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Ansible

Basics and how to get started

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Agenda

- What is Ansible
- Use cases
- Inventory files
- Playbooks, plays, tasks
- Roles/handlers
- Plugins/modules
- Installation/run playbook
- File encryption
- Authentication
- Template(s)
- Demo

1. What is Ansible

What is Ansible

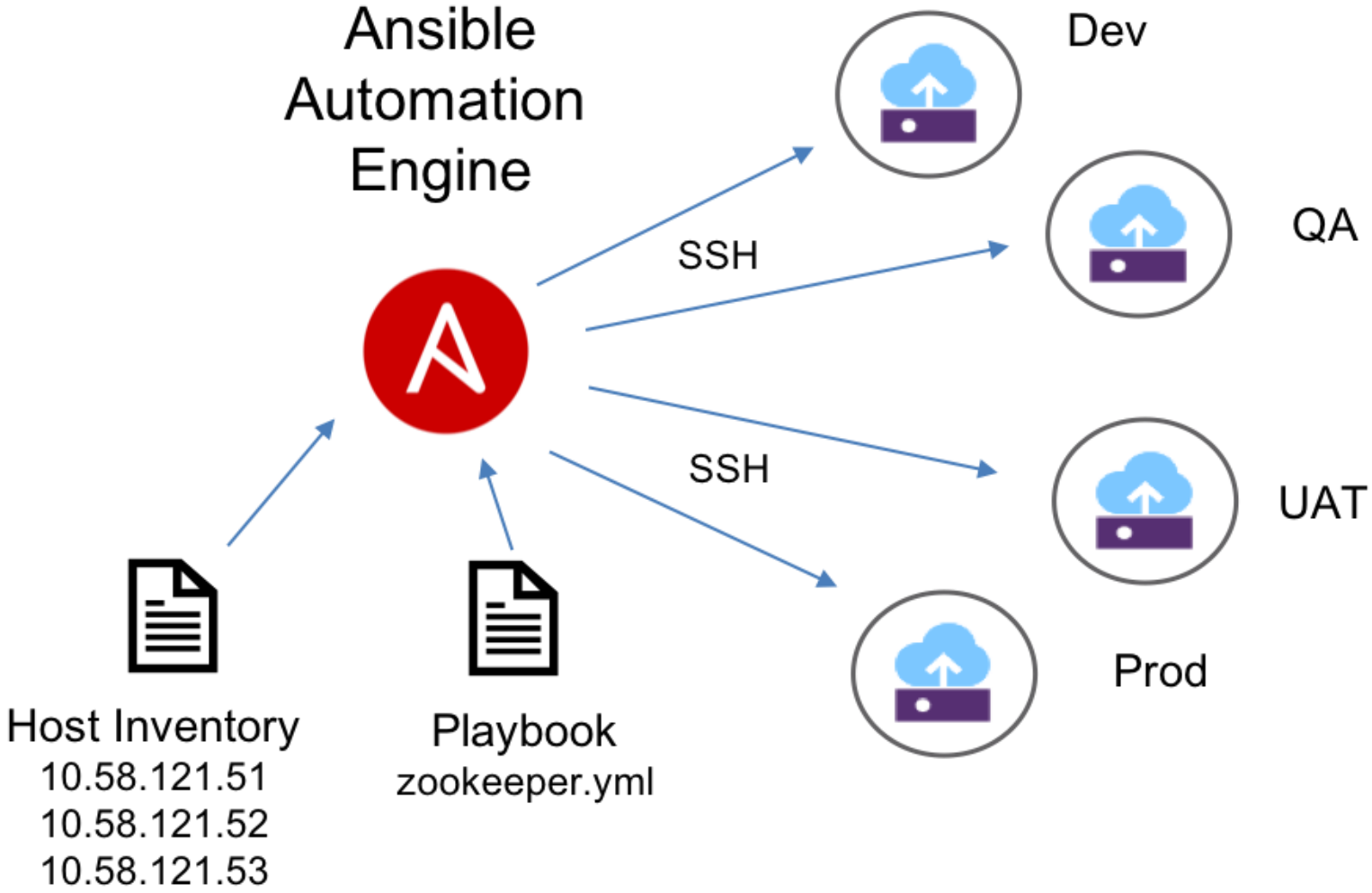
- Open source
- Automation engine
- Comparable to Chef and Puppet

puppet

CHEF

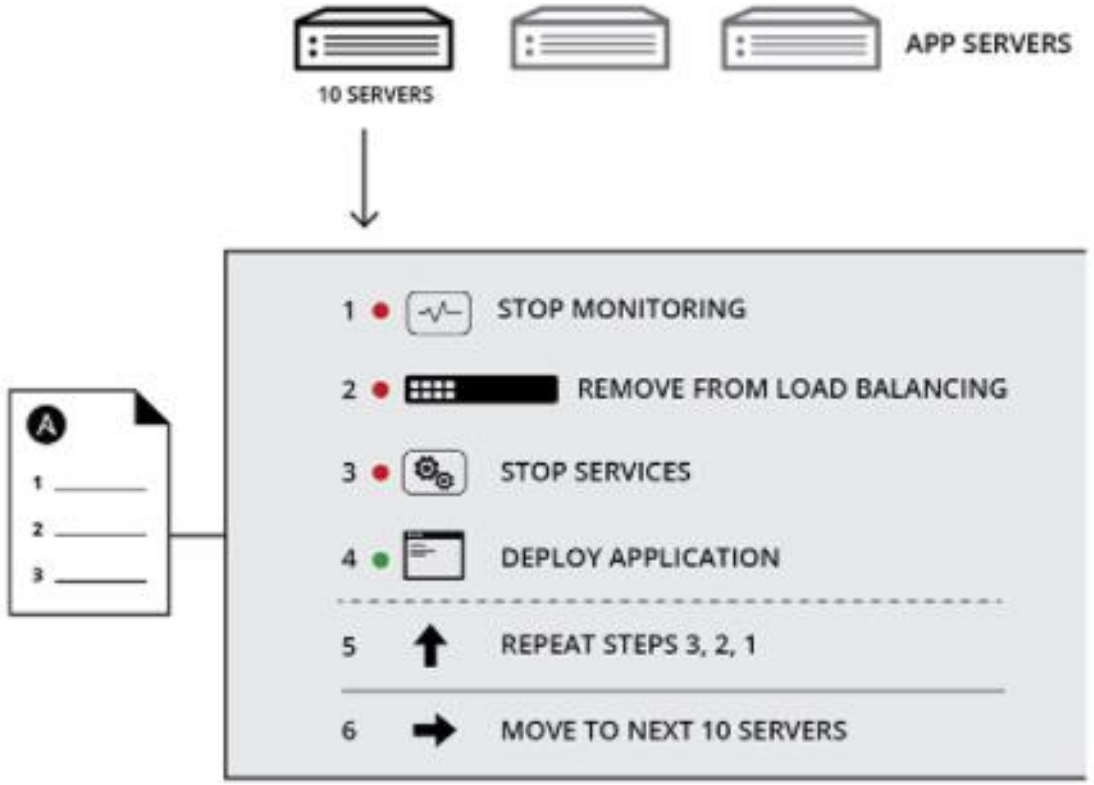
What is Ansible

- Brief overview



Use cases

- For repetitive tasks;
  1. Configuration
  2. Deployment
  3. Orchestration
  4. Management
  5. …



