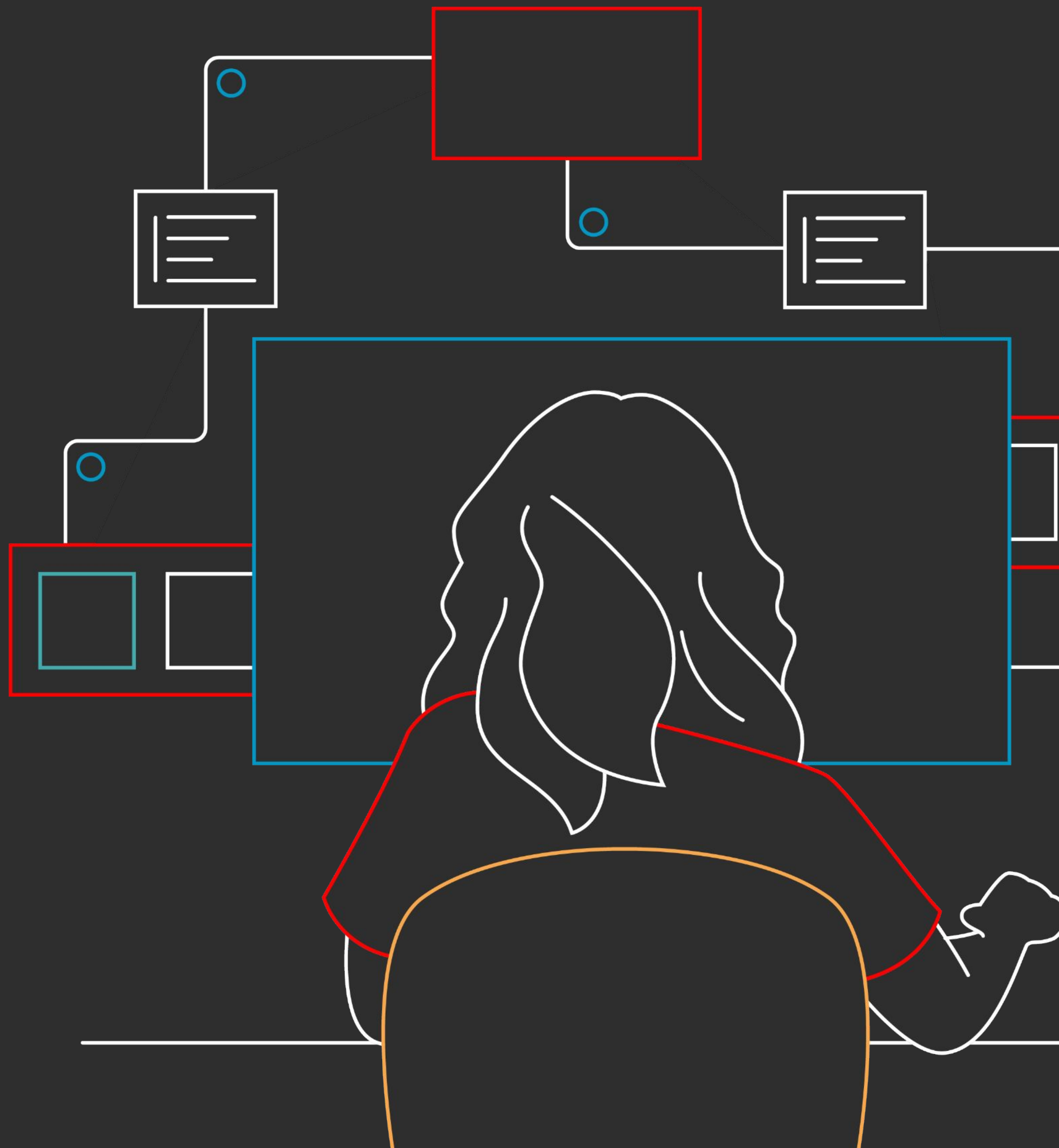
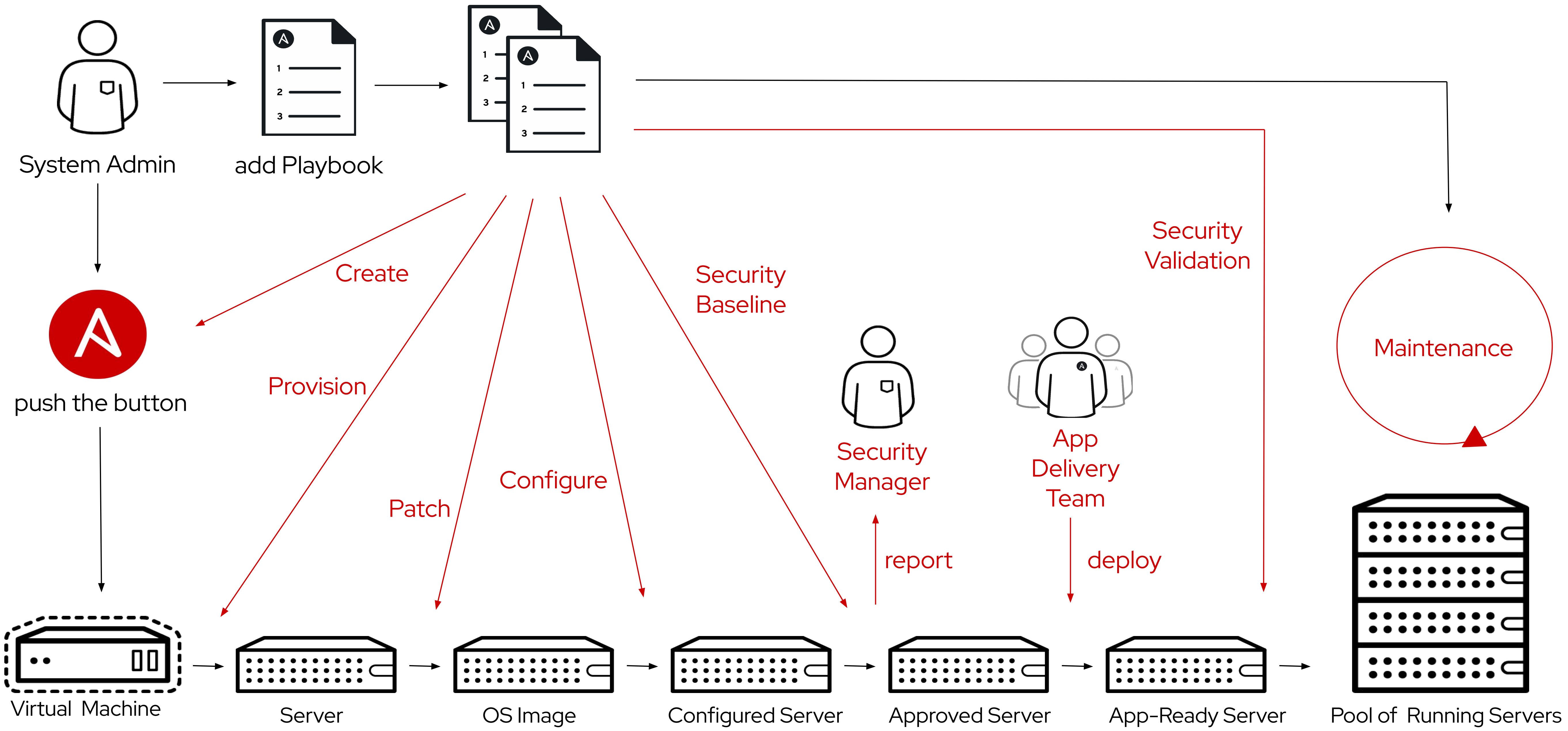
Automating SAP Deployments with Ansible

Describing Ansible Concepts

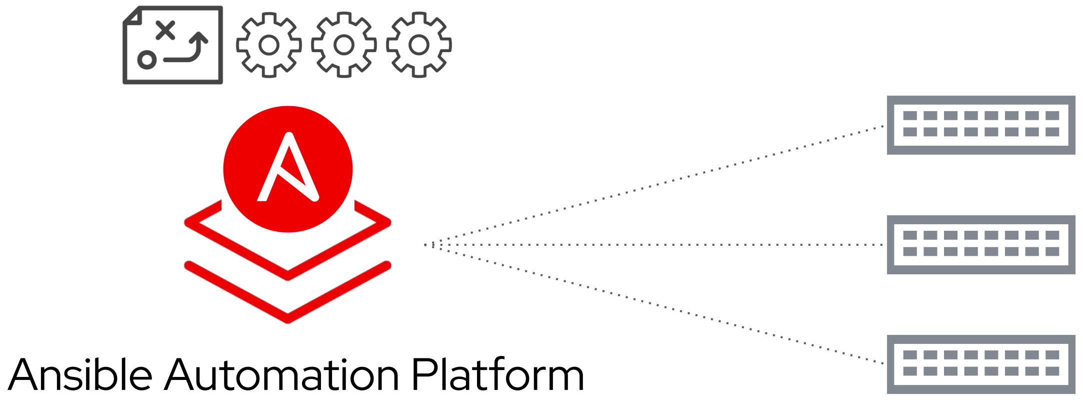


Nothing routinary should be done manually



Source:
Insert source data here
Insert source data here
Insert source data here

Control Node and Execution Environment



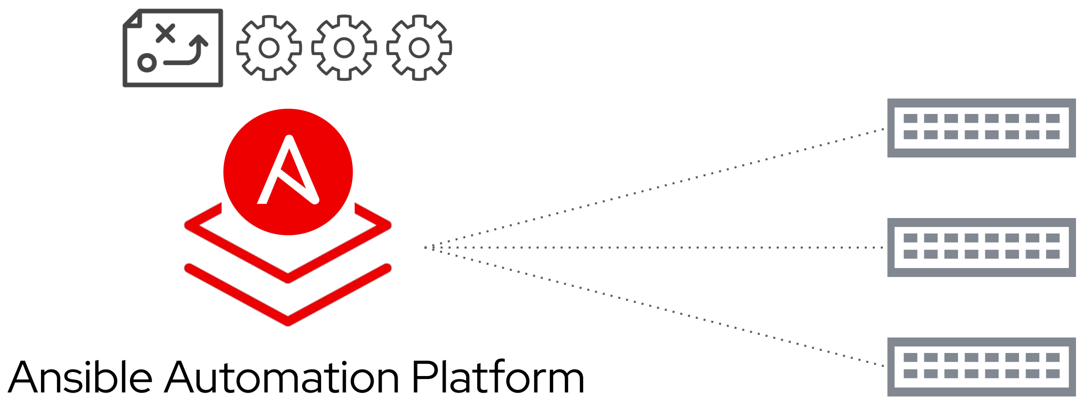
Control Node: host where automation content is stored

