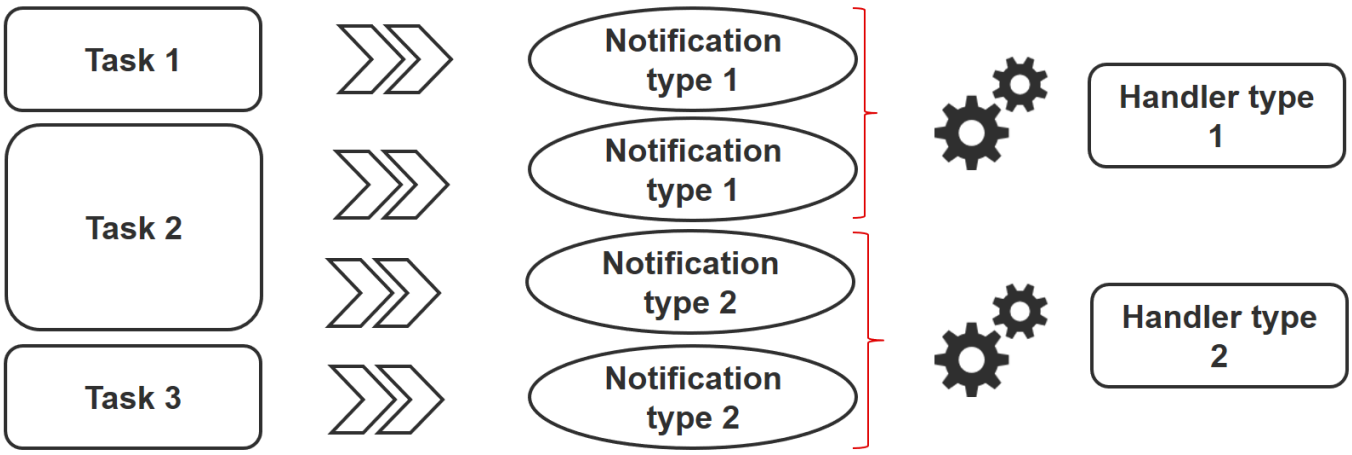
- Print the value of `service.web` only when `type` equals to `web`.

## 4.4 Managing changes: the `handlers`

> **Note**
>
> More information can be found here.

When changes occur, handlers are allowed to launch operations, like restarting a service.

A module, being idempotent, a playbook can detect that there has been a significant change on a remote system and thus trigger an operation in reaction to this change. A notification is sent at the end of a playbook task block, and the reaction operation will be triggered only once, even if several tasks send the same notification.




For example, several tasks may indicate that the `httpd` service needs to be restarted due to a change in its configuration files. However, the service will only be restarted once to avoid multiple unnecessary starts.

```
- name: template configuration file
  template:
    src: template-site.j2
    dest: /etc/httpd/sites-availables/test-site.conf
  notify:
```

```
      - restart memcached
      - restart httpd
```

A handler is a kind of task referenced by a unique global name:

- One or more notifiers activate it.
- It does not start immediately, but waits until all tasks are complete to run.

Example of handlers:

```
handlers:

  - name: restart memcached
    systemd:
      name: memcached
      state: restarted

  - name: restart httpd
    systemd:
      name: httpd
      state: restarted
```

Since version 2.2 of Ansible, handlers can listen directly as well:

```
handlers:

  - name: restart memcached
    systemd:
      name: memcached
      state: restarted
    listen: "web services restart"

  - name: restart apache
    systemd:
      name: apache
      state: restarted
    listen: "web services restart"

tasks:
    - name: restart everything
      command: echo "this task will restart the web services"
      notify: "web services restart"
```

## 4.5 Asynchronous tasks

> **Note**
>
> More information can be found here.

By default, SSH connections to hosts remain open while executing various playbook tasks on all nodes.

This can cause some problems, especially:

- if the execution time of the task is longer than the SSH connection timeout
- if the connection is interrupted during the action (server reboot, for example)

In this case, you will have to switch to asynchronous mode and specify a maximum execution time and the frequency (by default, 10s) with which you will check the host status.

By specifying a poll value of 0, Ansible will execute the task and continue without worrying about the result.

Here's an example using asynchronous tasks, which allows you to restart a server and wait for port 22 to be reachable again:

```
# Wait 2s and launch the reboot
- name: Reboot system
  shell: sleep 2 && shutdown -r now "Ansible reboot triggered"
  async: 1
  poll: 0
  ignore_errors: true
  become: true
  changed_when: False

  # Wait the server is available
  - name: Waiting for server to restart (10 mins max)
    wait_for:
      host: "{{ inventory_hostname }}"
      port: 22
      delay: 30
      state: started
      timeout: 600
    delegate_to: localhost
```

You can also decide to launch a long-running task and forget it (fire and forget) because the execution does not matter in the playbook.

## 4.6 Exercise results

- Write a playbook, `play-vars.yml, ' using global variables, that prints the target's distribution name and major version.

```
---
- hosts: ansible_clients

  tasks:

    - name: Print globales variables
      debug:
        msg: "The distribution is {{ ansible_distribution }} version
{{ ansible_distribution_major_version }}"
```

```
$ ansible-playbook play-vars.yml

PLAY [ansible_clients]
**********************************************************************************
**

TASK [Gathering Facts]
**********************************************************************************
**
ok: [192.168.1.11]

TASK [Print globales variables]
**********************************************************************
ok: [192.168.1.11] => {
    "msg": "The distribution is Rocky version 8"
}

PLAY RECAP
**********************************************************************************
**************
192.168.1.11               : ok=2    changed=0    unreachable=0    failed=0
skipped=0    rescued=0    ignored=0
```

- Write a playbook using the following dictionary to display the services that will be installed:

```
service:
  web:
    name: apache
    rpm: httpd
  db:
    name: mariadb
    rpm: mariadb-server
```

The default type should be "web".

```
---
- hosts: ansible_clients
  vars:
    type: web
    service:
      web:
        name: apache
        rpm: httpd
      db:
        name: mariadb
        rpm: mariadb-server

  tasks:

    - name: Print a specific entry of a dictionary
      debug:
        msg: "The {{ service[type]['name'] }} will be installed with the
packages {{ service[type].rpm }}"
```

```
$ ansible-playbook display-dict.yml

PLAY [ansible_clients]
*********************************************************************************
**

TASK [Gathering Facts]
*********************************************************************************
**
ok: [192.168.1.11]

TASK [Print a specific entry of a dictionnaire]
*****************************************************
ok: [192.168.1.11] => {
    "msg": "The apache will be installed with the packages httpd"
}
```

```
PLAY RECAP
*********************************************************************************
**************
192.168.1.11               : ok=2    changed=0    unreachable=0    failed=0
skipped=0    rescued=0    ignored=0
```

- Override the `type` variable using the command line:

```
ansible-playbook --extra-vars "type=db" display-dict.yml

PLAY [ansible_clients]
*********************************************************************************
**

TASK [Gathering Facts]
*********************************************************************************
**
ok: [192.168.1.11]

TASK [Print a specific entry of a dictionary]
*****************************************************
ok: [192.168.1.11] => {
    "msg": "The mariadb will be installed with the packages mariadb-server"
}

PLAY RECAP
*********************************************************************************
**************
192.168.1.11               : ok=2    changed=0    unreachable=0    failed=0
skipped=0    rescued=0    ignored=0
```

- Externalize variables in a `vars.yml` file

```
type: web
service:
  web:
    name: apache
    rpm: httpd
  db:
    name: mariadb
    rpm: mariadb-server
```

```
---
- hosts: ansible_clients
  vars_files:
```

```
    - vars.yml

  tasks:

    - name: Print a specific entry of a dictionary
      debug:
        msg: "The {{ service[type]['name'] }} will be installed with the
packages {{ service[type].rpm }}"
```

- Display the content of the `service` variable from the previous exercise using a loop.

> **Note**
>
> You will have to transform your `service` variable, which is a dictionary, to an item or a list with the help of the jinja filters `dict2items` or `list` as this:
>
> ```
> {{ service | dict2items }}
> ```
>
> ```
> {{ service.values() | list }}
> ```

With `dict2items`:

```
---
- hosts: ansible_clients
  vars_files:
    - vars.yml

  tasks:

    - name: Print a dictionary variable with a loop
      debug:
        msg: "{{item.key }} | The {{ item.value.name }} will be installed with
the packages {{ item.value.rpm }}"
      loop: "{{ service | dict2items }}"
```

```
$ ansible-playbook display-dict.yml

PLAY [ansible_clients]
*********************************************************************************
**

TASK [Gathering Facts]
*********************************************************************************
**
ok: [192.168.1.11]
```

```
TASK [Print a dictionary variable with a loop]
*********************************************************
ok: [192.168.1.11] => (item={'key': 'web', 'value': {'name': 'apache', 'rpm':
'httpd'}}) => {
    "msg": "web | The apache will be installed with the packages httpd"
}
ok: [192.168.1.11] => (item={'key': 'db', 'value': {'name': 'mariadb', 'rpm':
'mariadb-server'}}) => {
    "msg": "db | The mariadb will be installed with the packages mariadb-
server"
}

PLAY RECAP
*********************************************************************************
**************
192.168.1.11               : ok=2    changed=0    unreachable=0    failed=0
skipped=0    rescued=0    ignored=0
```

With `list`:

```
---
- hosts: ansible_clients
  vars_files:
    - vars.yml

  tasks:

    - name: Print a dictionary variable with a loop
      debug:
        msg: "The {{ item.name }} will be installed with the packages
{{ item.rpm }}"
      loop: "{{ service.values() | list}}"
~
```

```
$ ansible-playbook display-dict.yml

PLAY [ansible_clients]
*********************************************************************************
**

TASK [Gathering Facts]
*********************************************************************************
**
ok: [192.168.1.11]
```

```
TASK [Print a dictionary variable with a loop]
*****************************************************
ok: [192.168.1.11] => (item={'name': 'apache', 'rpm': 'httpd'}) => {
    "msg": "The apache will be installed with the packages httpd"
}
ok: [192.168.1.11] => (item={'name': 'mariadb', 'rpm': 'mariadb-server'}) => {
    "msg": "The mariadb will be installed with the packages mariadb-server"
}

PLAY RECAP
*********************************************************************************
**************
192.168.1.11               : ok=2    changed=0    unreachable=0    failed=0
skipped=0    rescued=0    ignored=0
```

- Print the value of `service.web` only when `type` equals to `web`.

```
---
- hosts: ansible_clients
  vars_files:
    - vars.yml

  tasks:

    - name: Print a dictionary variable
      debug:
        msg: "The {{ service.web.name }} will be installed with the packages
{{ service.web.rpm }}"
      when: type == "web"


    - name: Print a dictionary variable
      debug:
        msg: "The {{ service.db.name }} will be installed with the packages
{{ service.db.rpm }}"
      when: type == "db"
```

```
$ ansible-playbook display-dict.yml

PLAY [ansible_clients]
*********************************************************************************
**

TASK [Gathering Facts]
*********************************************************************************
**
```

```
ok: [192.168.1.11]

TASK [Print a dictionary variable]
*********************************************************************
ok: [192.168.1.11] => {
    "msg": "The apache will be installed with the packages httpd"
}

TASK [Print a dictionary variable]
*********************************************************************
skipping: [192.168.1.11]

PLAY RECAP
*********************************************************************************
**************
192.168.1.11               : ok=2    changed=0    unreachable=0    failed=0
skipped=1    rescued=0    ignored=0

$ ansible-playbook --extra-vars "type=db" display-dict.yml

PLAY [ansible_clients]
*********************************************************************************
**

TASK [Gathering Facts]
*********************************************************************************
**
ok: [192.168.1.11]

TASK [Print a dictionary variable]
*********************************************************************
skipping: [192.168.1.11]

TASK [Print a dictionary variable]
*********************************************************************
ok: [192.168.1.11] => {
    "msg": "The mariadb will be installed with the packages mariadb-server"
}

PLAY RECAP
*********************************************************************************
**************
192.168.1.11               : ok=2    changed=0    unreachable=0    failed=0
skipped=1    rescued=0    ignored=0
```

# 5. Ansible - Management of Files

In this chapter you will learn how to manage files with Ansible.

