



Red Hat Training and Certification

DO374 - Instructor Demo Guide

Travis Michette

Version 1.0

Table of Contents

1. Developing Playbooks with Ansible Automation Platform 2	1
1.1. Introducing Red Hat Ansible Automation Platform 2	1
1.1.1. Orientation to Red Hat Ansible Automation Platform 2	1
1.1.2. Red Hat Ansible Automation Platform 2 Components	1
1.1.2.1. Ansible Core	1
1.1.2.2. Ansible Content Collections	1
1.1.2.3. Ansible Content Navigator	2
1.1.2.4. Ansible Execution Environments	2
1.1.2.5. Automation Controller	3
1.1.2.6. Ansible Automation Hub	3
1.1.2.7. Hosted Services	3
1.1.3. Red Hat Ansible Automation Platform 2 Architecture	3
1.1.3.1. Developing Playbooks with Ansible Automation Platform 2	3
1.2. Running Playbooks with Automation Content Navigator	4
1.2.1. Introducing Automation Content Navigator	4
1.2.1.1. Improving Portability with Automation Execution Environments	4
1.2.2. Installing Automation Content Navigator	4
1.2.3. Configuring Authentication to Managed Hosts	4
1.2.3.1. Preparing SSH Key-Based Authentication	4
1.2.3.2. Providing Private Keys to the Automation Execution Environment	4
1.2.4. Running Automation Content Navigator	4
1.2.4.1. Running Playbooks	4
1.2.4.2. Reviewing Previous Playbook Runs	4
1.2.4.3. Reading Documentation	4
1.2.4.4. Getting Help	4
1.3. Demo - Ansible Content Navigator	4
1.4. Managing Ansible Project Materials Using Git	6
1.4.1. Defining Infrastructure as Code	6
1.4.2. Introducing Git	6
1.4.3. Describing Initial Git Configuration	6
1.4.4. Starting the Git Workflow	6
1.4.4.1. Examining the Git Log	6
1.4.5. Working with Branches and References	6
1.4.5.1. Creating Branches	6
1.4.5.2. Merging Branches	6
1.4.5.3. Creating Branches from Old Commits	6
1.4.5.4. Pushing Branches to Remote Repositories	7
1.4.6. Structuring Ansible Projects in Git	7
1.4.6.1. Roles and Ansible Content Collections	7
1.4.6.2. Configuring Git to Ignore Files	7
1.5. Demo - Using Git	7
1.6. Implementing Recommended Ansible Practices	9
1.6.1. The Effectiveness of Ansible	10

1.6.2. Keeping Things Simple	10
1.6.2.1. Keeping Your Playbooks Readable	10
1.6.2.2. Use Existing Modules	10
1.6.2.3. Adhering to a Standard Style	10
1.6.3. Staying Organized	10
1.6.3.1. Following Conventions for Naming Variables	10
1.6.3.2. Standardizing the Project Structure	10
1.6.3.3. Using Dynamic Inventories	10
1.6.3.4. Taking Advantage of Groups	10
1.6.3.5. Using Roles and Ansible Content Collections for Reusable Content	10
1.6.3.6. Running Playbooks Centrally	10
1.6.3.7. Building Automation Execution Environments	10
1.6.4. Testing Often	10
1.6.4.1. Testing the Results of Tasks	10
1.6.4.2. Using Block/Rescue to Recover or Rollback	10
1.6.4.3. Developing Playbooks with the Latest Ansible Version	10
1.6.4.4. Using Test Tools	10
2. Managing Content Collections and Execution Environments	11
2.1. Reusing Content from Ansible Content Collections	11
2.1.1. Defining Ansible Content Collections	11
2.1.1.1. Organizing Ansible Content Collections in Namespaces	11
2.1.2. Using Ansible Content Collections	11
2.1.2.1. Accessing Ansible Content Collection Documentation	11
2.1.2.2. Using Ansible Content Collections in Playbooks	11
2.1.2.3. Finding Ansible Content Collections	11
2.1.2.4. Using the Built-in Ansible Content Collection	11
2.2. Finding and Installing Ansible Content Collections	11
2.2.1. Sources for Ansible Content Collections	11
2.2.1.1. Finding Collections on Ansible Automation Hub	11
2.2.2. Installing Ansible Content Collections	11
2.2.2.1. Installing Collections from the Command Line	11
2.2.2.2. Installing Collections with a Requirements File	11
2.2.2.3. Listing Installed Collections	11
2.2.3. Configuring Collection Sources	11
2.2.3.1. Installing Collections from Ansible Automation Hub	11
2.2.3.2. Installing Collections from Private Automation Hub	11
2.3. Selecting an Execution Environment	11
2.3.1. Describing Automation Execution Environments	12
2.3.2. Selecting a Supported Automation Execution Environment	12
2.3.3. Inspecting Automation Execution Environments	12
2.3.4. Using Automation Execution Environments with Ansible Content Navigator	12
3. Running Playbooks with Automation Controller	13
3.1. Explaining the Automation Controller Architecture	13
3.1.1. Introduction to Automation Controller	13
3.1.2. Describing the Architecture of Automation Controller	13
3.1.3. Automation Controller Features	13