2. Ansible architecture

Ansible architecture

Most important files

- Ansible.cfg
- Hosts/inventory
- Playbook.yml

What do they contain

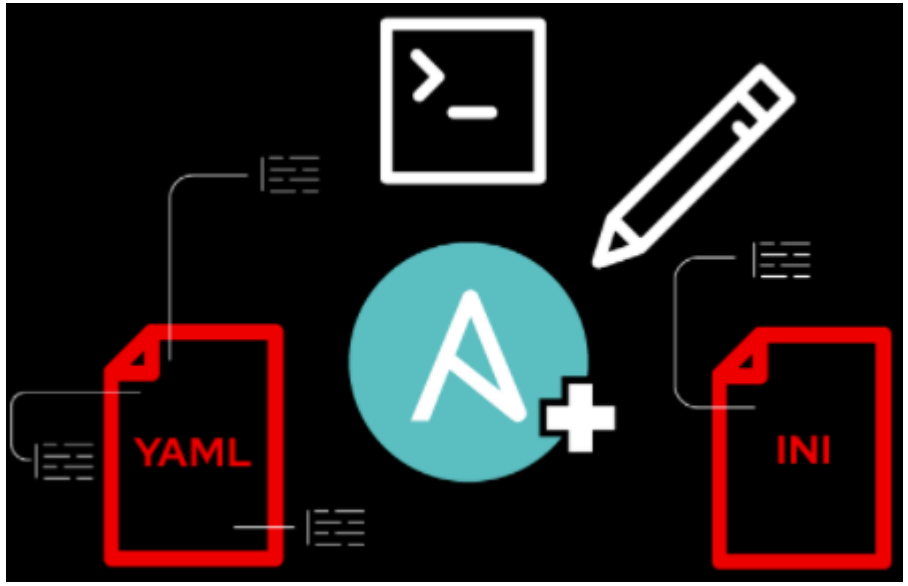
- Ansible.cfg = config
- Hosts = List of nodes
- Playbook = instructions to perform

```
ansible-project/              (root folder)
├── group_vars/               (dir)
├── host_vars/                (dir)
├── roles/                    (dir)
│   └── common/               (dir example role)
│       ├── tasks/            (dir)
│       │   └── main.yml
│       ├── handlers/         (dir)
│       │   └── main.yml
│       ├── templates/        (dir)
│       │   └── conf.j2
│       ├── files/            (dir)
│       │   └── voorbeeld.txt
│       ├── vars/             (dir)
│       │   └── main.yml
│       ├── defaults/         (dir)
│       │   └── main.yml
│       ├── meta/             (dir)
│       │   └── main.yml
│       ├── library/          (dir)
│       ├── module_utils/     (dir)
│       └── lookup_plugins/   (dir)
│
├── ansible.cfg               (ansible config file)
├── hosts                     (inventory/config file)
└── playbooks                 (playbook file(s))
```

3. Inventory files

Inventory files

- Runs against one/more/group of hosts
- Located under "`\etc\ansible\hosts`"
- Can create multiple host files (hosts file location needs to be specified in .cfg)
- Dynamically switch between host files with "`-i <file-path>`"
- Inventrory/host files can be in INI format or YAML
- Personal prefference



Inventory file formats

YAML

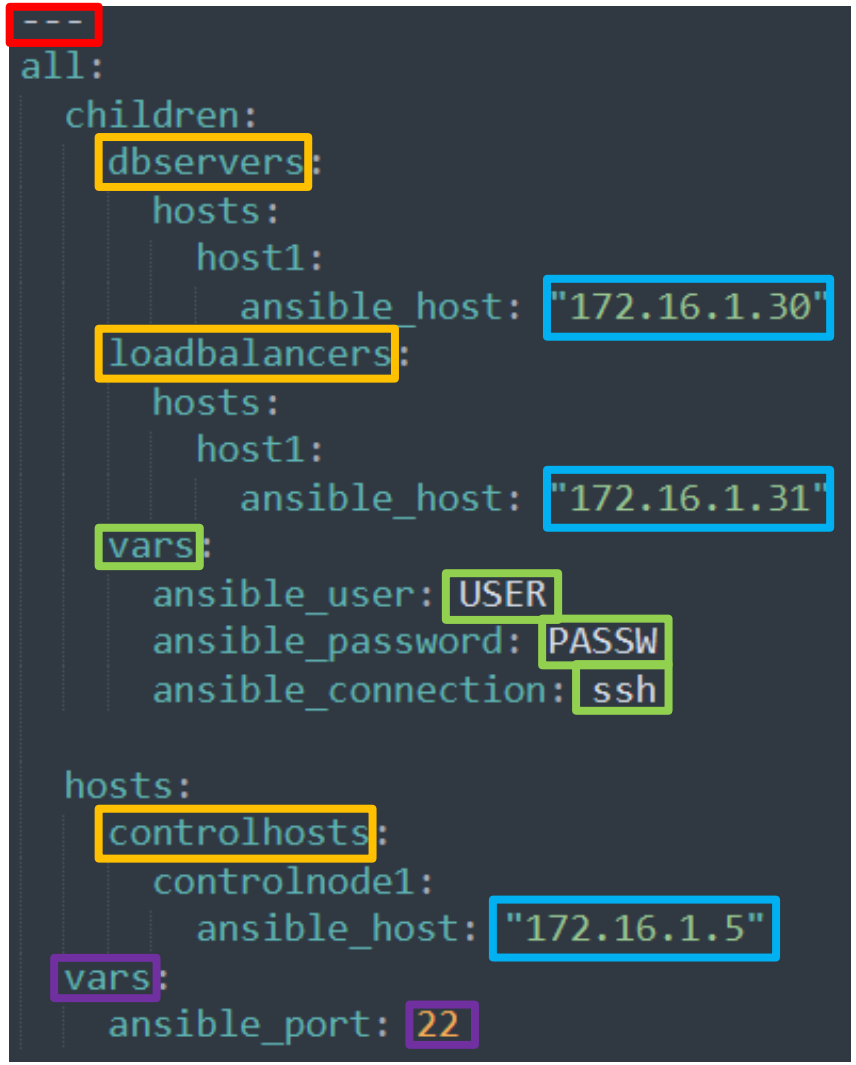
```yaml
all:
  hosts:
    mail.example.com:
  children:
    webservers:
      hosts:
        foo.example.com:
        bar.example.com:
    dbservers:
      hosts:
        one.example.com:
        two.example.com:
        three.example.com:
```