---

**Objectives**: In this chapter you will learn how to:

✔ modify the content of file;
✔ upload files to the targeted servers;
✔ retrieve files from the targeted servers.

🏁 **ansible**, **module**, **files**

**Knowledge**: ⭐⭐
**Complexity**: ⭐

**Reading time**: 20 minutes

---

Depending on your needs, you will have to use different Ansible modules to modify the system configuration files.

## 5.1 `ini_file` module

When you want to modify an INI file (section between `[]` then `key=value` pairs), the easiest way is to use the `ini_file` module.

> **Note**
>
> More information can be found here.

The module requires:

- The value of the section
- The name of the option
- The new value

Example of use:

```
- name: change value on inifile
  community.general.ini_file:
    dest: /path/to/file.ini
    section: SECTIONNAME
    option: OPTIONNAME
    value: NEWVALUE
```

## 5.2 `lineinfile` module

To ensure that a line is present in a file, or when a single line in a file needs to be added or modified, use the `linefile` module.

> **Note**
>
> More information can be found here.

In this case, the line to be modified in a file will be found using a regexp.

For example, to ensure that the line starting with `SELINUX=` in the `/etc/selinux/config` file contains the value `enforcing`:

```
- ansible.builtin.lineinfile:
    path: /etc/selinux/config
    regexp: '^SELINUX='
    line: 'SELINUX=enforcing'
```

## 5.3 `copy` module

When a file has to be copied from the Ansible server to one or more hosts, it is better to use the `copy` module.

> **Note**
>
> More information can be found here.

Here we are copying `myflile.conf` from one location to another:

```
- ansible.builtin.copy:
    src: /data/ansible/sources/myfile.conf
    dest: /etc/myfile.conf
    owner: root
```

```
    group: root
    mode: 0644
```

## 5.4 `fetch` module

When a file has to be copied from a remote server to the local server, it is best to use the `fetch` module.

> **Note**
>
> More information can be found here.

This module does the opposite of the `copy` module:

```
- ansible.builtin.fetch:
    src: /etc/myfile.conf
    dest: /data/ansible/backup/myfile-{{ inventory_hostname }}.conf
    flat: yes
```

## 5.5 `template` module

Ansible and its `template` module use the **Jinja2** template system (http://jinja.pocoo.org/docs/) to generate files on target hosts.

> **Note**
>
> More information can be found here.

For example:

```
- ansible.builtin.template:
    src: /data/ansible/templates/monfichier.j2
    dest: /etc/myfile.conf
    owner: root
    group: root
    mode: 0644
```

It is possible to add a validation step if the targeted service allows it (for example apache with the command `apachectl -t`):

```
- template:
    src: /data/ansible/templates/vhost.j2
    dest: /etc/httpd/sites-available/vhost.conf
    owner: root
    group: root
    mode: 0644
    validate: '/usr/sbin/apachectl -t'
```

## 5.6 `get_url` module

To upload files from a web site or ftp to one or more hosts, use the `get_url` module:

```
- get_url:
    url: http://site.com/archive.zip
    dest: /tmp/archive.zip
    mode: 0640
    checksum:
sha256:f772bd36185515581aa9a2e4b38fb97940ff28764900ba708e68286121770e9a
```

By providing a checksum of the file, the file will not be re-downloaded if it is already present at the destination location and its checksum matches the value provided.

# 6. Ansible Galaxy: Collections and Roles

In this chapter you will learn how to use, install, and manage Ansible roles and collections.

---

**Objectives**: In this chapter you will learn how to:

✓ install and manage collections.
✓ install and manage roles.

🏁 **ansible**, **ansible-galaxy**, **roles**, **collections**

**Knowledge**: ⭐⭐
**Complexity**: ⭐⭐⭐

**Reading time**: 40 minutes

---

Ansible Galaxy provides Ansible Roles and Collections from the Ansible Community.

The elements provided can be referenced in the playbooks and used out of the box

## 6.1 `ansible-galaxy` command

The `ansible-galaxy` command manages roles and collections using galaxy.ansible.com.

- To manage roles:

```
ansible-galaxy role [import|init|install|login|remove|...]
```

| Sub-commands | Functionality |
|---|---|
| `install` | installs a role. |
| `remove` | remove one or more roles. |
| `list` | display the name and the version of installed roles. |
| `info` | display information about a role. |
| `init` | generate a skeleton of a new role. |
| `import` | import a role from the galaxy web site. Requires a login. |

- To manage collections:

```
ansible-galaxy collection [import|init|install|login|remove|...]
```

| Sub-commands | Functionality |
|---|---|
| `init` | generate a skeleton of a new collection. |
| `install` | installs a collection. |
| `list` | display the name and the version of installed collections. |

## 6.2 Ansible Roles

An Ansible role is a unit that promotes the reusability of playbooks.

**Note**

More information can be found here

### 6.2.1 Installing useful Roles

In order to highlight the interest of using roles, I suggest you to use the `alemorvan/patchmanagement` role, which will allow you to perform a lot of tasks (pre-update or post-update for example) during your update process, in only a few lines of code.

You can check the code in the github repo of the role here.

- Install the role. This needs only one command:

```
ansible-galaxy role install alemorvan.patchmanagement
```

- Create a playbook to include the role:

```
- name: Start a Patch Management
  hosts: ansible_clients
  vars:
    pm_before_update_tasks_file: custom_tasks/pm_before_update_tasks_file.yml
    pm_after_update_tasks_file: custom_tasks/pm_after_update_tasks_file.yml

  tasks:
    - name: "Include patchmanagement"
      include_role:
        name: "alemorvan.patchmanagement"
```

With this role, you can add your own tasks for all your inventory or for only your targeted node.

Let's create tasks that will be run before and after the update process:

- Create the `custom_tasks` folder:

```
mkdir custom_tasks
```

- Create the `custom_tasks/pm_before_update_tasks_file.yml` (feel free to change the name and the content of this file)

```
---
- name: sample task before the update process
  debug:
    msg: "This is a sample tasks, feel free to add your own test task"
```

- Create the `custom_tasks/pm_after_update_tasks_file.yml` (feel free to change the name and the content of this file)

```
---
- name: sample task after the update process
  debug:
    msg: "This is a sample tasks, feel free to add your own test task"
```

And launch your first Patch Management:

```
ansible-playbook patchmanagement.yml

PLAY [Start a Patch Management]
*********************************************************************

TASK [Gathering Facts]
*********************************************************************************
***
ok: [192.168.1.11]

TASK [Include patchmanagement]
*********************************************************************

TASK [alemorvan.patchmanagement : MAIN | Linux Patch Management Job]
***********************************
ok: [192.168.1.11] => {
    "msg": "Start 192 patch management"
}

...

TASK [alemorvan.patchmanagement : sample task before the update process]
*******************************
ok: [192.168.1.11] => {
    "msg": "This is a sample tasks, feel free to add your own test task"
}

...

TASK [alemorvan.patchmanagement : MAIN | We can now patch]
*******************************************
included: /home/ansible/.ansible/roles/alemorvan.patchmanagement/tasks/
patch.yml for 192.168.1.11

TASK [alemorvan.patchmanagement : PATCH | Tasks depends on distribution]
*******************************
ok: [192.168.1.11] => {
    "ansible_distribution": "Rocky"
}

TASK [alemorvan.patchmanagement : PATCH | Include tasks for CentOS & RedHat
tasks] **********************
included: /home/ansible/.ansible/roles/alemorvan.patchmanagement/tasks/
linux_tasks/redhat_centos.yml for 192.168.1.11

TASK [alemorvan.patchmanagement : RHEL CENTOS | yum clean all]
```

```
*****************************************
changed: [192.168.1.11]

TASK [alemorvan.patchmanagement : RHEL CENTOS | Ensure yum-utils is installed]
*************************
ok: [192.168.1.11]

TASK [alemorvan.patchmanagement : RHEL CENTOS | Remove old kernels]
***********************************
skipping: [192.168.1.11]

TASK [alemorvan.patchmanagement : RHEL CENTOS | Update rpm package with yum]
****************************
ok: [192.168.1.11]

TASK [alemorvan.patchmanagement : PATCH | Inlude tasks for Debian & Ubuntu
tasks] ***********************
skipping: [192.168.1.11]

TASK [alemorvan.patchmanagement : MAIN | We can now reboot]
*******************************************
included: /home/ansible/.ansible/roles/alemorvan.patchmanagement/tasks/
reboot.yml for 192.168.1.11

TASK [alemorvan.patchmanagement : REBOOT | Reboot triggered]
*****************************************
ok: [192.168.1.11]

TASK [alemorvan.patchmanagement : REBOOT | Ensure we are not in rescue mode]
****************************
ok: [192.168.1.11]

...

TASK [alemorvan.patchmanagement : FACTS | Insert fact file]
*******************************************
ok: [192.168.1.11]

TASK [alemorvan.patchmanagement : FACTS | Save date of last PM]
*****************************************
ok: [192.168.1.11]

...

TASK [alemorvan.patchmanagement : sample task after the update process]
*********************************
ok: [192.168.1.11] => {
    "msg": "This is a sample tasks, feel free to add your own test task"
}
```

```
PLAY RECAP
*********************************************************************************
***************
192.168.1.11               : ok=31   changed=1    unreachable=0    failed=0
skipped=4    rescued=0    ignored=0
```

Pretty easy for such a complex process, isn't it?

