Lab 6. Consuming and Creating Plugins

In this lab, we will cover the following topics:

- Discovering the plugin types
- Finding the included plugins
- Creating custom plugins

Lab Environment

All lab file are present at below path. Close all terminals and run following command in the **new** terminal first before running commands in the lab:

`cd ~/Desktop/ansible-course/Lab_6`

Discovering the plugin types

Let's validate the presence of a suitably installed version of Ansible on your test machine before proceeding further:

```
$  ansible-doc --version

ansible-doc 2.9.6
  config file = /etc/ansible/ansible.cfg
  configured module search path = ['/root/.ansible/plugins/modules',
'/usr/share/ansible/plugins/modules']
  ansible python module location = /usr/lib/python3/dist-packages/ansible
  executable location = /usr/bin/ansible-doc
  python version = 3.8.5 (default, Jan 27 2021, 15:41:15) [GCC 9.3.0]
```

Exercise

We will leave exploring the plugin documentation on the Ansible website as an exercise for you to complete. However, if you want to explore the various plugins using the [ansible-doc] tool, you would need to run the following commands:

1. To use the [ansible-doc] command to list all the plugins available in a given category, you can run the following command:

```
$ ansible-doc -t connection -l
```

This will return a textual index of the connection plugins, similar to what we saw when we were looking at the module documentation. The first few lines of the index output are shown here:

```
kubectl            Execute tasks in pods running on Kubernetes
napalm             Provides persistent connection using NAPALM
qubes              Interact with an existing QubesOS AppVM
libvirt_lxc        Run tasks in lxc containers via libvirt
funcd              Use funcd to connect to target
chroot             Interact with local chroot
psrp               Run tasks over Microsoft PowerShell Remoting Protocol
zone               Run tasks in a zone instance
```

```
winrm              Run tasks over Microsoft's WinRM
paramiko_ssh       Run tasks via python ssh (paramiko)
```

2. You can then explore the documentation for a given plugin. For example, if we want to learn about the [paramiko_ssh] plugin, we can issue the following command:

```
$ ansible-doc -t connection paramiko_ssh
```

```
> PARAMIKO (/usr/lib/python3/dist-packages/ansible/plugins/connection/param

        Use the python ssh implementation (Paramiko) to connect to
        targets The paramiko transport is provided because many
        distributions, in particular EL6 and before do not support
        ControlPersist in their SSH implementations. This is needed on
        the Ansible control machine to be reasonably efficient with
        connections. Thus paramiko is faster for most users on these
        platforms. Users with ControlPersist capability can consider
        using -c ssh or configuring the transport in the configuration
        file. This plugin also borrows a lot of settings from the ssh
        plugin as they both cover the same protocol.

  * This module is maintained by The Ansible Community
OPTIONS (= is mandatory):

- host_key_auto_add
        TODO: write it
        [Default: (null)]
        set_via:
          env:
          - name: ANSIBLE_PARAMIKO_HOST_KEY_AUTO_ADD
          ini:
          - key: host_key_auto_add
```

Thanks to all the hard work and effort that goes into documenting every area of Ansible, you can easily find out about the plugins that are included with Ansible and how to work with them. So far, we have seen that the documentation for plugins is no less complete than it is for modules. In the next section of this lab, we'll dive a bit deeper into how to find the plugin code that accompanies your Ansible distribution.

Finding included plugins

If you installed Ansible on a Linux system using a package manager (that is, via an RPM or DEB package), then the location of your plugins will depend on your OS. For example, on my test CentOS 7 system where I installed Ansible from the official RPM package, I can see the plugins installed here:

```
$ find /usr/lib/ -name *ansible*
$ ls -ltr /usr/lib/python3/dist-packages/ansible/plugins/
```

Notice how the plugins are separated into subdirectories, all named after their categories. If we want to look up the [paramiko_ssh] plugin that we reviewed the documentation of in the preceding section, we can look in the [connection/] subdirectory:

```
$ ls -l /usr/lib/python3/dist-packages/ansible/plugins/connection/paramiko_ssh.py

-rw-r--r-- 1 root root 23544 Mar 5 05:39 /usr/lib/python3/dist-
packages/ansible/plugins/connection/paramiko_ssh.py
```

As one of our goals in this lab is to write our own simple custom plugin, let's look at how to find the plugins in the official Ansible source code:

1. Clone the official Ansible repository from GitHub, as we did previously, and change the directory to the location of your clone:

```
$ cd ~ && rm -r ansible     # delete existing clone
$ git clone https://github.com/ansible/ansible.git
$ cd ansible
```

2. Within the official source code directory structure, you will find that the plugins are all contained (again, in categorized subdirectories) under [lib/ansible/plugins/]:

```
$ cd lib/ansible/plugins
```

3. We can explore the connection-based plugins by looking in the [connection] directory:

```
$ ls -al connection/
```

The exact contents of this directory will depend on the version of Ansible source code that you have cloned. At the time of writing, it looks as follows, with one Python file for each plugin :

```
$ ls -al connection/

total 176

drwxr-xr-x 2 root root 109 Apr 15 17:24 .
drwxr-xr-x 19 root root 297 Apr 15 17:24 ..
-rw-r--r-- 1 root root 16411 Apr 15 17:24 __init__.py
-rw-r--r-- 1 root root 6855 Apr 15 17:24 local.py
-rw-r--r-- 1 root root 23525 Apr 15 17:24 paramiko_ssh.py
-rw-r--r-- 1 root root 32839 Apr 15 17:24 psrp.py
-rw-r--r-- 1 root root 55367 Apr 15 17:24 ssh.py
-rw-r--r-- 1 root root 31277 Apr 15 17:24 winrm.py
```

4. You can review the contents of each plugin to learn more about how they work, which is again part of the beauty of open source software:

```
$ less connection/paramiko_ssh.py
```

An example of the beginning of this file is shown in the following code block to give you an idea of the kind of output you should be seeing if this command runs correctly:

```
# (c) 2012, Michael DeHaan <michael.dehaan@gmail.com>
# (c) 2017 Ansible Project
# GNU General Public License v3.0+ (see COPYING or https://www.gnu.org/licenses/gpl-
3.0.txt)
from __future__ import (absolute_import, division, print_function)
```

```
__metaclass__ = type

DOCUMENTATION = """
    author: Ansible Core Team
    connection: paramiko
    short_description: Run tasks via python ssh (paramiko)
    description:
        - Use the python ssh implementation (Paramiko) to connect to targets
        - The paramiko transport is provided because many distributions, in particular
EL6 and before do not support ControlPersist
          in their SSH implementations.
....
```

Notice the [DOCUMENTATION] block, which is very similar to what we saw when we were working with the module source code. If you explore the source code of each plugin, you will find that the structure bears some similarity to the module code structure. However, rather than simply taking this statement at face value, in the next section, let's get started with building our very own custom plugin to learn, through a practical example, how they are put together.

Creating custom plugins

`cd ~/ansible`

Let's get started on creating our simple filter plugin. As we are only creating one, it will live in its own single Python file. You could propose a modification to one of the Ansible core filter Python files if you want to submit your code back to the Ansible project; but for now, we'll leave that as a project for you to complete yourself. Our filter file will be called [custom_filter.py] and it will live in a directory called [filter_plugins], which must be in the same directory as your playbook.

Perform the following steps to create and test your plugin code:

1. Start your plugin file with a header so that people will know who wrote the plugin and what license it is released under. Naturally, you should update both the copyright and license fields with values appropriate to your plugin, but the following text is given as an example for you to get started with:

```
# (c) 2020, Fenago <ansible@fenago.com>
# GNU General Public License v3.0+ (see COPYING or https://www.gnu.org/licenses/gpl-
3.0.txt)
```

2. Next, we'll add a very simple Python function---yours can be as complex as you want it to be, but for ours, we will simply use the Python [.replace] function to replace one string with another inside a [string] variable. The following example looks for instances of [Puppet] and replaces them with [Ansible]:

```
def improve_automation(a):
 return a.replace("Puppet", "Ansible")
```

3. Next, we need to create an object of the [FilterModule] class, which is how Ansible will know that this Python file contains a filter. Within this object, we can create a [filters] definition and return the value of our previously defined filter function to Ansible:

```
class FilterModule(object):
       '''improve_automation filters'''
```

```
    def filters(self):
        return {'improve_automation': improve_automation}
```