INI

```ini
mail.example.com

[webservers]
foo.example.com
bar.example.com

[dbservers]
one.example.com
two.example.com
three.example.com
```


Inventory real world example - YAML

- Start of YAML file
- Group name
- Group variables
- Host/node adress
- Common variable(s)
- YAML indentation



Inventory real world example - INI

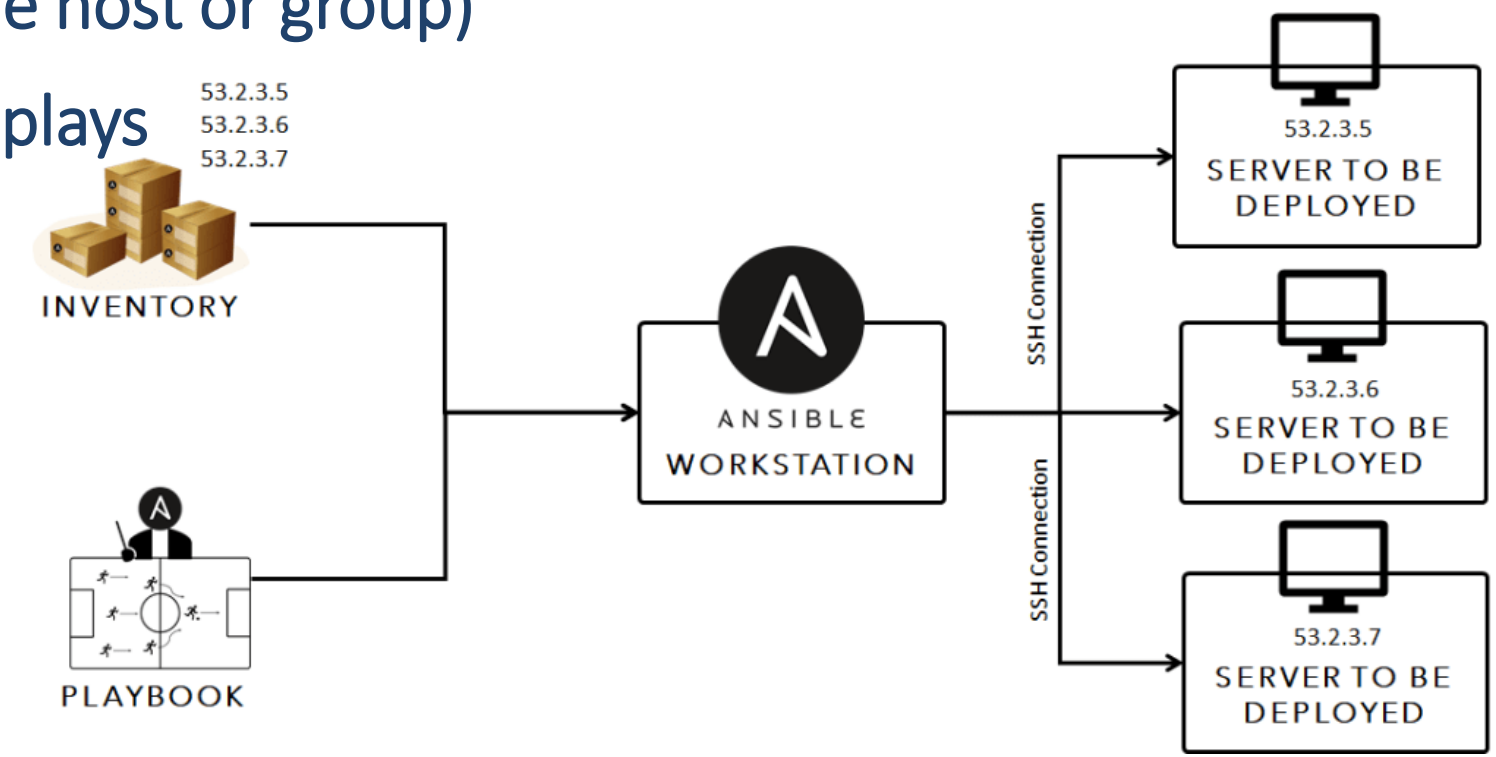
- Group name
- Group variables
- Host/node adress
- Common variable(s)
- No indentaion

```
[all.children.dbservers.hosts.host1]
ansible_host=172.16.1.30

[all.children.loadbalancers.hosts.host1]
ansible_host=172.16.1.31

[all.children.vars]
ansible_user=USER
ansible_password=PASSW
ansible_connection=ssh

[all.hosts.controlhosts.controlnode1]
ansible_host=172.16.1.5

[all.vars]
ansible_port=22
```


4. Playbooks, plays and tasks

Playbooks

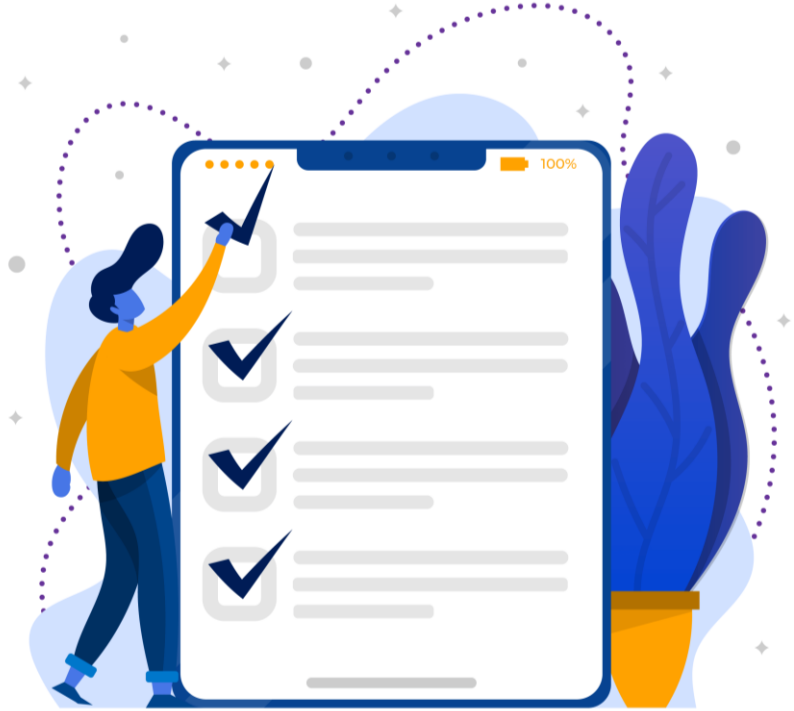
- Highest order of hirarchy
- Basically, list of plays
- Comparable to organized script
- Run against host (single host or group)
- Contains one or more plays