3.2. Running Playbooks in Automation Controller	13
3.2.1. Exploring Resources in Automation Controller	13
3.2.2. Creating Credential Resources	13
3.2.2.1. Listing Credentials	13
3.2.2.2. Creating a Machine Credential	13
3.2.2.3. Creating a Source Control Credential	13
3.2.3. Creating Project Resources	13
3.2.4. Creating Inventory Resources	13
3.2.4.1. Manually Creating Groups and Hosts	13
3.2.4.2. Populating Groups and Hosts Using a Project Inventory File	13
3.2.5. Creating Job Template Resources	13
3.2.6. Launching and Reviewing Jobs	13
4. Working with Ansible Configuration Settings	14
4.1. Examining Ansible Configuration with Automation Content Navigator	14
4.1.1. Inspecting Configuration in Interactive Mode	14
4.1.1.1. Searching for Specific Configuration Parameters	14
4.1.1.2. Accessing Parameter Details	14
4.1.1.3. Inspecting Local Configuration	14
4.1.2. Inspecting Ansible Configuration in Standard Output Mode	14
4.2. Configuring Automation Content Navigator	14
4.2.1. Format of the Settings File	14
4.2.2. Locating the Settings File	14
4.2.2.1. Selecting a Settings File to Use	14
4.2.3. Editing the Settings File	14
4.2.3.1. Setting a Default Automation Execution Environment	14
4.2.3.2. Default to Running in Standard Output Mode	14
4.2.3.3. Disabling Playbook Artifacts	14
4.2.3.4. Overview of an Example Settings File	14
5. Managing Inventories	15
5.1. Managing Dynamic Inventories	15
5.1.1. Generating Inventories Dynamically	15
5.1.2. Discussing Inventory Plug-ins	15
5.1.2.1. Using Inventory Plug-ins	15
5.1.3. Developing Inventory Scripts	15
5.1.3.1. Using Inventory Scripts	15
5.1.4. Managing Multiple Inventories	15
5.2. Writing YAML Inventory Files	15
5.2.1. Discussing Inventory Plug-ins	15
5.2.2. Writing YAML Static Inventory Files	15
5.2.2.1. Setting Inventory Variables	15
5.2.3. Converting a Static Inventory File in INI Format to YAML	15
5.2.4. Troubleshooting YAML Files	15
5.2.4.1. Protecting a Colon Followed by a Space	15
5.2.4.2. Protecting a Variable that Starts a Value	15
5.2.4.3. Knowing the Difference Between a String and a Boolean or Float	15
5.3. Managing Inventory Variables	15

5.3.1. Describing the Basic Principles of Variables	15
5.3.2. Variable Merging and Precedence	15
5.3.2.1. Determining Command-line Option Precedence	16
5.3.2.2. Determining Role Default Precedence	16
5.3.2.3. Determining Host and Group Variable Precedence	16
5.3.2.4. Determining Play Variable Precedence	16
5.3.2.5. Determining the Precedence of Extra Variables	16
5.3.3. Separating Variables from Inventory	16
5.3.4. Using Special Inventory Variables	16
5.3.4.1. Configuring Human Readable Inventory Host Names	16
5.3.5. Identifying the Current Host Using Variables	16
6. Managing Task Execution	17
6.1. Controlling Privilege Escalation	17
6.1.1. Privilege Escalation Strategies.	17
6.1.1.1. Privilege Escalation by Configuration.	17
6.1.1.2. Defining Privilege Escalation in Plays	17
6.1.1.3. Privilege Escalation in Tasks	17
6.1.1.4. Grouping Privilege Escalation Tasks with Blocks.	17
6.1.1.5. Applying Privilege Escalation in Roles	17
6.1.1.6. Listing Privilege Escalation with Connection Variables	17
6.2. Choosing Privilege Escalation Approaches	17
6.3. Controlling Task Execution	17
6.3.1. Controlling the Order of Execution	17
6.3.1.1. Importing or Including Roles as a Task	17
6.3.1.2. Defining Pre- and Post-tasks	17
6.3.1.3. Reviewing the Order of Execution	17
6.3.2. Listening to Handlers	17
6.3.2.1. Notifying Handlers	17
6.3.3. Controlling the Order of Host Execution.	17
6.4. Running Selected Tasks	17
6.4.1. Tagging Ansible Resources	17
6.4.2. Managing Tagged Resources	18
6.4.2.1. Running Tasks with Specific Tags	18
6.4.2.2. Combining Tags to Run Multiple Tasks	18
6.4.2.3. Skipping Tasks with Specific Tags	18
6.4.2.4. Listing Tags in a Playbook	18
6.4.3. Assigning Special Tags	18
6.5. Optimizing Execution for Speed.	18
6.5.1. Optimizing Playbook Execution	18
6.5.1.1. Optimizing the Infrastructure	18
6.5.1.2. Disabling Fact Gathering	18
6.5.1.3. Reusing Gathered Facts with Fact Caching.	18
6.5.1.4. Limiting Fact Gathering	18
6.5.1.5. Increasing Parallelism	18
6.5.1.6. Avoiding Loops with the Package Manager Modules.	18
6.5.1.7. Efficiently Copying Files to Managed Hosts.	18

