Red Hat
Training and
Certification

Ansible Automation Platform 2.x Webinar

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Version 1.0

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Introduction to Ansible Automation

1. Ansible & Ansible Automation Engine (Past)

1.1. Ansible Infrastructure

The Ansible infrastructure and Ansible Automation consists of multiple components. The initial main foundation of Ansible is the Ansible Automation Engine.

For the most part, Ansible is a declarative automation platform that is considered idempotent meaning that Ansible will only execute tasks and plays if the item needs to be changed/modified. Otherwise, Ansible will skip to the next task or play in a playbook.

Ansible Components

- **Control Node**: System with Ansible installed, contains Ansible inventory files, **ansible.cfg**, and playbooks. This system manages and controls other managed hosts/nodes.
- **Managed Host/Managed Node**: System or node being managed in the Ansible environment. The **Control Node** executes various Ansible modules against these devices.

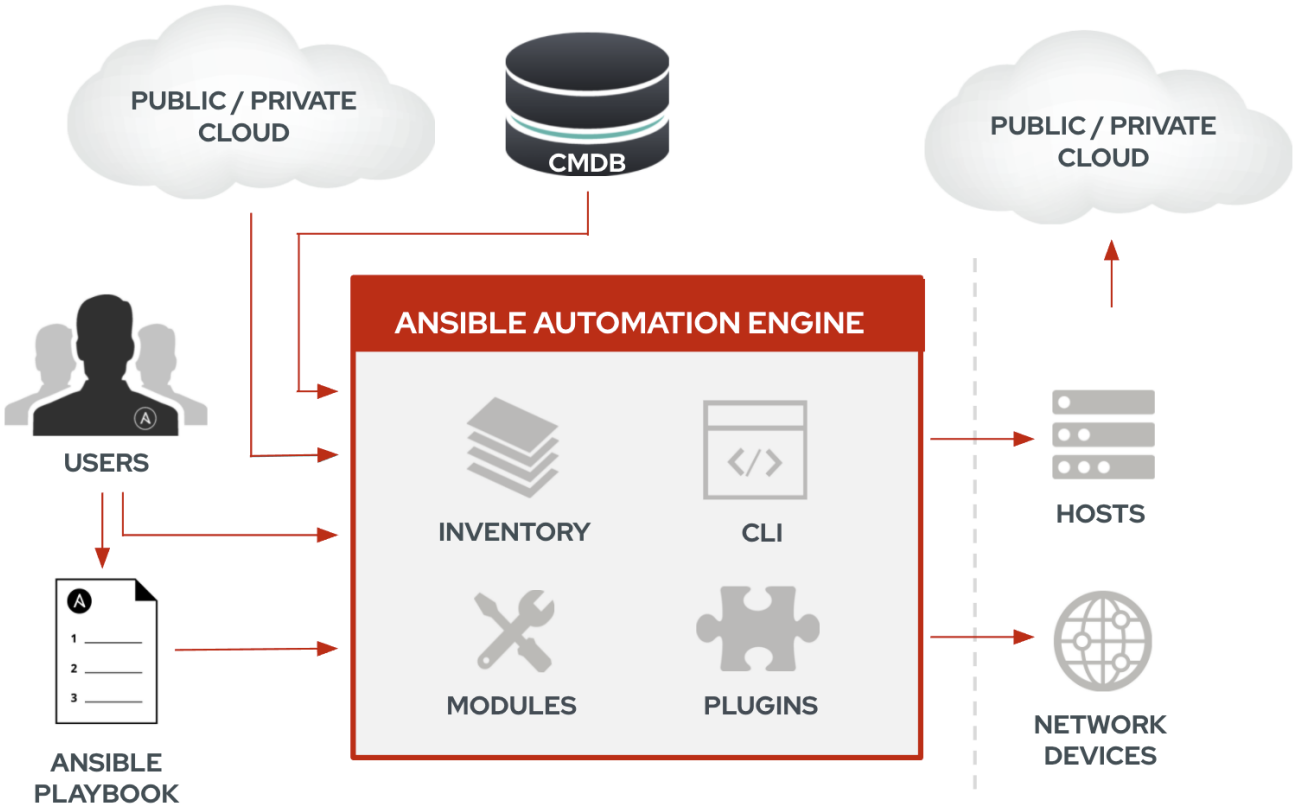

Figure 1. Ansible Automation

Ansible Automation Engine

- Inventory
- Command-Line Interface (CLI)
- Modules (Generally Python/Powershell)
- Plugins

Ansible Automation Engine utilizes the **ansible** command for Ad-Hoc Ansible Automation or the **ansible-playbook** command for running multiple tasks by leveraging and Ansible playbook containing one or more plays consisting of one or more tasks.