Plays

- Falls under playbook in hirarchy
- Environment specific parameters (e.g., host OS)
- Mapping between hosts using group or host name (correlates with inventory)
- No such thing as a standard play
- Contains one or more tasks

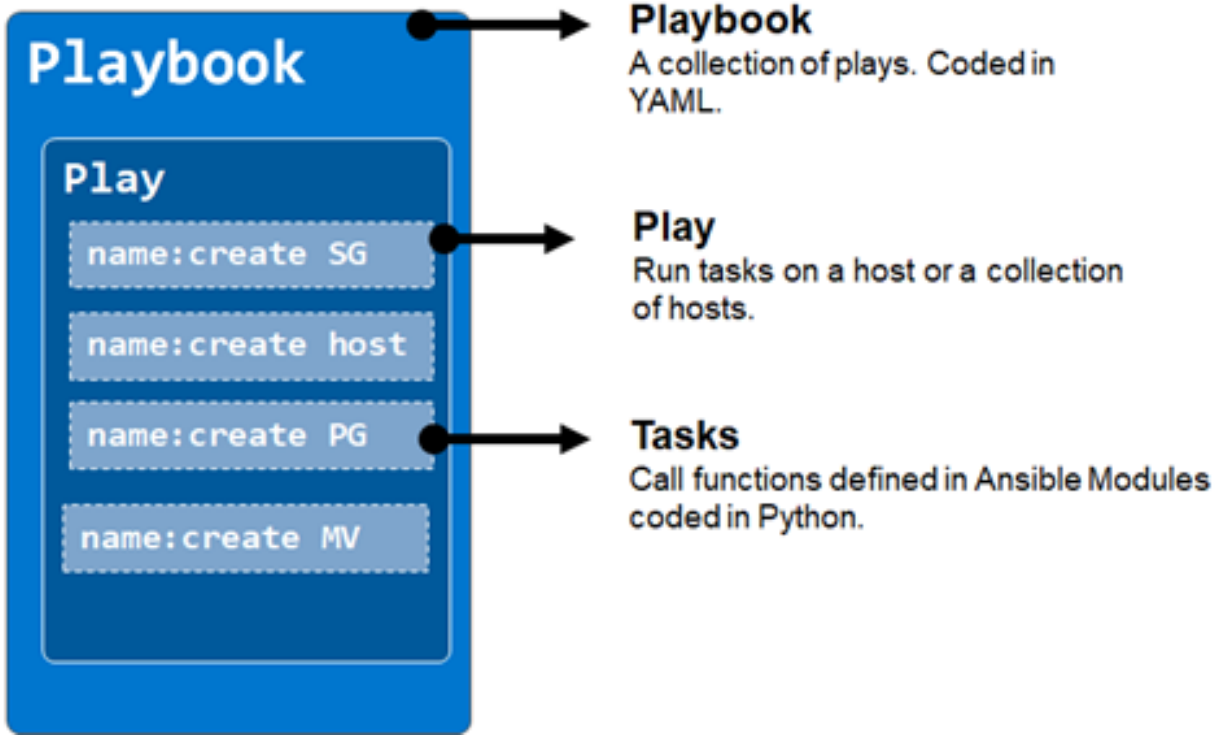
Tasks



- Falls under play in hirarchy
- Smallest unit of action
- Executed same order as defined in playbook
- Pushes small modules to target node
- A task that runs on host define role that host fulfills/performs

Playbook overview

Ansible Playbook Structure



5. Roles and handlers

Roles

- Hold specific parameters/variables for group of hosts
- Separates and organizes groups
- Defined in a play

```yaml
---
- name: Deploy web-server
  hosts:
    web-servers
  become: true
  roles:
    - wordpress-prod
```

(common)

```
ansible-project/              (root folder)
├── group_vars/               (dir)
├── host_vars/                (dir)
├── roles/                    (dir)
│   └──common/                (dir example role)
│       ├──tasks/             (dir)
│       │   └──main.yml
│       ├──handlers/          (dir)
│       │   └──main.yml
│       ├──templates/         (dir)
│       │   └──conf.j2
│       ├──files/             (dir)
│       │   └──voorbeeld.txt
│       ├──vars/              (dir)
│       │   └──main.yml
│       ├──defaults/          (dir)
│       │   └──main.yml
│       ├──meta/              (dir)
│       │   └──main.yml
│       ├──library/           (dir)
│       ├──module_utils/      (dir)
│       └──lookup_plugins/    (dir)
│
├── ansible.cfg               (ansible config file)
├── hosts                     (inventory/config file)
└── playbooks                 (playbook file(s))
```

Handlers

- Comparable to function/methods in programming
- Only gets called when needed
- Call handler with "`notify: arguement`"
- Mostly used for system/service restart


```
- name: Write the apache config file
    ansible.builtin.template:
      src: /srv/httpd.j2
      dest: /etc/httpd.conf
    notify:
    - Restart apache
```

6. Plugins and modules

Modules

- Keywords defined in task (calls Ansible API)
- Reusable standalone scripts and execute on target node
- Can take arguments
- Displays json output after run
- Interacts with target node

```
- name: show run
  ios_command:
    commands:
      - show running-config
  register: config
```


Plugins

- Pieces of code that add to core functionality of Ansible
- Complementary to module
- Types of plugins:
  - Lookup plugins (pull data from source and returns to Ansible)
  - Caching plugins (store gathered facts for later use - e.g., Json file)
  - Action (performs prerequisite work, and runs part on ctrl-node)
  - Shell (Ensures basic commands are run properly by Ansible)
  - ...

7. Intallation

Ansible Installation

1. Update/upgrade the machine:

```
sudo apt-get update && upgrade -y
```

2. Pull Ansible repository:

```
sudo apt-add-repository ppa:ansible/Ansible
```

3. Install python:

```
sudo apt-get install python3 -y
```

4. Install Ansible:

```
sudo apt-get install ansible -y
```

```
student@ansible-ctrl-node:~$ python3 --version
Python 3.8.10
student@ansible-ctrl-node:~$ ansible --version
ansible 2.9.6
  config file = /etc/ansible/ansible.cfg
  configured module search path = ['/home/student/.ansible/plugins/modules', '/usr/share/ansible/plugins/modules']
  ansible python module location = /usr/lib/python3/dist-packages/ansible
  executable location = /usr/bin/ansible
  python version = 3.8.10 (default, Nov 26 2021, 20:14:08) [GCC 9.3.0]
student@ansible-ctrl-node:~$
```