6.5.1.8. Using Templates	18
6.5.1.9. Enabling Pipelining	18
6.5.2. Profiling Playbook Execution with Callback Plug-ins	18
6.5.2.1. Timing Tasks and Roles	18
7. Transforming Data with Filters and Plug-ins	19
7.1. Processing Variables Using Filters	19
7.1.1. Ansible Filters	19
7.1.2. Variable Types	19
7.1.3. Manipulating Lists	19
7.1.3.1. Extracting list elements	19
7.1.3.2. Modifying the Order of List Elements	19
7.1.3.3. Merging Lists	19
7.1.3.4. Operating on Lists as Sets	19
7.1.4. Manipulating Dictionaries	19
7.1.4.1. Joining dictionaries	19
7.1.4.2. Converting Dictionaries	19
7.1.5. Hashing, Encoding, and Manipulating Strings	19
7.1.5.1. Hashing strings and passwords	19
7.1.5.2. Encoding strings	19
7.1.5.3. Formatting Text	19
7.1.5.4. Replacing Text	19
7.1.6. Manipulating JSON Data	19
7.1.6.1. JSON Queries	19
7.1.6.2. Parsing and Encoding Data Structures	19
7.2. Templating External Data using Lookups	19
7.2.1. Lookup Plug-ins	20
7.2.2. Calling Lookup Plug-ins	20
7.2.3. Selecting Lookup Plug-ins	20
7.2.3.1. Reading the Contents of Files	20
7.2.3.2. Applying Data with a Template	20
7.2.3.3. Reading Command Output in the Execution Environment	20
7.2.3.4. Getting Content from a URL	20
7.2.3.5. Getting Information from the Kubernetes API	20
7.2.3.6. Using Custom Lookup Plug-ins	20
7.2.4. Handling Lookup Errors	20
7.3. Implementing Advanced Loops	20
7.3.1. Comparing Loops and Lookup Plug-ins	20
7.3.2. Example Iteration Scenarios	20
7.3.2.1. Iterating over a List of Lists	20
7.3.2.2. Iterating Over Nested Lists	20
7.3.2.3. Iterating Over a Dictionary	20
7.3.2.4. Iterating Over a File Globbing Pattern	20
7.3.2.5. Retrying a Task	20
7.4. Using Filters to Work with Network Addresses	20
7.4.1. Gathering and Processing Networking Information	20
7.4.2. Network Information Filters	20

7.4.2.1. Testing IP Addresses	21
7.4.2.2. Filtering Data	21
7.4.2.3. Manipulating IP Addresses.	21
7.4.2.4. Reformatting or Calculating Network Information.	21
8. Coordinating Rolling Updates	22
8.1. Delegating Tasks and Facts	22
8.1.1. Delegating Tasks	22
8.1.1.1. Delegating to localhost	22
8.1.2. Delegating Facts	22
8.2. Configuring Parallelism	22
8.2.1. Configure Parallelism in Ansible Using Forks	22
8.2.2. Running Batches of Hosts Through the Entire Play	22
8.3. Managing Rolling Updates.	22
8.3.1. Overview	22
8.3.2. Controlling Batch Size	22
8.3.2.1. Setting a Fixed Batch Size	22
8.3.2.2. Setting Batch Size as a Percentage.	22
8.3.2.3. Setting Batch Sizes to Change During the Play	22
8.3.3. Aborting the Play	22
8.3.3.1. Specifying Failure Tolerance	22
8.3.4. Running a Task Once	22
9. Creating Content Collections and Execution Environments	23
9.1. Writing Ansible Content Collections.	23
9.1.1. Developing Ansible Content Collections	23
9.1.1.1. Selecting a Namespace for Collections	23
9.1.1.2. Creating Collection Skeletons	23
9.1.1.3. Adding Content to Collections	23
9.1.1.4. Updating Collection Metadata	23
9.1.1.5. Declaring Collection Dependencies	23
9.1.1.6. Building Collections	23
9.1.1.7. Validating and Testing Collections	23
9.1.2. Publishing Collections	23
9.2. Building a Custom Execution Environment	23
9.2.1. Deciding When to Create a Custom Automation Execution Environment	23
9.2.2. Preparing for a New Automation Execution Environment	23
9.2.2.1. Declaring the Ansible Content Collections to Install.	23
9.2.2.2. Declaring Python Packages	23
9.2.2.3. Declaring RPM Packages	23
9.2.3. Building a New Automation Execution Environment	23
9.2.3.1. Interacting with the Build Process	23
9.3. Validating a Custom Execution Environment.	23
9.3.1. Testing Automation Execution Environments Locally	24
9.3.1.1. Running a Test Playbook	24
9.3.1.2. Providing Authentication Credentials	24
9.3.2. Sharing an Automation Execution Environment from Private Automation Hub	24
9.4. Using Custom Content Collections and Execution Environments in Automation Controller	24

9.4.1. Using Custom Collections with Existing Execution Environments	24
9.4.1.1. Preparing Ansible Projects for Automation Controller	24
9.4.1.2. Storing Authentication Credentials for Collections	24
9.4.2. Using Custom Automation Execution Environments with Automation Controller	24
9.4.2.1. Storing Container Registry Credentials	24
9.4.2.2. Configuring Automation Execution Environments	24
9.4.2.3. Configuring the Default Automation Execution Environment for a Project.	24
9.4.2.4. Specifying an Automation Execution Environment in a Template	24

1. Developing Playbooks with Ansible Automation Platform 2

1.1. Introducing Red Hat Ansible Automation Platform 2

Describing the architecture of Red Hat Ansible Automation Platform 2 (AAP2) and new features for Ansible development.

1.1.1. Orientation to Red Hat Ansible Automation Platform 2

New evolution of Ansible Platform providing customization with Ansible Execution Environments (EEs), Ansible Navigator, and a redesign of Ansible Tower which has now become Ansible Controller. Ansible Automation Platform now also provides Ansible Automation Hub which is a private Ansible Galaxy as well as a container registry service for Ansible EEs.