1.1.1. Inventory

List of systems in the infrastructure to be managed. Inventories can be static, dynamic, or a combination of both static and dynamic. Ansible also allows inventories to contain variables for the devices being managed. Devices must exist in inventory in order for Ansible to be capable of managing the devices.

1.1.2. Modules

Code utilized by the Ansible core engine which is used to perform a given tasks. Most modules are written in Python for Linux and Powershell for Windows. Modules can extend Ansible automation to multiple platforms simplifying and extending the automation to the entire stack.

Non-Idempotent Modules

There are some Ansible modules that aren't idempotent. Modules such as **commmand**, **shell**, and **raw** to name a few will execute regardless of the state. It is possible to use these modules with logic to make a playbook idempotent, but it is recommended to find an actual Ansible module to perform the task. These modules should be used as a last resort when no other module exists to perform a task.

1.1.3. Plugins

Code utilized by the Ansible core engine which is used to manipulate, transform, or otherwise modify either data in the playbook or items captured by the playbook and modules so that it is adaptable and usable on different platforms.

1.1.4. Playbooks

List of sequential tasks to allowing individual Ansible modules to be executed to perform a sequence of steps in an automation task. Playbooks are written in YAML and are simple easy-to-read steps on the end state of the system.

1.1.5. Ansible Tower

Ansible Tower delivers enterprise management and features to the Ansible family. Through Tower, Ansible can provide the following:

- Role-Based Access Control (RBAC)
- Restful API
- Push button deployment

- Workflows
- Credential and Secret Management
- Integration into SCM systems
- Integration into other management systems for dynamic inventory
- WebUI
- … and more

Ansible Tower allows enterprises to manage their IT environment by providing a centralized web solution to end-users and administrators to perform automation and self-service tasks. :pygments-style: tango :source-highlighter: pygments :toc: :toclevels: 7 :sectnums: :sectnumlevels: 6 :numbered: :chapter-label: :icons: font :icons: font :imagesdir: ../images/

1.2. Ansible Inventory, Ansible Config File, and Ansible Ad-Hoc Commands

1.2.1. Ansible Inventory

Ansible inventories can be either static, dynamic, or a combination of both static and dynamic. The traditional form of the Ansible inventory file is either YAML or INI. Inventory items consist of either individual managed nodes or groups of managed nodes.

Listing 1. Ansible Inventory File **INI** *Format*

```
servera ①
serverb
serverc
serverd

[load_balancers] ②
servere
serverf
```

① Individual managed host/node

② Inventory Group

Converting INI to YAML Inventory

Ansible provides the **ansible-inventory** command that will easily allow the inventory to be transformed from one form to another.

```
ansible-inventory --list -y
```

Listing 2. Ansible Inventory File **YAML** *Format*

```
all:
  children:
    load_balancers: ①
      hosts:
        servere: {}
        serverf: {}
    ungrouped:
      hosts: ②
        servera: {}
        serverb: {}
        serverc: {}
        serverd: {}
```

① Inventory Hosts in a Group

② Individual managed host/node (ungrouped)

1.2.1.1. Inventory Variables

It is possible for Ansible playbooks and Ansible ad-hoc commands to utilize inventory variables. These variables can be defined directly within the static inventory files themselves or those variables can be defined within the directory structure of the project utilizing either project directories or inventory directories.

Keep Inventory Simple and Organized

It is extremely important not to define variables for inventory in multipe locations as variable precedence and variable merging comes into play. It is equally important to devise an inventory strategy on where/how variables will be defined so that the playbooks and automation goals are kept simple and easy to understand and follow.