This is just one example of what can be done using roles made available by the community. Have a look at galaxy.ansible.com to discover the roles that could be useful for you!

You can also create your own roles for your own needs and publish them on the Internet if you feel like it. This is what we will briefly cover in the next chapter.

## 6.2.2 Introduction to Role development

A role skeleton, serving as a starting point for custom role development, can be generated by the `ansible-galaxy` command:

```
$ ansible-galaxy role init rocky8
- Role rocky8 was created successfully
```

The command will generate the following tree structure to contain the `rocky8` role:

```
tree rocky8/
rocky8/
├── defaults
│   └── main.yml
├── files
├── handlers
│   └── main.yml
├── meta
│   └── main.yml
├── README.md
├── tasks
│   └── main.yml
├── templates
├── tests
│   ├── inventory
│   └── test.yml
└── vars
```

```
    └── main.yml

8 directories, 8 files
```

Roles allow you to do away with the need to include files. There is no need to specify file paths or `include` directives in playbooks. You just have to specify a task, and Ansible takes care of the inclusions.

The structure of a role is fairly obvious to understand.

Variables are simply stored either in `vars/main.yml` if the variables are not to be overridden, or in `default/main.yml` if you want to leave the possibility of overriding the variable content from outside your role.

The handlers, files, and templates needed for your code are stored in `handlers/main.yml`, `files` and `templates` respectively.

All that remains is to define the code for your role's tasks in `tasks/main.yml`.

Once all this is working well, you can use this role in your playbooks. You will be able to use your role without worrying about the technical aspect of its tasks, while customizing its operation with variables.

## 6.2.3 Practical work: create a first simple role

Let's implement this with a "go anywhere" role that will create a default user and install software packages. This role can be systematically applied to all your servers.

### Variables

We will create a `rockstar` user on all of our servers. As we don't want this user to be overridden, let's define it in the `vars/main.yml`:

```
---
rocky8_default_group:
  name: rockstar
  gid: 1100
rocky8_default_user:
  name: rockstar
```

```
    uid: 1100
    group: rockstar
```

We can now use those variables inside our `tasks/main.yml` without any inclusion.

```
---
- name: Create default group
  group:
    name: "{{ rocky8_default_group.name }}"
    gid: "{{ rocky8_default_group.gid }}"

- name: Create default user
  user:
    name: "{{ rocky8_default_user.name }}"
    uid: "{{ rocky8_default_user.uid }}"
    group: "{{ rocky8_default_user.group }}"
```

To test your new role, let's create a `test-role.yml` playbook in the same directory as your role:

```
---
- name: Test my role
  hosts: localhost

  roles:

    - role: rocky8
      become: true
      become_user: root
```

and launch it:

```
ansible-playbook test-role.yml

PLAY [Test my role]
*********************************************************************************
*****

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

TASK [rocky8 : Create default group]
*****************************************************************
```

```
changed: [localhost]

TASK [rocky8 : Create default user]
*********************************************************************
changed: [localhost]

PLAY RECAP
*********************************************************************************
**************
localhost                  : ok=3    changed=1    unreachable=0    failed=0
skipped=0    rescued=0    ignored=0
```

Congratulations! You are now able to create great things with a playbook of only a few lines.

Let's see the use of default variables.

Create a list of packages to install by default on your servers and an empty list of packages to uninstall. Edit the `defaults/main.yml` files and add those two lists:

```
rocky8_default_packages:
  - tree
  - vim
rocky8_remove_packages: []
```

and use them in your `tasks/main.yml`:

```
- name: Install default packages (can be overridden)
  package:
    name: "{{ rocky8_default_packages }}"
    state: present

- name: "Uninstall default packages (can be overridden)
{{ rocky8_remove_packages }}"
  package:
    name: "{{ rocky8_remove_packages }}"
    state: absent
```

Test your role with the help of the playbook previously created:

```
ansible-playbook test-role.yml

PLAY [Test my role]
*********************************************************************************
```

```
*****

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

TASK [rocky8 : Create default group]
*****************************************************************
ok: [localhost]

TASK [rocky8 : Create default user]
*****************************************************************
ok: [localhost]

TASK [rocky8 : Install default packages (can be overridden)]
*****************************************
ok: [localhost]

TASK [rocky8 : Uninstall default packages (can be overridden) []]
*************************************
ok: [localhost]

PLAY RECAP
*********************************************************************************
**************
localhost                  : ok=5    changed=0    unreachable=0    failed=0
skipped=0    rescued=0    ignored=0
```

You can now override the `rocky8_remove_packages` in your playbook and uninstall for example `cockpit`:

```
---
- name: Test my role
  hosts: localhost
  vars:
    rocky8_remove_packages:
      - cockpit

  roles:

    - role: rocky8
      become: true
      become_user: root
```

```
ansible-playbook test-role.yml

PLAY [Test my role]
*********************************************************************************
*****

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

TASK [rocky8 : Create default group]
*******************************************************************
ok: [localhost]

TASK [rocky8 : Create default user]
********************************************************************
ok: [localhost]

TASK [rocky8 : Install default packages (can be overridden)]
*****************************************
ok: [localhost]

TASK [rocky8 : Uninstall default packages (can be overridden) ['cockpit']]
*****************************
changed: [localhost]

PLAY RECAP
*********************************************************************************
**************
localhost                  : ok=5    changed=1    unreachable=0    failed=0
skipped=0    rescued=0    ignored=0
```

Obviously, there is no limit to how much you can improve your role. Imagine that for one of your servers, you need a package that is in the list of those to be uninstalled. You could then, for example, create a new list that can be overridden and then remove from the list of packages to be uninstalled those in the list of specific packages to be installed by using the jinja `difference()` filter.

```
- name: "Uninstall default packages (can be overridden)
{{ rocky8_remove_packages }}"
  package:
    name: "{{ rocky8_remove_packages |
difference(rocky8_specifics_packages) }}"
    state: absent
```

## 6.3 Ansible Collections

Collections are a distribution format for Ansible content that can include playbooks, roles, modules, and plugins.

> **Note**
>
> More information can be found here

To install or upgrade a collection:

```
ansible-galaxy collection install namespace.collection [--upgrade]
```

You can then use the newly installed collection using its namespace and name before the module's name or role's name:

```
- import_role:
    name: namespace.collection.rolename

- namespace.collection.modulename:
    option1: value
```

You can find a collection index here.

Let's install the `community.general` collection:

```
ansible-galaxy collection install community.general
Starting galaxy collection install process
Process install dependency map
Starting collection install process
Downloading https://galaxy.ansible.com/download/community-general-3.3.2.tar.gz
to /home/ansible/.ansible/tmp/ansible-local-51384hsuhf3t5/tmpr_c9qrt1/
community-general-3.3.2-f4q9u4dg
Installing 'community.general:3.3.2' to '/home/ansible/.ansible/collections/
ansible_collections/community/general'
community.general:3.3.2 was installed successfully
```

We can now use the newly available module `yum_versionlock`:

```
- name: Start a Patch Management
  hosts: ansible_clients
  become: true
  become_user: root
```

```
  tasks:

    - name: Ensure yum-versionlock is installed
      package:
        name: python3-dnf-plugin-versionlock
        state: present

    - name: Prevent kernel from being updated
      community.general.yum_versionlock:
        state: present
        name: kernel
      register: locks

    - name: Display locks
      debug:
        var: locks.meta.packages
```

```
ansible-playbook versionlock.yml

PLAY [Start a Patch Management]
**********************************************************************

TASK [Gathering Facts]
**********************************************************************************
***
ok: [192.168.1.11]

TASK [Ensure yum-versionlock is installed]
************************************************************
changed: [192.168.1.11]

TASK [Prevent kernel from being updated]
************************************************************
changed: [192.168.1.11]

TASK [Display locks]
**********************************************************************************
*****
ok: [192.168.1.11] => {
    "locks.meta.packages": [
        "kernel"
    ]
}

PLAY RECAP
**********************************************************************************
***************
```

```
192.168.1.11               : ok=4    changed=2    unreachable=0    failed=0
skipped=0    rescued=0    ignored=0
```

## 6.3.1 Creating your own collection

As with roles, you are able to create your own collection with the help of the `ansible-galaxy` command:

```
ansible-galaxy collection init rocky8.rockstarcollection
- Collection rocky8.rockstarcollection was created successfully
```

```
tree rocky8/rockstarcollection/
rocky8/rockstarcollection/
├── docs
├── galaxy.yml
├── plugins
│   └── README.md
├── README.md
└── roles
```

You can then store your own plugins or roles inside this new collection.

# 7. Ansible Deployments with Ansistrano

In this chapter you will learn how to deploy applications with the Ansible role Ansistrano.

---

**Objectives**: In this chapter you will learn how to:

✔ Implement Ansistrano;
✔ Configure Ansistrano;
✔ Use shared folders and files between deployed versions;
✔ Deploying different versions of a site from git;
✔ React between deployment steps.

🏁 **ansible**, **ansistrano**, **roles**, **deployments**

**Knowledge**: ⭐⭐
**Complexity**: ⭐⭐⭐

**Reading time**: 40 minutes

---

Ansistrano is an Ansible role to easily deploy PHP, Python, etc. applications. It is based on the functionality of Capistrano.