1.1.2. Red Hat Ansible Automation Platform 2 Components

1.1.2.1. Ansible Core

The Ansible Core package is provided by **ansible-core** and is version Ansible Core 2.11 in AAP2.0. This package provides the **ansible** command as well as the built-in modules allowing administrators to run playbooks with the **ansible-playbook** command. The **ansible-core** package only contains a minimal set of modules (**ansible.builtin**) collection and all other modules have been moved to Ansible collections.



*The **ansible** Package*

It is still possible to install the package called **ansible**. This will install Ansible 2.9 which is AAP1.2. This version of Ansible will support collections, but is not the full AAP2.0 version of Ansible.

1.1.2.2. Ansible Content Collections

Ansible content and modules have now been re-organized into what is referred to as Ansible Content Collections (**Content Collections**) in order to support the growth and rapid development of modules and packages. This separation allows modules, roles, plug-in to be separated from the **Ansible Core** for a simpler management style.

This separation provides the following

- Developers can easily upgrade and deploy new version of their modules without depending on Ansible
- Only needed modules can be present on the Ansible system or in the execution environment
- New modules and content doesn't need to wait for a new version of Ansible to be deployed



ansible.builtin

The **ansible.builtin** collection is a special collection that will always be part of Ansible Core. However, this has a limited number of modules. Things like the **Firealld** module have now been moved as part of the **POSIX** Ansible Collection.



Collection Mapping

Ansible mapping of content collections: https://github.com/ansible/ansible/blob/devel/lib/ansible/config/ansible_builtin_runtime.yml

Red Hat Official Collections are available from: <https://console.redhat.com/ansible/ansible-dashboard>

1.1.2.3. Ansible Content Navigator

AAP provides **ansible-navigator** which is the new *preferred* tool to run and interact with Ansible on the CLI. It extends and includes the functionality of the **ansible-playbook**, **ansible-inventory**, and **ansible-config** commands.

While Ansible Navigator still leverages **ansible.cfg**, it has its own configuration file that must point to both the **ansible.cfg** being used as well as using its own **ansible-navigator.yml** configuration file which has even more options to extend and control the behavior of Ansible Navigator.



Why ansible-navigator?

The purpose of **ansible-navigator** is to separate the control node from the execution environment. This makes it easier for playbooks to be run in a production environment from Ansible Controller Nodes (formerly known as Ansible Tower).

1.1.2.4. Ansible Execution Environments

Ansible Execution Environments (EEs) as container images which contain the following items:

Ansible EEs

- Ansible Core
- Ansible Content Collections
 - Ansible Modules
 - Ansible Roles
- Python Libraries
- Other dependencies

The default AAP2 environment provides Ansible Core 2.11 and Red Hat Certified Content Collections to give a similar experience to AAP1.2 which is what provides Ansible 2.9.



AAP1.2 and Ansible 2.9

Ansible 2.9 is part of AAP1.2, but it supports things like Ansible Collections. You must have AAP2 to support things like Ansible Navigator, and other components of the AAP2 platform.

The **ansible-builder** package can be used to create and develop your own custom execution environments.

[Section1 5ee3b] | *Section1-5ee3b.png*

Figure 1. AAP2 Utilities

1.1.2.5. Automation Controller

Automation Controller provides a central web-based UI and REST API which can be used to automate Ansible jobs. Previous iterations of Ansible leveraged Ansible Tower which was the control node and execution environment. With the deployment of AAP2, Ansible Tower was re-named to Ansible Automation Controller and serves as the control node **only**, as with Ansible Automation Controller, the execution environment can be separated from the controller node as it now runs in a container.

[Section1 85d04] | *Section1-85d04.png*

Figure 2. AAP2 Automation Controller Components, align=

By separating the control node functionality and execution environments, it is much easier to leverage the system when playbooks could require different python environments or other requirements to run.



Automation Controller

AAP2 Automation Controllers has the ability to use multiple execution environments on playbook and project levels as the execution plan is 100% separate from the control plane.

1.1.2.6. Ansible Automation Hub

Ansible Automation Hub allows easy management and distribution of Ansible automation content. Red Hat maintains supported and certified content collections and Ansible Galaxy maintains the community-based content. The addition of Automation Hub also provides the ability to host a private automation hub which is basically a self-hosted version of Ansible Galaxy or Red Hat's **console.redhat.com** version of Automation Hub.

The private automation hub provides a container registry for distribution of custom execution environments as well as a repository for Ansible Collections and namespaces.

1.1.2.7. Hosted Services

Red Hat provides three (3) hosted Ansible Automation services

- Ansible Automation Hub
- Ansible Automation Services Catalog
- Ansible Insights for Red Hat AAP

1.1.3. Red Hat Ansible Automation Platform 2 Architecture

1.1.3.1. Developing Playbooks with Ansible Automation Platform 2

Ansible Execution Engines (EEs) can be built and customized to contain everything needed to execute playbooks developed by your organization. These playbooks can be leveraged seamlessly between content navigator and automation controller providing access is available to the EEs being used (which is where automation hub comes into play). :pygments-style: tango :source-highlighter: pygments :toc: :toclevels: 7 :sectnums: :sectnumlevels: 6 :numbered: :chapter-label: :icons: font :icons: font :imagesdir: ./images/

1.2. Running Playbooks with Automation Content Navigator

Section Info Here

1.2.1. Introducing Automation Content Navigator

1.2.1.1. Improving Portability with Automation Execution Environments

1.2.2. Installing Automation Content Navigator

1.2.3. Configuring Authentication to Managed Hosts

1.2.3.1. Preparing SSH Key-Based Authentication

1.2.3.2. Providing Private Keys to the Automation Execution Environment

1.2.4. Running Automation Content Navigator

1.2.4.1. Running Playbooks

1.2.4.2. Reviewing Previous Playbook Runs

1.2.4.3. Reading Documentation

1.2.4.4. Getting Help

1.3. Demo - Ansible Content Navigator

Ansible Content Navigator can be used to run playbooks in place of the Ansible command. At this point, the **ansible-navigator.yml** file doesn't exist, so additional command line options will need to exist. Later chapters introduce how to fully configure navigator for execution environments.