4. As you can see, this code is all incredibly simple and we're able to use built-in Python functions, such as [replace], to manipulate the strings. There isn't a specific test harness for plugins in Ansible, so we will test out our plugin code by writing a simple playbook that will implement it. The following playbook code defines a simple string that includes the word [Puppet] in it and prints this to the console using the [debug] module, applying our newly defined filter to the string:

```
---
- name: Play to demonstrate our custom filter
  hosts: frontends
  gather_facts: false
  vars:
    statement: "Puppet is an excellent automation tool!"

  tasks:
    - name: make a statement
      debug:
        msg: "{{ statement | improve_automation }}"
```

Now, before we attempt to run this, let's recap what the directory structure should look like. Just as we were able to utilize the custom module that we created in Lab 5, by creating a [library/] subdirectory to house our module, we can also create a [filter_plugins/] subdirectory for our plugin. Your directory tree structure, when you have finished coding the various file details in the preceding code block, should look something like this:

```
.
├── filter_plugins
│   ├── custom_filter.py
├── hosts
├── myplugin.yml
```

Let's now run our little test playbook and see what output we get. If all goes well, it should look something like the following:

```
$ cd ~/Desktop/ansible-course/Lab_6/
$ ansible-playbook -i hosts myplugin.yml


PLAY [Play to demonstrate our custom filter] ***********************************

TASK [make a statement] ********************************************************
ok: [frt01.example.com] => {
    "msg": "Ansible is an excellent automation tool!"
}

PLAY RECAP *********************************************************************
frt01.example.com : ok=1 changed=0 unreachable=0 failed=0 skipped=0 rescued=0
ignored=0
```

As you can see, our new filter plugin replaced the [Puppet] string in our variable's contents and replaced it with the [Ansible] string.

As an example of this, let's repeat the preceding process, but to create a [lookup] plugin, instead. This plugin will be based heavily on a simplified version of the file [lookup] plugin. If you intend to test this from a playbook, as executed previously, you should create this in a directory called [lookup_plugins/]:

1. Start by adding a header to the plugin file, as before, so that the maintainer and copyright details are clear. We are borrowing a large chunk of the original [file.py] [lookup] plugin code for our example, so it is important we include the relevant credit:

```
# (c) 2020, Fenago <ansible@fenago.com>
# (c) 2017 Ansible Project
# GNU General Public License v3.0+ (see COPYING or https://www.gnu.org/licenses/gpl-
3.0.txt)
```

2. Next, add in the Python 3 headers---these are an absolute requirement if you intend to submit your plugin via a **Pull Request** (**PR**) to the Ansible project:

```
from __future__ import (absolute_import, division, print_function)
__metaclass__ = type
```

3. Next, add a [DOCUMENTATION] block to your plugin so that other users can understand how to interact with it:

```
DOCUMENTATION = """
    lookup: firstchar
    author: Fenago <ansible@fenago.com>
    version_added: "2.9"
    short_description: read the first character of file contents
    description:
        - This lookup returns the first character of the contents from a file on the
Ansible controller's file system.
    options:
      _terms:
        description: path(s) of files to read
        required: True
    notes:
      - if read in variable context, the file can be interpreted as YAML if the
content is valid to the parser.
      - this lookup does not understand 'globing', use the fileglob lookup instead.
"""
```

4. Add the relevant [EXAMPLES] blocks to show how to use your plugin, just as we did for modules:

```
EXAMPLES = """
- debug: msg="the first character in foo.txt is {{lookup('firstchar', '/etc/foo.txt')
}}"

"""
```

5. Also, make sure you document the [RETURN] values from your plugin:

```
RETURN = """
  _raw:
    description:
      - first character of content of file(s)
"""
```

6. With the documentation complete, we can now start to work on our Python code. We will start by importing all the Python modules we need to make our module work. We'll also set up the [display] object, which is used in verbose output and debugging. This should be used in place of the [print] statements in your plugin code if you need to display the [debug] output:

```
from ansible.errors import AnsibleError, AnsibleParserError
from ansible.plugins.lookup import LookupBase
from ansible.utils.display import Display

display = Display()
```

7. We will now create an object of the [LookupModule] class. Define a default function within this called [run] (this is expected for the Ansible [lookup] plugin framework) and initialize an empty array for our return data:

```
class LookupModule(LookupBase):

    def run(self, terms, variables=None, **kwargs):

        ret = []
```