Listing 3. Sample Inventory File with Variables

```
[app1srv]
appserver01 ansible_host=10.42.0.2 ①
appserver02 ansible_host=10.42.0.3

[web]
node-[1:30] ansible_host=10.42.0.[31:60]

[web:vars] ②
apache_listen_port=8080
apache_root_path=/var/www/mywebdocs/

[all:vars] ③
ansible_user=kev
ansible_ssh_private_key_file=/home/kev/.ssh/id_rsa
```

① Defined variable at a **host** level

② Defined variables at a **group** level

③ Defined variables for all inventory items

1.2.2. Ansible Config

The **ansible.cfg** file controls how the **ansible** and **ansible-playbook** commands are run and interpreted. The configuration file has two (2) main sections that are commonly used, but include other sections as well. For the purpose of understanding how Ansible works, we will examine both the **[defaults]** section and the **[privilege_escalation]** section.

Listing 4. **ansible.cfg** *Defaults Section*

```
[defaults]
inventory = inventory ①
remote_user = devops ②
```

① Specifies which inventory file Ansible will use

② Specifies the remote user to be used by **ansible** or **ansible-playbook** commands.

A perfectly acceptable **ansible.cfg** might only have a [defaults] section specifying the inventory to be used.

Listing 5. **ansible.cfg** *Privilege Escalation Section*

```
[privilege_escalation]
become = False ①
become_method = sudo ②
become_user = root ③
become_ask_pass = False ④
```

① Sets default behavior whether to elevate privileges

② Sets method for privilege escalation

③ Sets username of privileged user

④ Sets option on whether or not user is prompted for password when perfoming privilege escalation.

Ansible Config File Precedence

- **ANSIBLE_CONFIG** - Environment Variable (highest)
- **ansible.cfg** - Config file in current working directory (most common and recommended)
- **~/.ansible.cfg** - Ansible config file in the home directory
- **/etc/ansible/ansible.cfg** - Ansible's installed default location (lowest)

1.2.3. Ansible Ad-Hoc Commands

Ansible Ad-Hoc commands are most often used to quickly perform an automation task using a single Ansible module. These commands can be executed against one or more hosts in the Ansible inventory file.

Table 1. Ansible **Ad-Hoc** *Command Arguments*

Command Argument	Description
-m MODULE_NAME	Module name to execute for the ad-hoc command

Command Argument	Description
-a MODULE_ARGS	Module arguments needed for the ad-hoc command
-b	Runs ad-hoc command as a privileged user
-K	Runs ad-hoc command as a privileged user and requests the **become** password
-e EXTRA_VARS	Provides extra variables as **KEY=VALUE** to be used for the execution of the ad-hoc command

1.2.4. DEMO - Ansible Ad-Hoc Commands

Demonstration and hands-on workshop for Ad-Hoc commands. The demo will utilize the **ping** module to ensure that the **ansible.cfg** and the **inventory** file are correctly setup and working within the Ansible environment.

Example 1. **DEMONSTRATION - Ansible Ping**

1. Change to correct directory

```
[student@workstation ~]$ cd /home/student/Github/AAP_Webinar/Past/ad-hoc
```

2. Run the **ansible** ad-hoc command

```
[student@workstation ad-hoc]$ ansible -m ping all
servere | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/libexec/platform-python"
    },
    "changed": false,
    "ping": "pong"
}
servera | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/libexec/platform-python"
    },
    "changed": false,
    "ping": "pong"
}
serverc | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/libexec/platform-python"
    },
    "changed": false,
    "ping": "pong"
}
serverb | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/libexec/platform-python"
    },
    "changed": false,
    "ping": "pong"
}
serverd | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/libexec/platform-python"
    },
    "changed": false,
    "ping": "pong"
}
serverf | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/libexec/platform-python"
    },
    "changed": false,
    "ping": "pong"
}
```

Checking Sudoers Ability and Setup

Listing 6. Checking **ansible.cfg** *for Ability to* **BECOME** *without* **sudo** *Password*

```
[student@workstation ad-hoc]$ ansible -m ping all --become
```

Listing 7. Checking **ansible.cfg** *for Ability to* **BECOME** *with* **sudo** *and Prompting for Password*

```
[student@workstation ad-hoc]$ ansible -m ping all --become -K
BECOME password:
```

The next demonstration will use the **copy** module to create a user in the managed systems making an entry to the **sudoers** file.