Example 1. Navigator Demo

1. Switch to Demo Directory

```
[student@workstation ~]$ cd /home/student/github/do374/Demos/CH1/navigator
```

2. Install Navigator

```
[student@workstation navigator]$ sudo yum install ansible-navigator
```

```
... OUTPUT OMITTED ...
```

```
Installed:
  ansible-navigator-1.0.0-2.el8ap.noarch
```

```
Complete!
```

3. Login to **hub.lab.example.com** to allow downloading of the EE **ee-supported-rhel8:2.0** for navigator

```
[student@workstation navigator]$ podman login -u admin -p redhat hub.lab.example.com
Login Succeeded!
```

4. Set an execution environment variable and verify

```
[student@workstation navigator]$ export EE=ee-supported-rhel8:2.0 ; echo $EE
ee-supported-rhel8:2.0
```

5. Run the playbook with the **ansible-navigator run** command

```
[student@workstation navigator]$ ansible-navigator run playbook.yml -m stdout --eei $EE ①

... OUTPUT OMITTED ...

servera.lab.example.com : ok=3   changed=0   unreachable=0   failed=0   skipped=0   rescued=0   ignored=0
serverf.lab.example.com : ok=3   changed=0   unreachable=0   failed=0   skipped=0   rescued=0   ignored=0
```

- ① The **\$EE** environment variable provides the EE for the **ansible-navigator** command

SSH Key Errors from Execution Environment

If you receive this as a message ... it is possible you are running ansible using SSH and the SSH keys haven't been added. it is necessary to use an **eval \$(ssh-agent)** followed by adding the key to your keyring.

Listing 1. Error

```
fatal: [servera.lab.example.com]: UNREACHABLE! => {"changed": false, "msg": "Failed to connect to the host via ssh: Warning: Permanently added 'servera.lab.example.com,172.25.250.10' (ECDSA) to the list of known hosts.\r\ndevops@servera.lab.example.com: Permission denied (publickey,gssapi-keyex,gssapi-with-mic,password,keyboard-interactive).", "unreachable": true}
```

Listing 2. Adding SSH Keys for Ansible Execution Environment

```
[student@workstation navigator]$ eval $(ssh-agent) ①
Agent pid 234883

[student@workstation navigator]$ ssh-add ~/.ssh/lab_rsa ②
Identity added: /home/student/.ssh/lab_rsa (/home/student/.ssh/lab_rsa)
```

- ① Starting **ssh-agent**

- ② Adding key to keyring for SSH-Agent

ansible-playbook Equivalence

The **ansible-navigator run playbook.yml -m stdout** will provide the same STDOUT as the **ansible-playbook** command. There are some other features about **ansible-navigator** but those will be covered in a later chapter and section.

6. Run the **ansible-navigator run** command interactively (*Leave out the -m stdout*)
 - a. Get output of first playbook/play (Hit **0** and Enter to navigate)
 - b. Get detailed output of **Task 13** (Hit **:** and then hit **13** and enter to navigate)

```
[student@workstation navigator]$ ansible-navigator run playbook.yml --eei $EE
```

[S2Demo 4dd38] | S2Demo-4dd38.png

Figure 3. Navigator Interactive Window

[S2Demo 12ea6] | S2Demo-12ea6.png

Figure 4. Attempting to get Task 13 Information

[S2Demo e90f4] | S2Demo-e90f4.png

Figure 5. Task 13 Information

7. Exit Ansible Navigator by hitting the **ESC** key multiple times to exit each layer.

```
[student@workstation navigator]$
```

1.4. Managing Ansible Project Materials Using Git

Section Info Here

1.4.1. Defining Infrastructure as Code

1.4.2. Introducing Git

1.4.3. Describing Initial Git Configuration

1.4.4. Starting the Git Workflow

1.4.4.1. Examining the Git Log

1.4.5. Working with Branches and References

1.4.5.1. Creating Branches

1.4.5.2. Merging Branches

1.4.5.3. Creating Branches from Old Commits

1.4.5.4. Pushing Branches to Remote Repositories

1.4.6. Structuring Ansible Projects in Git

1.4.6.1. Roles and Ansible Content Collections

1.4.6.2. Configuring Git to Ignore Files

1.5. Demo - Using Git

Ansible playbooks can be leveraged for Infrastructure-as-Code (IaC). In order to do this, playbooks and other assets should exist in version control. One way to accomplish this is by using Github or Gitlab. The course has been setup to use Gitlab, but this demo, we will see how to use Github and personal access tokens.