## 7.1 Introduction

Ansistrano requires the following to run:

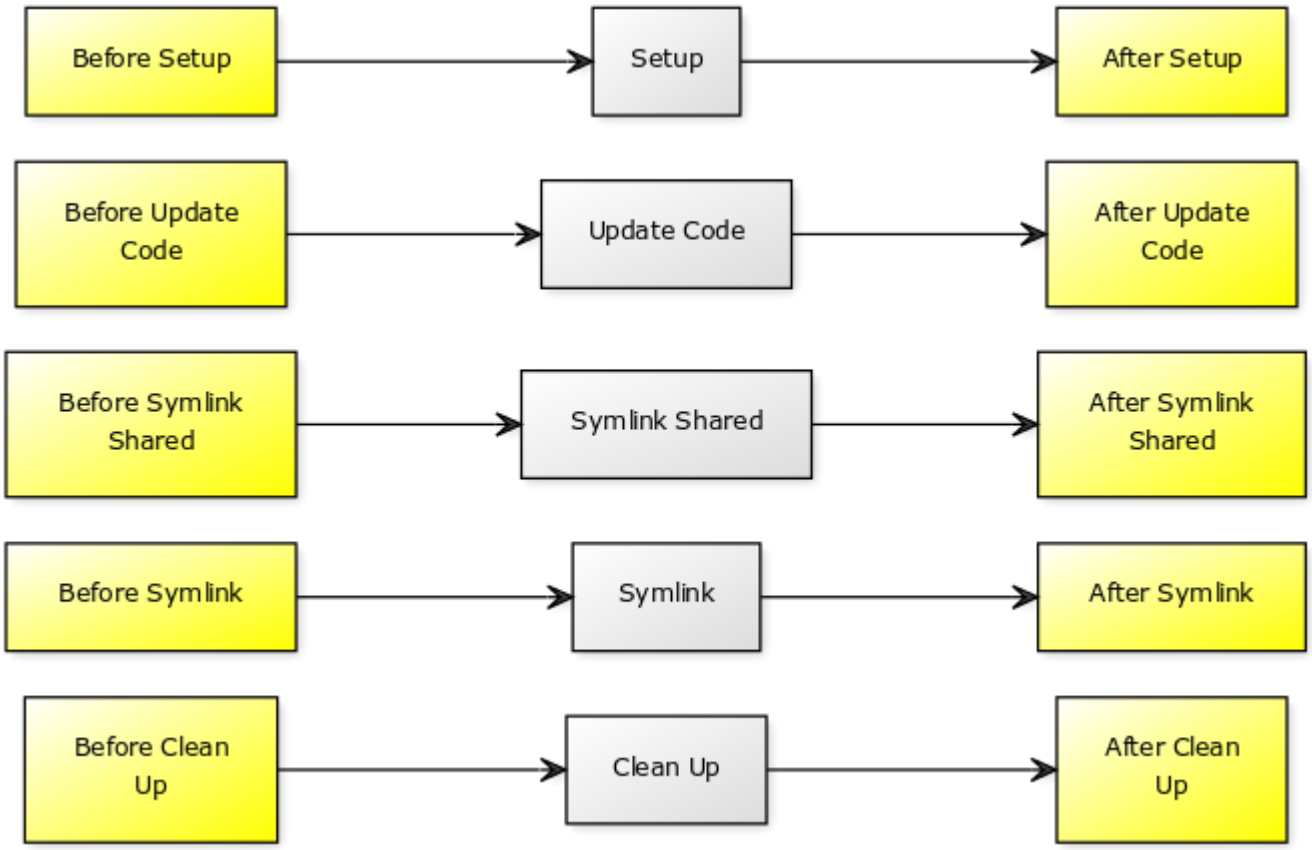
- Ansible on the deployment machine,
- `rsync` or `git` on the client machine.

It can download source code from `rsync`, `git`, `scp`, `http`, `S3`, ...

> **Note**
>
> For our deployment example, we will use the `git` protocol.

Ansistrano deploys applications by following these 5 steps:

- **Setup**: create the directory structure to host the releases;
- **Update Code**: downloading the new release to the targets;
- **Symlink Shared** and **Symlink**: after deploying the new release, the `current` symbolic link is modified to point to this new release;
- **Clean Up**: to do some clean up (remove old versions).




The skeleton of a deployment with Ansistrano looks like this:

```
/var/www/site/
├── current -> ./releases/20210718100000Z
├── releases
│   └── 20210718100000Z
│       ├── css -> ../../shared/css/
│       ├── img -> ../../shared/img/
│       └── REVISION
├── repo
└── shared
    ├── css/
    └── img/
```

You can find all the Ansistrano documentation on its Github repository.

## 7.2 Labs

You will continue to work on your 2 servers:

The management server:

• Ansible is already installed. You will have to install the `ansistrano.deploy` role.

The managed server:

• You will need to install Apache and deploy the client site.

### 7.2.1 Deploying the Web server

For more efficiency, we will use the `geerlingguy.apache` role to configure the server:

```
$ ansible-galaxy role install geerlingguy.apache
Starting galaxy role install process
- downloading role 'apache', owned by geerlingguy
- downloading role from https://github.com/geerlingguy/ansible-role-apache/
archive/3.1.4.tar.gz
- extracting geerlingguy.apache to /home/ansible/.ansible/roles/
geerlingguy.apache
- geerlingguy.apache (3.1.4) was installed successfully
```

We will probably need to open some firewall rules, so we will also install the collection `ansible.posix` to work with its module `firewalld`:

```
$ ansible-galaxy collection install ansible.posix
Starting galaxy collection install process
Process install dependency map
Starting collection install process
Downloading https://galaxy.ansible.com/download/ansible-posix-1.2.0.tar.gz to /
home/ansible/.ansible/tmp/ansible-local-519039bp65pwn/tmpsvuj1fw5/ansible-
posix-1.2.0-bhjbfdpw
Installing 'ansible.posix:1.2.0' to '/home/ansible/.ansible/collections/
ansible_collections/ansible/posix'
ansible.posix:1.2.0 was installed successfully
```

Once the role and the collection are installed, we can create the first part of our playbook, which will:

- Install Apache,
- Create a target folder for our `vhost`,
- Create a default `vhost`,
- Open the firewall,
- Start or restart Apache.

Technical considerations:

- We will deploy our site to the `/var/www/site/` folder.
- As we will see later, `ansistrano` will create a `current` symbolic link to the current release folder.
- The source code to be deployed contains a `html` folder which the vhost should point to. Its `DirectoryIndex` is `index.htm`.
- The deployment is done by `git`, the package will be installed.

> **Note**
>
> The target of our vhost will therefore be: `/var/www/site/current/html`.

Our playbook to configure the server: `playbook-config-server.yml`

```
---
- hosts: ansible_clients
  become: yes
  become_user: root
  vars:
    dest: "/var/www/site/"
    apache_global_vhost_settings: |
      DirectoryIndex index.php index.htm
    apache_vhosts:
      - servername: "website"
    documentroot: "{{ dest }}current/html"

  tasks:

    - name: create directory for website
      file:
```

```
        path: /var/www/site/
        state: directory
        mode: 0755

    - name: install git
      package:
        name: git
        state: latest

    - name: permit traffic in default zone for http service
      ansible.posix.firewalld:
        service: http
        permanent: yes
        state: enabled
        immediate: yes

  roles:
    - { role: geerlingguy.apache }
```

The playbook can be applied to the server:

```
ansible-playbook playbook-config-server.yml
```

Note the execution of the following tasks:

```
TASK [geerlingguy.apache : Ensure Apache is installed on RHEL.]
****************
TASK [geerlingguy.apache : Configure Apache.]
*********************************
TASK [geerlingguy.apache : Add apache vhosts configuration.]
******************
TASK [geerlingguy.apache : Ensure Apache has selected state and enabled on
boot.] ***
TASK [permit traffic in default zone for http service]
************************
RUNNING HANDLER [geerlingguy.apache : restart apache]
************************
```

The `geerlingguy.apache` role makes our job much easier by taking care of the installation and configuration of Apache.

You can check that everything is working by using `curl`:

```
$ curl -I http://192.168.1.11
HTTP/1.1 404 Not Found
```

```
Date: Mon, 05 Jul 2021 23:30:02 GMT
Server: Apache/2.4.37 (rocky) OpenSSL/1.1.1g
Content-Type: text/html; charset=iso-8859-1
```

**Note**

We have not yet deployed any code, so it is normal for `curl` to return a `404` HTTP code. But we can already confirm that the `httpd` service is working and that the firewall is open.

## 7.2.2 Deploying the software

Now that our server is configured, we can deploy the application.

For this, we will use the `ansistrano.deploy` role in a second playbook dedicated to application deployment (for more readability).

```
$ ansible-galaxy role install ansistrano.deploy
Starting galaxy role install process
- downloading role 'deploy', owned by ansistrano
- downloading role from https://github.com/ansistrano/deploy/archive/
3.10.0.tar.gz
- extracting ansistrano.deploy to /home/ansible/.ansible/roles/
ansistrano.deploy
- ansistrano.deploy (3.10.0) was installed successfully
```

The sources of the software can be found in the github repository.

We will create a playbook `playbook-deploy.yml` to manage our deployment:

```
---
- hosts: ansible_clients
  become: yes
  become_user: root
  vars:
    dest: "/var/www/site/"
    ansistrano_deploy_via: "git"
    ansistrano_git_repo: https://github.com/alemorvan/demo-ansible.git
    ansistrano_deploy_to: "{{ dest }}"

  roles:
     - { role: ansistrano.deploy }
```

```
$ ansible-playbook playbook-deploy.yml

PLAY [ansible_clients]
*******************************************************

TASK [ansistrano.deploy : ANSISTRANO | Ensure deployment base path exists]
*****
TASK [ansistrano.deploy : ANSISTRANO | Ensure releases folder exists]
TASK [ansistrano.deploy : ANSISTRANO | Ensure shared elements folder exists]
TASK [ansistrano.deploy : ANSISTRANO | Ensure shared paths exists]
TASK [ansistrano.deploy : ANSISTRANO | Ensure basedir shared files exists]
TASK [ansistrano.deploy : ANSISTRANO | Get release version]
*******************
TASK [ansistrano.deploy : ANSISTRANO | Get release path]
TASK [ansistrano.deploy : ANSISTRANO | GIT | Register ansistrano_git_result
variable]
TASK [ansistrano.deploy : ANSISTRANO | GIT | Set git_real_repo_tree]
TASK [ansistrano.deploy : ANSISTRANO | GIT | Create release folder]
TASK [ansistrano.deploy : ANSISTRANO | GIT | Sync repo subtree[""] to release
path]
TASK [ansistrano.deploy : ANSISTRANO | Copy git released version into REVISION
file]
TASK [ansistrano.deploy : ANSISTRANO | Ensure shared paths targets are absent]
TASK [ansistrano.deploy : ANSISTRANO | Create softlinks for shared paths and
files]
TASK [ansistrano.deploy : ANSISTRANO | Ensure .rsync-filter is absent]
TASK [ansistrano.deploy : ANSISTRANO | Setup .rsync-filter with shared-folders]
TASK [ansistrano.deploy : ANSISTRANO | Get current folder]
TASK [ansistrano.deploy : ANSISTRANO | Remove current folder if it's a
directory]
TASK [ansistrano.deploy : ANSISTRANO | Change softlink to new release]
TASK [ansistrano.deploy : ANSISTRANO | Clean up releases]

PLAY RECAP
*********************************************************************************
*********************************************************************************
****************************************
192.168.1.11 : ok=25   changed=8    unreachable=0    failed=0    skipped=14
rescued=0    ignored=0
```

So many things done with only 11 lines of code!

```
$ curl http://192.168.1.11
<html>
<head>
<title>Demo Ansible</title>
</head>
```

```
<body>
<h1>Version Master</h1>
</body>
<html>
```

## 7.2.3 Checking on the server

You can now connect by ssh to your client machine.