Execution Environment: container, that runs (executes) a playbook

configuration: ansible.cfg - ini style file for configuration of Ansible beahviour

How Ansible Automation Works

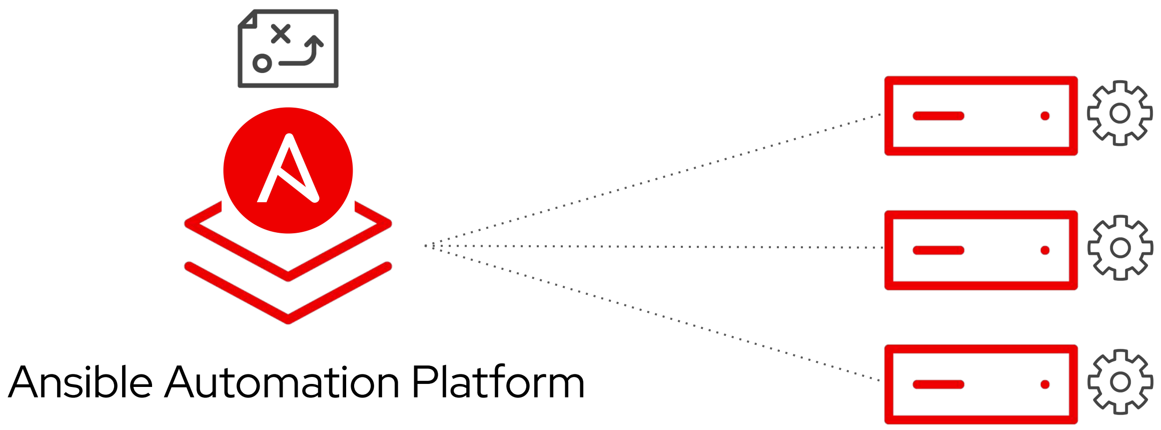
Module code is executed locally on the control node


Ansible Automation Platform

Local Execution

Network Devices / API Endpoints

Module code is copied to the managed node, executed, then removed


Ansible Automation Platform

Remote Execution

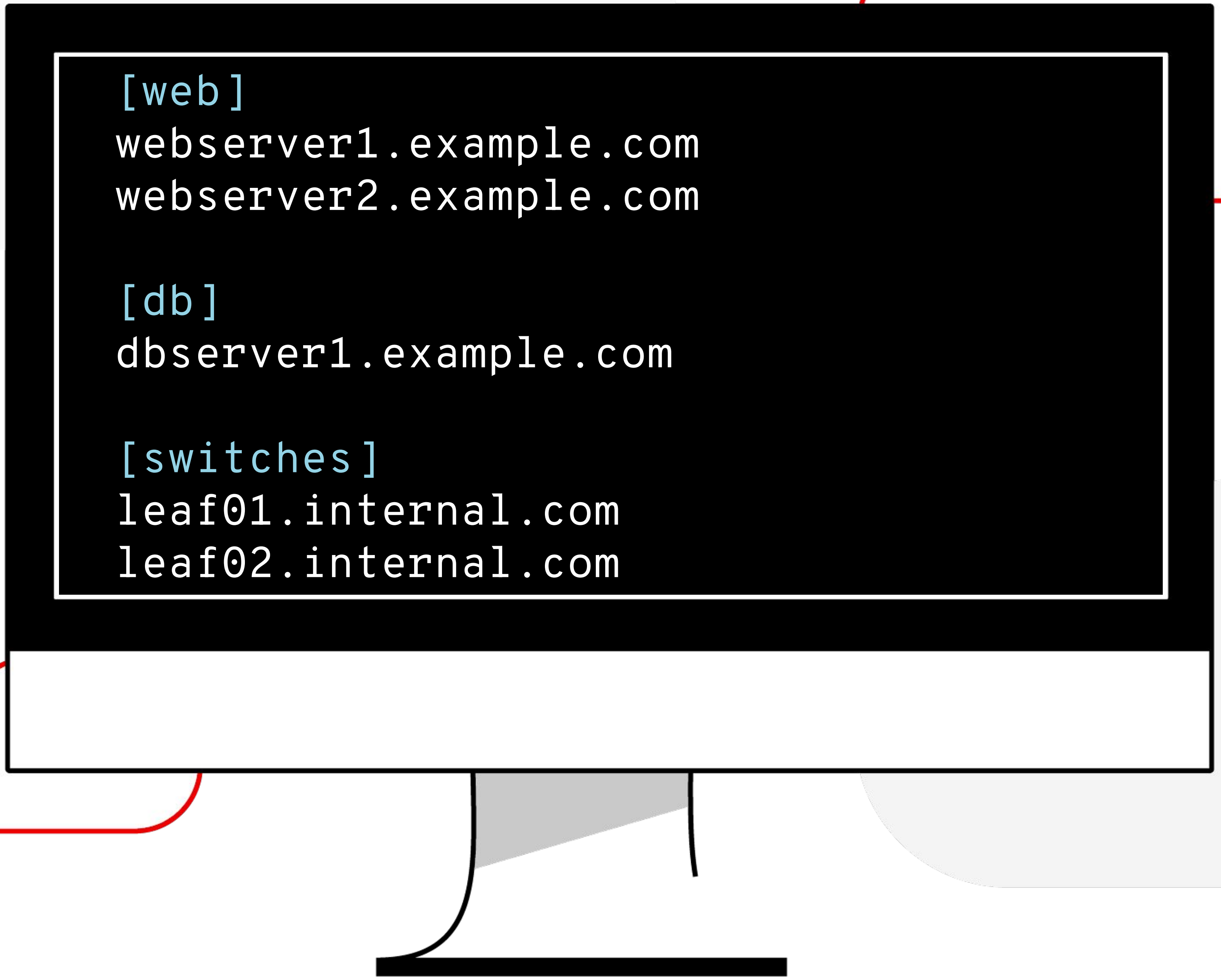
Linux / Windows Hosts

Ansible Inventory

The systems that a playbook runs against

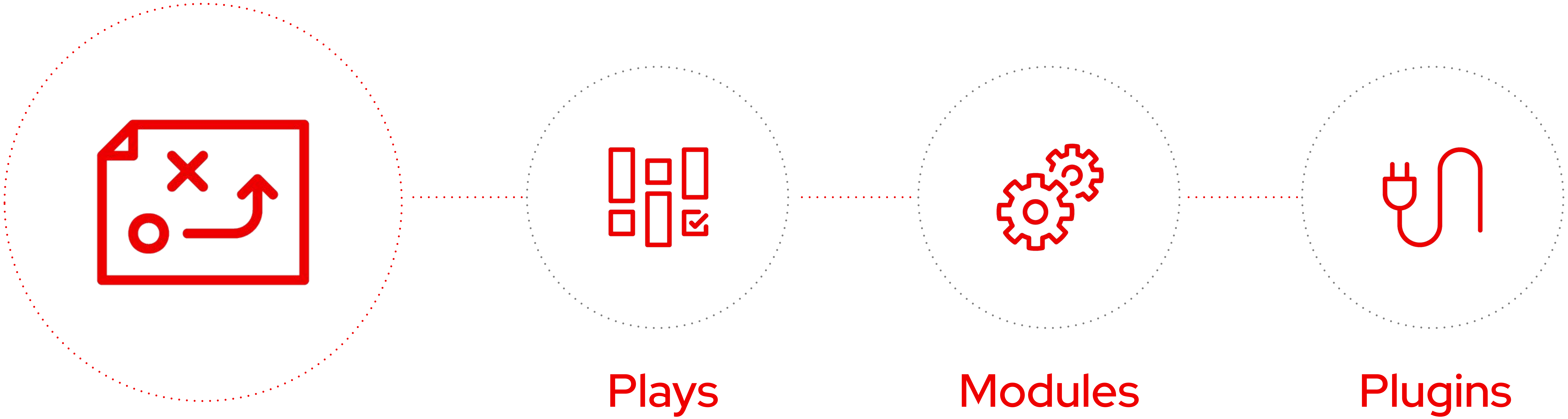
What are they?

List of systems in your infrastructure that automation is executed against



```
[web]
webserver1.example.com
webserver2.example.com

[db]
dbserver1.example.com

[switches]
leaf01.internal.com
leaf02.internal.com
```

What makes up an Ansible playbook?