8. File encryption

Encrypting existing files

- For when file contains sensitive data
- Command: `ansible-vault encrypt filename`

```
student@ansible-ctrl-node:~/ansible-demo/roles/core-switch/vars$ ls
main.yml
student@ansible-ctrl-node:~/ansible-demo/roles/core-switch/vars$ cat main.yml
---
PASSWD: Azerty123
student@ansible-ctrl-node:~/ansible-demo/roles/core-switch/vars$ ansible-vault encrypt main.yml
New Vault password:
Confirm New Vault password:
Encryption successful
```

```
student@ansible-ctrl-node:~/ansible-demo/roles/core-switch/vars$ cat main.yml
$ANSIBLE_VAULT;1.1;AES256
65376463356130313038353866323963613336393032636364366633262623763303730663563656
39613635653539636665316362363364386461353962313 00a6636396161643432353536303766363
39326131383361663461633938353863636633633736663966363265623964363866303763663461
30646135336431306 60a32376635313235613434653165633330353436653730306661383536393 7
66306662646535333730623530306463376437306565656638366434626432626135
```

Run playbook with encrypted files

- Command: `ansible-playbook playbook.yml --verbose --ask-vault-pass`

```
student@ansible-ctrl-node:~/ansible-demo$ ansible-playbook playbook.yml --verbose --ask-vault-pass
Using /home/student/ansible-demo/ansible.cfg as config file
Vault password:

PLAY [Start configuring core networking devices] ********************************************************

TASK [core-switch : Retrieve current switch configuration - SW1] ****************************************
ok: [switch1] => changed=false
  ansible_facts:
    discovered_interpreter_python: /usr/bin/python3
```


Decrypting files

- Command: `ansible-vault decrypt filename`
- No more vault password needed when running playbook

```
student@ansible-ctrl-node:~/ansible-demo/roles/core-switch/vars$ ansible-vault decrypt main.yml
Vault password:
Decryption successful
student@ansible-ctrl-node:~/ansible-demo/roles/core-switch/vars$ cat main.yml
---
PASSWD: Azerty123
```


9. Authentication

Passwordless authentication

- Prevents repeatadly manual login at run time
- Makes playbook execution seamless

1. Create an SSH-key: “ssh-keygen -t -rsa”
2. Copy the public key to remote machine:

   “`ssh-copy-id -i ~/.ssh/id_rsa.pub user@nodeIP`”

3. Connect to machine (no login password should be required).

10. Template(s)

What is a template

- Any kind of file
- Script/configuration files with dynamic variables

Task (call template file and specify dest):

```yaml
- name: Call template example
  template:
    src: example_template.j2
    dest: /home/student/template-output.txt
```

Variables defined for host/role:

roles > core-switch > vars > ! main.yml

```yaml
---
PASSWD: [redacted]
var1: variables
var2: dynamically

my_list: ['Item1: This is','Item2: ansible','Item3: templates']
```

Template (calls defined variables):

roles > core-switch > templates > example_template.j2

```
Here is an example of a template.
The {{ var1 }} are defined {{ var2 }}.

{% for text in my_list %}
    {{ text }}
{% endfor %}
```

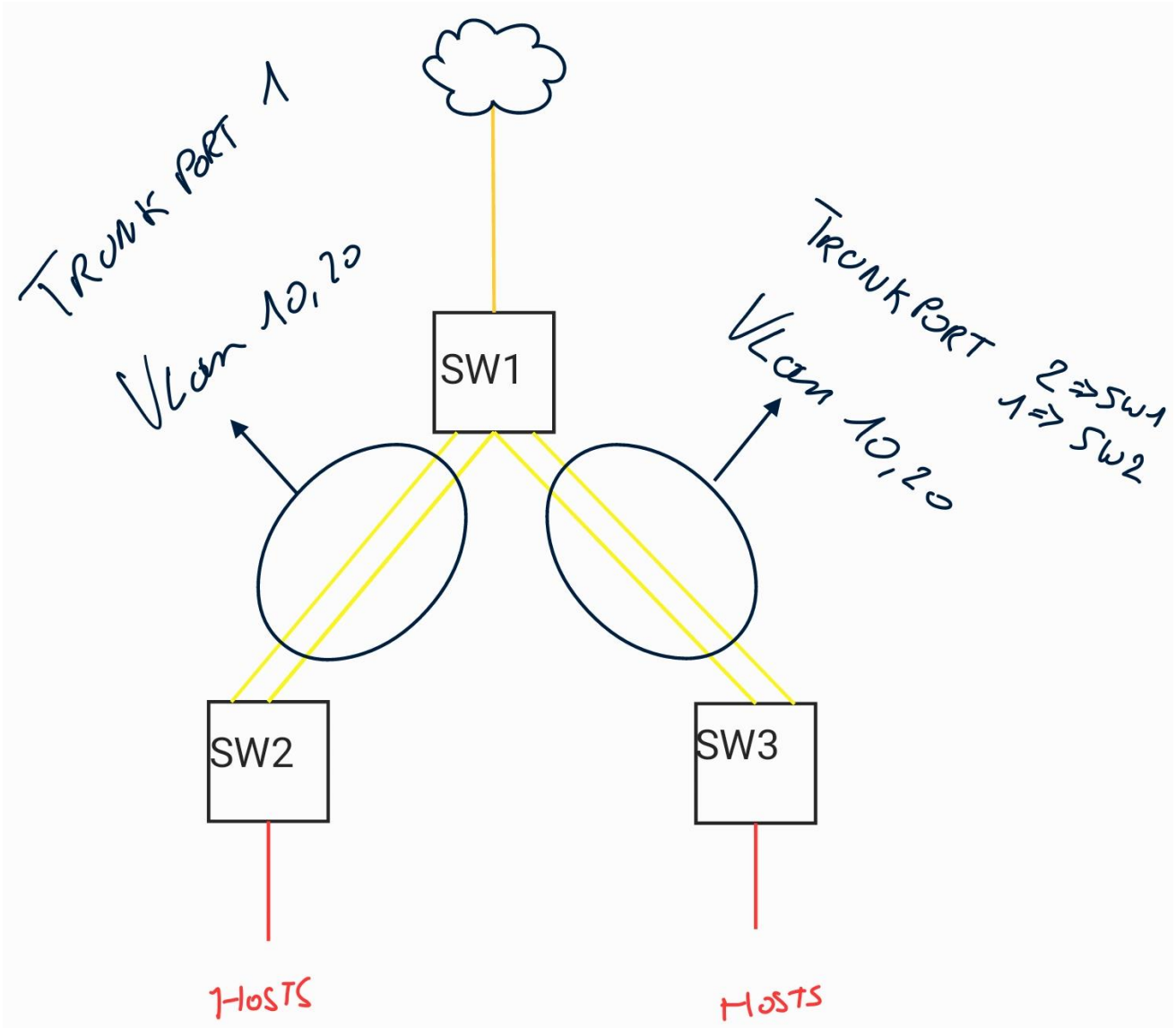
Properties of template output file during play execution:

```
TASK [core-switch : Call template example] ********************************************************************************
changed: [switch1] => changed=true
  checksum: 0d72f6a8b0c4b2895989f9af031afb7978e3f4b6
  dest: /home/student/template-output.txt
  gid: 1000
  group: student
  md5sum: d7fdec3b76e3b0d6349f8d66904df3b8
  mode: '0664'
  owner: student
  size: 73
  src: /home/student/.ansible/tmp/ansible-local-324515k2vu977/ansible-tmp-1644842744.8323867-169419845506940/source
  state: file
  uid: 1000
```