- Make a `tree` on the `/var/www/site/` directory:

```
$ tree /var/www/site/
/var/www/site
├── current -> ./releases/20210722155312Z
├── releases
│   └── 20210722155312Z
│       ├── REVISION
│       └── html
│    └── index.htm
├── repo
│   └── html
│       └── index.htm
└── shared
```

Please note:

- the `current` symlink to the release `./releases/20210722155312Z`
- the presence of a directory `shared`
- the presence of the git repos in `./repo/`
- From the Ansible server, restart the deployment **3** times, then check on the client.

```
$ tree /var/www/site/
var/www/site
├── current -> ./releases/20210722160048Z
├── releases
│   ├── 20210722155312Z
│   │   ├── REVISION
│   │   └── html
│   │       └── index.htm
│   ├── 20210722160032Z
│   │   ├── REVISION
│   │   └── html
```

```
│   │       └── index.htm
│   ├── 20210722160040Z
│   │   ├── REVISION
│   │   └── html
│   │       └── index.htm
│   └── 20210722160048Z
│       ├── REVISION
│       └── html
│    └── index.htm
├── repo
│   └── html
│       └── index.htm
└── shared
```

Please note:

- `ansistrano` kept the 4 last releases,
- the `current` link linked now to the lastest release

## 7.2.4 Limit the number of releases

The `ansistrano_keep_releases` variable is used to specify the number of releases to keep.

- Using the `ansistrano_keep_releases` variable, keep only 3 releases of the project. Check.

```
---
- hosts: ansible_clients
  become: yes
  become_user: root
  vars:
    dest: "/var/www/site/"
    ansistrano_deploy_via: "git"
    ansistrano_git_repo: https://github.com/alemorvan/demo-ansible.git
    ansistrano_deploy_to: "{{ dest }}"
    ansistrano_keep_releases: 3

  roles:
     - { role: ansistrano.deploy }
```

```
---
$ ansible-playbook -i hosts playbook-deploy.yml
```

On the client machine:

```
$ tree /var/www/site/
/var/www/site
├── current -> ./releases/20210722160318Z
├── releases
│   ├── 20210722160040Z
│   │   ├── REVISION
│   │   └── html
│   │       └── index.htm
│   ├── 20210722160048Z
│   │   ├── REVISION
│   │   └── html
│   │       └── index.htm
│   └── 20210722160318Z
│       ├── REVISION
│       └── html
│     └── index.htm
├── repo
│   └── html
│       └── index.htm
└── shared
```

## 7.2.5 Using shared_paths and shared_files

```
---
- hosts: ansible_clients
  become: yes
  become_user: root
  vars:
    dest: "/var/www/site/"
    ansistrano_deploy_via: "git"
    ansistrano_git_repo: https://github.com/alemorvan/demo-ansible.git
    ansistrano_deploy_to: "{{ dest }}"
    ansistrano_keep_releases: 3
    ansistrano_shared_paths:
      - "img"
      - "css"
    ansistrano_shared_files:
      - "logs"

  roles:
     - { role: ansistrano.deploy }
```

On the client machine, create the file `logs` in the `shared` directory:

```
sudo touch /var/www/site/shared/logs
```

Then execute the playbook:

```
TASK [ansistrano.deploy : ANSISTRANO | Ensure shared paths targets are absent]
*********************************************************
ok: [192.168.10.11] => (item=img)
ok: [192.168.10.11] => (item=css)
ok: [192.168.10.11] => (item=logs/log)

TASK [ansistrano.deploy : ANSISTRANO | Create softlinks for shared paths and
files] ************************************************
changed: [192.168.10.11] => (item=img)
changed: [192.168.10.11] => (item=css)
changed: [192.168.10.11] => (item=logs)
```

On the client machine:

```
$  tree -F /var/www/site/
/var/www/site/
├── current -> ./releases/20210722160631Z/
├── releases/
│   ├── 20210722160048Z/
│   │   ├── REVISION
│   │   └── html/
│   │       └── index.htm
│   ├── 20210722160318Z/
│   │   ├── REVISION
│   │   └── html/
│   │       └── index.htm
│   └── 20210722160631Z/
│       ├── REVISION
│       ├── css -> ../../shared/css/
│       ├── html/
│       │   └── index.htm
│       ├── img -> ../../shared/img/
│       └── logs -> ../../shared/logs
├── repo/
│   └── html/
│       └── index.htm
└── shared/
    ├── css/
```

```
    ├── img/
    └── logs
```

Please note that the last release contains 3 links: `css`, `img`, and `logs`

- from `/var/www/site/releases/css` to the `../../shared/css/` directory.
- from `/var/www/site/releases/img` to the `../../shared/img/` directory.
- from `/var/www/site/releases/logs` to the `../../shared/logs` file.

Therefore, the files contained in these 2 folders and the `logs` file are always accessible via the following paths:

- `/var/www/site/current/css/`,
- `/var/www/site/current/img/`,
- `/var/www/site/current/logs`,

but above all they will be kept from one release to the next.

### 7.2.6 Use a sub-directory of the repository for deployment

In our case, the repository contains a `html` folder, which contains the site files.

- To avoid this extra level of directory, use the `ansistrano_git_repo_tree` variable by specifying the path of the sub-directory to use.

Don't forget to modify the Apache configuration to take into account this change!

Change the playbook for the server configuration `playbook-config-server.yml`

```
---
- hosts: ansible_clients
  become: yes
  become_user: root
  vars:
    dest: "/var/www/site/"
    apache_global_vhost_settings: |
      DirectoryIndex index.php index.htm
    apache_vhosts:
      - servername: "website"
 documentroot: "{{ dest }}current/" # <1>
```

```
  tasks:

    - name: create directory for website
      file:
path: /var/www/site/
state: directory
mode: 0755

    - name: install git
      package:
name: git
state: latest

  roles:
    - { role: geerlingguy.apache }
```

<1> Modify this line

Change the playbook for the deployment `playbook-deploy.yml`

```
---
- hosts: ansible_clients
  become: yes
  become_user: root
  vars:
    dest: "/var/www/site/"
    ansistrano_deploy_via: "git"
    ansistrano_git_repo: https://github.com/alemorvan/demo-ansible.git
    ansistrano_deploy_to: "{{ dest }}"
    ansistrano_keep_releases: 3
    ansistrano_shared_paths:
      - "img"
      - "css"
    ansistrano_shared_files:
      - "log"
    ansistrano_git_repo_tree: 'html' # <1>

  roles:
     - { role: ansistrano.deploy }
```

<1> Modify this line

- Don't forget to run both of the playbooks
- Check on the client machine:

```
$  tree -F /var/www/site/
/var/www/site/
├── current -> ./releases/20210722161542Z/
├── releases/
│   ├── 20210722160318Z/
│   │   ├── REVISION
│   │   └── html/
│   │       └── index.htm
│   ├── 20210722160631Z/
│   │   ├── REVISION
│   │   ├── css -> ../../shared/css/
│   │   ├── html/
│   │   │   └── index.htm
│   │   ├── img -> ../../shared/img/
│   │   └── logs -> ../../shared/logs
│   └── 20210722161542Z/
│       ├── REVISION
│       ├── css -> ../../shared/css/
│       ├── img -> ../../shared/img/
│       ├── index.htm
│       └── logs -> ../../shared/logs
├── repo/
│   └── html/
│       └── index.htm
└── shared/
    ├── css/
    ├── img/
    └── logs
```

<1> Please note the absence of `html`

### 7.2.7 Managing git branch or tags

The `ansistrano_git_branch` variable is used to specify a `branch` or `tag` to deploy.

• Deploy the `releases/v1.1.0` branch:

```
---
- hosts: ansible_clients
  become: yes
  become_user: root
  vars:
    dest: "/var/www/site/"
    ansistrano_deploy_via: "git"
    ansistrano_git_repo: https://github.com/alemorvan/demo-ansible.git
```

```
    ansistrano_deploy_to: "{{ dest }}"
    ansistrano_keep_releases: 3
    ansistrano_shared_paths:
      - "img"
      - "css"
    ansistrano_shared_files:
      - "log"
    ansistrano_git_repo_tree: 'html'
    ansistrano_git_branch: 'releases/v1.1.0'

  roles:
     - { role: ansistrano.deploy }
```

**Note**

You can have fun, during the deployment, refreshing your browser, to see in 'live' the change.

```
$ curl http://192.168.1.11
<html>
<head>
<title>Demo Ansible</title>
</head>
<body>
<h1>Version 1.0.1</h1>
</body>
<html>
```

- Deploy the `v2.0.0` tag:

```
---
- hosts: ansible_clients
  become: yes
  become_user: root
  vars:
    dest: "/var/www/site/"
    ansistrano_deploy_via: "git"
    ansistrano_git_repo: https://github.com/alemorvan/demo-ansible.git
    ansistrano_deploy_to: "{{ dest }}"
    ansistrano_keep_releases: 3
    ansistrano_shared_paths:
      - "img"
      - "css"
    ansistrano_shared_files:
      - "log"
    ansistrano_git_repo_tree: 'html'
    ansistrano_git_branch: 'v2.0.0'
```

```
  roles:
     - { role: ansistrano.deploy }
```