Plays

Modules

Plugins

Ansible plays

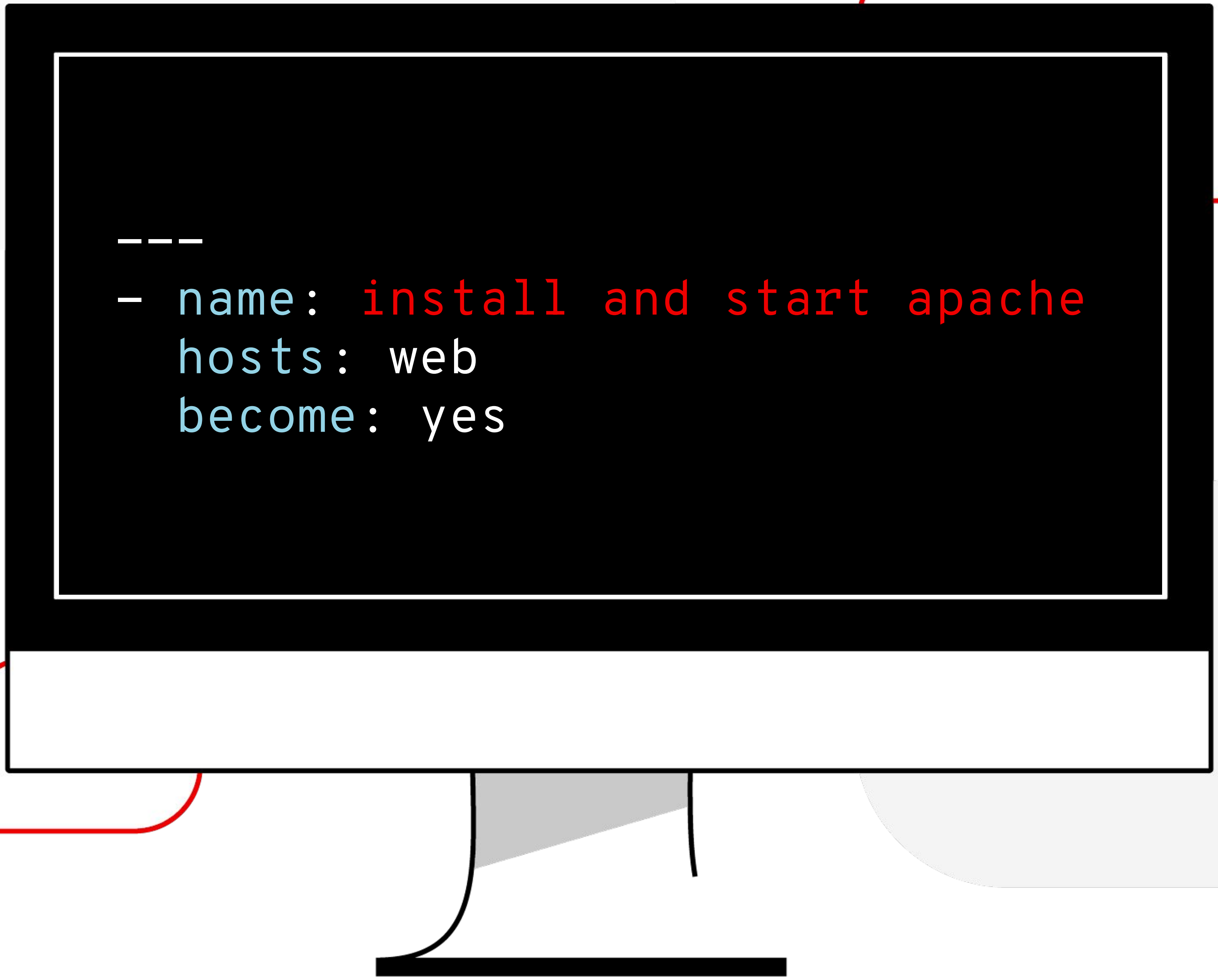
What am I automating?

What are they?

Top level specification for a group of tasks. Will tell that play which hosts it will execute on and control behavior such as fact gathering or privilege level.

Building blocks for playbooks

Multiple plays can exist within an Ansible playbook that execute on different hosts.



```
---
- name: install and start apache
  hosts: web
  become: yes
```

Ansible playbooks

A play

```
---
- name: install and start apache
  hosts: web
  become: yes

  tasks:
    - name: httpd package is present
      yum:
       name: httpd
       state: latest

    - name: latest index.html file is present
      template:
        src: files/index.html
        dest: /var/www/html/

    - name: httpd is started
      service:
        name: httpd
        state: started
```

Ansible playbooks

A task

```
---
- name: install and start apache
  hosts: web
  become: yes

  tasks:
    - name: httpd package is present
      yum:
        name: httpd
        state: latest

    - name: latest index.html file is present
      template:
        src: files/index.html
        dest: /var/www/html/

    - name: httpd is started
      service:
        name: httpd
        state: started
```

Ansible playbooks

A module →

```
---
- name: install and start apache
  hosts: web
  become: yes

  tasks:
    - name: httpd package is present
      yum:
       name: httpd
       state: latest

    - name: latest index.html file is present
      template:
        src: files/index.html
        dest: /var/www/html/

    - name: httpd is started
      service:
        name: httpd
        state: started
```

Ansible Colors

Running Playbooks

The most important colors of Ansible

```
A task executed as expected, no change was made.

A task executed as expected, making a change

A task failed to execute successfully
```

Ansible modules

The “tools in the toolkit”

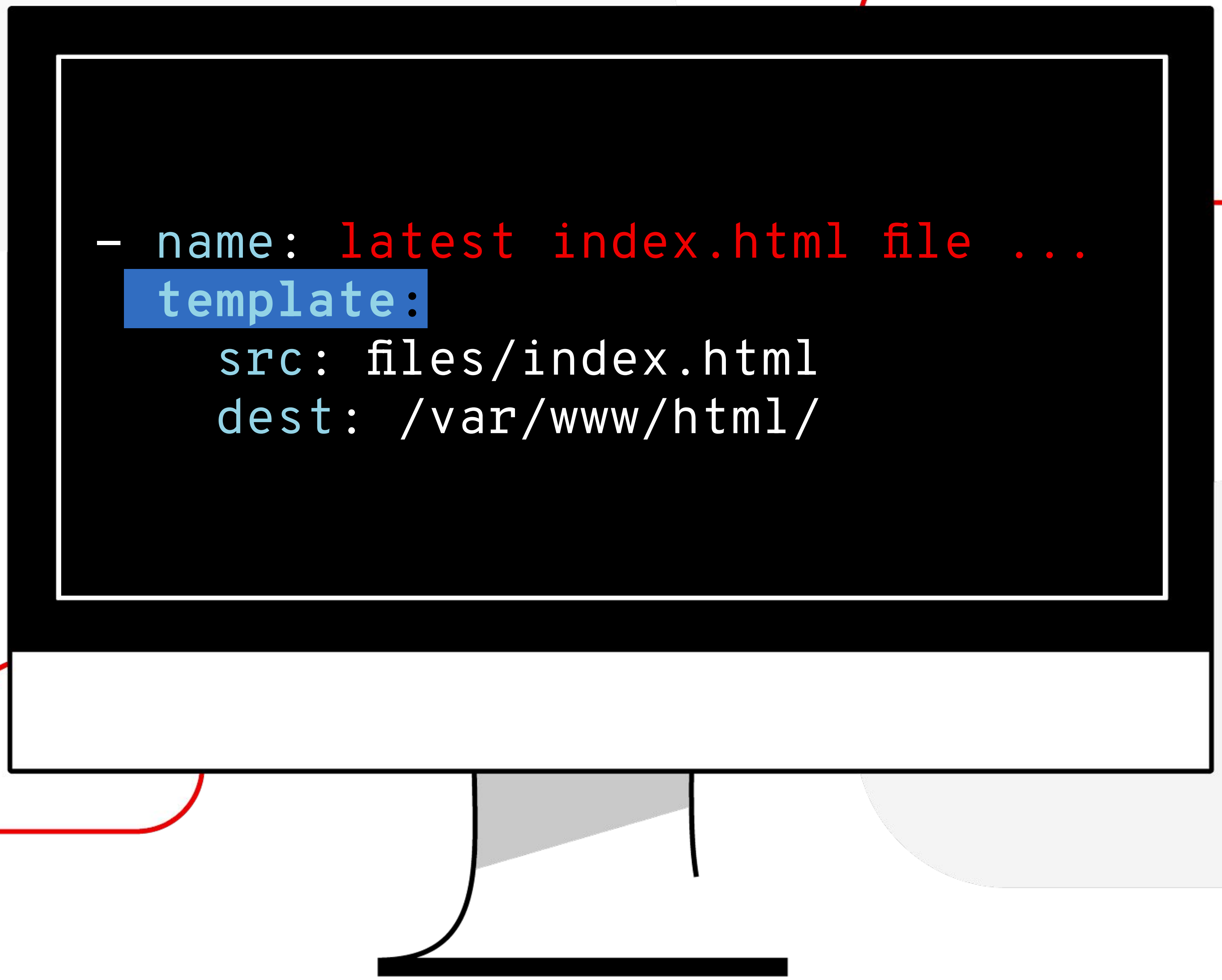
What are they?

Parametrized components with internal logic, representing a single step to be done.

The modules “do” things in Ansible.

Language

Usually Python, or Powershell for Windows setups. But can be of any language.



```
- name: latest index.html file ...
  template:
    src: files/index.html
    dest: /var/www/html/
```

Ansible playbooks

```yaml
---
- name: variable playbook test
  hosts: localhost

  vars:
    var_one: awesome
    var_two: ansible is
    var_three: "{{ var_two }} {{ var_one }}"

  tasks:
    - name: print out var_three
      debug:
        msg: "{{ var_three }}"
```