Example 2. **DEMONSTRATION - Ansible Ad-Hoc Command to Create User and Sudoers File**

1. Change to correct directory

```
[student@workstation ~]$ cd /home/student/Github/AAP_Webinar/Past/ad-hoc
```

2. Run the **ansible** commands to create the user and update the **sudoers** file.

   a. Create the user on the remote system.

```
[student@workstation ad-hoc]$ ansible -m user -a 'name=travis uid=1040 comment="Travis Michette" group=wheel' servera -b
servera | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/libexec/platform-python"
    },
    "append": false,
    "changed": false,
    "comment": "Travis Michette",
    "group": 10,
    "home": "/home/travis",
    "move_home": false,
    "name": "travis",
    "shell": "/bin/bash",
    "state": "present",
    "uid": 1040
}
```

   b. Create the user in a **sudoers** file.

```
[student@workstation ad-hoc]$ ansible -m copy -a 'content="travis ALL=(ALL) NOPASSWD:ALL" dest=/etc/sudoers.d/travis' servera
-b
```

3. Test new user and sudo rights

   a. SSH to **servera**

```
[student@workstation ad-hoc]$ ssh travis@servera
```

   b. **sudo** without a password

```
[travis@servera ~]$ sudo -i
[root@servera ~]#
```

1.3. Ansible Playbooks

Ansible playbooks contain one or more tasks to execute against specified inventory nodes. Playbooks consist of one or more play and each play in a playbook consists of one or more tasks. Ansible playbooks and tasks are all about **key:value** pairs and **lists**. Understanding this basic format allows someone developing Ansible to form playbooks that are easier to create,

troubleshoot/debug, and for someone else to understand.

1.3.1. Playbook Basics

An Ansible playbook is written/formatted in YAML so horizontal whitespace is critical and often the most troublesome part of debugging new Ansible playbooks. Playbooks have a general structure for the plays with directives such as: **name**, **hosts**, **vars**, **tasks**, and more. These play-level directives help form a readable structure much like **task-level** directives.

Listing 8. Play Structure Components

```
---
- name: install and start apache ①
  hosts: web ②
  become: yes ③

  tasks: ④
```

① Name of play in playbook

② List of hosts from inventory to execute play against **(required)**

③ Directive to override **ansible.cfg** and elevate privileges

④ Beginning of **tasks** section.

There can be other directives here, but at the most basic playbook, you will generally always see a **hosts** and a **tasks** section.

Naming Plays

It is recommended and considered a best practice to name all plays within a playbook.

The first indentation level in a playbook denoted by **-** is the list of plays and this level will contain the **key:value** pairs that correspond to Ansible playbook directives. Understanding this and developing good habits and standards for indentations allows Ansible users to create playbook skeletons which help tremendously during the development/debugging cycle.

1.3.1.1. Task Structure

A task within a playbook is generally specified similar to a play having a **name** section so that it is easier to debug.

Listing 9. Task Structure and Components

```
tasks:
  - name: httpd package is present ①
     yum: ②
       name: httpd ③
       state: latest ④

  - name: latest index.html file is present ⑤
    template:
      src: files/index.html
      dest: /var/www/html/

  - name: httpd is started ⑥
    service:
      name: httpd
      state: started
```

① Name of first task in playbook

② Name of module to be used in first task in playbook

③ Argument/Option provided to module, in this instance **name** and is ***required*** for the package name in the case of the **yum** module.

④ Argument/Option provided to module, in this instance the **state** describes whether the module will install, update, or remove the package for the **yum** module.

⑤ Name of second task in playbook

⑥ Name of third task in playbook

Naming Tasks

It is recommended and considered a best practice to name all tasks within a playbook. Naming tasks especially helps with debugging issues in playbooks as the Ansible STDOUT will display and record task names.

The second indentation level in a playbook denoted by **-** is generally under the **tasks:** section and contains the list of tasks. This level will contain the **key:value** pairs that correspond to Ansible task directives always starting with the module being used at the same level before going to the third indentation level which are the **key:value** pair options that belong to the module being used in that task.