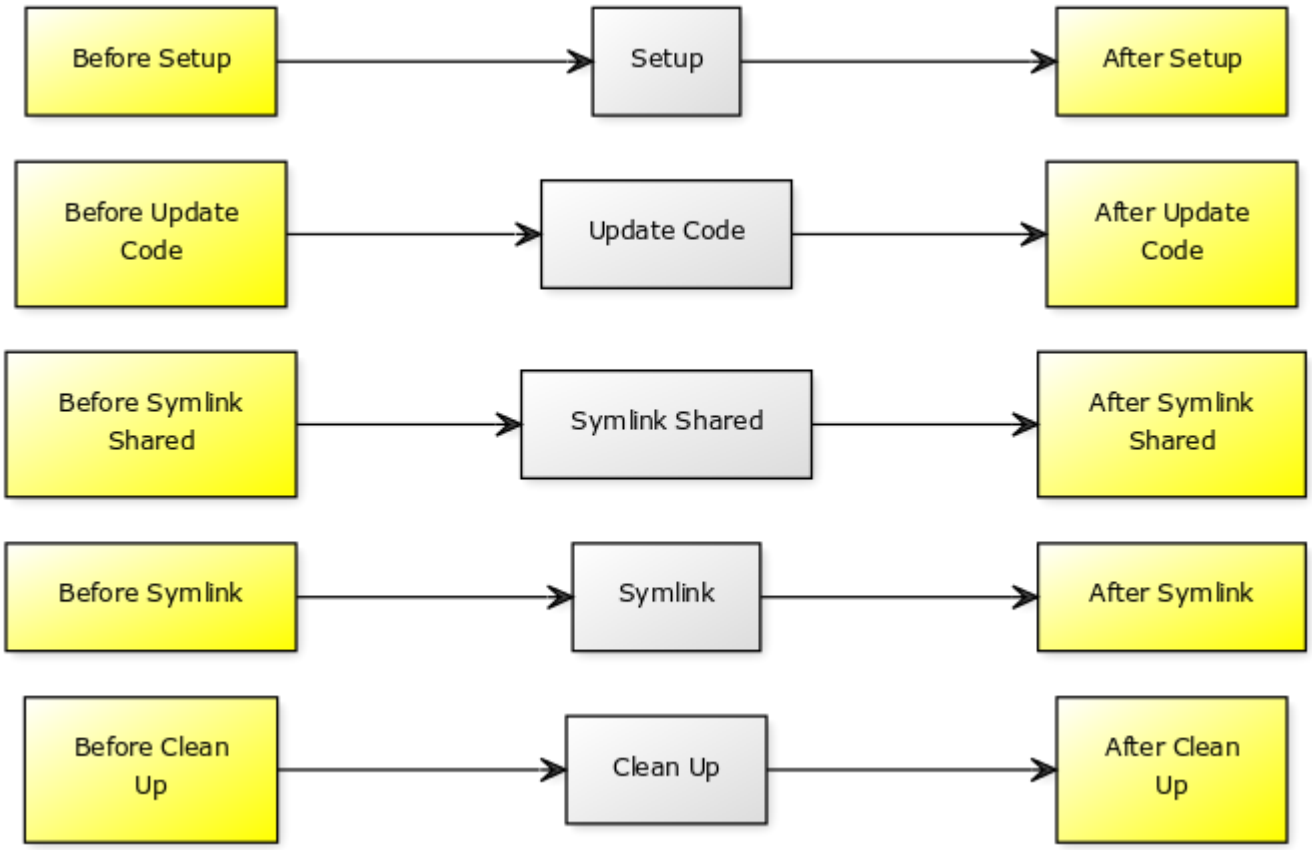
```
$ curl http://192.168.1.11
<html>
<head>
<title>Demo Ansible</title>
</head>
<body>
<h1>Version 2.0.0</h1>
</body>
<html>
```

## 7.2.8 Actions between deployment steps

A deployment with Ansistrano respects the following steps:

- `Setup`
- `Update Code`
- `Symlink Shared`
- `Symlink`
- `Clean Up`

It is possible to intervene before and after each of these steps.




A playbook can be included through the variables provided for this purpose:

- `ansistrano_before_<task>_tasks_file`
- or `ansistrano_after_<task>_tasks_file`
- Easy example: send an email (or whatever you want like Slack notification) at the beginning of the deployment:

```
---
- hosts: ansible_clients
  become: yes
  become_user: root
  vars:
    dest: "/var/www/site/"
    ansistrano_deploy_via: "git"
    ansistrano_git_repo: https://github.com/alemorvan/demo-ansible.git
    ansistrano_deploy_to: "{{ dest }}"
    ansistrano_keep_releases: 3
    ansistrano_shared_paths:
      - "img"
      - "css"
    ansistrano_shared_files:
      - "logs"
```

```
    ansistrano_git_repo_tree: 'html'
    ansistrano_git_branch: 'v2.0.0'
    ansistrano_before_setup_tasks_file: "{{ playbook_dir }}/deploy/before-
setup-tasks.yml"

  roles:
     - { role: ansistrano.deploy }
```

Create the file `deploy/before-setup-tasks.yml`:

```
---
- name: Send a mail
  mail:
    subject: Starting deployment on {{ ansible_hostname }}.
  delegate_to: localhost
```

```
TASK [ansistrano.deploy : include]
*********************************************************************************
******
included: /home/ansible/deploy/before-setup-tasks.yml for 192.168.10.11

TASK [ansistrano.deploy : Send a mail]
*********************************************************************************
******
ok: [192.168.10.11 -> localhost]
```

```
[root] # mailx
Heirloom Mail version 12.5 7/5/10.  Type ? for help.
"/var/spool/mail/root": 1 message 1 new
>N  1 root@localhost.local  Tue Aug 21 14:41  28/946   "Starting deployment on
localhost."
```

- You will probably have to restart some services at the end of the deployment, to flush caches for example. Let's restart Apache at the end of the deployment:

```
---
- hosts: ansible_clients
  become: yes
  become_user: root
  vars:
    dest: "/var/www/site/"
    ansistrano_deploy_via: "git"
    ansistrano_git_repo: https://github.com/alemorvan/demo-ansible.git
    ansistrano_deploy_to: "{{ dest }}"
```

```
    ansistrano_keep_releases: 3
    ansistrano_shared_paths:
      - "img"
      - "css"
    ansistrano_shared_files:
      - "logs"
    ansistrano_git_repo_tree: 'html'
    ansistrano_git_branch: 'v2.0.0'
    ansistrano_before_setup_tasks_file: "{{ playbook_dir }}/deploy/before-
setup-tasks.yml"
    ansistrano_after_symlink_tasks_file: "{{ playbook_dir }}/deploy/after-
symlink-tasks.yml"

  roles:
     - { role: ansistrano.deploy }
```

Create the file `deploy/after-symlink-tasks.yml`:

```
---
- name: restart apache
  systemd:
    name: httpd
    state: restarted
```

```
TASK [ansistrano.deploy : include]
*********************************************************************
******
included: /home/ansible/deploy/after-symlink-tasks.yml for 192.168.10.11

TASK [ansistrano.deploy : restart apache]
*********************************************************************
*******
changed: [192.168.10.11]
```

As you have seen during this chapter, Ansible can greatly improve the life of the system administrator. Very intelligent roles like Ansistrano are "must haves" that quickly become indispensable.

Using Ansistrano, ensures that good deployment practices are respected, reduces the time needed to put a system into production, and avoids the risk of potential human errors. The machine works fast, well, and rarely makes mistakes!

# 8. Ansible - Large Scale infrastructure

In this chapter you will learn how to scale your configuration management system.

---

**Objectives**: In this chapter you will learn how to:

✔ Organize your code for large infrastructure;
✔ Apply all or part of your configuration management to a group of nodes;

🏁 **ansible**, **config management**, **scale**

**Knowledge**: ★ ★ ★
**Complexity**: ★ ★ ★ ★

**Reading time**: 30 minutes

---

We have seen in the previous chapters how to organize our code in the form of roles but also how to use some roles for the management of updates (patch management) or the deployment of code.

What about configuration management? How to manage the configuration of tens, hundreds, or even thousands of virtual machines with Ansible?

The advent of the cloud has changed the traditional methods a bit. The VM is configured at deployment. If its configuration is no longer compliant, it is destroyed and replaced by a new one.

The organization of the configuration management system presented in this chapter will respond to these two ways of consuming IT: "one-shot" use or regular "re-configuration" of a pool of servers.

However, be careful: using Ansible to ensure a pool of servers compliance requires changing work habits. It is no longer possible to manually modify the configuration of a service manager without seeing these modifications overwritten the next time Ansible is run.

> **Note**
>
> What we are going to set up below is not Ansible's favorite terrain. Technologies like Puppet or Salt will do much better. Let's remember that Ansible is a Swiss army knife of automation and is agentless, which explains the differences in performance.

> **Note**
>
> More information can be found here

## 8.1 Variables storage

The first thing we have to discuss is the separation between data and Ansible code.

As the code gets larger and more complex, it will be more and more complicated to modify the variables it contains.

To ensure the maintenance of your site, the most important thing is correctly separating the variables from the Ansible code.

We haven't discussed it here yet, but you should know that Ansible can automatically load the variables it finds in specific folders depending on the inventory name of the managed node, or its member groups.

The Ansible documentation suggests that we organize our code as below:

```
inventories/
   production/
      hosts               # inventory file for production servers
      group_vars/
         group1.yml       # here we assign variables to particular groups
         group2.yml
      host_vars/
         hostname1.yml    # here we assign variables to particular systems
         hostname2.yml
```

If the targeted node is `hostname1` of `group1`, the variables contained in the `hostname1.yml` and `group1.yml` files will be automatically loaded. It's a nice way to store all the data for all your roles in the same place.

In this way, the inventory file of your server becomes its identity card. It contains all the variables that differ from the default variables for your server.

From the point of view of centralization of variables, it becomes essential to organize the naming of its variables in the roles by prefixing them, for example, with the name of the role. It is also recommended to use flat variable names rather than dictionaries.

For example, if you want to make the `PermitRootLogin` value in the `sshd_config` file a variable, a good variable name could be `sshd_config_permitrootlogin` (instead of `sshd.config.permitrootlogin` which could also be a good variable name).

## 8.2 About Ansible tags

The use of Ansible tags allows you to execute or skip a part of the tasks in your code.

> **Note**
>
> More information can be found here

For example, let's modify our users creation task:

```
- name: add users
  user:
    name: "{{ item }}"
    state: present
    groups: "users"
  loop:
     - antoine
     - patrick
     - steven
     - xavier
  tags: users
```

You can now play only the tasks with the tag `users` with the `ansible-playbook` option `--tags`:

```
ansible-playbook -i inventories/production/hosts --tags users site.yml
```

You can also use the `--skip-tags` option.

## 8.3 About the directory layout

Let's focus on a proposal for the organization of files and directories necessary for the proper functioning of a CMS (Content Management System).

Our starting point will be the `site.yml` file. This file is a bit like the orchestra conductor of the CMS since it will only include the necessary roles for the target nodes if needed:

```
---
- name: "Config Management for {{ target }}"
  hosts: "{{ target }}"

  roles:

    - role: roles/functionality1

    - role: roles/functionality2
```

Of course, those roles must be created under the `roles` directory at the same level as the `site.yml` file.