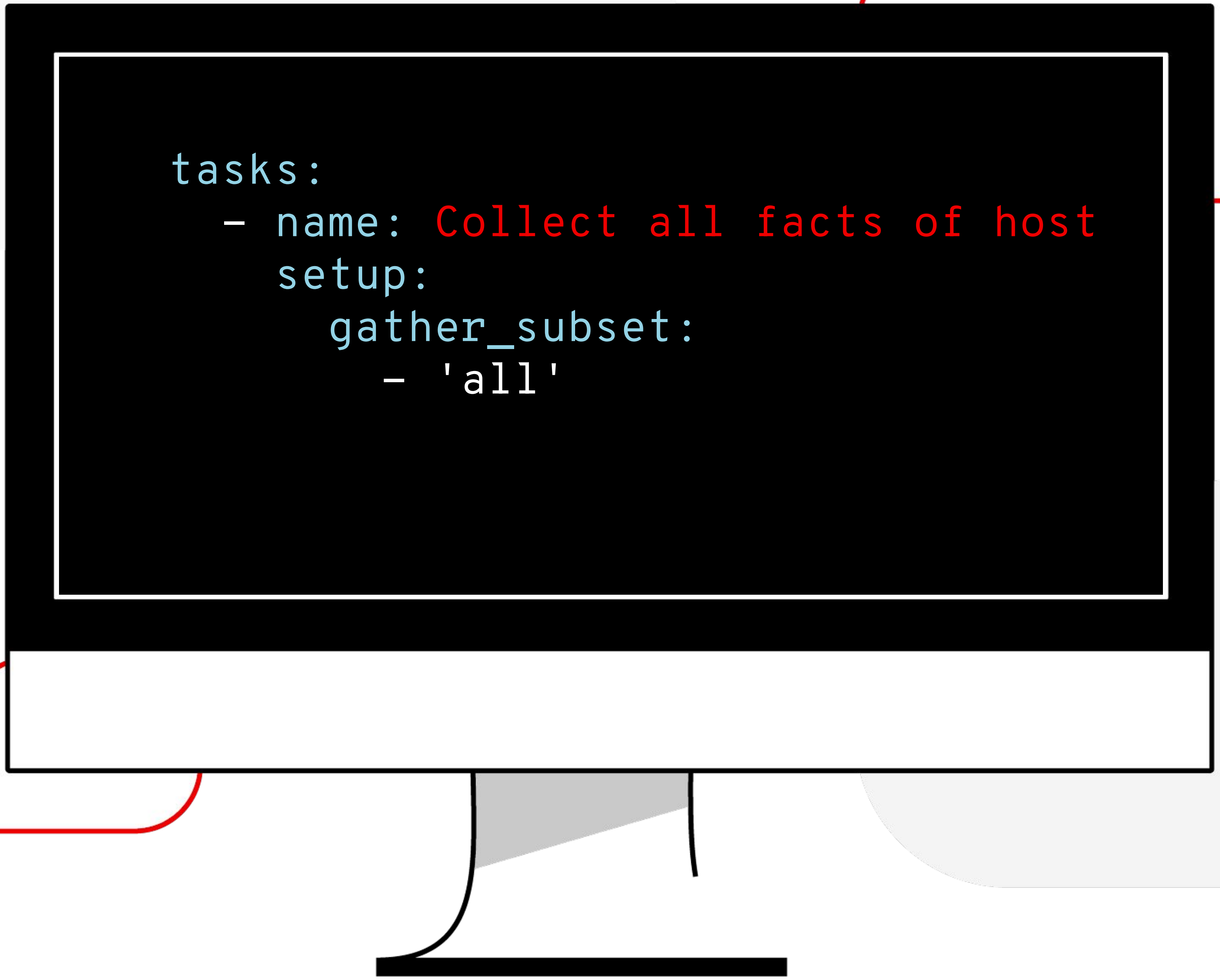
Ansible playbooks

```
---
- name: variable playbook test
  hosts: localhost

  vars:
    var_one: awesome
    var_two: ansible is
    var_three: "{{ var_two }} {{ var_one }}"

  tasks:
    - name: print out var_three
      debug:
        msg: "{{ var_three }}"
```

ansible is awesome

Ansible Facts

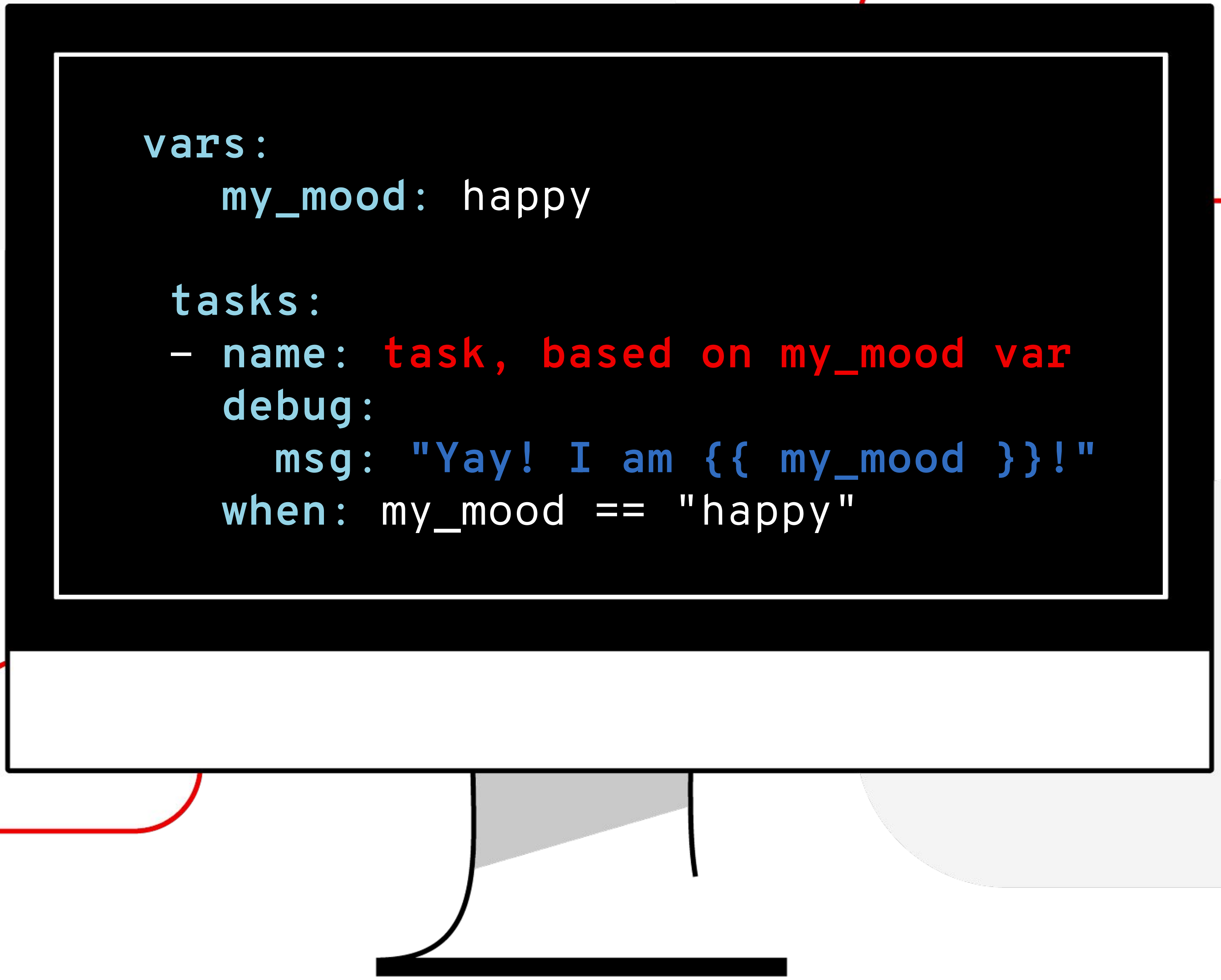
- Just like variables, really…
- … but: coming from the host itself!
- Check them out with the setup module



```
tasks:
  - name: Collect all facts of host
    setup:
      gather_subset:
        - 'all'
```

Conditionals via VARS

Example of using a variable labeled *my_mood* and using it as a conditional on a particular task.



```
vars:
   my_mood: happy

 tasks:
 - name: task, based on my_mood var
   debug:
     msg: "Yay! I am {{ my_mood }}!"
   when: my_mood == "happy"
```

Ansible Conditionals

```
---
- name: variable playbook test
  hosts: localhost

  vars:
    my_mood: happy

  tasks:
    - name: task, based on my_mood var
      debug:
        msg: "Yay! I am {{ my_mood }}!"
      when: my_mood == "happy"
```

Alternatively

```
    - name: task, based on my_mood var
      debug:
        msg: "Ask at your own risk. I’m {{ my_mood
}}!"
      when: my_mood == "grumpy"
```

Ansible Conditionals w/ Facts

```
---
- name: variable playbook test
  hosts: localhost

  tasks:
  - name: Install httpd
    yum:
      name: httpd
      state: latest
    when: ansible_distribution == 'RedHat'

  - name: Install apache
    apt:
      name: apache2
      state: latest
    when: ansible_distribution == 'Debian' or
          ansible_distribution == 'Ubuntu'
```

Using Previous Task State

```
---
- name: variable playbook test
  hosts: localhost

  tasks:
  - name: Ensure httpd package is present
    yum:
      name: httpd
      state: latest
    register: httpd_results

  - name: Restart httpd
    service:
      name: httpd
      state: restarted
    when: httpd_results.changed
```

Ansible Handler Tasks

```
---
- name: variable playbook test
  hosts: localhost

  tasks:
  - name: Ensure httpd package is present
    yum:
      name: httpd
      state: latest
  notify: restart_httpd

  handlers:
  - name: restart_httpd
    service:
      name: httpd
      state: restarted
```

Ansible Handler Tasks

```
tasks:
- name: Ensure httpd package is present
  yum:
    name: httpd
    state: latest
  notify: restart_httpd

- name: Standardized index.html file
  copy:
    content: "This is my index.html file for {{ ansible_host }}"
    dest: /var/www/html/index.html
  notify: restart_httpd
```

If **either** task notifies a **changed** result, the handler will be notified **ONCE**.

```
TASK [Ensure httpd package is present] ******************************************************
ok: [web2]
ok: [web1]
```

unchanged

```
TASK [Standardized index.html file] *********************************************************
changed: [web2]
changed: [web1]
```

changed

```
NOTIFIED: [restart_httpd] *******************************************************************
changed: [web2]
changed: [web1]
```

handler runs once

Ansible Handler Tasks

```
tasks:
- name: Ensure httpd package is present
  yum:
    name: httpd
    state: latest
  notify: restart_httpd

- name: Standardized index.html file
  copy:
    content: "This is my index.html file for {{ ansible_host }}"
    dest: /var/www/html/index.html
  notify: restart_httpd
```

If **both** of these tasks notifies of a **changed** result, the handler will be notified **ONCE**.

```
TASK [Ensure httpd package is present] *****************************************************
changed: [web2]
changed: [web1]

TASK [Standardized index.html file] ********************************************************
changed: [web2]
changed: [web1]

NOTIFIED: [restart_httpd] ******************************************************************
changed: [web2]
changed: [web1]
```

changed

changed

handler runs once

Ansible Handler Tasks

```
tasks:
- name: Ensure httpd package is present
  yum:
    name: httpd
    state: latest
  notify: restart_httpd

- name: Standardized index.html file
  copy:
    content: "This is my index.html file for {{ ansible_host }}"
    dest: /var/www/html/index.html
  notify: restart_httpd
```

If **neither** task notifies a **changed** result, the handler ***does not run.***

```
TASK [Ensure httpd package is present] *****************************************************
ok: [web2]
ok: [web1]
```

unchanged

```
TASK [Standardized index.html file] ********************************************************
ok: [web2]
ok: [web1]
```

unchanged

```
PLAY RECAP *********************************************************************************
web2      : ok=2  changed=0  unreachable=0  failed=0  skipped=0  rescued=0 ignored=0
web1      : ok=2  changed=0  unreachable=0  failed=0  skipped=0  rescued=0 ignored=0
```