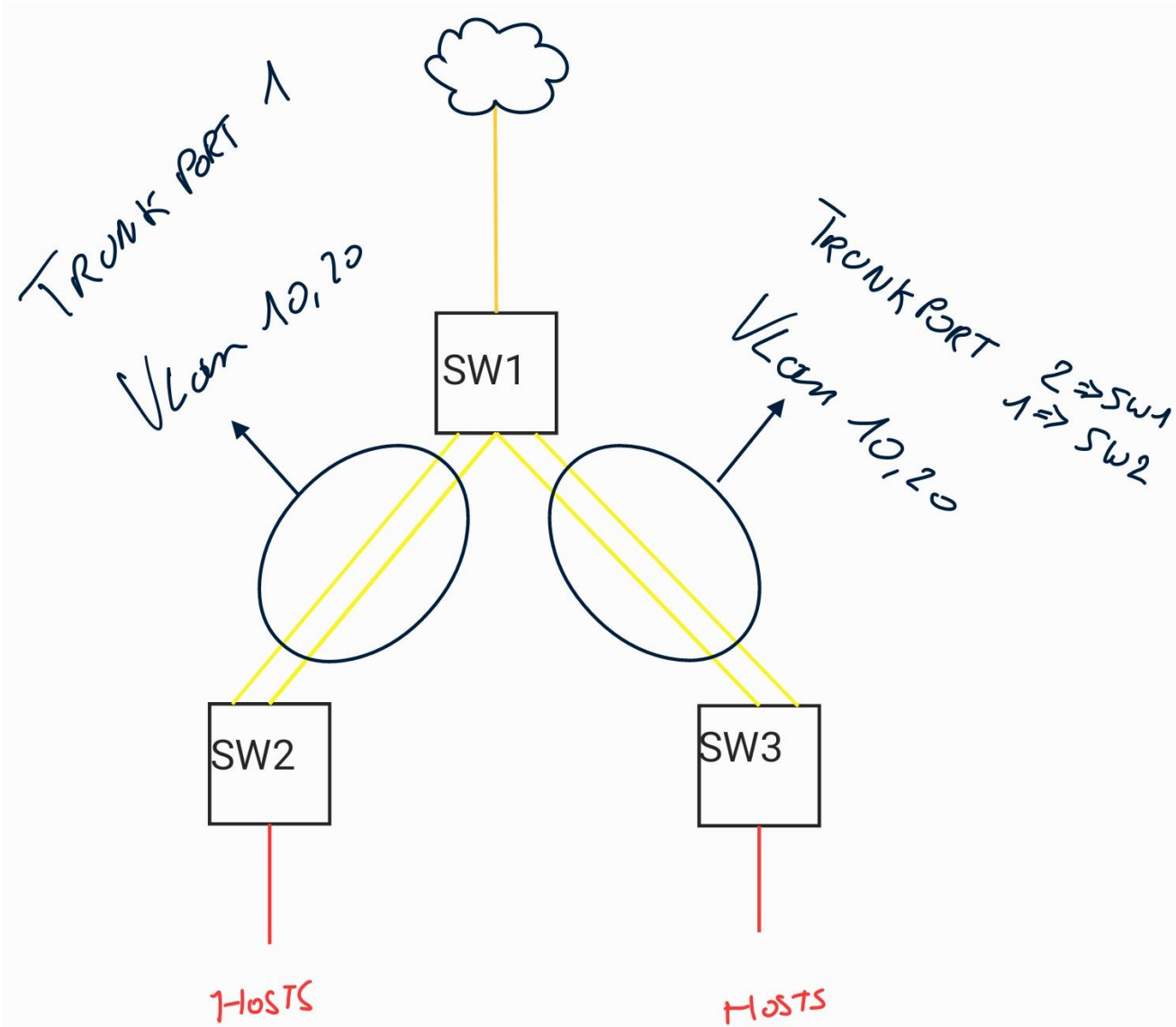
11. Demo

Topology

- Purpose of playbook
  - Check starting configuration
  - Setup LAG on switches
  - Add vlan's (10,20)
  - Check changes



Purpose of playbook



How are devices called upon

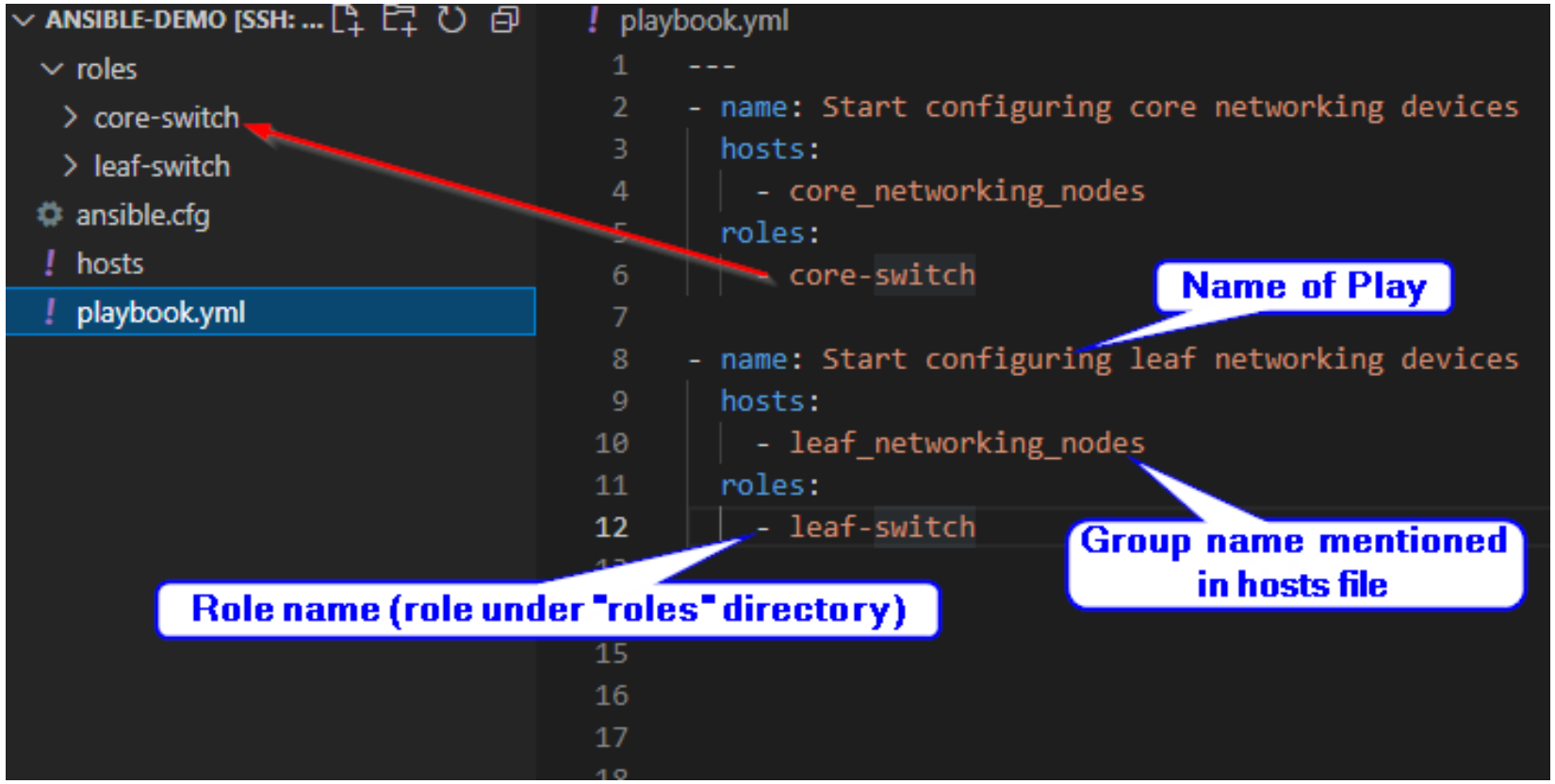
- With use of the file/inventory file
  - Host-ID's are for individual plays/tasks
  - Group name's are for common plays
  - Variables are for groups or individual hosts (caution for spacing!)