Example 2. Git Demo

1. Update the BASHRC file to use the **git-prompt.sh** Assets

Listing 3. .bashrc File

```
[student@workstation ~]$ vim .bashrc
# .bashrc

# Source global definitions
if [ -f /etc/bashrc ]; then
    . /etc/bashrc
fi

## Lines added for Git Management
source /usr/share/git-core/contrib/completion/git-prompt.sh
export GIT_PS1_SHOWDIRTYSTATE=true
export GIT_PS1_SHOWUNTRACKEDFILES=true
export PS1='[\u@\h \W$(declare -F __git_ps1 &>/dev/null && __git_ps1 " (%s)")]\$ '

# User specific environment
PATH="$HOME/.local/bin:$HOME/bin:$PATH"
export PATH

# Uncomment the following line if you don't like systemctl's auto-paging feature:
# export SYSTEMD_PAGER=

# User specific aliases and functions
```

2. Apply changes for BASHRC

```
[student@workstation ~]$ source .bashrc
```

3. Configure system for PAT (Personal Access Tokens)

```
[student@workstation ~]$ git config --global credential.helper cache
```

4. Verify credential helper and other configurations

```
[student@workstation ~]$ git config --global -l
user.name=Git Lab
user.email=git@lab.example.com
push.default=simple
```

5. Create Github Directory and Switch to it

```
[student@workstation ~]$ mkdir Github ; cd Github
```

6. Clone **DO374** Repository

```
[student@workstation Github]$ git clone https://github.com/tmichett/do374.git
Cloning into 'do374'...
remote: Enumerating objects: 56, done.
remote: Counting objects: 100% (56/56), done.
remote: Compressing objects: 100% (38/38), done.
remote: Total 56 (delta 11), reused 51 (delta 9), pack-reused 0
Unpacking objects: 100% (56/56), 556.15 KiB | 2.93 MiB/s, done
```

7. Change to **do374** Directory

```
[student@workstation Github]$ cd do374/
[student@workstation do374 (main)]$ ①
```

① Notice it shows main branch

8. Create a dummy file and observe prompt change

```
[student@workstation do374 (main)]$ echo "I'm a dummy file" > test.txt
[student@workstation do374 (main %)]$ ①
```

① Prompt changed to % indicating new "untracked" files

9. Add and Commit File

Listing 4. Adding File for Tracking

```
[student@workstation do374 (main %)]$ git add .
[student@workstation do374 (main +)]$ ①
```

① Prompt changed to + indicating new files being tracked, but not committed

Listing 5. Committing File Locally

```
[student@workstation do374 (main +)]$ git commit -m "Testing"
[main 9697a39] Testing
1 file changed, 1 insertion(+)
create mode 100644 test.txt
[student@workstation do374 (main)]$ ①
```

① Normal Prompt

10. Get status of repository

```
[student@workstation do374 (main)]$ git status
On branch main
Your branch is ahead of 'origin/main' by 1 commit.
(use "git push" to publish your local commits)

nothing to commit, working tree clean
```

11. Push to remote repository

```
[student@workstation do374 (main)]$ git push
Enumerating objects: 4, done.
Counting objects: 100% (4/4), done.
Delta compression using up to 4 threads
Compressing objects: 100% (2/2), done.
Writing objects: 100% (3/3), 285 bytes | 285.00 KiB/s, done.
Total 3 (delta 1), reused 0 (delta 0), pack-reused 0
remote: Resolving deltas: 100% (1/1), completed with 1 local object.
To https://github.com/tmichett/do374.git
2b7cf28..9697a39 main -> main
```

First time pushing saves credentials

Listing 6. SSH/CLI Version - Warning doesn't appear if using X11/Wayland and Gnome in Graphical Environment



```
[student@workstation CH1]$ git push

(gnome-ssh-askpass:236143): Gtk-WARNING **: 11:50:21.480: cannot open display:
error: unable to read askpass response from '/usr/libexec/openssh/gnome-ssh-askpass'
Username for 'https://github.com': tmichett

(gnome-ssh-askpass:236144): Gtk-WARNING **: 11:50:23.638: cannot open display:
error: unable to read askpass response from '/usr/libexec/openssh/gnome-ssh-askpass'
Password for 'https://tmichett@github.com':
```