Ansible Variables & Loops

```yaml
---
- name: Ensure users
  hosts: node1
  become: yes

  tasks:
    - name: Ensure user is present
      user:
        name: dev_user
        state: present

    - name: Ensure user is present
      user:
        name: qa_user
        state: present

    - name: Ensure user is present
      user:
        name: prod_user
        state: present
```

Ansible Variables & Loops

```
---
- name: Ensure users
  hosts: node1
  become: yes

  tasks:
    - name: Ensure user is present
      user:
        name: “{{item}}”
        state: present
     loop:
       - dev_user
       - qa_user
       - prod_user
```

Variable Precedence

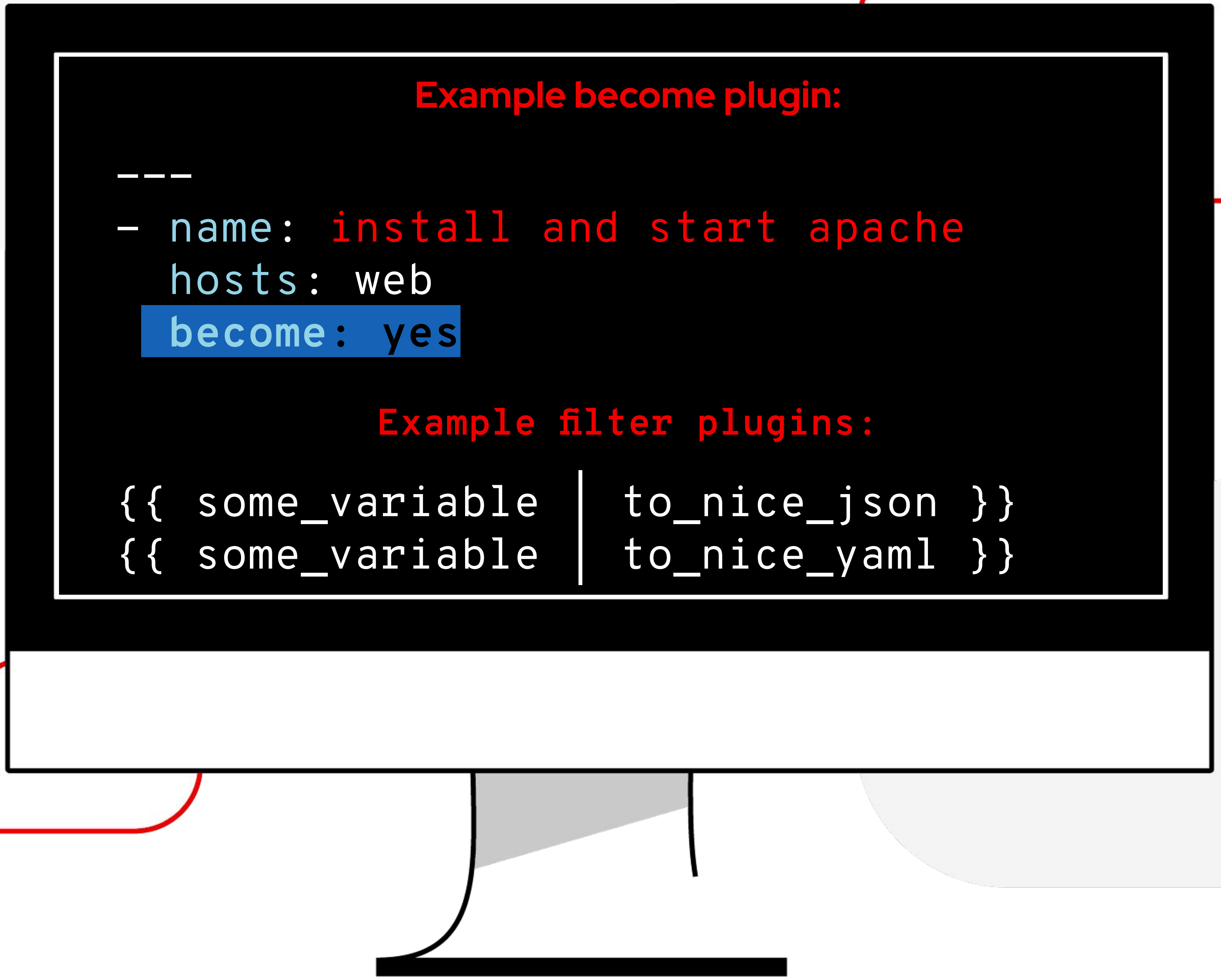
- role defaults (`roles/$ROLE/defaults/main.yml`)
- inventory vars (`vars/main.yml`)
- inventory group_vars (`group_vars/$HOSTGROUP/*.yml`)
- inventory host_vars (`host_vars/$FQDN/*.yml`)
- playbook group_vars (we don’t make a difference to inventory group_vars)
- playbook host_vars (we don’t make a difference to inventory host_vars)
- host facts (default facts of a host Information discovered from system facts)
- play vars
- play vars_prompt (Prompts)
- play vars_files (?)
- registered vars (Register Variables)
- set_facts (Module set_fact)
- role and include vars (`roles/$ROLE/vars/main.yml`)
- block vars (only for tasks in block; Blocks)
- task vars (only for the task)
- extra vars (always win precedence; `ansible --extra-vars='foo=bar'`)

Ansible plugins

The “extra bits”

What are they?

Plugins are pieces of code that augment Ansible’s core functionality. Ansible uses a plugin architecture to enable a rich, flexible, and expandable feature set.



Example become plugin:

```
---
- name: install and start apache
  hosts: web
  become: yes
```

Example filter plugins:

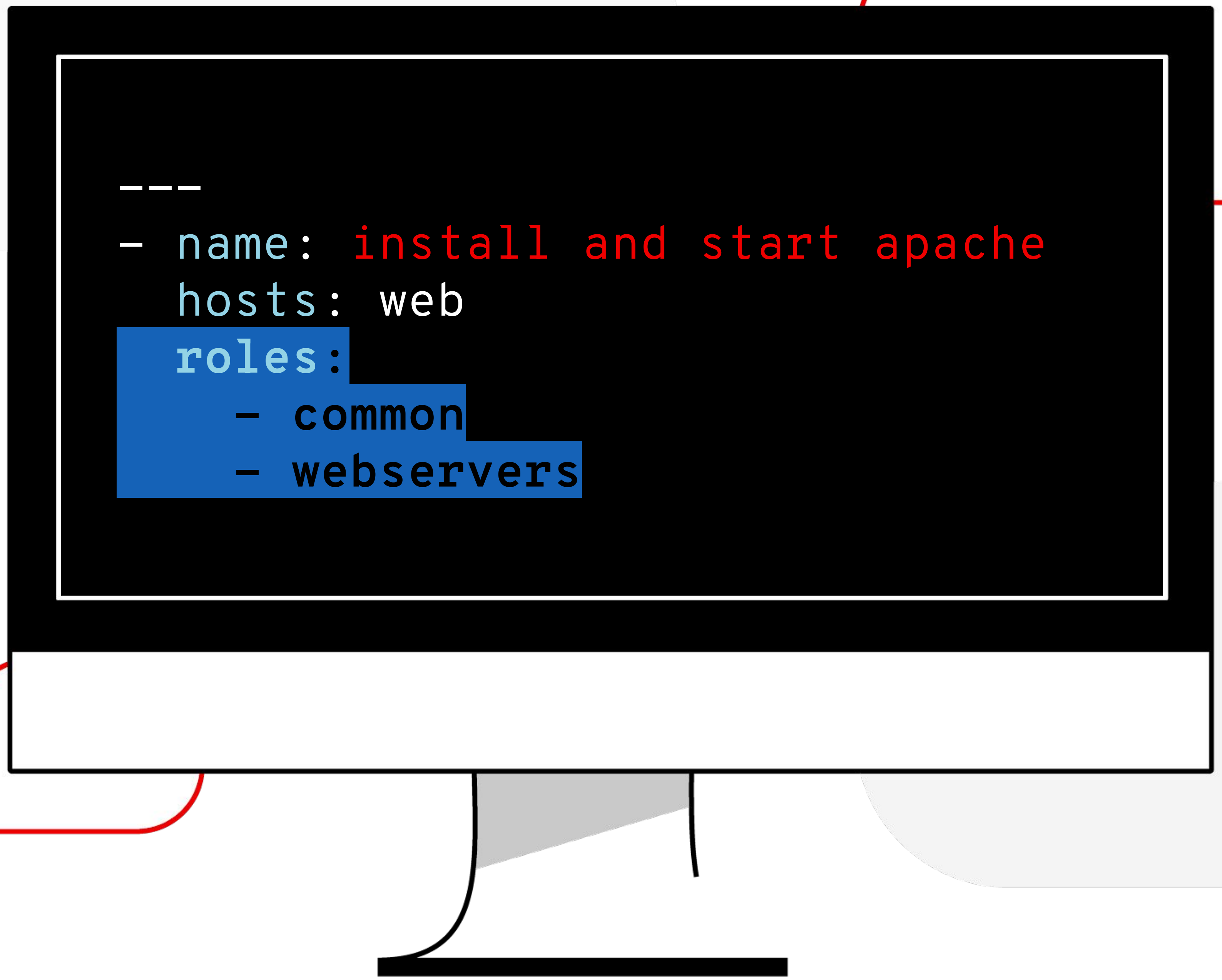
```
{{ some_variable | to_nice_json }}
{{ some_variable | to_nice_yaml }}
```

Ansible roles

Reusable automation actions

What are they?