Connect hosts/groups to roles

- Roles/groups are linked to each other in the playbook
- Roles are linked to a group or host

(Which roles are specified under specific group are own choice)

- Playbook can have different name than “playbook”



Tasks and used modules

core-switch > tasks > ! main.yml

```yaml
---
- name: Retrieve current switch configuration - SW1
  ce_command:
    commands:
      - display current-configuration
  register: output
```

Save config in "output" var

```yaml
- debug:
    var: output
```

Debug module prints output to console

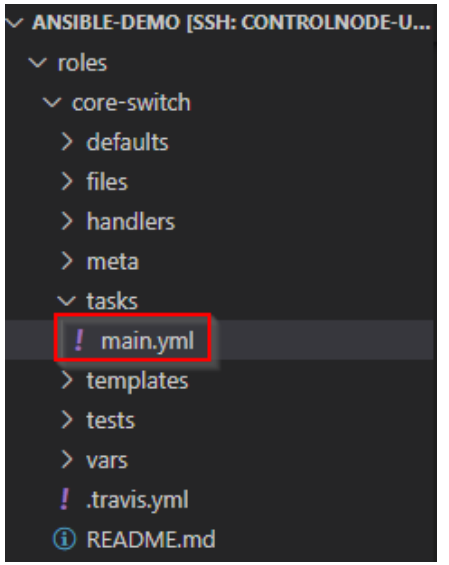
```yaml
- name: Create ethernet trunk 1/2 - SW1
  ce_command:
    commands:
      - system-view
      - interface eth-trunk 1
      - undo shutdown
      - quit
      - interface eth-trunk 2
      - undo shutdown
      - quit
```

```yaml
- name: Add interfaces to ethernet trunk 1/2 - SW1
  ce_command:
    commands:
      - system-view
      - interface gigabitethernet 1/0/3
      - eth-trunk 1
      - undo shutdown
      - quit
      - interface gigabitethernet 1/0/4
      - eth-trunk 1
      - undo shutdown
      - quit
      - interface gigabitethernet 1/0/5
      - eth-trunk 2
      - undo shutdown
      - quit
      - interface gigabitethernet 1/0/6
      - eth-trunk 2
      - undo shutdown
      - quit
```

Module to execute command on device itself

```yaml
- name: Create vlans 10, 20 and add to trunk interface 1/2 - SW1
  ce_command:
    commands:
      - system-view
      - vlan batch 10 20
      - interface eth-trunk 1
      - port link-type trunk
      - port trunk allow-pass vlan 10 20
      - vlan batch 10 20
      - interface eth-trunk 2
      - port link-type trunk
      - port trunk allow-pass vlan 10 20
      - quit
```

Specific module for networking devices



Not in playbook.yml but in task/main.yml

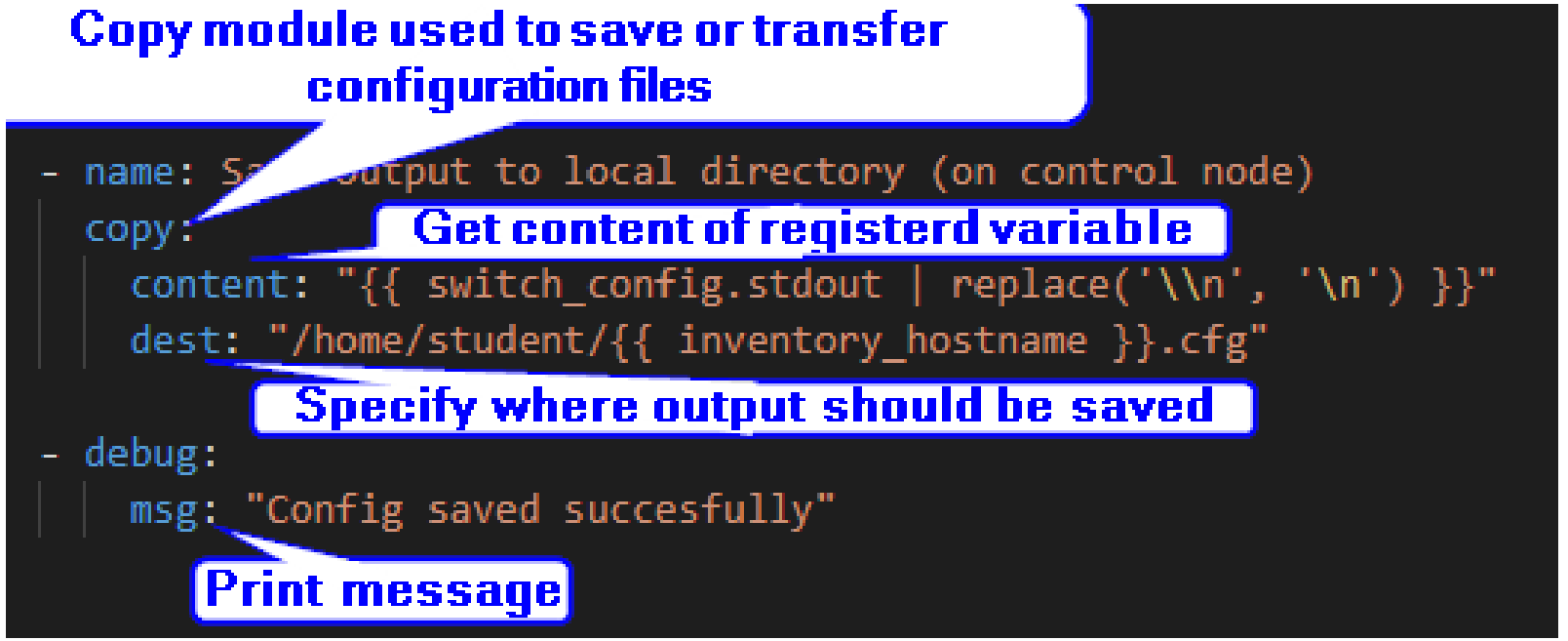
```yaml
- name: Display updated configuration (trunk ports) - SW1
  ce_command:
    commands:
      - display eth-trunk
  register: output

- debug:
    var: output
```