I like to manage my global vars inside a `vars/global_vars.yml`, even if I could store them inside a file located at `inventories/production/group_vars/all.yml`

```
---
- name: "Config Management for {{ target }}"
  hosts: "{{ target }}"
  vars_files:
    - vars/global_vars.yml
  roles:

    - role: roles/functionality1

    - role: roles/functionality2
```

I also like to keep the possibility of disabling a functionality. So I include my roles with a condition and a default value like this:

```
---
- name: "Config Management for {{ target }}"
  hosts: "{{ target }}"
  vars_files:
```

```
    - vars/global_vars.yml
  roles:

    - role: roles/functionality1
      when:
        - enable_functionality1|default(true)

    - role: roles/functionality2
      when:
        - enable_functionality2|default(false)
```

Don't forget to use the tags:

```
- name: "Config Management for {{ target }}"
  hosts: "{{ target }}"
  vars_files:
    - vars/global_vars.yml
  roles:

    - role: roles/functionality1
      when:
        - enable_functionality1|default(true)
      tags:
        - functionality1

    - role: roles/functionality2
      when:
        - enable_functionality2|default(false)
      tags:
        - functionality2
```

You should get something like this:

```
$ tree cms
cms
├── inventories
│   └── production
│       ├── group_vars
│       │   └── plateform.yml
│       ├── hosts
│       └── host_vars
│           ├── client1.yml
│           └── client2.yml
├── roles
│   ├── functionality1
│   │   ├── defaults
```

```
│   │   │   └── main.yml
│   │   └── tasks
│   │       └── main.yml
│   └── functionality2
│       ├── defaults
│       │   └── main.yml
│       └── tasks
│           └── main.yml
├── site.yml
└── vars
    └── global_vars.yml
```

**Note**

You are free to develop your roles within a collection

## 8.4 Tests

Let's launch the playbook and run some tests:

```
$ ansible-playbook -i inventories/production/hosts -e "target=client1" site.yml

PLAY [Config Management for client1]
*******************************************************************************

TASK [Gathering Facts]
*******************************************************************************
***********
ok: [client1]

TASK [roles/functionality1 : Task in functionality 1]
************************************************************
ok: [client1] => {
    "msg": "You are in functionality 1"
}

TASK [roles/functionality2 : Task in functionality 2]
************************************************************
skipping: [client1]

PLAY RECAP
*******************************************************************************
***********************
client1                    : ok=2    changed=0    unreachable=0    failed=0
skipped=1    rescued=0    ignored=0
```

As you can see, by default, only the tasks of the `functionality1` role are played.

Let's activate in the inventory the `functionality2` for our targeted node and rerun the playbook:

```
$ vim inventories/production/host_vars/client1.yml
---
enable_functionality2: true
```

```
$ ansible-playbook -i inventories/production/hosts -e "target=client1" site.yml

PLAY [Config Management for client1]
*************************************************************************

TASK [Gathering Facts]
*************************************************************************
***********
ok: [client1]

TASK [roles/functionality1 : Task in functionality 1]
*******************************************************
ok: [client1] => {
    "msg": "You are in functionality 1"
}

TASK [roles/functionality2 : Task in functionality 2]
*******************************************************
ok: [client1] => {
    "msg": "You are in functionality 2"
}

PLAY RECAP
*************************************************************************
**********************
client1                    : ok=3    changed=0    unreachable=0    failed=0
skipped=0    rescued=0    ignored=0
```

Try to apply only `functionality2`:

```
$ ansible-playbook -i inventories/production/hosts -e "target=client1" --tags
functionality2 site.yml

PLAY [Config Management for client1]
*************************************************************************
```

```
TASK [Gathering Facts]
*********************************************************************************
***********
ok: [client1]

TASK [roles/functionality2 : Task in functionality 2]
*********************************************************
ok: [client1] => {
    "msg": "You are in functionality 2"
}

PLAY RECAP
*********************************************************************************
***********************
client1                    : ok=2    changed=0    unreachable=0    failed=0
skipped=0    rescued=0    ignored=0
```

Let's run on the whole inventory:

```
$ ansible-playbook -i inventories/production/hosts -e "target=plateform"
site.yml

PLAY [Config Management for plateform]
*********************************************************************

TASK [Gathering Facts]
*********************************************************************************
***********
ok: [client1]
ok: [client2]

TASK [roles/functionality1 : Task in functionality 1]
*********************************************************
ok: [client1] => {
    "msg": "You are in functionality 1"
}
ok: [client2] => {
    "msg": "You are in functionality 1"
}

TASK [roles/functionality2 : Task in functionality 2]
*********************************************************
ok: [client1] => {
    "msg": "You are in functionality 2"
}
skipping: [client2]
```

```
PLAY RECAP
*********************************************************************************
**********************
client1                    : ok=3    changed=0    unreachable=0    failed=0
skipped=0    rescued=0    ignored=0
client2                    : ok=2    changed=0    unreachable=0    failed=0
skipped=1    rescued=0    ignored=0
```

As you can see, `functionality2` is only played on the `client1`.

## 8.5 Benefits

By following the advice given in the Ansible documentation, you will quickly obtain a:

- easily maintainable source code even if it contains a large number of roles
- a relatively fast, repeatable compliance system that you can apply partially or completely
- can be adapted on a case-by-case basis and by servers
- the specifics of your information system are separated from the code, easily auditable, and centralized in the inventory files of your configuration management.

# 9. Ansible - Working with filters

In this chapter you will learn how to transform data with jinja filters.

---

**Objectives**: In this chapter you will learn how to:

✔ Transform data structures as dictionaries or lists;
✔ Transform variables.

🏁 **ansible**, **jinja**, **filters**

**Knowledge**: ⭐⭐⭐
**Complexity**: ⭐⭐⭐⭐

**Reading time**: 20 minutes

---

We have already had the opportunity, during the previous chapters, to use the jinja filters.

These filters, written in python, allow us to manipulate and transform our ansible variables.

> **Note**
>
> More information can be found here.

Throughout this chapter, we will use the following playbook to test the different filters presented:

```
- name: Manipulating the data
  hosts: localhost
  gather_facts: false
  vars:
    zero: 0
    zero_string: "0"
    non_zero: 4
    true_booleen: True
    true_non_booleen: "True"
    false_boolean: False
```

```
    false_non_boolean: "False"
    whatever: "It's false!"
    user_name: antoine
    my_dictionary:
      key1: value1
      key2: value2
    my_simple_list:
      - value_list_1
      - value_list_2
      - value_list_3
    my_simple_list_2:
      - value_list_3
      - value_list_4
      - value_list_5
    my_list:
      - element: element1
        value: value1
      - element: element2
        value: value2

  tasks:
    - name: Print an integer
      debug:
        var: zero
```

**Note**

The following is a non-exhaustive list of filters that you are most likely to encounter or need. Fortunately, there are many others. You could even write your own!

The playbook will be played as follows:

```
ansible-playbook play-filter.yml
```

## 9.1 Converting data

Data can be converted from one type to another.

To know the type of a data (the type in python language), you have to use the `type_debug` filter.

Example:

```
- name: Display the type of a variable
  debug:
    var: true_boolean|type_debug
```

which gives us:

```
TASK [Display the type of a variable]
*********************************************************************
ok: [localhost] => {
    "true_boolean|type_debug": "bool"
}
```

It is possible to transform an integer into a string:

```
- name: Transforming a variable type
  debug:
    var: zero|string
```

```
TASK [Transforming a variable type]
*********************************************************************
ok: [localhost] => {
    "zero|string": "0"
}
```

Transform a string into an integer:

```
- name: Transforming a variable type
  debug:
    var: zero_string|int
```

or a variable into a boolean:

```
- name: Display an integer as a boolean
  debug:
    var: non_zero | bool

- name: Display a string as a boolean
  debug:
    var: true_non_boolean | bool

- name: Display a string as a boolean
  debug:
    var: false_non_boolean | bool
```

```
- name: Display a string as a boolean
  debug:
    var: whatever | bool
```

A character string can be transformed into upper or lower case:

```
- name: Lowercase a string of characters
  debug:
    var: whatever | lower

- name: Uppercase a string of characters
  debug:
    var: whatever | upper
```

which gives us:

```
TASK [Lowercase a string of characters]
*****************************************************
ok: [localhost] => {
    "whatever | lower": "it's false!"
}

TASK [Uppercase a string of characters]
*****************************************************
ok: [localhost] => {
    "whatever | upper": "IT'S FALSE!"
}
```

The `replace` filter allows you to replace characters by others.

Here we remove spaces or even replace a word:

```
- name: Replace a character in a string
  debug:
    var: whatever | replace(" ", "")

- name: Replace a word in a string
  debug:
    var: whatever | replace("false", "true")
```

which gives us:

```
TASK [Replace a character in a string]
*****************************************************
ok: [localhost] => {
    "whatever | replace(\" \", \"\")": "It'sfalse!"
}

TASK [Replace a word in a string]
*****************************************************
ok: [localhost] => {
    "whatever | replace(\"false\", \"true\")": "It's true !"
}
```

The `split` filter splits a string into a list based on a character:

```
- name: Cutting a string of characters
  debug:
    var: whatever | split(" ", "")
```

```
TASK [Cutting a string of characters]
*****************************************************
ok: [localhost] => {
    "whatever | split(\" \")": [
        "It's",
        "false!"
    ]
}
```

## 9.2 Join the elements of a list

It is frequent to have to join the different elements in a single string. We can then specify a character or a string to insert between each element.

```
- name: Joining elements of a list
  debug:
    var: my_simple_list|join(",")

- name: Joining elements of a list
  debug:
    var: my_simple_list|join(" | ")
```

which gives us:

```
TASK [Joining elements of a list]
*********************************************************************
ok: [localhost] => {
    "my_simple_list|join(\",\")": "value_list_1,value_list_2,value_list_3"
}

TASK [Joining elements of a list]
*********************************************************************
ok: [localhost] => {
    "my_simple_list|join(\" | \")": "value_list_1 | value_list_2 |
value_list_3"
}
```

## 9.3 Transforming dictionaries into lists (and vice versa)

The filters `dict2items` and `itemstodict`, a bit more complex to implement, are frequently used, especially in loops.