Group your tasks and variables of your automation in a reusable structure. Write roles once, and share them with others who have similar challenges in front of them.



```
---
- name: install and start apache
  hosts: web
  roles:
    - common
    - webservers
```

An Ansible Playbook

update-chrony.yml

```
---
- name: manage chrony.conf
  hosts: hana
  become: yes

  vars:
    timeserver: time.example.org


  tasks:
  - name: Copy chrony configuration file
    template:
      src: chrony.conf.j2
      dest: /etc/chrony.conf
    notify:
       - restart_chronyd

 handlers:
    - name: restart_chronyd
      service:
        name: chronyd
        state: restarted
```

An Ansible Playbook

update-chrony.yml

```
---
- name: manage chrony.conf
  hosts: hana
  become: yes

  vars:
    timeserver: time.example.org

  tasks:
  - name: Copy chrony configuration file
    template:
      src: chrony.conf.j2
      dest: /etc/chrony.conf
    notify:
       - restart_chronyd

 handlers:
    - name: restart_chronyd
      service:
        name: chronyd
        state: restarted
```

In the Filesystem:

```
$ ls

 inventory
 chrony-playbook.yml
 chrony.conf.j2
```

Creating Role: “update-chrony”

update-chrony.yml

```
---
- name: manage chrony.conf
  hosts: hana
  become: yes

  vars:
    timeserver: time.example.org

      dest: /etc/chrony.conf
    notify:
       - restart_chronyd

 handlers:
    - name: restart_chronyd
      service:
        name: chronyd
        state: restarted
```

```
$ mkdir roles; cd roles

$ ansible-galaxy init update-chrony
```

In the Filesystem:

```
$ ls

 inventory

roles/update-chrony/tasks/main.yml
                   /handlers/main.yml
                   /templates/
                   /files/
                   /defaults/main.yml
                   /vars/main.yml
                   /meta/main.yml
```

Move content from playbook to role

update-chrony.yml

```
---
- name: manage chrony.conf
  hosts: hana
  become: yes

  vars:
    timeserver: time.example.org

  tasks:
  - name: Copy chrony configuration file
    template:
      src: chrony.conf.j2
      dest: /etc/chrony.conf
    notify:
       - restart_chronyd

 handlers:
    - name: restart_chronyd
      service:
        name: chronyd
        state: restarted
```

In the Filesystem:

```
$ ls

 inventory
 chrony-playbook.yml
 chrony.conf.j2
 roles/

roles/update-chrony/tasks/main.yml
                   /handlers/main.yml
                   /templates/chrony.conf.j2
                   /files/
                   /defaults/main.yml
                   /vars/main.yml
                   /meta/main.yml
```

The playbook calling a role

update-chrony.yml

```
---
- name: manage chrony.conf
  hosts: hana
  become: yes

  roles:
     - update-chrony
```

main.yml

```
---
timeserver: time.example.org
```

main.yml

```
---
- name: Copy chrony configuration file
  template:
    src: chrony.conf.j2
    dest: /etc/chrony.conf
  notify:
     - restart_chronyd
```

main.yml

```
---
- name: restart_chronyd
  service:
    name: chronyd
    state: restarted
```

In the Filesystem:

```
$ tree
├── chrony-playbook.yml
├── inventory
└── roles
    └── update-chrony
        ├── defaults
        │   └── main.yml
        ├── files
        ├── handlers
        │   └── main.yml
        ├── meta
        │   └── main.yml
        ├── tasks
        │   └── main.yml
        ├── templates
        │   └── chrony.conf.j2
        └── vars
            └── main.yml
```

Additional Files

- Variables are stored in two locations
  - defaults/main.yml: least priority, i.e. default setting if not defined elsewhere
  - vars/main.yml: can only be overridden on the commandline with -e

- Meta Information of the role used by ansible galaxy:

```
galaxy_info:
  author: Markus Koch, Thomas Bludau
  description: Configures a RHEL OS to be ready for SAP HANA installation
  license: Apache 2.0
  min_ansible_version: 2.5
  platforms:
  - name: EL
    versions: [ 6, 7 ]

  galaxy_tags: [ 'system', 'sap', 'hana', 'beta' ]

dependencies: []
  # List your role dependencies here, one per line. Be sure to remove the '[]' above,
  # if you add dependencies to this list.
```

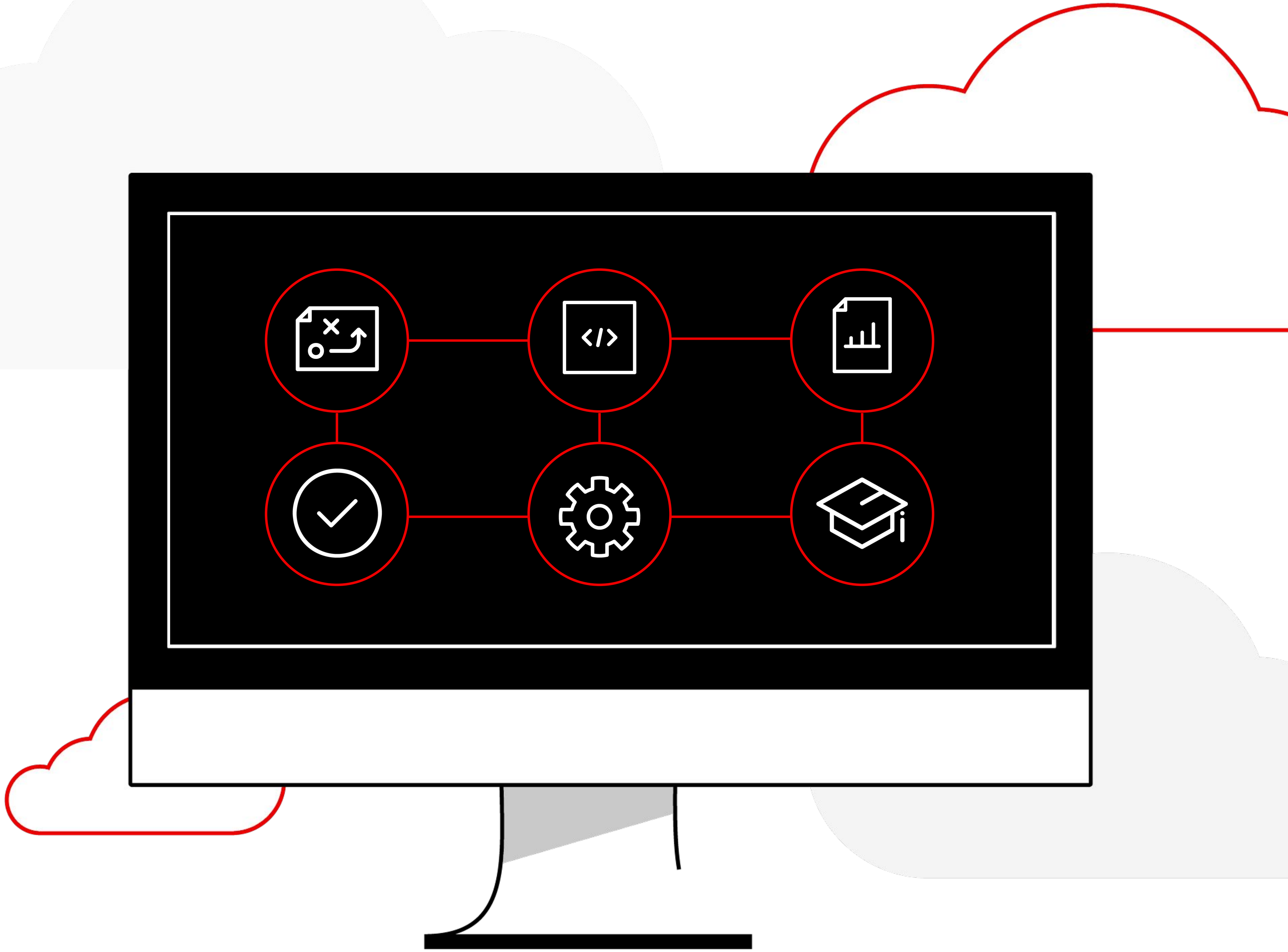
Collections

Simplified and consistent content delivery

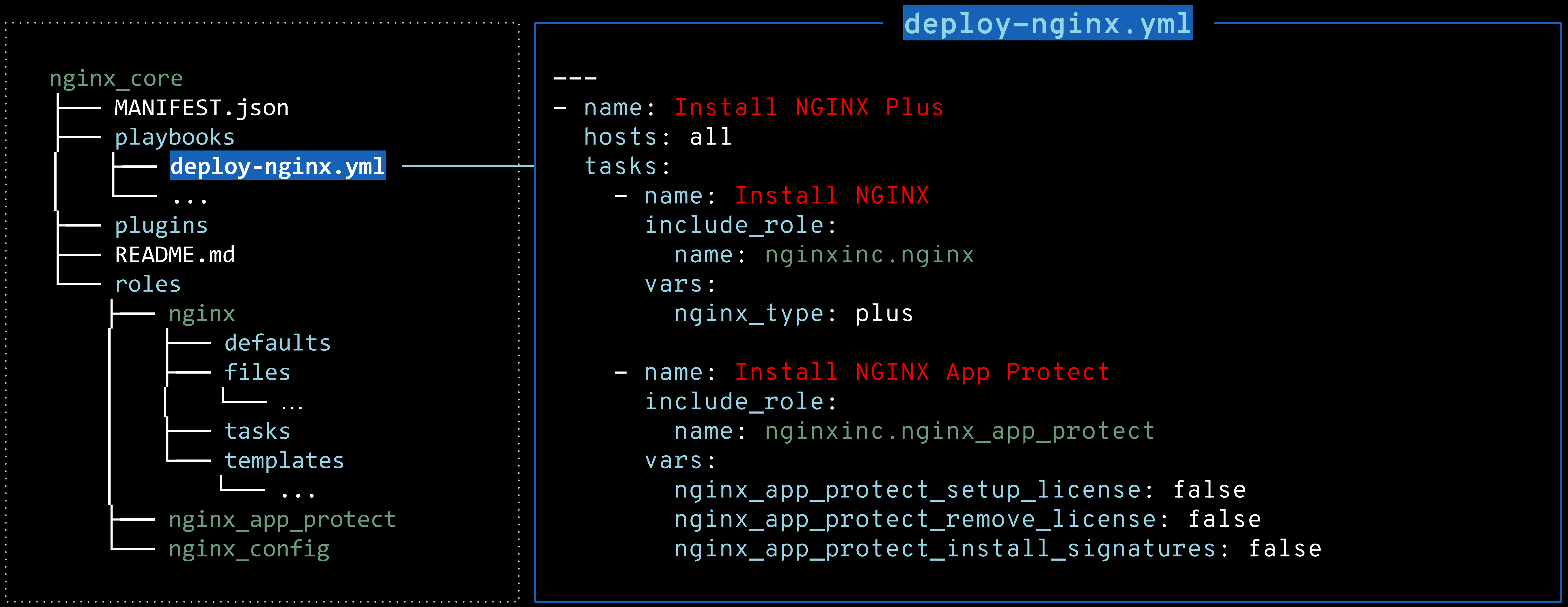
What are they?