1.3.2. Running Playbooks

Playbooks can be run just like Ansible **ad-hoc** commands. In order to execute or run a playbook, it is necessary to use the **ansible-playbook** command and specify the playbook. The additional options available for the **ad-hoc** commands such as: **-e**, **-K**, **-b**, and others all still apply and perform the same functions when leveraged with the **ansible-playbook** command.

Example 3. DEMONSTRATION - Running Ansible Playbooks

In this demonstration, we will be creating a user on **serverb** using playbooks as opposed to leveraging **ad-hoc** commands.

1. Switch to correct directory

```
[student@workstation ~]$ cd ~/Github/AAP_Webinar/Past/Playbooks
```

2. Examine playbook

```
[student@workstation Playbooks]$ vim playbook.yml

---
- name: Playbook to Create User and Sudoers without Password
  hosts: serverb
  tasks:
    - name: Create User Named Travis
      user:
        name: travis
        uid: 1040
        comment: "Travis Michette"
        group: wheel

    - name: Create User in Sudoers File
      copy:
        content: "travis ALL=(ALL) NOPASSWD:ALL\n"
        dest: /etc/sudoers.d/travis
        validate: /usr/sbin/visudo -csf %s
```

3. Execute and run the playbook

```
[student@workstation Playbooks]$ ansible-playbook playbook.yml -b

PLAY [Playbook to Create User and Sudoers without Password] ***************************

... OUTPUT OMITTED ...
```

4. Test and Verify User

   a. SSH to remote system

```
[student@workstation Playbooks]$ ssh travis@serverb
```

   b. Verify Sudo without Password

```
[travis@serverb ~]$ sudo -i
[root@serverb ~]#
```

Example 4. DEMONSTRATION - Failure of Old Playbook

It is important to constantly test playbooks with the most current and recent versions of Ansible to ensure all modules work as expected and items haven't been deprecated. The following playbook was developed for use with Ansible 2.8 and earlier. The playbook now fails as some of the modules being used have been migrated from Ansible **built-in** modules to Ansible collections. More on this migration and discussion of collections will come in future chapters and sections.

1. Examine Playbook for Website

```
---
- name: Playbook to Fully Setup and Configure a Webserver
  hosts: servera
  tasks:
    - name: Install Packages for Webserver
      yum:
        name:
          - httpd
          - firewalld
        state: latest

    - name: Create Content for Webserver
      copy:
        content: "I'm an awesome webserver"
        dest: /var/www/html/index.html

    - name: Create Content for Webserver
      copy:
        content: "I'm an awesome webserver"

    - name: Firewall is Enabled
      service:
        name: firewalld
        state: started
        enabled: true

    - name: HTTP Service is Open on Firewall
      firewalld:
        service: http
        state: enabled
        permanent: true
        immediate: yes

    - name: httpd is started
      systemd:
        name: httpd
        state: started
        enabled: true
```

2. Execute the playbook

```
[student@workstation Playbooks]$ ansible-playbook Website_Past.yml
ERROR! couldn't resolve module/action 'firewalld'. This often indicates a misspelling, missing collection, or incorrect module
path. ①

The error appears to be in '/home/student/Github/AAP_Webinar/Past/Playbooks/Website_Past.yml': line 27, column 7, but may
be elsewhere in the file depending on the exact syntax problem.

The offending line appears to be:


    - name: HTTP Service is Open on Firewall
      ^ here
```

① The **firewalld** module is not available. This was moved in AAP 2.x to an Ansible collection and is no longer able to be referenced without the collection and module being installed.

Test Often

As Ansible has changed going into Ansible Automation Platform 2+, many changes have been made. There was a duplication and mapping of several of the modules allowing for existing playbooks to still run correctly, however, at some point modules become completely deprecated, and mappings get removed. It is extremely important to execute old playbooks and test with new versions of Ansible and to look for **deprecation warnings** so that playbooks can be fixed proactively instead of reactively.

1.4. Ansible Roles

Section Info Here

1.4.1. Ansible Role Overview

1.4.2. Using Roles

2. Ansible Automation Platform 1.x (Present)

2.1. <SECTION TITLE>

Section Info Here

2.1.1. <Section_Sub_Intro_Here>

3. Ansible Automation Platform 2.x (Future)

3.1. <SECTION TITLE>

Section Info Here

3.1.1. <Section_Sub_Intro_Here>