1.6. Implementing Recommended Ansible Practices

Section Info Here

1.6.1. The Effectiveness of Ansible

1.6.2. Keeping Things Simple

1.6.2.1. Keeping Your Playbooks Readable

1.6.2.2. Use Existing Modules

1.6.2.3. Adhering to a Standard Style

1.6.3. Staying Organized

1.6.3.1. Following Conventions for Naming Variables

1.6.3.2. Standardizing the Project Structure

1.6.3.3. Using Dynamic Inventories

1.6.3.4. Taking Advantage of Groups

1.6.3.5. Using Roles and Ansible Content Collections for Reusable Content

1.6.3.6. Running Playbooks Centrally

1.6.3.7. Building Automation Execution Environments

1.6.4. Testing Often

1.6.4.1. Testing the Results of Tasks

1.6.4.2. Using Block/Rescue to Recover or Rollback

1.6.4.3. Developing Playbooks with the Latest Ansible Version

1.6.4.4. Using Test Tools

2. Managing Content Collections and Execution Environments

2.1. Reusing Content from Ansible Content Collections

Section Info Here

2.1.1. Defining Ansible Content Collections

2.1.1.1. Organizing Ansible Content Collections in Namespaces

2.1.2. Using Ansible Content Collections

2.1.2.1. Accessing Ansible Content Collection Documentation

2.1.2.2. Using Ansible Content Collections in Playbooks

2.1.2.3. Finding Ansible Content Collections

2.1.2.4. Using the Built-in Ansible Content Collection

2.2. Finding and Installing Ansible Content Collections

Section Info Here

2.2.1. Sources for Ansible Content Collections

2.2.1.1. Finding Collections on Ansible Automation Hub

2.2.2. Installing Ansible Content Collections

2.2.2.1. Installing Collections from the Command Line

2.2.2.2. Installing Collections with a Requirements File

2.2.2.3. Listing Installed Collections

2.2.3. Configuring Collection Sources

2.2.3.1. Installing Collections from Ansible Automation Hub

2.2.3.2. Installing Collections from Private Automation Hub

2.3. Selecting an Execution Environment

Section Info Here

2.3.1. Describing Automation Execution Environments

2.3.2. Selecting a Supported Automation Execution Environment

2.3.3. Inspecting Automation Execution Environments

2.3.4. Using Automation Execution Environments with Ansible Content Navigator

3. Running Playbooks with Automation Controller

3.1. Explaining the Automation Controller Architecture

Section Info Here

3.1.1. Introduction to Automation Controller

3.1.2. Describing the Architecture of Automation Controller

3.1.3. Automation Controller Features

3.2. Running Playbooks in Automation Controller

Section Info Here

3.2.1. Exploring Resources in Automation Controller

3.2.2. Creating Credential Resources

3.2.2.1. Listing Credentials

3.2.2.2. Creating a Machine Credential

3.2.2.3. Creating a Source Control Credential

3.2.3. Creating Project Resources

3.2.4. Creating Inventory Resources

3.2.4.1. Manually Creating Groups and Hosts

3.2.4.2. Populating Groups and Hosts Using a Project Inventory File

3.2.5. Creating Job Template Resources

3.2.6. Launching and Reviewing Jobs

4. Working with Ansible Configuration Settings

4.1. Examining Ansible Configuration with Automation Content Navigator

Section Info Here

4.1.1. Inspecting Configuration in Interactive Mode

4.1.1.1. Searching for Specific Configuration Parameters

4.1.1.2. Accessing Parameter Details

4.1.1.3. Inspecting Local Configuration

4.1.2. Inspecting Ansible Configuration in Standard Output Mode

4.2. Configuring Automation Content Navigator

Section Info Here

4.2.1. Format of the Settings File

4.2.2. Locating the Settings File

4.2.2.1. Selecting a Settings File to Use

4.2.3. Editing the Settings File

4.2.3.1. Setting a Default Automation Execution Environment

4.2.3.2. Default to Running in Standard Output Mode

4.2.3.3. Disabling Playbook Artifacts

4.2.3.4. Overview of an Example Settings File

5. Managing Inventories

5.1. Managing Dynamic Inventories

Section Info Here

5.1.1. Generating Inventories Dynamically

5.1.2. Discussing Inventory Plug-ins

5.1.2.1. Using Inventory Plug-ins

5.1.3. Developing Inventory Scripts

5.1.3.1. Using Inventory Scripts

5.1.4. Managing Multiple Inventories

5.2. Writing YAML Inventory Files

Section Info Here

5.2.1. Discussing Inventory Plug-ins

5.2.2. Writing YAML Static Inventory Files

5.2.2.1. Setting Inventory Variables

5.2.3. Converting a Static Inventory File in INI Format to YAML

5.2.4. Troubleshooting YAML Files

5.2.4.1. Protecting a Colon Followed by a Space

5.2.4.2. Protecting a Variable that Starts a Value

5.2.4.3. Knowing the Difference Between a String and a Boolean or Float

5.3. Managing Inventory Variables

Section Info Here

5.3.1. Describing the Basic Principles of Variables

5.3.2. Variable Merging and Precedence

5.3.2.1. Determining Command-line Option Precedence

5.3.2.2. Determining Role Default Precedence

5.3.2.3. Determining Host and Group Variable Precedence

5.3.2.4. Determining Play Variable Precedence

5.3.2.5. Determining the Precedence of Extra Variables

5.3.3. Separating Variables from Inventory

5.3.4. Using Special Inventory Variables

5.3.4.1. Configuring Human Readable Inventory Host Names

5.3.5. Identifying the Current Host Using Variables

6. Managing Task Execution

6.1. Controlling Privilege Escalation

Section Info Here

6.1.1. Privilege Escalation Strategies

6.1.1.1. Privilege Escalation by Configuration

6.1.1.2. Defining Privilege Escalation in Plays

6.1.1.3. Privilege Escalation in Tasks

6.1.1.4. Grouping Privilege Escalation Tasks with Blocks

6.1.1.5. Applying Privilege Escalation in Roles

6.1.1.6. Listing Privilege Escalation with Connection Variables