8. With this in place, we will start a loop to iterate over each of the terms (which, in our simple plugin, will be the filenames passed to the plugin). Although we will only test this on simple use cases, the way that lookup plugins can be used means that they need to support the lists of [terms] to operate on. Within this loop, we display valuable debugging information and, most importantly, define an object with the details of each of the files we will open, called [lookupfile]:

```
      for term in terms:
            display.debug("File lookup term: %s" % term)

   lookupfile = self.find_file_in_search_path(variables, 'files', term)

      display.vvvv(u"File lookup using %s as file" % lookupfile)
```

9. Now, we will read in the file contents. This could be as simple as using one line of Python code, but we know from our work on modules in Lab 5 that we should not take it for granted that we will be passed a file we can actually read. As a result, we will put the statement to read our file contents into a [try] block and implement exception handling to ensure that the behavior of the plugin is sensible, even in error cases, and that easy-to-understand error messages are passed back to the user, rather than to Python tracebacks:

```
            try:
                if lookupfile:
               contents, show_data = self._loader._get_file_contents(lookupfile)
                     ret.append(contents.rstrip()[0])
                else:
                     raise AnsibleParserError()
            except AnsibleParserError:
                raise AnsibleError("could not locate file in lookup: %s" % term)
```

Notice that within this, we append the first character of the file contents (denoted by the [[0]] index) to our empty array. We also remove any training spaces using [rstrip].

10. Finally, we return the character we gathered from the file to Ansible with a [return] statement:

```
        return ret
```

11. Once again, we can create a simple test playbook to test out our newly created plugin:

```
---
- name: Play to demonstrate our custom lookup plugin
  hosts: frontends
  gather_facts: false

  tasks:
    - name: make a statement
      debug:
        msg: "{{ lookup('firstchar', 'testdoc.txt')}}"
```

Again, we are using the debug module to print output to the console and referencing our [lookup] plugin to obtain the output.

12. Create the text file referenced in the previous code block, called [testdoc.txt]. This can contain anything you like---mine contains the following simple text:

```
Hello
```

For clarity, your final directory structure should look as follows:

```
.
├── hosts
├── lookup_plugins
│   └── firstchar.py
├── myplugin2.yml
└── testdoc.txt
```

13. Now, when we run our new playbook, we should see an output similar to the following:

```
$ ansible-playbook -i hosts myplugin2.yml


PLAY [Play to demonstrate our custom lookup plugin] ****************************

TASK [make a statement] ********************************************************
ok: [frt01.example.com] => {
    "msg": "72"
}

PLAY RECAP *********************************************************************
frt01.example.com : ok=1 changed=0 unreachable=0 failed=0 skipped=0 rescued=0
ignored=0
```

If all goes well, your playbook should return the first character of the text file you created. Naturally, there is a lot we could do to enhance this code, but this serves as a nice, simple example to get you started.

Learning to integrate custom plugins with Ansible source code

So far, we have only tested our plugin in a standalone manner. This is all well and good, but what if you actually wanted to add it either to your own fork of the Ansible source code---or, better yet, submit it back to the Ansible project for inclusion with a PR? Fortunately, this process is very similar to the one we covered in Lab 5, only with slightly different folder structures.

As before, your first task will be to obtain a copy of the official Ansible project source code---for example, by cloning the GitHub repository to your local machine:

```
$ cd ~/ansible
```

Next, you will need to copy your plugin code into one of the appropriate plugin directories.

1. For example, our example filter would be copied to the following directory in the source code you just cloned:

```
$ cp ~/Desktop/ansible-course/Lab_6/filter_plugins/custom_filter.py
./lib/ansible/plugins/filter/
```

2. Similarly, our custom [lookup] plugin would go in the [lookup] plugin's directory, using a command such as the following:

```
$ cp ~/Desktop/ansible-course/Lab_6/lookup_plugins/firstchar.py
./lib/ansible/plugins/lookup/
```