Collections are a data structure containing automation content:

- Modules
- Playbooks
- Roles
- Plugins
- Docs
- Tests



Collections



```
nginx_core
├── MANIFEST.json
├── playbooks
│   ├── deploy-nginx.yml
│   └── ...
├── plugins
├── README.md
└── roles
    ├── nginx
    │   ├── defaults
    │   ├── files
    │   │   └── ...
    │   ├── tasks
    │   └── templates
    │       └── ...
    ├── nginx_app_protect
    └── nginx_config
```

deploy-nginx.yml

```yaml
---
- name: Install NGINX Plus
  hosts: all
  tasks:
    - name: Install NGINX
      include_role:
        name: nginxinc.nginx
      vars:
        nginx_type: plus

    - name: Install NGINX App Protect
      include_role:
        name: nginxinc.nginx_app_protect
      vars:
        nginx_app_protect_setup_license: false
        nginx_app_protect_remove_license: false
        nginx_app_protect_install_signatures: false
```

Supported and certified content you can trust.

130+

Certified Content Collections

55+

Certified technology partners

Infrastructure

Cloud

Network

Security

Edge

aws

Hewlett Packard Enterprise

Infoblox NEXT LEVEL NETWORKING

JUNIPer NETWORKS

Check Point SOFTWARE TECHNOLOGIES LTD

DELLEMC

ARISTA

Open Switch

NVIDIA.

SAP

splunk>

vmware

NUTANIX

N

IBM

f5

wti

TIRASA. {open source excellence}

CROWDSTRIKE

Sensu

New Relic

PURESTORAGE

VyOS

dynatrace

FRRouting

CYBERARK

Microsoft

Google

rubrik

Chocolatey

aruba NETWORKS

COHESITY

CISCO

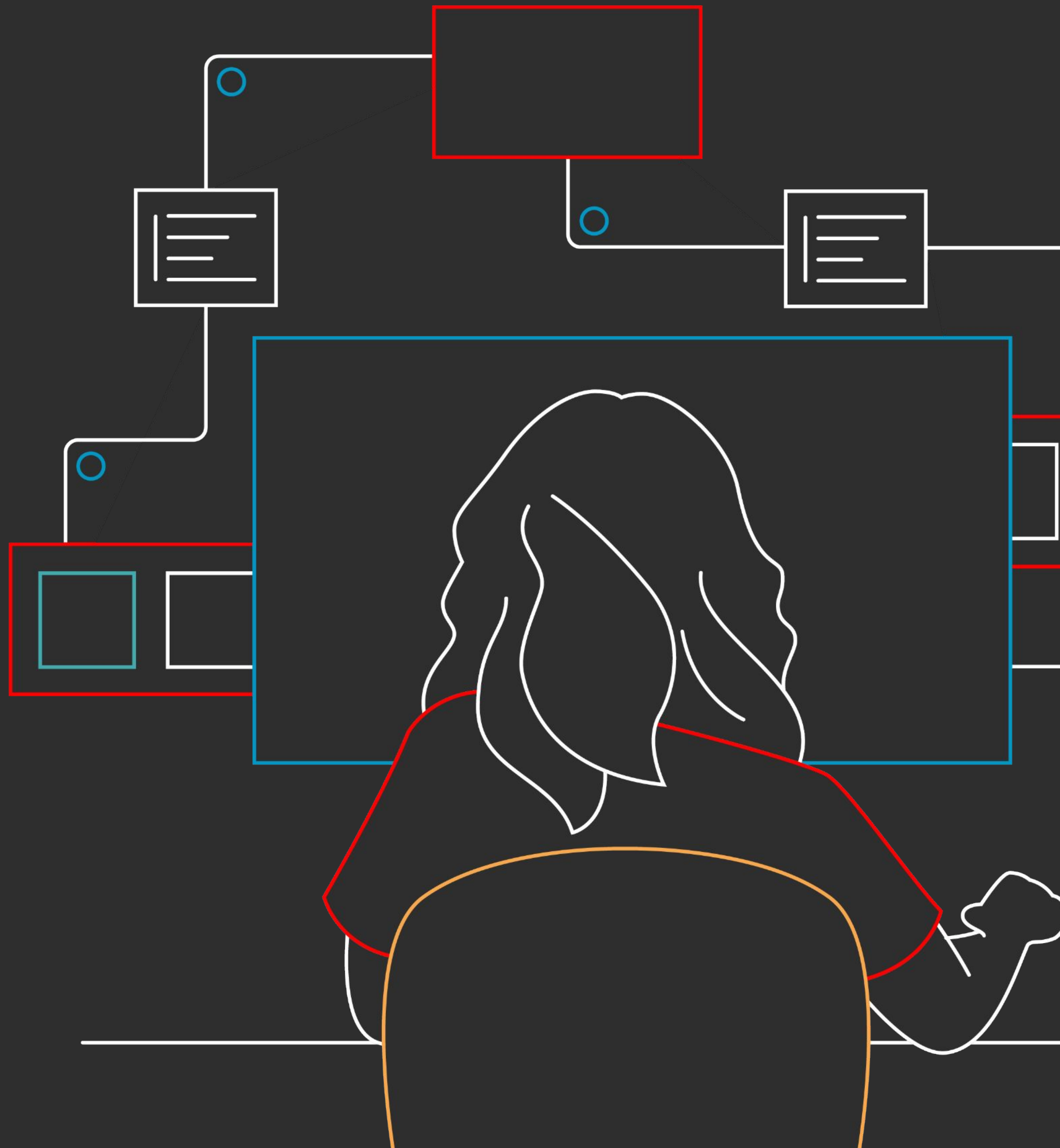
A10

NetApp

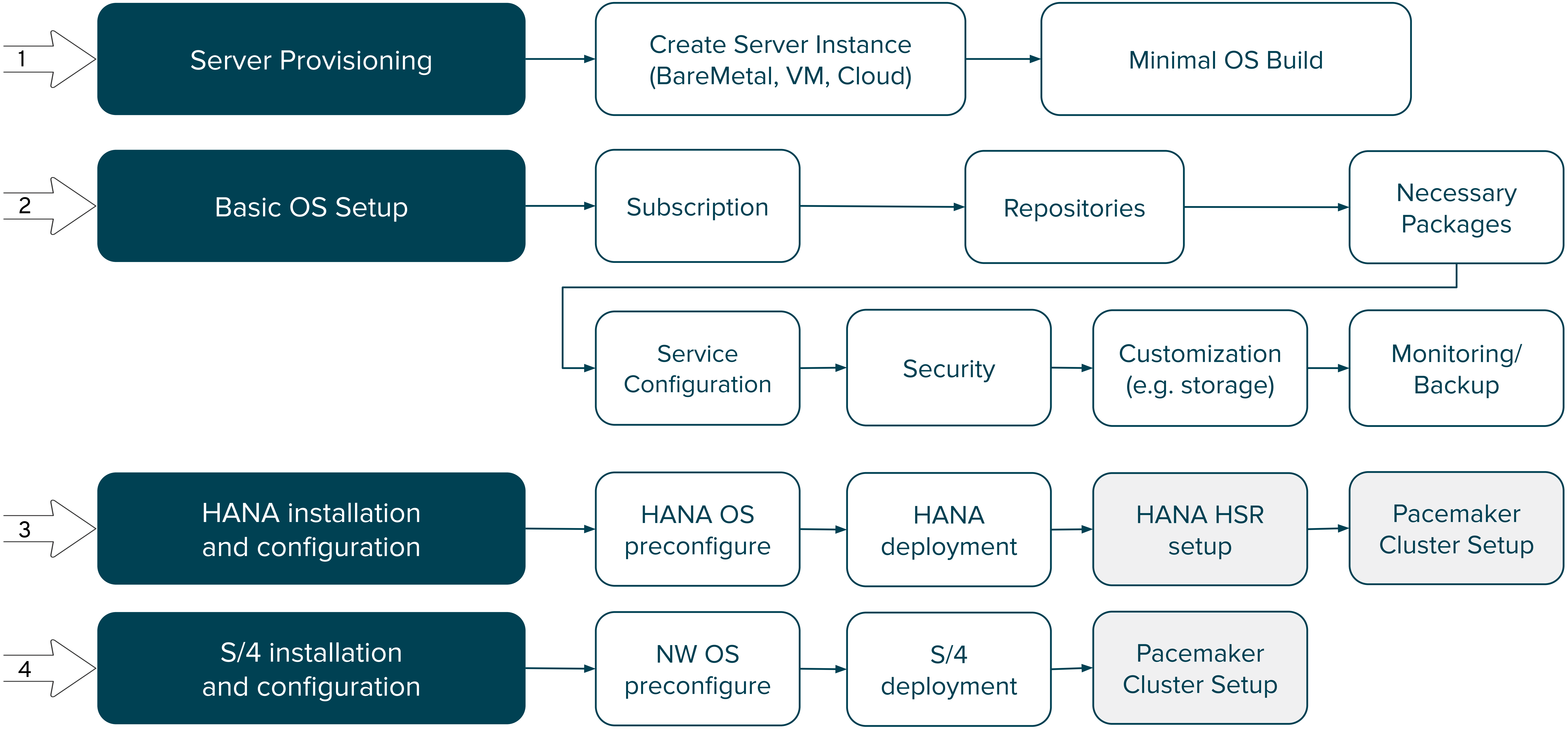
FORTINET

Automating SAP Deployments with Ansible

Installing and Configuring Ansible Roles for Base Configuration of SAP Systems



The SAP S/4 HANA deployment process breakdown



Red Hat

Central Upstream respository

SAP Linuxlab

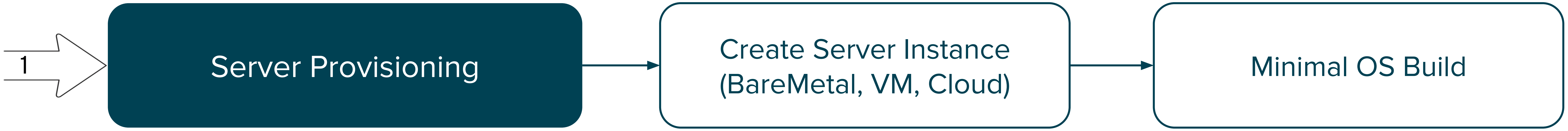
A place for open source software that helps to make creating and managing SAP environments on Linux easier

https://sap-linuxlab.github.io/
https://github.com/sap-linuxlab

- Terraform templates
- Ansible collections for
  - Software Download
  - Initial Install
  - Maintenance (Day 2 ops)
- Sizing Tools
- Reference Architectures