Note that it is possible to specify the name of the key and of the value to use in the transformation.

```
- name: Display a dictionary
  debug:
    var: my_dictionary

- name: Transforming a dictionary into a list
  debug:
    var: my_dictionary | dict2items

- name: Transforming a dictionary into a list
  debug:
    var: my_dictionary | dict2items(key_name='key', value_name='value')

- name: Transforming a list into a dictionary
  debug:
    var: my_list | items2dict(key_name='element', value_name='value')
```

```
TASK [Display a dictionary]
*********************************************************************
ok: [localhost] => {
    "my_dictionary": {
        "key1": "value1",
        "key2": "value2"
    }
```

```
}

TASK [Transforming a dictionary into a list]
************************************************************
ok: [localhost] => {
    "my_dictionary | dict2items": [
        {
            "key": "key1",
            "value": "value1"
        },
        {
            "key": "key2",
            "value": "value2"
        }
    ]
}

TASK [Transforming a dictionary into a list]
************************************************************
ok: [localhost] => {
    "my_dictionary | dict2items (key_name = 'key', value_name = 'value')": [
        {
            "key": "key1",
            "value": "value1"
        },
        {
            "key": "key2",
            "value": "value2"
        }
    ]
}

TASK [Transforming a list into a dictionary]
************************************************************
ok: [localhost] => {
    "my_list | items2dict(key_name='element', value_name='value')": {
        "element1": "value1",
        "element2": "value2"
    }
}
```

## 9.4 Working with lists

It is possible to merge or filter data from one or more lists:

```
- name: Merger of two lists
  debug:
    var: my_simple_list | union(my_simple_list_2)
```

```
ok: [localhost] => {
    "my_simple_list | union(my_simple_list_2)": [
        "value_list_1",
        "value_list_2",
        "value_list_3",
        "value_list_4",
        "value_list_5"
    ]
}
```

To keep only the intersection of the 2 lists (the values present in the 2 lists):

```
- name: Merger of two lists
  debug:
    var: my_simple_list | intersect(my_simple_list_2)
```

```
TASK [Merger of two lists]
*********************************************************************************
ok: [localhost] => {
    "my_simple_list | intersect(my_simple_list_2)": [
        "value_list_3"
    ]
}
```

Or on the contrary keep only the difference (the values that do not exist in the second list):

```
- name: Merger of two lists
  debug:
    var: my_simple_list | difference(my_simple_list_2)
```

```
TASK [Merger of two lists]
*********************************************************************************
ok: [localhost] => {
    "my_simple_list | difference(my_simple_list_2)": [
        "value_list_1",
        "value_list_2",
```

```
    ]
}
```

If your list contains non-unique values, it is also possible to filter them with the `unique` filter.

```
- name: Unique value in a list
  debug:
    var: my_simple_list | unique
```

## 9.5 Transformation json/yaml

You may have to import json data (from an API for example) or export data in yaml or json.

```
- name: Display a variable in yaml
  debug:
    var: my_list | to_nice_yaml(indent=4)

- name: Display a variable in json
  debug:
    var: my_list | to_nice_json(indent=4)
```

```
TASK [Display a variable in yaml]
**********************************************************************
ok: [localhost] => {
    "my_list | to_nice_yaml(indent=4)": "-   element: element1\n    value:
value1\n-   element: element2\n    value: value2\n"
}

TASK [Display a variable in json]
**********************************************************************
ok: [localhost] => {
    "my_list | to_nice_json(indent=4)": "[\n    {\n        \"element\":
\"element1\",\n        \"value\": \"value1\"\n    },\n    {\n
\"element\": \"element2\",\n        \"value\": \"value2\"\n    }\n]"
}
```

## 9.6 Default values, optional variables, protect variables

You will quickly be confronted with errors in the execution of your playbooks if you do not provide default values for your variables, or if you do not protect them.

The value of a variable can be substituted for another one if it does not exist with the `default` filter:

```
- name: Default value
  debug:
    var: variablethatdoesnotexists | default(whatever)
```

```
TASK [Default value]
*********************************************************************************
*
ok: [localhost] => {
    "variablethatdoesnotexists | default(whatever)": "It's false!"
}
```

Note the presence of the apostrophe `'` which should be protected, for example, if you were using the `shell` module:

```
- name: Default value
  debug:
    var: variablethatdoesnotexists | default(whatever| quote)
```

```
TASK [Default value]
*********************************************************************************
*
ok: [localhost] => {
    "variablethatdoesnotexists | default(whatever|quote)": "'It'\"'\"'s
false!'"
}
```

Finally, an optional variable in a module can be ignored if it does not exist with the keyword `omit` in the `default` filter, which will save you an error at runtime.

```
- name: Add a new user
  ansible.builtin.user:
    name: "{{ user_name }}"
    comment: "{{ user_comment | default(omit) }}"
```

## 9.7 Associate a value according to another one (`ternary`)

Sometimes you need to use a condition to assign a value to a variable, in which case it is common to go through a `set_fact` step.

This can be avoided by using the `ternary` filter:

```
- name: Default value
  debug:
    var: (user_name == 'antoine') | ternary('admin', 'normal_user')
```

```
TASK [Default value]
*********************************************************************************
*
ok: [localhost] => {
    "(user_name == 'antoine') | ternary('admin', 'normal_user')": "admin"
}
```

## 9.8 Some other filters

- `{{ 10000 | random }}`: as its name indicates, gives a random value.
- `{{ my_simple_list | first }}`: extracts the first element of the list.
- `{{ my_simple_list | length }}`: gives the length (of a list or a string).
- `{{ ip_list | ansible.netcommon.ipv4 }}`: only displays v4 IPs. Without dwelling on this, if you need, there are many filters dedicated to the network.
- `{{ user_password | password_hash('sha512') }}`: generates a hashed password in sha512.

# 10. Management server optimizations

In this chapter, we will review the configuration options that may be of interest to optimize our Ansible management server.

## 10.1 The `ansible.cfg` configuration file

Some interesting configuration options to comment on:

- `forks`: by default to 5, it is the number of processes that Ansible will launch in parallel to communicate with remote hosts. The higher this number is, the more clients Ansible will be able to manage at the same time, and thus speed up processing. The value you can set is dependent on the CPU/RAM limits of your management server. Note that the default value, `5`, is very small, the Ansible documentation states that many users set it to 50, even 500 or more.
- `gathering`: this variable changes the policy for collecting facts. By default, the value is `implicit`, which implies that facts will be collected systematically. Switching this variable to `smart` allows for collection facts only when they have not already been collected. Coupled with a facts cache (see below), this option can greatly increase performance.
- `host_key_checking`: Be careful with your server security! However, if you are in control of your environment, it can be interesting to disable the key control of remote servers and save some time at the connection. You can also, on remote servers, disable the use of the DNS of the SSH server (in `/etc/ssh/sshd_config`, option `UseDNS no`), this option wastes time at the connection and is, most of the time, only used in the connection logs.
- `ansible_managed`: This variable, containing `Ansible managed` by default, is typically used in file templates that are deployed on remote servers. It allows you to specify to an administrator that the file is managed automatically and that any changes they make to it will potentially be lost. It can be interesting to let the administrators have a more complete message. Be careful though, if you change this variable, it may cause daemons to restart (via the handlers associated with the templates).
- `ssh_args = -C -o ControlMaster=auto -o ControlPersist=300s -o PreferredAuthentications=publickey`: specify the ssh connection options. By disabling all authentication methods other than public key, you can save a lot of time. You can also increase the `ControlPersist` to improve performance (the documentation suggests that a value equivalent to 30 minutes may be appropriate). The connection to a client will stay open longer and can be reused when reconnecting to the same server, which is a significant time saving.
- `control_path_dir`: Specify the path to the connection sockets. If this path is too long, it can cause problems. Consider changing it to something short, such as `/tmp/.cp`.

- `pipelining`: Setting this value to `True` increases performance by reducing the number of SSH connections needed when running remote modules. You must first make sure that the `requiretty` option is disabled in the `sudoers` options (see documentation).

## 10.2 Caching the facts

Gathering facts is a process that can take some time. It can be interesting to disable this gathering for playbooks that don't need it (via `gather_facts` option) or to keep these facts in memory in a cache for a certain period of time (for example 24H).

These facts can be easily stored in a `redis` database:

```
sudo yum install redis
sudo systemctl start redis
sudo systemctl enable redis
sudo pip3 install redis
```

Don't forget to modify the ansible configuration:

```
fact_caching = redis
fact_caching_timeout = 86400
fact_caching_connection = localhost:6379:0
```

To check the correct operation, it is enough to request the `redis` server:

```
redis-cli
127.0.0.1:6379> keys *
127.0.0.1:6379> get ansible_facts_SERVERNAME
```

## 10.3 Using Vault

The various passwords and secrets cannot be stored in clear text with the Ansible source code, either locally on the management server or on a possible source code manager.

Ansible proposes using an encryption manager: `ansible-vault`.

The principle is to encrypt a variable or a whole file with the `ansible-vault` command.

Ansible will be able to decrypt this file at runtime by retrieving the encryption key from the file (for example) `/etc/ansible/ansible.cfg`. The latter can also be a python script or other.

Edit the `/etc/ansible/ansible.cfg` file:

```
#vault_password_file = /path/to/vault_password_file
vault_password_file = /etc/ansible/vault_pass
```

Store the password in this file `/etc/ansible/vault_pass` and assign necessary restrictive rights:

```
mysecretpassword
```

You can then encrypt your files with the command:

```
ansible-vault encrypt myfile.yml
```

A file encrypted by `ansible-vault` can be easily recognized by its header:

```
$ANSIBLE_VAULT;1.1;AES256
353765323436633533306131336638346261363162343239643337353633333961366132663839
6
666432226163326135656638343839373838616533396666 0a34303266323334376263393631363
0
343732301245616637663061346562353862333239643362393366616534336630366333343666
1
643465663030626165 0a313364636261393931313739363931336664386536333766326264633333
0
6334
```

Once a file is encrypted, it can still be edited with the command:

```
ansible-vault edit myfile.yml
```

You can also deport your password storage to any password manager.

For example, to retrieve a password that would be stored in the rundeck vault:

```
#!/usr/bin/env python
# -*- coding: utf-8 -*-
import urllib.request
import io
import ssl

def get_password():
    '''
    :return: Vault password
    :return_type: str
    '''
    ctx = ssl.create_default_context()
    ctx.check_hostname = False
    ctx.verify_mode = ssl.CERT_NONE

    url = 'https://rundeck.rockylinux.org/api/11/storage/keys/ansible/vault'
    req = urllib.request.Request(url, headers={
                         'Accept': '*/*',
                         'X-Rundeck-Auth-Token': '****token-rundeck****'
                         })
    response = urllib.request.urlopen(req, context=ctx)

    return response.read().decode('utf-8')

if __name__ == '__main__':
    print(get_password())
```

## 10.4 Working with Windows servers

It will be necessary to install on the management server several packages:

• Via the package manager:

```
sudo dnf install python38-devel krb5-devel krb5-libs krb5-workstation
```

and configure the `/etc/krb5.conf` file to specify the correct `realms`:

```
[realms]
ROCKYLINUX.ORG = {
    kdc = dc1.rockylinux.org
    kdc = dc2.rockylinux.org
}
```

```
[domain_realm]
  .rockylinux.org = ROCKYLINUX.ORG
```

- Via the python package manager:

```
pip3 install pywinrm
pip3 install pywinrm[credssp]
pip3 install kerberos requests-kerberos
```

## 10.5 Working with IP modules

Network modules usually require the `netaddr` python module:

```
sudo pip3 install netaddr
```

## 10.6 Generating a CMDB

A tool, `ansible-cmdb` has been developed to generate a CMDB from ansible.

```
pip3 install ansible-cmdb
```

The facts must be exported by ansible with the following command:

```
ansible --become --become-user=root -o -m setup --tree /var/www/ansible/cmdb/
out/
```

You can then generate a global `json` file:

```
ansible-cmdb -t json /var/www/ansible/cmdb/out/linux > /var/www/ansible/cmdb/
cmdb-linux.json
```

If you prefer a web interface:

```
ansible-cmdb -t html_fancy_split /var/www/ansible/cmdb/out/
```

https://docs.rockylinux.org/