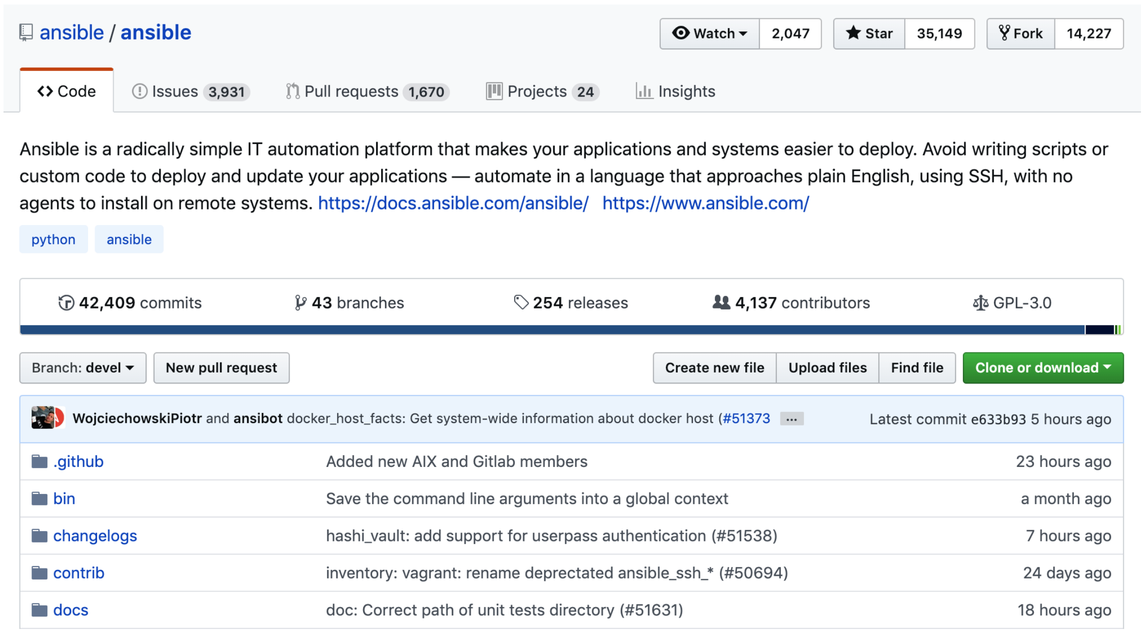
With your code copied into place, you need to test the documentation (that is, whether your plugin includes it) as before. You can build the [webdocs] documentation in exactly the same way as we did in Lab 5 so we will not recap this here. However, as a refresher, we can quickly check whether the documentation renders correctly using the [ansible-doc] command, as follows:

```
$ . hacking/env-setup
```

Armed with this knowledge, you should now be well placed to begin your own plugin development work, and even to submit your code back to the community, if you desire. We'll offer a brief recap of this in the next section.

Sharing plugins with the community (Optional)

In order to submit your plugin as a PR of the Ansible repository, you first need to fork the [devel] branch of the official Ansible repository. To do this, log into your GitHub account on your web browser (or create an account if you don't already have one), and then navigate to https://github.com/ansible/ansible.git. Click on [Fork] at the top-right corner of the page:


ansible / ansible

Ansible is a radically simple IT automation platform that makes your applications and systems easier to deploy. Avoid writing scripts or custom code to deploy and update your applications — automate in a language that approaches plain English, using SSH, with no agents to install on remote systems. https://docs.ansible.com/ansible/ https://www.ansible.com/

WojciechowskiPiotr and ansibot docker_host_facts: Get system-wide information about docker host (#51373 … Latest commit e633b93 5 hours ago

.github	Added new AIX and Gitlab members	23 hours ago
bin	Save the command line arguments into a global context	a month ago
changelogs	hashi_vault: add support for userpass authentication (#51538)	7 hours ago
contrib	inventory: vagrant: rename deprectated ansible_ssh_* (#50694)	24 days ago
docs	doc: Correct path of unit tests directory (#51631)	18 hours ago

Once you have forked the repository to your own account, we will walk you through the commands you need to run to add your module code to it and then to create the required PRs in order to merge your new module with the upstream Ansible project:

1. Clone the [devel] branch that you just forked to your local machine. Use a command similar to the following, but be sure to replace the URL with one that matches your own GitHub account:

```
$ git clone https://github.com/<your GitHub account>/ansible.git
```