Lab Time

The SAP S/4 HANA deployment process breakdown



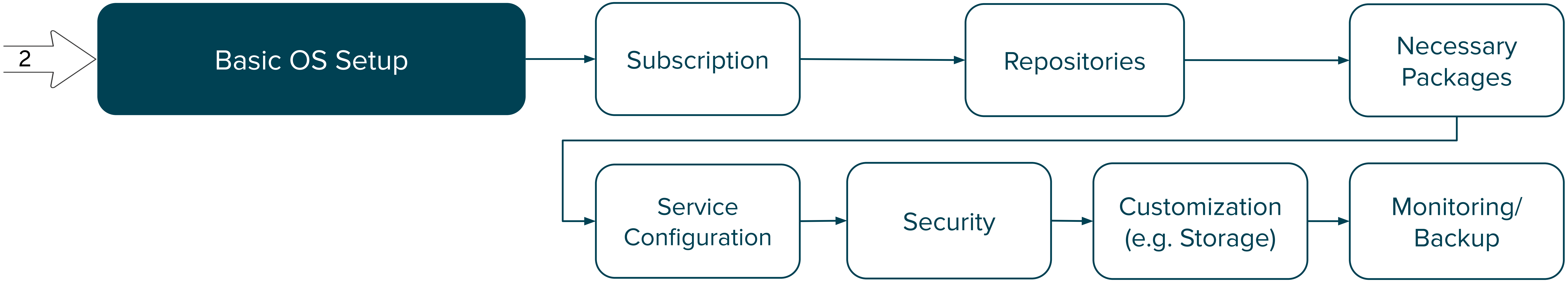
- Provision can be solved in various ways
  - Bare Metal rack mounting and cabling + Satellite kickstart
  - Virtual environments with kickstart + image provisioning
  - public/private cloud with image provisioning

- multiple ways to reach this initial phase
  - ansible
  - terraform
  - custom scripts
  - manual process

- always ends up at least with a minimal RHEL system
  - with fully attached resources (Disk, CPU,memory)
  - reachable via ssh from ansible host

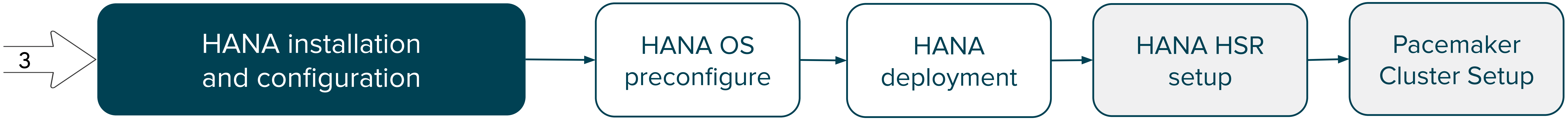
Phase 1 will not be covered in detail in this course

The SAP S/4 HANA deployment process breakdown



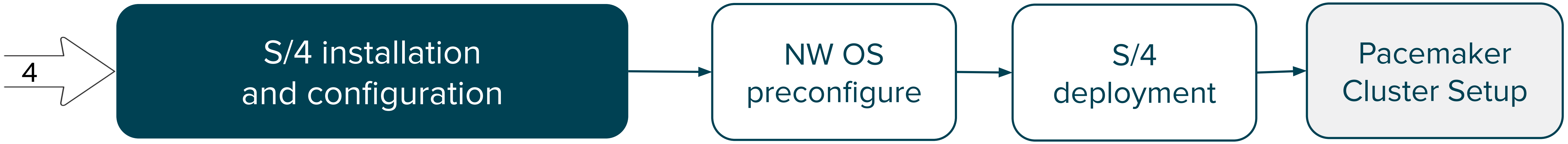
- typically already in place “Corporate Standard Build”
- modules and roles exist in rhel_system_roles collection on Automation Hub (linux_system_roles on Galaxy)
- modules and roles to do these primary tasks, e.g.
  - rhel_system_roles / linux_system_roles (available also as RPM package)
    - rhc
    - network
    - timesync
    - storage
  - Ansible Galaxy or self-created collections for Monitoring and Backup

The SAP S/4 HANA deployment process breakdown



- roles are available in community.sap_install collection
- HANA OS preconfigure
  - sap_general_preconfigure
  - sap_hana_preconfigure
- HANA deployment:
  - sap_hana_install
- HANA HSR setup
  - sap_ha_install_hana_hsr
- Pacemaker Cluster Setup
  - sap_ha_pacemaker_cluster

The SAP S/4 HANA deployment process breakdown



- roles are available in community.sap_install collection
  Netweaver OS preconfigure
  - sap_general_preconfigure
  - sap_netweaver_preconfigure
- S/4 deployment:
  - sap_swpm
- Pacemaker Cluster Setup (Optional)
  - sap_ha_install_pacemaker (TechPreview in 1.3.2)

Ansible Roles for OS base configuration

Role Details: Register system to satellite or RHN

rhel_system_roles.rhc

The first step is to make sure a system is registered and can access the correct repositories

This role is used to register against Satellite or RHN and configure the SAP repositories

Example:

- Playbook:

```
- hosts: servers
    roles:
     - role: rhel_system_role.rhc
```

- Variables

```
rhc_auth:
  activation_keys:
     keys:
      - "{{ sap_rhsm_activationkey }}"
 rhc_organization: "{{ sap_rhsm_org_id }}"
 rhc_repositories: "{{ repositories }}"
 rhc_release: "8.6"
 rhc_state: "present"
 rhc_insights:
   state: present
```

Configure Activtion key here

https://access.redhat.com/management/activation_keys

Ansible Roles for OS base configuration

Role Details: Storage Setup

This role is very useful to configure complex disk setups

On the right side you see an example configuration of a HANA disk setup

rhel-system-roles.storage

```
storage_pools:
  - name: sap
    disks:
      - xvdf
    volumes:
      - name: data
        size: "128 GiB"
        mount_point: "/hana/data"
        fs_type: xfs
        state: present
      - name: log
        size: "64 GiB"
        mount_point: "/hana/log"
        fs_type: xfs
        state: present
      - name: shared
        size: "256 GiB"
        mount_point: "/hana/shared"
        fs_type: xfs
        state: present
      - name: sap
        size: "50 GiB"
        mount_point: "/usr/sap"
        state: present
```

Ansible Roles for OS base configuration

Role Details: Storage Setup

rhel-system-roles.storage

This role is very useful to configure complex disk setups

On the right side you see an example configuration of a S/4HANA disk setup

```
storage_pools:
  - name: sap
    disks:
      - xvdf
    volumes:
      - name: sap
        size: "50 GiB"
        mount_point: "/usr/sap"
        state: present
      - name: sapmnt
        size: "20 GiB"
        mount_point: "/usr/sapmnt"
        state: present
      - name: swap
        size: "21 GiB"
        fs_type: swap
        mount_options: swap
        state: present
```

Ansible Roles for OS base configuration

Role Details: Configure Timeserver

rhel-system-roles.timesync

SAP requires proper time synchronisation.

So the linux system role is an easy way to set the time correctly

Example:

- Playbook:

```
- hosts: servers
  roles:
   - role: rhel-system-roles.timesync
```

- Variables

```
timesync_ntp_servers:
    - hostname: 0.rhel.pool.ntp.org
      iburst: yes
timesync_ntp_provider: chrony
```

Role Details: Networking Setup

rhel-system-roles.network

In most automaticly deployed environments the network setup is done properly.

You could use `rhel-system-roles.network` to configure a more complex network preconfiguration. Simple configurations can also be done with `nmcli` module

Example:

- Playbook:

```
- hosts: servers
  roles:
    - role: rhel-system-roles.network
```

- Variables

```
network_provider: nm
network_connections:
 - name: eth0
   #...
network_allow_restart: yes
```

Ansible Roles for OS base configuration

Role Details: Generic SAP settings

**redhat.sap_install.
sap_general_preconfigure**

SAP requires a couple of base settings that are described in SAP Note 2369910 and other SAP notes which are required for all SAP systems. The role sap-preconfigure will set the parameters that have to be set for all SAP software.

The role is designed to be used without parameters to produce a valid output and has an assert mode, which can be used to verify the configuration

```
sap_general_preconfigure_modify_etc_hosts: true
sap_general_preconfigure_update: true
sap_general_preconfigure_fail_if_reboot_required: false
sap_general_preconfigure_reboot_ok: true
sap_hostname: myserver
sap_domain: example.com
sap_ip: 192.168.2.3
```

Role Details: configure SAP Netweaver Settings

redhat.sap_install.
sap_netweaver_preconfigure

This role does all preconfiguration steps for SAP Netweaver which are described in SAP Note 2772999 for RHEL8.

It can be used without any additional parameters. It automatically fails, if not enough swap space is configured.

If you require different swap space that the recommended, you have variables to influence this setting.

Role Details: configure SAP HANA Settings

**redhat.sap_install.
sap_hana_preconfigure**

This role performs the configurations according to the necessary SAP Notes

This role can be used without any additional parameters, although there are some that might tweaked in production. e.g. some kernel parameters.
SAP NOTE 2382421 defines a lot of kernel parameter options, that can be set, in the variable `sap_hana_preconfigure_kernel_parameters`.

```
sap_hana_preconfigure_set_minor_release: true
sap_hana_preconfigure_update: true
sap_hana_preconfigure_reboot_ok: true
sap_hana_preconfigure_fail_if_reboot_required: false
```

Thank You !

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https://twitter.com/RedHat