6.2. Choosing Privilege Escalation Approaches

6.3. Controlling Task Execution

Section Info Here

6.3.1. Controlling the Order of Execution

6.3.1.1. Importing or Including Roles as a Task

6.3.1.2. Defining Pre- and Post-tasks

6.3.1.3. Reviewing the Order of Execution

6.3.2. Listening to Handlers

6.3.2.1. Notifying Handlers

6.3.3. Controlling the Order of Host Execution

6.4. Running Selected Tasks

Section Info Here

6.4.1. Tagging Ansible Resources

6.4.2. Managing Tagged Resources

6.4.2.1. Running Tasks with Specific Tags

6.4.2.2. Combining Tags to Run Multiple Tasks

6.4.2.3. Skipping Tasks with Specific Tags

6.4.2.4. Listing Tags in a Playbook

6.4.3. Assigning Special Tags

6.5. Optimizing Execution for Speed

Section Info Here

6.5.1. Optimizing Playbook Execution

6.5.1.1. Optimizing the Infrastructure

6.5.1.2. Disabling Fact Gathering

6.5.1.3. Reusing Gathered Facts with Fact Caching

6.5.1.4. Limiting Fact Gathering

6.5.1.5. Increasing Parallelism

6.5.1.6. Avoiding Loops with the Package Manager Modules

6.5.1.7. Efficiently Copying Files to Managed Hosts

6.5.1.8. Using Templates

6.5.1.9. Enabling Pipelining

6.5.2. Profiling Playbook Execution with Callback Plug-ins

6.5.2.1. Timing Tasks and Roles

7. Transforming Data with Filters and Plug-ins

7.1. Processing Variables Using Filters

Section Info Here

7.1.1. Ansible Filters

7.1.2. Variable Types

7.1.3. Manipulating Lists

7.1.3.1. Extracting list elements

7.1.3.2. Modifying the Order of List Elements

7.1.3.3. Merging Lists

7.1.3.4. Operating on Lists as Sets

7.1.4. Manipulating Dictionaries

7.1.4.1. Joining dictionaries

7.1.4.2. Converting Dictionaries

7.1.5. Hashing, Encoding, and Manipulating Strings

7.1.5.1. Hashing strings and passwords

7.1.5.2. Encoding strings

7.1.5.3. Formatting Text

7.1.5.4. Replacing Text

7.1.6. Manipulating JSON Data

7.1.6.1. JSON Queries

7.1.6.2. Parsing and Encoding Data Structures

7.2. Templating External Data using Lookups

Section Info Here

7.2.1. Lookup Plug-ins

7.2.2. Calling Lookup Plug-ins

7.2.3. Selecting Lookup Plug-ins

7.2.3.1. Reading the Contents of Files

7.2.3.2. Applying Data with a Template

7.2.3.3. Reading Command Output in the Execution Environment

7.2.3.4. Getting Content from a URL

7.2.3.5. Getting Information from the Kubernetes API

7.2.3.6. Using Custom Lookup Plug-ins

7.2.4. Handling Lookup Errors

7.3. Implementing Advanced Loops

Section Info Here

7.3.1. Comparing Loops and Lookup Plug-ins

7.3.2. Example Iteration Scenarios

7.3.2.1. Iterating over a List of Lists

7.3.2.2. Iterating Over Nested Lists

7.3.2.3. Iterating Over a Dictionary

7.3.2.4. Iterating Over a File Globbing Pattern

7.3.2.5. Retrying a Task

7.4. Using Filters to Work with Network Addresses

Section Info Here

7.4.1. Gathering and Processing Networking Information

7.4.2. Network Information Filters

7.4.2.1. Testing IP Addresses

7.4.2.2. Filtering Data

7.4.2.3. Manipulating IP Addresses

7.4.2.4. Reformatting or Calculating Network Information

8. Coordinating Rolling Updates

8.1. Delegating Tasks and Facts

Section Info Here

8.1.1. Delegating Tasks

8.1.1.1. Delegating to localhost

8.1.2. Delegating Facts

8.2. Configuring Parallelism

Section Info Here

8.2.1. Configure Parallelism in Ansible Using Forks

8.2.2. Running Batches of Hosts Through the Entire Play

8.3. Managing Rolling Updates

Section Info Here

8.3.1. Overview

8.3.2. Controlling Batch Size

8.3.2.1. Setting a Fixed Batch Size

8.3.2.2. Setting Batch Size as a Percentage

8.3.2.3. Setting Batch Sizes to Change During the Play

8.3.3. Aborting the Play

8.3.3.1. Specifying Failure Tolerance

8.3.4. Running a Task Once

9. Creating Content Collections and Execution Environments

9.1. Writing Ansible Content Collections

Section Info Here

9.1.1. Developing Ansible Content Collections

9.1.1.1. Selecting a Namespace for Collections

9.1.1.2. Creating Collection Skeletons

9.1.1.3. Adding Content to Collections

9.1.1.4. Updating Collection Metadata

9.1.1.5. Declaring Collection Dependencies

9.1.1.6. Building Collections

9.1.1.7. Validating and Testing Collections

9.1.2. Publishing Collections

9.2. Building a Custom Execution Environment

Section Info Here

9.2.1. Deciding When to Create a Custom Automation Execution Environment

9.2.2. Preparing for a New Automation Execution Environment

9.2.2.1. Declaring the Ansible Content Collections to Install

9.2.2.2. Declaring Python Packages

9.2.2.3. Declaring RPM Packages

9.2.3. Building a New Automation Execution Environment

9.2.3.1. Interacting with the Build Process

9.3. Validating a Custom Execution Environment

Section Info Here

9.3.1. Testing Automation Execution Environments Locally

9.3.1.1. Running a Test Playbook

9.3.1.2. Providing Authentication Credentials

9.3.2. Sharing an Automation Execution Environment from Private Automation Hub

9.4. Using Custom Content Collections and Execution Environments in Automation Controller

Section Info Here

9.4.1. Using Custom Collections with Existing Execution Environments

9.4.1.1. Preparing Ansible Projects for Automation Controller

9.4.1.2. Storing Authentication Credentials for Collections

9.4.2. Using Custom Automation Execution Environments with Automation Controller

9.4.2.1. Storing Container Registry Credentials

9.4.2.2. Configuring Automation Execution Environments

9.4.2.3. Configuring the Default Automation Execution Environment for a Project

9.4.2.4. Specifying an Automation Execution Environment in a Template