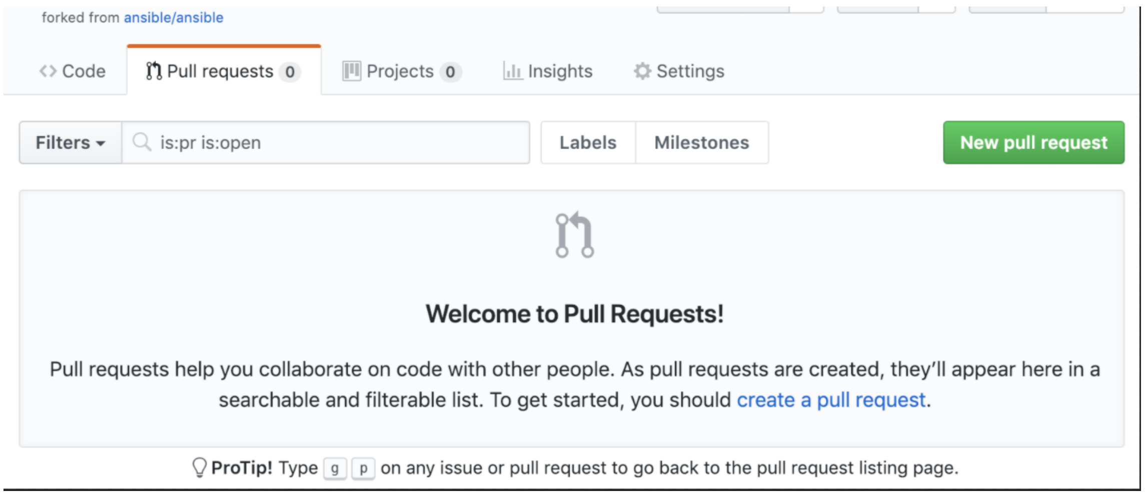
2. Copy your module code into the appropriate [plugins/] directory. The [copy] command used in the following code block is just an example to give you an idea as to what to do---in reality, you should choose the appropriate category subdirectory for your plugin as it won't necessarily fit into the [lookup] category. Once you've added your Python file, perform a [git add] command to make Git aware of the new file, and then commit it with a meaningful [commit] message. Some example commands are shown here:

```
$ cd ansible
$ cp ~/ansible-development/plugindev/firstchar.py ./lib/ansible/plugins/lookup
$ git add lib/ansible/plugins/lookup/firstchar.py
$ git commit -m 'Added tested version of firstchar.py for pull request creation'
```

3. Now, be sure to push the code to your forked repository using the following command:

```
$ git push
```

4. Return to GitHub in your web browser and navigate to the [Pull Requests] page, as in the following screenshot. Click on the [New pull request] button:

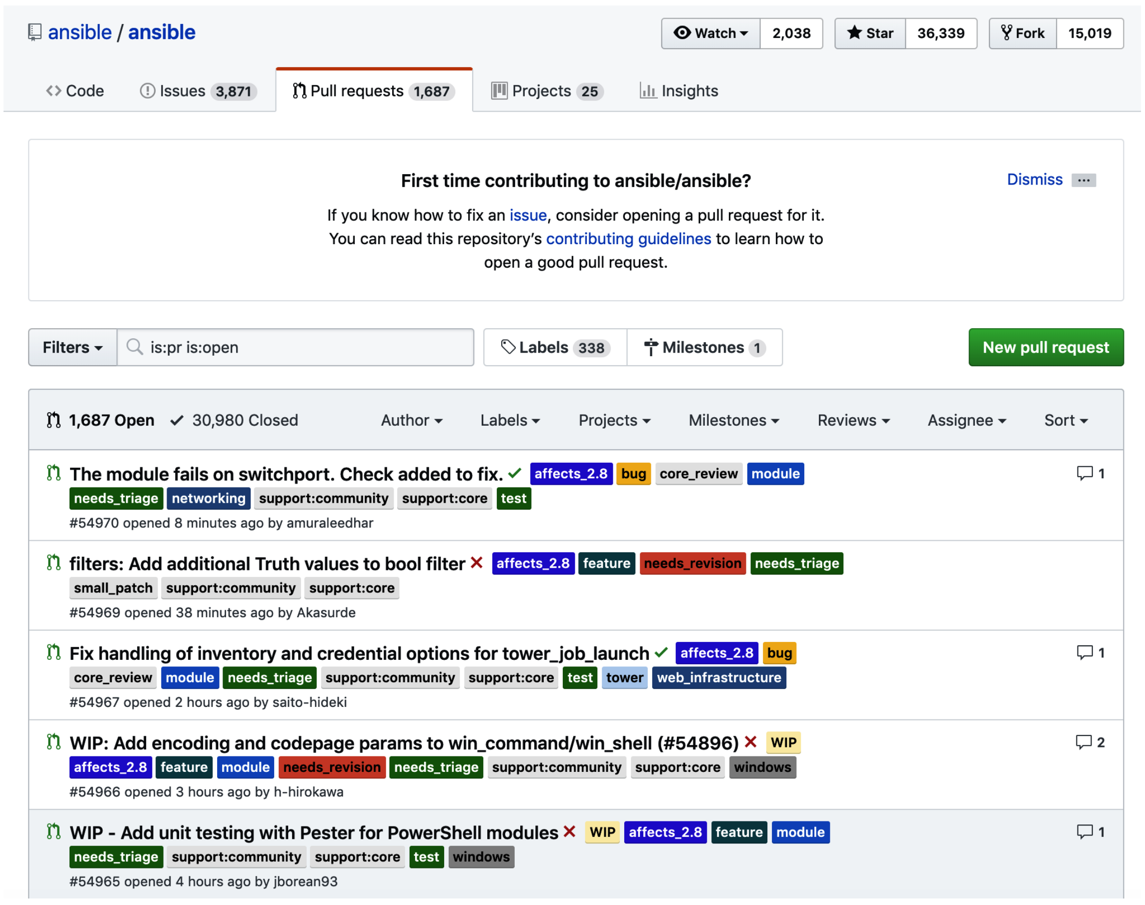

forked from ansible/ansible

Welcome to Pull Requests!

Pull requests help you collaborate on code with other people. As pull requests are created, they'll appear here in a searchable and filterable list. To get started, you should create a pull request.

ProTip! Type g p on any issue or pull request to go back to the pull request listing page.

Follow the PR creation process, as guided by the GitHub website. Once you have successfully submitted your PR, you should be able to navigate to the list of PRs on the official Ansible source code repository and find yours there. An example of the PR list is shown in the following screenshot for your reference:



First time contributing to ansible/ansible?

If you know how to fix an issue, consider opening a pull request for it.
You can read this repository's contributing guidelines to learn how to open a good pull request.

The module fails on switchport. Check added to fix. ✓ affects_2.8 bug core_review module needs_triage networking support:community support:core test — 1
#54970 opened 8 minutes ago by amuraleedhar

filters: Add additional Truth values to bool filter ✗ affects_2.8 feature needs_revision needs_triage small_patch support:community support:core
#54969 opened 38 minutes ago by Akasurde

Fix handling of inventory and credential options for tower_job_launch ✓ affects_2.8 bug core_review module needs_triage support:community support:core test tower web_infrastructure — 1
#54967 opened 2 hours ago by saito-hideki

WIP: Add encoding and codepage params to win_command/win_shell (#54896) ✗ WIP affects_2.8 feature module needs_revision needs_triage support:community support:core windows — 2
#54966 opened 3 hours ago by h-hirokawa

WIP - Add unit testing with Pester for PowerShell modules ✗ WIP affects_2.8 feature module needs_triage support:community support:core test windows — 1
#54965 opened 4 hours ago by jborean93

That completes our look at the creation of plugins, including two working examples. Hopefully, you have found this journey informative and valuable and it has enhanced your ability to work with Ansible and extend its functionality where required.

Summary

In this lab, we learned about the various types of plugins that are supported by Ansible, before exploring them in greater detail and looking at how you can obtain documentation and information on the existing ones. We then completed two practical examples to create two different types of plugin for Ansible while looking at the best practices for plugin development and how this overlaps with module development. We finished off by recapping how to submit our new plugin code as a PR back to the Ansible project.

In the next lab, we will explore the best practices that you should adhere to when writing your Ansible playbooks to ensure that you produce manageable, high-quality automation code.

Questions

1. Which of the following [ansible-doc] commands can you use to list the names of all the cache plugins?

A) [ansible-doc -a cache -l]

B) [ansible-doc cache -l]

C) [ansible-doc -a cache]

D) [ansible-doc -t cache -l]

E) [ansible-doc cache]

2. Which class do you need to add to your [lookup] plugin's code to include the bulk of the plugin code, including [run()], the [items] loop, [try], and [except]?

A) [LookupModule]

B) [RunModule]

C) [StartModule]

D) [InitModule]

E) [LoadModule]

3. True or false -- in order to create custom plugins using Python, you need to install Python with the relevant dependencies on your OS:

A) True

B) False