Task name

```yaml
- debug: "{{ output }}"
```

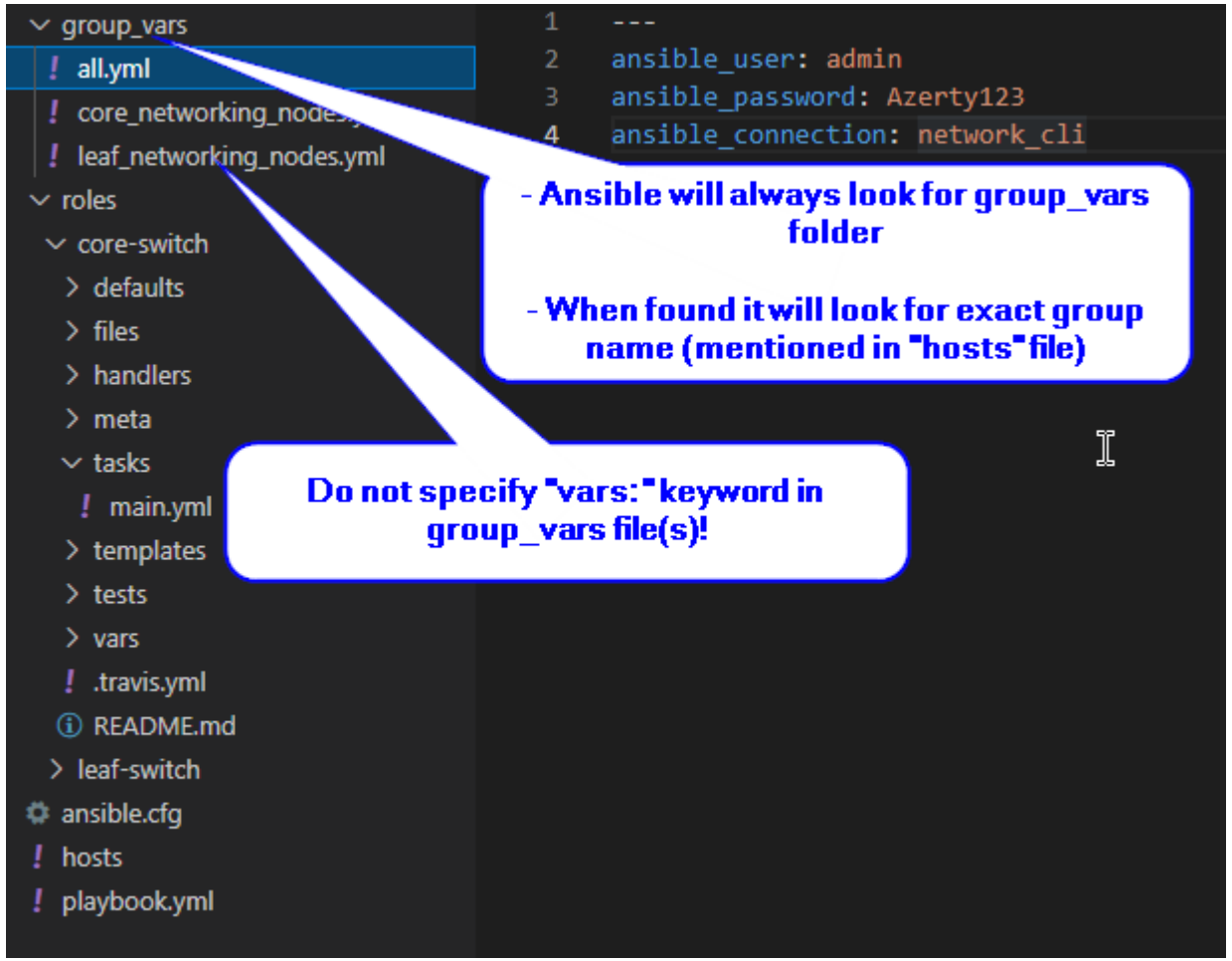
Alternative variable call

Tasks and used modules



Group/role specific variables

- Can be defined:
  - Under same group-indent (in hosts file) with “vars” keyword
  - Under vars/main.yml of role in “roles” directory
  - Under group_vars directory



Run playbook

- Start playbook with "`ansible-playbook plabookName.yml`"
- Add "`--check-syntax`" to check playbook for syntax errors
- Add "`--verbose`" to view live output when playbook runs (more for debugging)
- Play recap shows quick overview of run playbook:

```
PLAY RECAP *********************************************************************************************************
switch1                    : ok=9    changed=1    unreachable=0    failed=0    skipped=0    rescued=0    ignored=0
switch2                    : ok=9    changed=1    unreachable=0    failed=0    skipped=0    rescued=0    ignored=0
switch3                    : ok=9    changed=1    unreachable=0    failed=0    skipped=0    rescued=0    ignored=0
```

- Play recap of legend:
  - Yellow = something changed (saved file in this case)
  - Green = everything is OK no errors occurred
  - Red = an error occurred (play stops once error occurs):

```
student@ansible-ctrl-node:~/ansible-demo$ ansible-playbook playbook.yml
ERROR! conflicting action statements: debug, msg

The error appears to be in '/home/student/ansible-demo/roles/core-switch
be elsewhere in the file depending on the exact syntax problem.

The offending line appears to be:

                    Caused by indentation error at "msg" under "debug"
- debug:
  ^ here
```

Refferences

- See Ansible paper:

https://www.newupdate.be/wp-content/uploads/2021/11/PaperAnsible_gerritvanmol.pdf